

**AUTOMATIC
RECORD CHANGERS
and
RECORDERS**

by
JOHN F. RIDER



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**AUTOMATIC
RECORD CHANGERS
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RECORDERS**

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by

JOHN F. RIDER

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Dedicated to the

RADIO SERVICEMAN

*who through no fault of his own now is surrounded
with pawls and cams and gears*



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AUTHOR'S FOREWORD

THE AUTOMATIC RECORD CHANGER is by no means a new device, for several such units have been available for many years. However, the last four or five years have witnessed a tremendous boom in the production and sale of these units to the owners of radio receivers. In fact, it is possible to credit the revival of phonograph record sales and interest in such records to the successful development of a simple record changer. We say simple, for so it is when compared to the devices of years ago.

At the same time, the wide-spread sale of these units and the service work necessary thereon represented a new era in the operations of the radio serviceman. For almost two decades, his interest revolved around the invisible defects which accompany the operation of electrical devices. Mechanics in radio receivers was limited to such things as remote control and motor driven condensers. Mechanical operation was so much in the minority that very few if any serviceman paid the slightest attention to even the simplest terms used in mechanics, let alone the study of gears and linkages.

Then along comes the automatic record changer and introduces almost a new language, the language of mechanics. Fortunately, the nature of the device is such that a study of mechanics is not necessary, but it must be admitted that even if a study of mechanics is not required, the development of motion in many different directions by means of gears, levers, and cams, is something which is foreign to the radio-minded man. And when this new device is not too gently thrown into his lap and he is told to service something, the prototype of which he has never seen, he cannot help but be at a loss.

The birth of this volume covering automatic record changers and recorders is a direct effort to supply to the radio serviceman, a book which will give him general and specific facts about the record changers and recorders now in the hands of the public, so that he will at least have available some source of specific information.

As is clearly evident in the text, no effort is made to cover the theory of mechanics, for we do not deem it necessary. At no time is the individual who does the service work called upon to improvise an arrangement in place of something which has failed. The mechanical system is already designed and his part is to keep it running

and clear whatever defects develop. At the same time, the general discussion of mechanical troubles is limited. This is brought about by the fact that the respective manufacturers indicate the exact parts to be investigated in the event that some defect develops. . . . Since variations exist between record changers, it is far more important that the reader refer to the manufacturers' notes and derive specific information, than try to interpret general service references.

We have refrained from publishing design theory, as far as recorders are concerned, because the subject matter of this volume concerns units already manufactured and which must be kept in operation. Since these units function with other available devices, records and needles, all that we deem necessary to say about records and needles are those things which relate to faults and those things which will enable a serviceman to answer questions submitted by the average user of a recorder to his not getting the kind of results he expected.

The remainder of the problems, that is service problems surrounding the individual recorders, those are answered by information furnished by the respective manufacturers, for they not only give the solution to the problem, but also stipulate the exact part of the system which must be manipulated to accomplish a certain aim.

As this book goes to press, it just about covers all of the devices of the kind listed in the title, which have been sold to the public. With the requirements for National Defense becoming more and more urgent, it is doubtful if there will be need for a second volume covering future units for quite a few years. Be that as it may, we hope that what we present in these pages will be of practical aid to the serviceman. In this connection we desire to express our sincere appreciation to all of the service managers of the manufacturers represented in this book for their wholehearted cooperation. Without such cooperation this book would have been impossible. That goes for some of the staff of the publisher, particularly Mr. G. C. B. Rowe whose job it was to edit the text we wrote and who helped us watch the gyrations of gears and levers and cams within the record changers that were purchased for observation and analysis.

JOHN F. RIDER

November 29, 1941.



Chapter I

MOTORS AND DRIVES

THE primary driving device in record changers, recording devices, and phonographs is the electric motor. That is what converts electrical energy into the mechanical energy required to rotate the turntable upon which the record rests, either for reproduction or for recording. Since this is a manual aimed at furnishing service information, our primary concern is with information of this character. But in the case of motors, as well as other completely assembled electrical mechanisms, like pick-ups and cutter heads, there is comparatively little which can be described as service information.

Of course, there are details relating to service which shall be discussed, but due to the nature of such devices as motors and the others named, the kinds of defects which are within the province of the repairman are relatively few and simple. Those defects which are major in nature are, unfortunately, of such character as to require virtual reconstruction of the device, hence invariably mean replacement of the defective unit with a new one. This is particularly true of burnouts of windings or coils, such as are employed in motors, pick-ups as well as recorder cutting heads. When such defects develop, the lack of facilities for repair and the specialized nature of the repair make replacement the only feasible and most practical method of overcoming the problem.

This does not mean that these subjects need be dismissed by nothing more than a tabulation of the simple faults and their remedies. In fact they cannot be dealt with in such an easy way, for it is highly desirable that the serviceman who works on such devices, regardless of the nature of the defect, have a general idea of what electrical principles govern the operation.

This is particularly true in the case of pick-ups and recorder cutters, for much of the success in reproduction as well as recording is founded upon the performance of these respective units. The more familiar the individual with their operation, the better the results obtained because of the many related devices and operations.

In the case of motors, the parallel is not as close because the electrical characteristics of the driving unit have no relationship, assuming correct selection of the electrical power source, the power line frequency and voltage, to the manner of reproduction or recording. Unlike the other two units, only a defect in the motor will interfere with the attainment of its proper performance. Yet, it cannot help but be valuable to

the user of this manual to understand the manner in which the different kinds of motors used in automatic record changers and recorders, operate. Therefore we shall discuss in brief the kinds of motors used as well as the related driving mechanisms.

Motors

Motors as a whole are identified in four ways. First is the general classification associated with the kind of power supply, namely for use on either alternating current, direct current, or both. Second, is the rating of the voltage which must be impressed upon the motor, or to put it differently, the voltage of the power supply for which the motor has been designed. Third, the classification of the electrical design of the motor, that is, the basic principle responsible for the turning action of the motor, and fourth is the horse-power rating. As we go along in this discussion examples of the first three will be given. As to the last named, no need exists for any discussion, in that the general category of all motors used in recording units as well as record changers and phonographs, is "fractional horse-power," by which is meant something of the order of $\frac{1}{16}$ horsepower or higher, although there seldom appears any reference to some particular value. The fact that the motors are of fractional horsepower is generally accepted as sufficient.

Basic Principles of Motors

While it is true that different kinds of motors make use of certain definite electrical laws in certain special ways, it nevertheless is possible to state in general terms the principles which govern the operation of motors. Essentially a motor revolves because of forces developed by the interaction between two electromagnetic fields. The manner in which these fields are developed is of no consequence. In some instances they may be due to current which is caused to flow through conductors by the application of an external voltage and then again it may be due to induced currents.

The exact manner in which these principles are employed is a different matter. Some of the arrangements are native only to those devices which are intended for use with an alternating-current form of supply, whereas others are used for direct current and some for a combination of both. It is the distinction between these arrangements which supplies the data for

this discussion. . . . Suppose then that we start with the d-c motor, although it so happens that d-c motors are by far in the minority in such devices. In fact, in most cases, where operation may be necessary upon a d-c line, the kind of motor furnished is one which is equally suitable for use on alternating as well as direct-current power supply circuits. However, by discussing the basic principles of d-c motors, we provide a more solid basis of comprehension of what makes a motor revolve.

D-C MOTORS

The d-c motor is comparatively simple in its basis of operation. Essentially it consists of a current carrying conductor located within a magnetic field. (Fig. 1.) In principle it is like the simple d-c moving coil type of meter. When a current is passed through the conductor, which incidentally consists of numerous windings, a magnetic field is created around the numerous turns. This part of the motor is known as the *armature*. This magnetic field interacts with the magnetic field of the field magnets, which you may recall was originally mentioned as being the area within which the armature windings were located. The field magnets may be permanent magnets or electromagnets, that is iron cores surrounded by windings.

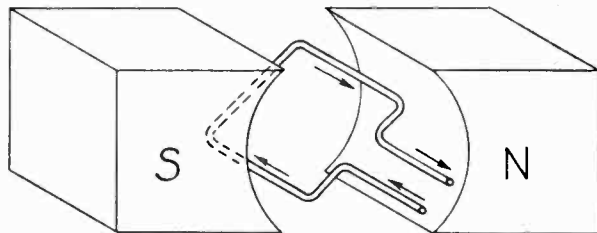


FIG. 1. Essentially a d-c motor consists of a loop of wire carrying current which sets up a field around the wire and reacts with the field set up by a permanent magnet. The interaction of these two fields causes the loop to rotate.

When two such magnetic fields combine, the resultant forces developed by the combined fields tend to make the windings located within the field move. Since the structure of the system is such that motion of these coils is possible only in a rotary manner, the whole armature assembly revolves. The turning force or torque existing at the armature shaft is transferred to whatever device is to be turned by any one of a number of linking systems.

Imagine if you will, a single length of conductor located between the pole pieces of a permanent magnet, as shown in Fig. 2, and then the passage of current through the conductor as indicated in Fig. 3. Due to the passage of current through the conductor, lines of force are created around the conductor. As a result of the direction of current flow through the conductor and the location of the N and S poles of the magnet,

we find that the direction of the flux lines beneath the conductor *aid* the flux lines due to the magnet and that those above the conductor *buck* the flux lines due to the magnet. The net result of the combination of

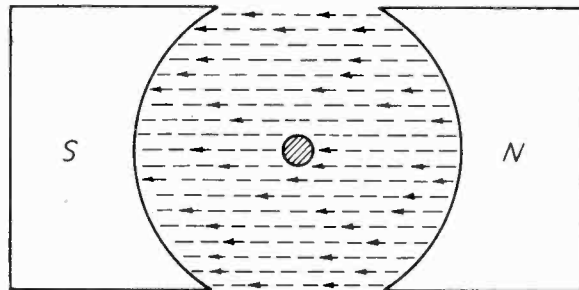


FIG. 2. The dotted lines indicate a magnetic field set up between the two poles N and S of a magnet. The circle in the midst of this field represents the cross section of a wire through which no current is flowing.

these two magnetic fields is as shown in Fig. 3; there is a bunching of the lines of force *beneath* the conductor and a reduction in the strength of the field *above* the conductor. . . .

Since lines of force behave like stretched rubber bands, the bunched or distorted lines beneath the conductor will tend to straighten themselves and in so doing will exert an upward force upon the conductor. This can be said in another way, which perhaps is a closer approach to basic electrical laws: "when a current-carrying conductor disturbs a uniform field, thus making the field stronger on one side of the conductor than upon the other, the conductor will move from the stronger to the weaker field."

Now suppose that instead of having a single conductor in a magnetic field, we arrange a loop which can pivot upon a shaft as in Fig. 4, and pass current through this conductor. Whereas the combined field bunches beneath coil side A, it bunches above coil side B. The reason is that the direction of the current flow through coil side B is exactly opposite to that through coil side A. If we assume that the direction of cur-

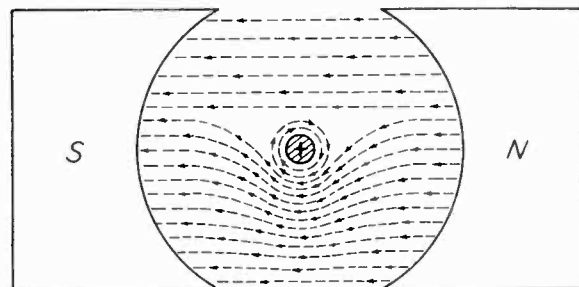


FIG. 3. When current flows downward through the wire of Fig. 2, the field set up (indicated by the concentric dotted circles) reacts with the field of the magnet so that the lines of force are crowded under the wire and thinned out above it.

rent through this loop is away from the observer in coil side A, it is towards the observer in side B. As to the force now exerted upon the coil sides, it is in the upward direction on side A and in the downward direction upon side B, with the result that the coil turns as a whole.

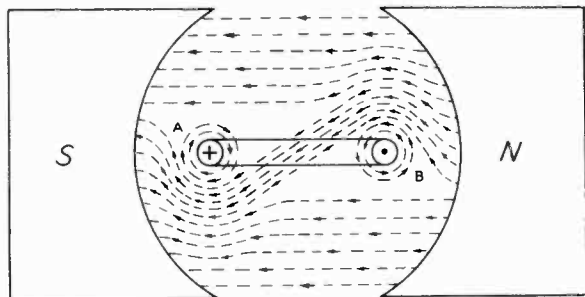


FIG. 4. A loop of wire with sides A and B has been substituted here for the single wire of Fig. 3. As the current is going down into the paper in side A and up in side B, the resulting crowding of the magnetic lines below A and above B give a clockwise rotation to the loop.

Essentially, this is the story of the motor, although as you can probably appreciate, it is not the entire story. The principle which governs the motion of the coil AB in Fig. 4 does effectively explain the operation of motors in that it states that "a coil carrying current and located in a magnetic field would tend to orient itself in such manner that its lines of force would be parallel to those of the magnetic field" . . .

According to this law, the coil of Fig. 4 would, under the action of the combined magnetic fields, shift through an angle of 90 degrees to the position shown in Fig. 5, in which position there would be no further tendency for the coil to rotate, for it has attained the position established by the electrical law. . . . The coil no longer is subjected to a turning force. . . . As to the arrangement of the strong and weak magnetic fields around the conductor, the fact that the strong field is on the inside of the loop sides is due to the direction of the current flow through the coil and the direction of the magnetic field from the magnets. If

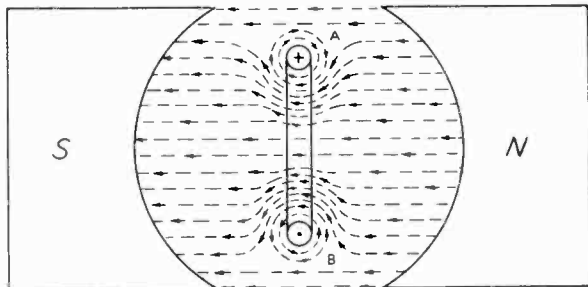


FIG. 5. Here the loop has rotated 90 degrees and now the turning force, shown in Fig. 4, is cancelled so that when the loop reaches this position, it remains stationary.

by chance the current flow through the coil was reversed, the coil would remain in the same position, but the location of the strong and weak fields would shift through 180 degrees around each side; the "bunched" lines now would be located on the outside of the coil sides and the weak field on the inside.

Naturally such a temporary shift in the position of the armature of the motor is of little value in practice. . . . What is needed is continuous rotation. This is accomplished by using an armature made up of a number of separate coils rather than a single loop as shown in Fig. 5 and also an arrangement whereby the exciting voltage responsible for the current flow through the armature coils is switched from one coil to the next as each coil swings from the active to the inactive position. All of this can be described as multi-coil armatures and the use of a commutator. The function of the commutator is to switch the armature exciting voltage from coil to coil.

A simple illustration of how continuous rotation is accomplished is shown in Figs. 6 and 7, wherein the armature consists of two separate coils and the exciting voltage is fed to the armature coils by means of the commutator and brushes. The four commutator

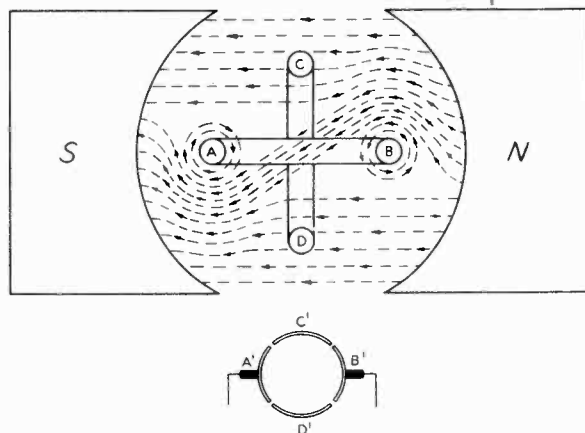


FIG. 6. Here two loops with sides AB and CD at 90 degrees, terminate in four commutator segments, shown below, with corresponding letters. Current flows through the loop A-B and the resulting interacting fields give the combination a clockwise rotation.

segments A', B', C', and D' are identified with the four coil sides A, B, C, and D. In Fig. 6, current is flowing through AB and the distribution of the magnetic field between the pole pieces is as shown in Fig. 4. In Fig. 7, we assume that coil AB has swung through 90 degrees into the position shown, which corresponds with that of Fig. 5, except that as a result of the rotation of the commutator segments which connect to the coil terminals, commutator segments A'B' have moved away from the two brushes, so that the current now is flowing through coil CD and the magnetic field now is

acting upon these sides. The result is that coil CD moves up into the position of AB and the latter again is in the active position and the motor armature con-

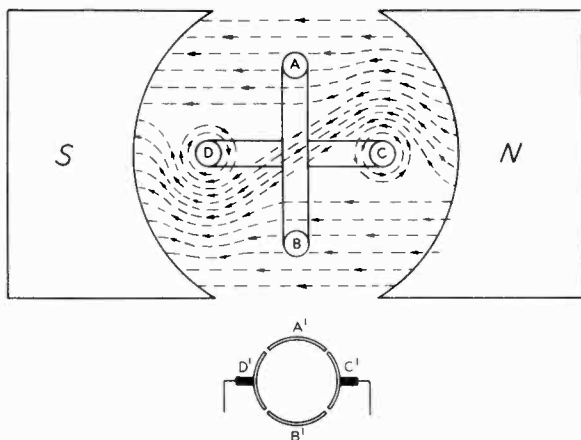


FIG. 7. The loops are here shown advanced 90 degrees from their position in Fig. 6. Current is now flowing through C-D and none is flowing through the other; therefore, C-D is now doing the work of rotating the combination.

tinues rotating. . . . In practice the armature consists of more than two windings, as does the commutator consist of more than four segments. In this way the jerky motion of a two-coil armature is overcome and the rotation is smooth.

Speed Control

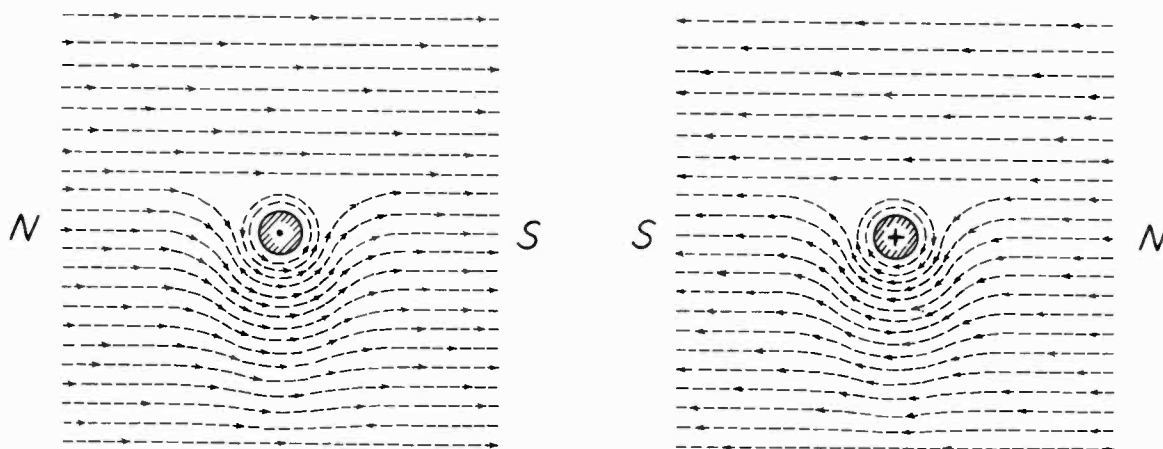
Let us now investigate some of the electrical characteristics of the simple motor shown in Figs. 6 and 7. The torque or turning force applied to the active coils in the armature depends upon the strength of the combined fields, hence an increase in the strength of these fields will tend to make the loop move faster, in other

words will increase the speed of rotation of the armature. Conversely any decrease in the strength of these combined fields will have the opposite effect: the motor speed will decrease. Hence we see that the speed of rotation of the motor is a function of those conditions which determine the strength of the combined fields. . . .

Since the current through the armature coils is one of the contributors to the combined field, the magnitude of the armature current is a controlling agency, increasing the motor speed as the current increases and decreasing the motor speed as the current decreases. The magnetic field due to the magnets also is a controlling agency. Any decrease in this field strength will slow down the motor speed and an increase in the field strength will increase the motor speed. With permanent magnets used for the production of the field, the field would be fixed in strength, but there is no need for permanent magnets. Instead of permanent magnets, electromagnets can be used,—in fact are used in commercial units—in which case the current through the field windings becomes a controlling agency. The greater the strength of the field current, the greater the speed of the motor and the less the strength of the field current, the slower the speed of the motor. . . . Thus two basic forms of motor speed control exist for such d-c motors, namely either or both the armature and field currents.

Direction of Rotation

Let us now look into the direction of rotation of the revolving armature. As you witnessed in Figs. 4 and 7, the direction of rotation is a function of the relative directions of the armature current and the direction of the current through the field winding. For any one motor, this is determined in the design as identified by positive and negative markings upon the input exciting



FIGS. 8A, left, and 8B. In Fig. 8A the current is flowing up out of the paper and in the opposite direction in Fig. 8B. Note that in each case the interacting fields force the wire upwards, which is because the polarity of the magnet has also been reversed as well as the direction of current flow.

voltage terminals of the motor. If we were to reverse the direction of motion of the coil sides in Fig. 6, it would be necessary to shift the bunched lines of the combined fields from the under side of loop side A to the upper side and from the upper side of loop side B to the underside.

This can be done in two ways, both of which entail a change in the direction of *one* of the two magnetic fields which make up the combined field. We can change either the direction of the current through the armature or the direction of the current through the field, *but not both*. If both are changed, the direction of rotation remains the same. This is shown in simple form in Fig. 8 A and B, which shows the magnetic lines of force around one side of the active turn of the armature winding, for the field and the current flow in one direction and then both field and current flow reversed. Note that the force exerted is upwards in both cases, which means that it would be downwards in both cases upon the other loop side of the same coil. . . . It is this which makes possible the design of a d-c motor which is suitable for use upon a-c power supply lines, in other words the universal motor.

Speed and Torque Characteristics

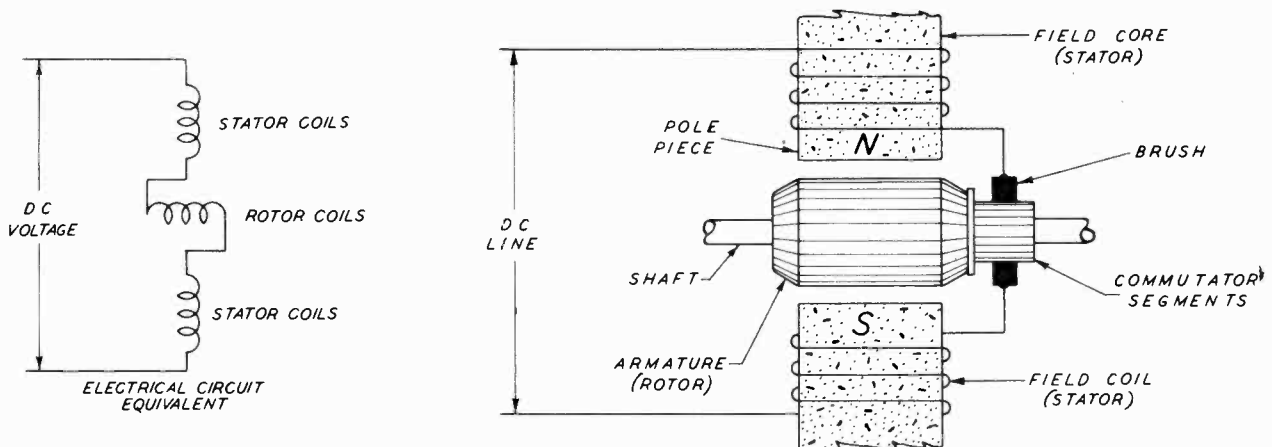
One of the major operating characteristics of motors in general is their behavior relative to the speed and turning power or torque. From what has been said you can gather that the speed of a motor may vary as a result of what conditions are created by changes in line voltage, as for example changes in either field or armature current due to changes in the exciting voltage applied to either or both of these parts of the motor. If the speed varies what happens to the torque developed by the motor?

These considerations introduce certain special conditions in motors of the kind being discussed. First they involve a basic electrical law which has not been mentioned as yet and which is associated with the armature, and second, they introduce certain relationships between the armature and field arrangements. Let's take the first item, the reaction of the armature.

We know that the flow of current in the armature winding is responsible for the fact that the motor armature turns. Also that the greater the current in this armature, the greater the speed of rotation. If nothing but this one condition controlled the speed of a motor, it would be pretty much impossible to attain any semblance of constancy of speed or a variation in torque required to meet different conditions. However, there is another condition which exists in a motor: it is the reaction of the armature in motion upon itself.

When the armature is revolving in the magnetic field, it represents a series of conductors cutting a magnetic field. As is well known, one of the basic electrical laws states that when a conductor cuts a magnetic field, a voltage is induced in the conductor. This happens in the motor armature, so that during operation we have two voltages acting upon the armature: the impressed voltage from the power line and the back emf or counter electromotive force developed by the motion of the conductor in the magnetic field. It is the difference between these two voltages, or the effective emf, which is responsible for the amount of current which actually flows through the armature during operation.

At the instant before the armature starts turning, the back emf is zero, so that a very high value of current flows through the armature. This develops a very high torque, for the combined magnetic field acting upon the armature is very strong and this explains the very high starting current of motors. . . . As the



FIGS. 9, left, and 10. The simple series d-c motor is illustrated schematically in Fig. 9 and diagrammatically in Fig. 10. Note that the field coils and the one in the armature, connected by means of the commutator and brushes, are in series with the source of voltage, the d-c line.

motor starts turning, back emf is developed in the armature and at every instant, the amount of current being forced through the resistance of the armature is the difference between the impressed voltage and the back emf, until at normal running speed the actual effective voltage responsible for the armature current may be but a few volts even though the impressed voltage is more than 100 volts.

Because of this condition it is proper to say that the speed of a motor is largely controlled by the back emf rather than the impressed voltage because the back emf is a function of the load. The greater the load, the slower the speed of the motor and the less the back emf, hence the greater the amount of current caused to flow through the armature and required to develop sufficient torque to overcome the drag of the load. As the motor picks up speed, having overcome the initial drag of the load, the required torque decreases, for as the motor speeds up, the back emf increases and the effective voltage decreases with consequent reduction in the current through the armature.

The manner in which this relationship, that is, torque and load, is established in a motor depends upon the way in which the currents in the field and armature circuits are controlled. This gives rise to three basic types of d-c motors differentiated in the form of the connections between the field and armature circuits. However only one of these is of interest in this limited discussion.

The Series D-C Motor

The simplest of the d-c motors is that identified as the series type. By "series" is meant that the armature and field windings are connected in series, as shown in Figs. 9 and 10. As is evident the current is the same throughout all the windings. It should, of course, be understood that while the rotor is shown as a single winding, and it would appear as if the current flows through all of the windings at the same time, actually the current is fed only to one coil at a time.

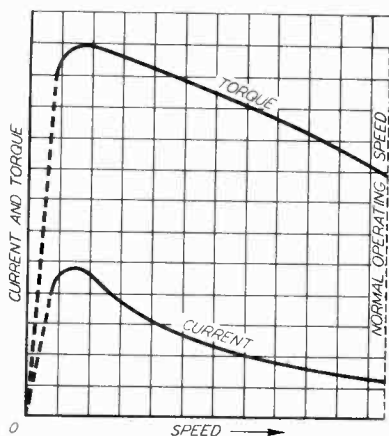


FIG. 11. These curves show that as the series motor gains in speed, its torque and current, high at the start, decrease gradually as explained in the accompanying text.

That coil, which by virtue of its position between the pole pieces, is the active winding, as illustrated in simple form in Figs. 6 and 7. Since the armature and field windings are connected in series, any change in current causes a change in intensity of both magnetic fields; consequently, a definite change in the speed of the rotor.

When such a motor is used in a record-changer mechanism, it has to start up under full load, that of the drag of the turntable, the record, the various driving mechanisms, as well as the pick-up, the latter being the least of them all for as a rule pick-up devices are extremely light in weight. When the motor is switched "on" to the power supply, the full line voltage is therefore applied to the windings. Consequently, there is a momentary "rush" of current which is several times greater than the current existing at normal operating speed. The reason for this was explained previously in connection with the discussion of counter emf. The amount of current which will flow during the instant of starting is limited only by the total resistance of the rotor or armature and field windings. Thus, both magnetic fields are at very high intensity; and since the torque or turning force is directly proportional to the reaction between the two magnetic fields, which is very high at the start, the motor is capable of starting easily with a full load. This happens to be one of the salient characteristics of the series type of motor. The relationship between the current and the torque for such a series motor is shown in Fig. 11

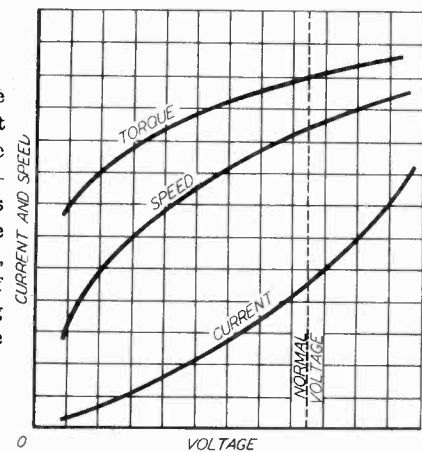


FIG. 12. These curves show that the value of the d-c voltage impressed on a series motor affects the torque, current, and speed, all of these increasing with an increase in voltage.

The decrease in torque concurrently with the decrease in current was explained previously in connection with the development of the counter emf and the fact that as the initial drag of the load is overcome, the required torque decreases and the motor speed increases. As the motor speed increases, the counter emf likewise increases and the effective voltage across the armature decreases; hence the current through the armature likewise decreases.

In Fig. 12 it is seen that the voltage impressed does have a definite effect upon the characteristics of the series type d-c motor. This means that line voltage as well as load will cause a change in speed. If the line voltage rises above the average normal value, the speed is increased correspondingly; if it is decreased, the speed is reduced.

Since turntables used in record changers, phonographs, and recording devices must revolve at certain speeds, generally $33\frac{1}{3}$ or 78 rpm, a governor or speed regulator assembly (discussed in detail elsewhere in this book) is provided with the motor assembly as well as speed reduction mechanisms whereby the high-speed armature is geared down to provide the proper number of revolutions of the turntable.

In view of the high instantaneous current flow when a series type motor starts under load, it is customary to provide a current control series resistance. The purpose of this resistance is to reduce the magnitude of current flowing in the system at the instant of starting and thus avoid possible damage to the windings. In practically all motors of the variety suitable for use in record changers and other devices which employ fractional horsepower units, this series resistance is omitted because of the comparatively high resistance of the motor itself. This system does not apply without qualifications to the universal type of motor which will be discussed later, after the a-c types of motors have been introduced.

A-C MOTORS

ALTHOUGH we started this chapter with a discussion of the direct-current motor, it does not mean that those motors are the most popular; in fact just the reverse is true. The alternating-current motor is by far the most commonplace. It seems safe to say that fully 95 percent of all rotating machinery operated in the United States employs alternating current types of motors as the driving power. The reasons for this are simple and numerous. To mention just a few; it is far more economical to transmit electrical energy as alternating current rather than as direct current; also motors intended for a-c operation are much simpler to build, operate, and maintain than direct-current equipment.

In the field of automatic record changers and recorders, the same thing is true. In fact most of this equipment is intended for a-c operation and even when provision is made for d-c operation it is by means of a "universal" motor which is suitable for both a-c and d-c use. As far as d-c application is concerned, the basic series type d-c motor is the basis of the universal motor and it will be dealt with later. At the moment we wish to delve into those fractional horsepower motors which are intended for a-c operation.

You will recall that we mentioned earlier in this chapter the fact that comparatively few defects found in motors come within the province of the radio serviceman, although some few defects are within his scope. In the case of a-c motors this is even more true, for there are still fewer things in such motors which can go wrong. Nevertheless, a general understanding of the operation of a few types of a-c motors will do no harm.

Among the a-c motors which are used in recorders and record changers the most popular is the "induction" motor, hence that kind will be discussed first. As the name implies, the operation of the motor is based upon electromagnetic induction of electric current into one part of the system. As in the case of the d-c motor the turning force or torque is the result of the interaction between two magnetic fields. Such is true in the a-c motor too, but whereas in the d-c motor, a current-carrying conductor revolves within a magnetic field, which also is created by the flow of current through a conductor, in the induction type of a-c motor, the field is produced by the flow of current, but the rotor or armature has no electrical connection with the remainder of the system.

The rotor revolves as the consequence of electric current which is electromagnetically induced within the conducting surfaces of the rotor. We refrain from speaking about coils or windings of the rotor, because in the design of the small induction-motor rotor, which is the equivalent of the d-c armature, there are no coils, as we normally understand the term. About the best comparison between the electrical conditions existing in an induction motor and some other electrical device is an ordinary transformer with a multi-turn primary and a single turn secondary. The primary winding of the transformer is the equivalent of the field winding in the motor and the one turn secondary is the equivalent of the rotor.

To appreciate the manner in which this type of motor operates, it is necessary to go back to one of the early discoveries in the realm of electricity. No doubt you recall that a compass needle placed near a conductor carrying current will orient itself in a definite manner, depending upon the direction of the current flow through the conductor. Reversing the direction of the current through the conductor will reverse the orientation of the needle; or shifting the needle from below the current-carrying wire to a position above the current-carrying wire will also change the direction of the needle. In other words the magnetic field surrounding the wire which carries the current will react upon the magnetic needle and if the current through this wire were reversed at a definite rate and slowly enough, the needle will oscillate back and forth upon its suspension. This illustrates the fact that a changing field can cause motion in a neighboring element which also has a magnetic field.

But a more direct discovery which is related to the induction motor, is that wherein it was found that if a magnet were supported beneath a copper disc and this magnet was revolved, the copper disc also would revolve in the same direction as the revolving field (See Fig. 13). . . . The copper disc would not revolve as rapidly as the magnet, but once a uniform rate of rotation had been set up for the magnet, the copper disc would also move at a uniform rate, although somewhat more slowly than the magnet.

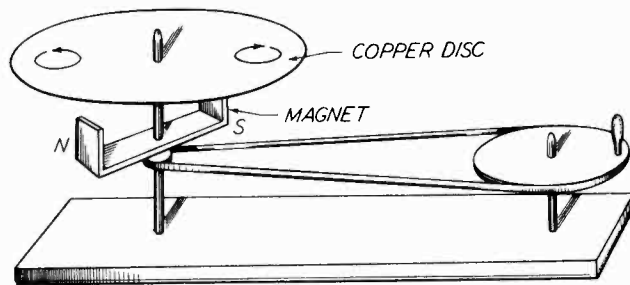


FIG. 13. Because of the setting up of eddy currents in the copper disc by the revolving magnet and the resulting interaction of the magnet's field with that set up by the eddy currents, the disc will also rotate but more slowly than the magnet.

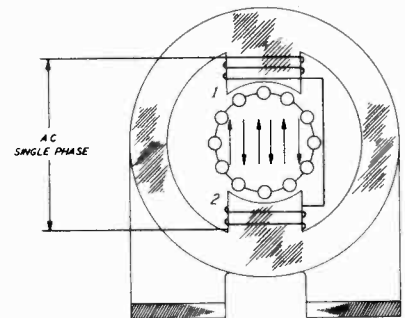
Obviously, since copper is a non-magnetic substance, the principle of operation could not be the same as that of the magnet needle and the current-carrying wire. After due deliberation it was established that the reason behind the movement of the copper disc was that the original movement of the magnet under the surface of the originally stationary conductor (copper disc) was the equivalent of moving magnetic lines of force cutting a conductor. As a result eddy currents were induced in the conductor. Since current flow existed in the conductor, magnetic lines of force were created. The reaction between these two sets of flux lines was such as to tend to stop the magnet from revolving, for it is a basic law of electricity that if a changing flux links with a circuit and induces current in that circuit, the direction of that current flow and the consequent direction of the resultant magnetic field, is such as to oppose the change in the inducing flux. Since the force of the revolving magnet was stronger than that of the retarding action, a force was exerted upon the disc which tended to make it follow the revolving magnet. Since the disc was mounted upon a spindle which permitted it to turn, it followed the direction of the motion of the revolving field of the magnet. . . . It could never catch up to the magnet in speed, for if it did, there would be no cutting of flux lines by the conductor. It would be just as if the disc and magnet were moved simultaneously, in which case no voltage would be induced in the conductor, hence no current and no re-

sultant magnetic field and no interaction of the two fields to produce the turning force or torque.

The above is essentially the basis of operation of the induction motor. Expressed differently, it is that a revolving electromagnetic field is set up in the induction motor. This field surrounds the rotor and induces electric currents in it. A magnetic field is created by the current flow through the rotor and this field reacts with the revolving field; the result is a torque applied to the rotor and the rotor turns after the revolving field and will continue turning as long as the inducing field continues revolving. As in the case of the revolving magnet and disc, the motor rotor speed can never equal the speed of the revolving field, for then there would be no cutting of flux lines by the rotor. The difference in speed between the revolving field and the revolving rotor is known as the "slip" and in small motors may be as high as 40 percent. As you can readily appreciate, many factors can contribute to the "lag" between the revolving field and the revolving rotor, such as the friction of the rotor bearings, the load upon the motor, etc. . . .

Now, the problem of producing such a revolving field is interesting. It is easy to see that the use of revolving permanent magnets of even the most modern design, or even electromagnets instead of permanent magnets, would not be the most convenient method, for it would require a direct-current source to excite the electromagnets, the use of contact brushes and connections to the revolving circuits, a separate means of revolving the magnets, etc. The use of alternating current, however, does afford the means of attaining the desired condition, although certain conditions and arrangements must be set up.

FIG. 14. With single-phase alternating current creating two magnetic poles even though a changing field is set up, there will be no rotating field and so the rotor will not turn.



For example, the use of two magnetic poles, like those shown in Fig. 14, with a rotor located between the pole pieces, would not be satisfactory, for while it is true that a changing field would exist between the two pole pieces and each pole would alternately be North and South, the arrangement would still be shy the rotating field. True that voltages would be induced in the conductors of the rotor due to the varying flux, but no rotating force would be applied to the conductors.

Incidentally, the type of rotor used in induction motors is like that shown in Fig. 15, wherein the conductors are a series of copper bars, or even castings of a light metal, attached to two end rings which short circuit the bars, forming one conducting member. This is known as a "squirrel cage" rotor. Various manufacturers use modified designs, as for example the entire rotor assembly with the exception of the shaft, is a casting.

Referring again to Fig. 14, that arrangement while not self starting, would still function as an induction motor, if the rotor is given an initial spin each time the motor is to be started. Once started, it will continue turning. While we will not show the exact things mentioned, since such arrangement is not used commercially, we can say that the rotor continues revolving, once it has been started, because it develops its

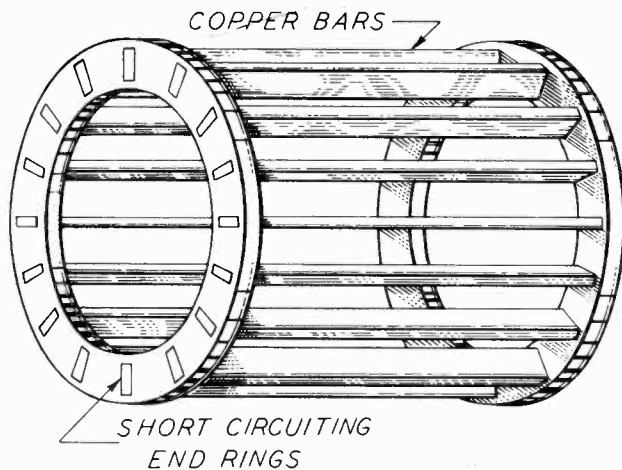


FIG. 15. The squirrel-cage rotor is a series of copper bars held in position by end rings that short-circuit the bars.

own magnetic field, which field is at right angles to that due to the excitation of the field magnets by the current from the power line. Just what is meant by these two fields being at right angles will become evident a little later; in the meantime, let it be known that as the rotor is caused to revolve by some external means, the conductors are cutting the lines of the field. This results in induced currents flowing in the rotor conductors. Since this rotor is entirely inductive, these currents lag behind the induced voltage by 90 degrees, hence the magnetic field created by these induced currents also lags the inducing field by 90 degrees. Thus two fields at right angles to each other exist in the mechanism. As the result of the change in polarity and direction of flux lines of the inducing field, the polarity of the induced field also changes, with the result that the reaction between these two fields causes the rotor to continue turning.

The simplest method, which however is not used in record changers and recorder motors because the

kind of electric power needed—two-phase supply—is not available, is the use of two-phase supply. We show this arrangement in order to illustrate the development of the rotating field. Later you will see how virtually the same thing is accomplished in commercial units by one or more ingenious arrangements which permit the application of conventional single-phase a-c supply.

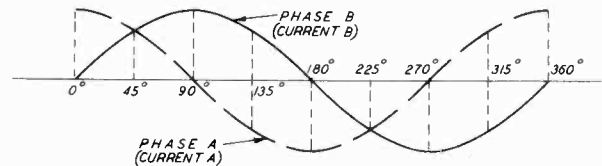
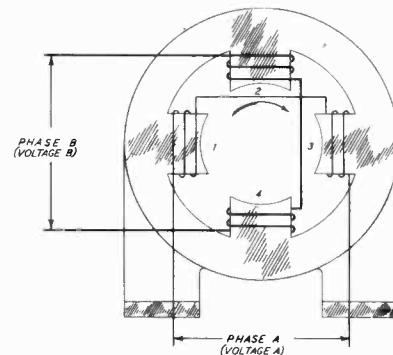


FIG. 16. Voltage waves of two-phase alternating current wherein phase A leads phase B by 90 degrees.

In the example we shall show and in commercial units, one thing remains the same, namely the use of four-pole field magnets. These are electromagnets which are excited by current from the power lines. At the moment we shall assume the use of two-phase supply, which is nothing more than two a-c lines of like voltage, but wherein the two voltages are 90 degrees apart, as for example as illustrated in Fig. 16. One supply is identified as phase A and the other as phase B. The reference to "current" can just as readily be interpreted as "voltage." The arrangement of the field magnets is shown in Fig. 17. Between the pole pieces you can assume the existence of a squirrel cage rotor such as shown in Fig. 15. A commercial example of such rotor as used in a conventional automatic record changer motor is shown in Fig. 18.

The poles of the field magnet are numbered from 1 to 4 in a clockwise direction and they are arranged in pairs of 1 and 3 and 2 and 4. Phase A current windings are around poles 1 and 3 and phase B current windings are around coils 2 and 4. When such an arrangement is connected to a two-phase power supply, there will be times when all coils are carrying current of varying magnitude, depending upon the phase relationships and other times when only one pair of coils

FIG. 17. Two of the field windings, 1 and 3, are connected in series with phase A and the other two are connected in series with phase B, these being the components of the alternating voltage of Fig. 16.



will be carrying current, this too depending upon the phase condition. Just what we mean can be seen in Fig. 19, by referring to the curves of the two currents.

For example at the start of the cycle—and this point is arbitrarily selected—the current in phase A is maximum whereas in phase B it is zero. After a 45-degree time lapse, the current in both phases is the same, except that one is increasing whereas the other is decreasing, although both are still positive. After a time interval of 90 degrees, or one-quarter cycle, the current in phase A is zero, whereas that in phase B is maximum. In like manner you can trace through and note the change in both magnitude as well as direction of the currents in both phases during a complete cycle. . . . Starting at any point other than as shown, makes no difference for the conditions shown still prevail.

Now, when these currents are applied to the field windings, the poles will become energized in accordance with the magnitude and direction of the currents shown in the wave curves. In the various illustrations of the flux lines existing between the poles of the field magnet, it is essential to understand one important condition. In those illustrations which indicate quarter-cycle changes, that is when only one pair of poles are being energized, as for example at 0 degrees, 90 degrees, 180 degrees, 270 degrees, and 360 degrees, the horizontal or vertical lines indicate the flux between the two poles, but in the other illustrations, the curved lines representative of flux between adjacent poles indicate the resultant flux due to the combined fluxes, for all poles are being excited as you can see by the examination of the current curves at the 45-degree, 135-degree, 225-degree and 315-degree positions. You may imagine in the lower four illustrations of the field magnets that some change has taken place in the mode of connecting the coils around the pole pieces. Such has not taken place. The connection of these windings is exactly the same for all cases, but as was stated, the direction and location of the flux lines is the result of the combination of the flux lines between the two pairs of magnets.

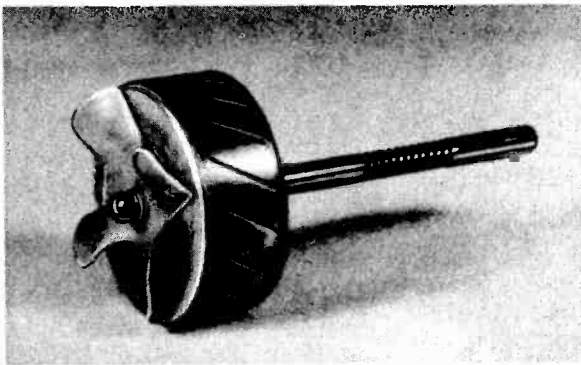


FIG. 18. A commercial type of rotor such as is used with an a-c motor employed in a record changer.

For proper understanding of the rotation of this field, you must realize that the polarity of any pole is dependent upon the direction of the current through the coil surrounding the pole piece. Thus pole 1 in the first illustration of the field magnets and pole 3 in the same illustration remain N and S respectively as long as phase A current is in the *positive* direction, that is, above the zero reference line of the current curves. When phase A changes, i.e., is in the negative direction, pole 1 becomes S and pole 3 becomes N.

In the same manner, when phase B is in the positive direction pole 2 is N and pole 4 is S, but when phase B is in the negative direction, pole 2 is S and pole 4 is N. Because of these conditions, when current is flowing through all the coils, the flux lines are caused to exist between those poles which are unlike in polarity but nearest to each other. The combination of these various fields gives rise to a resultant field which tends to move the rotor in the direction of the solid line arrow. If you wish you can assume a definite relationship between say the N pole of the very first illustration of the field magnets of Fig. 19 and the rotor and imagine that whatever the reaction between this N pole and the rotor, it exists as the N pole of the field magnet systems swings around through 360 degrees.

What was just said is a perfectly logical method of visualizing the action taking place. Since the speed of rotation of the field is uniform, being determined by the frequency of the supply line, and we assume that the rotor also revolves at a uniform rate, (always less than that of the rotating field), it is possible to select some point on the rotor and view that point as always being a certain distance behind the rotating field, or for example the rotating N pole of the field magnet system. Of course you must remember that when we say "rotating N pole," we do not mean that the magnet itself revolves, physically speaking. . . . We simply mean that the position of what is the N pole of the magnetic system revolves.

The basis of movement of the rotor within such a field has been described in connection with the disc and the magnet. The rotating field cuts the conductors of the rotor and induces current in them. A magnetic field then is created around the rotor conductors. This induced field reacts with the revolving field and causes the rotor to follow the revolving field.

You will recall that such two-phase supply is not available in those places where automatic record changers and recorders are used, yet such induction motors are employed. It is therefore of interest to learn how such a rotating field can be simulated with single-phase supply and still obviate the necessity of giving the rotor that initial spin to start it moving.

There are various ways in which this is accomplished. The most frequent are "shaded poles" and "phase splitting." Just what these terms mean will

become evident as we progress through the discussion. In all of these, as was stated earlier, the field magnet system consists of four poles.

Shaded Pole Type

The use of the shaded-pole magnet makes possible self starting of the induction motor with single-phase power supply and is representative of the majority of the a-c motors used in record changers.

The general construction of this type of motor is nearly the same as that of the two-phase variety, for certain definite requirements exist and these must be fulfilled. Thus the motor employs a four-pole magnet and it is still necessary to energize or excite the pole pieces; hence the field winding is required, except that in this case a number of different arrangements are used. In the most economically constructed units, a single winding is employed, which is so arranged that it weaves in and out or rather above and below each of the poles as shown in Fig. 20.

In more expensive units, four coils are used, each surrounding a pole piece and these are interconnected in such a manner as to produce the proper polarity at the various poles. This is shown in Fig. 21, which illustration also shows the four shaded poles.

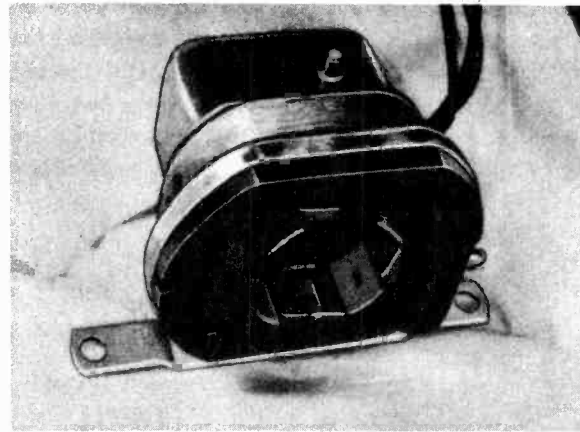


FIG. 20. A commercial shaded-pole motor wherein a single field winding is used that weaves above and below the pole pieces.

By shaded poles is meant an arrangement in the structure of the poles whereby a short circuiting coil is placed around one portion of the pole piece. You can see in Fig. 21, that a portion of each pole is divided into two unequal parts by means of a slot. A solid copper ring is placed around the smaller part of the pole piece, thus creating two separate active areas at each pole.

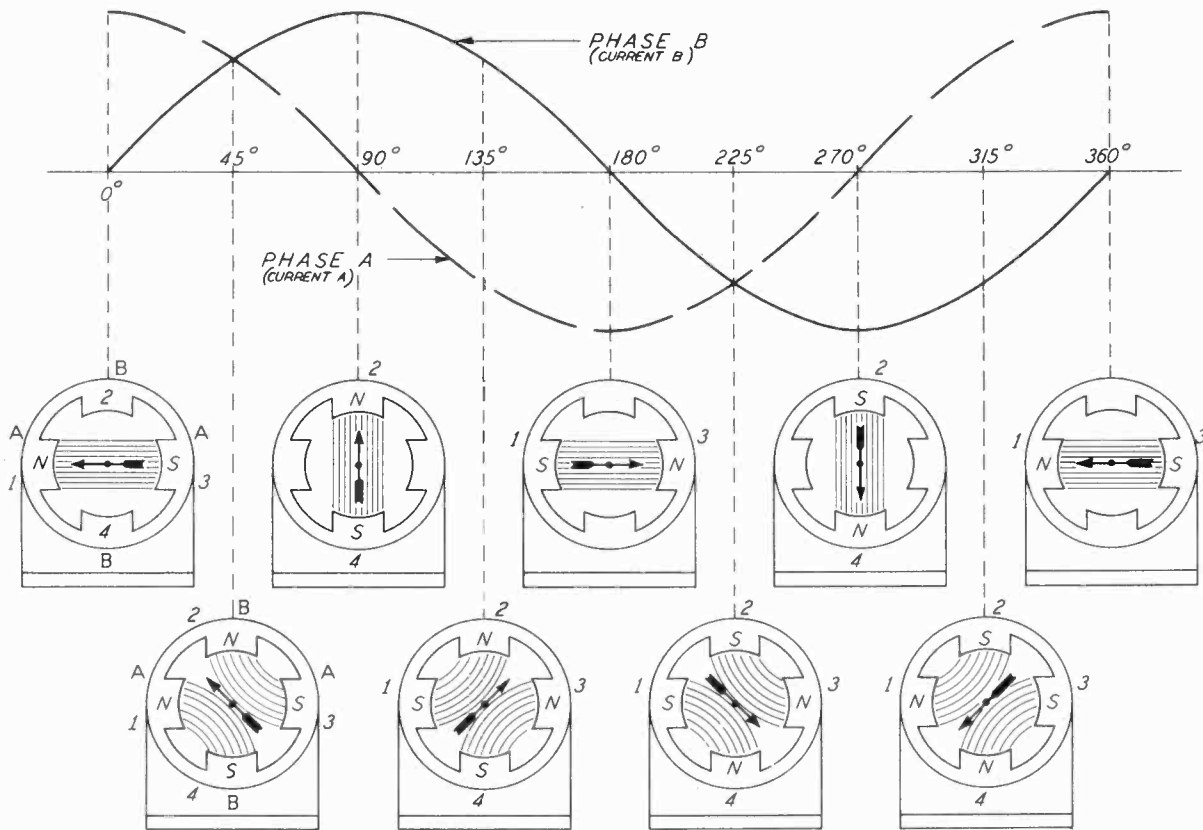


FIG. 19. When two-phase alternating voltage is impressed across the two sets of field windings of a motor, such as shown in Fig. 17, the field set up by these electromagnets will rotate as shown, with the different conditions indicated for each 45 degrees of the complete cycle.

Under normal conditions when a magnetic pole is starting to develop flux, it will tend to spread out uniformly over the entire cross section area of the pole. As this takes place, it represents a varying flux, hence a voltage will be induced in the single-turn copper loop, that is, the "shading coil." This naturally in-

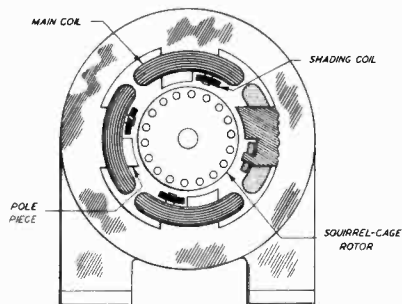


FIG. 21. The pole pieces of a shaded-pole motor are divided, the main winding being around the entire pole and a single-turn copper loop around the smaller portion.

duces a flow of current in the coil, which in turn sets up its own magnetic field. The net result is that the field emanating from any one pole is not uniform in density or in the rate of change, for that which is due to the shaded pole lags behind that due to the regular pole, as shown in Fig. 22. The lag in time between the unshaded pole and the shaded pole does not appear upon this illustration, but the variation in density is evident. You can readily see that the unshaded portion of the pole develops the field first for there is nothing to hinder the growth of the field. Likewise it is the part wherein the field decays first as the current flow through the coil is decreasing.

But not so in the shaded portion. Here, current is induced in the shading coil during the original rise of the field as well as during the decay. Thus there appears a condition of a shift in the position of maximum flux density from the unshaded pole to the shaded pole and this is best illustrated in Fig. 23. The original plane of maximum flux density is as shown by the solid line A as being between one pair of N and S poles. After the current in the coils has started to decrease and the field to decay, the field in the shaded pole is first starting to increase, so that there has taken place a shift in the field to the new plane designated

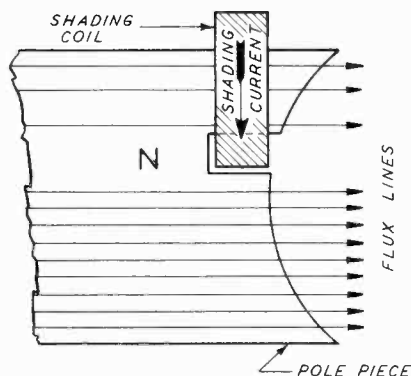
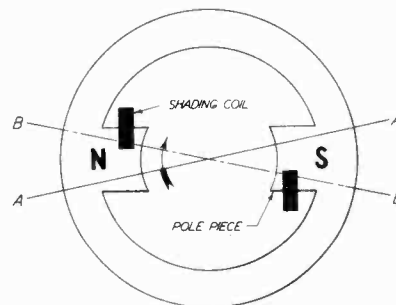


FIG. 22. The density of the field from the unshaded portion of a pole is greater than that part of the field from the shaded portion and the latter field lags behind the former, as explained in the text.

by the dashed line B. . . . This is the equivalent of a "traveling" or "rotating" field, at least sufficiently so, when it takes place across all four poles, to start the motor turning. Once the rotor is turning it will keep on rotating as long as power is applied to the field windings. As to the direction of rotation, it is towards the shaded pole.

If you compare Fig. 23 with Fig. 19, you will see the similarity between the rotation of the original N pole in the magnetic field in the two-phase motor and the movement of the field in Fig. 23. True that the action of the shaded pole is really only a shift of the

FIG. 23. The line A-A indicates the plane of maximum field density between one pair of poles. When the lagging field, of the shaded portion of the poles, has reached its greatest density, the plane of the resultant field is at B-B.



field, only about 45 degrees, as against the 90 degrees in the two-phase motor, but it is sufficient, for all that is needed is the starting torque, which it supplies very satisfactorily.

Split Phase Methods

We have seen in the various examples given so far that a basic requirement of self starting induction motors is the presence of two separate magnetic fields which are out of phase and which rotate in the space within the field magnets.

In the various examples given the field magnets were comprised of four poles, all of which were used in connection with the operation of the motor. There is, however, another arrangement, one which is quite popular, wherein a single-phase supply is used, but this phase is split. By splitting the phase we mean that two channels are provided for the current obtained from the supply and a phase difference is created between the currents in the two branches. One of these circuit branches is affiliated with two of the four poles and forms what is known as the "starting" field and the other branch is associated with the remaining two poles of the field magnet assembly and forms what is known as the "running" field . . . You no doubt will recall that two poles are sufficient to keep the motor running, once it has been started.

One of the two most convenient methods of splitting the phase of the power-supply current is the use of capacity and inductance in one leg of the circuit as

against the presence of substantially pure inductance in the other. The other is the use of different values of inductance in the "starting" and "running" winding systems.

Capacity-Start Motor

The schematic arrangement of the capacity system is shown in Fig. 24. As you can see the capacity is inserted into the starting circuit, shown in thin lines, whereas the normal circuit arrangement is used for the running windings, shown in heavy lines. In order to keep the value of the capacity low and still create the greatest phase difference between the starting and running fields, the running winding is generally wound with about twice as many turns as are used for the starting winding. The average value of capacity used in this type of starting system employed to drive record changers, is between 1.0 and 1.5 mf. In larger motors, larger values of capacity are used. The general design of the starting winding in record-changer motors is to provide for continuous operation of this winding as well as the running winding. We make this reference so as to correct any misconceptions which may arise because of the nature of identification of the two windings and the previous statement that the motor can run upon just one winding, once it has been started. Also, because under certain conditions in the case of large sized motors, provision is often made to disconnect the starting winding automatically once the motor is running. Such automatic systems are seldom used in the fractional horse-power motors utilized in devices of the kind described in this book.

As to the manner of producing the rotating field by such phase splitting, you can understand in accordance with basic electrical theory that current through a condenser leads the voltage and current through an inductance lags the voltage. Thus when current from a circuit is caused to flow through two paths, one of which contains substantially inductance only, and the other path contains inductance as well as capacity, with the former at a minimum, a definite phase difference will be created between the currents in the two paths. The final phase of the current in the capacity-inductance branch with respect to the current in the inductance branch is, of course, determined by the relative values of capacity and inductance in that branch. By making the capacity effect preponderant, the current in that branch is caused to lead the current in the inductance branch. In other words, the starting current leads the running current, so that the basic condition of a phase difference between the two currents which create the magnetic fields at the four poles, is caused to exist and the conditions resemble those which are obtained with the two-phase supply.

The circuitual arrangements of the windings and the capacity are shown in Fig. 24, as well as an approximation of the phase difference between the two circuits. This wave diagram shows a phase difference of about 60 degrees which is not intended to portray specific constants for any one motor.

As to pertinent facts relating to the starting condenser, too small a value interferes with proper starting while too large a value impairs the running performance. As it happens, motors of the type which we have in mind afford sufficient leeway in the selection of the capacity

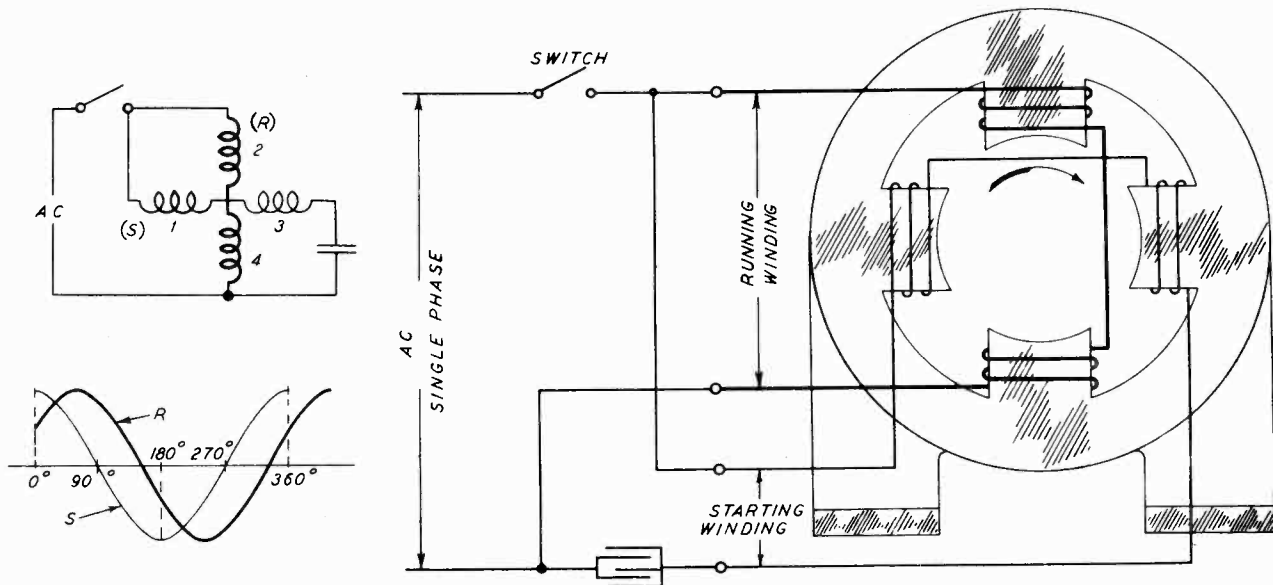


FIG. 24. By inserting a capacity in the starting winding of a single-phase induction motor, a phase difference is created wherein the current S, in the starting winding, leads that in the running winding, see R in wave diagram at left. Compare with Fig. 19.

value so that an ample tolerance is permitted. As a rule, capacity values between 1.0 and 1.5 mf, as stated before, represent a fair range from which to choose for replacement. Of course, the final basis for selection of the capacitor is identification of the value used in the original motor. This also applies to the voltage rating of the condenser, bearing in mind that the voltage rating should be at least twice the line voltage.

Inasmuch as these small fractional horse-power motor systems do not cut out the starting coils when the motor is running, it is imperative that the current flow in the starting winding, that is through the condenser, be kept within safe limits. General limits are about 0.65 to 0.8 ampere per microfarad during running, although the initial starting current will be greater.

At the same time it is necessary to appreciate that the capacity and inductance in the starting system are connected in series and voltage far in excess of the line voltage may be built up in the system, for the voltage across the inductive as well as the capacitive elements is a function of the reactance of the element and the current through it. The possibility of damage to the condenser due to excessive current load is something which deserves consideration during service operations. Referring again to the size of the condenser, a satisfactory description of its selection is that whereby the motor when running at normal speed does not stall during a temporary overload and whereby the motor speed will rise quickly to normal.

Inductive Method

Perhaps this is not the most perfect caption to describe the split-phase motor which operates upon the basis of a difference in value of inductance in the two current branches, but it will suffice since it does describe the basis of the system and we already have identified the general classification as well as the capacity type.

In the split-phase motor which depends for the production of the rotating field by the use of two difference values of inductance for the field windings, the required phase difference is established by using one value of inductance for the "running" winding and another value of inductance for the "starting" winding. Now, since the general condition of "lag" between current and voltage holds in the case of all inductances, the simplest method of creating a phase difference between currents in two branches of a supply is by a difference in the value of inductance present in each branch. When this is done, that branch wherein the inductance is less, will in effect "lead" the current in the other branch, because, the phase difference in two such branches is relative to each other.

By making the inductance of the "starting" winding less than that of the "running" winding, the field between the pole pieces and due to the current flow in the starting winding, will be displaced ahead of the field due to the current in the running windings. The net result will be a rotating field, equivalent in its effect, although not in its efficiency of operation, to the two-phase system.

A general idea of the schematic connection of such a split-phase system is shown in Fig. 25, with the running coils shown in heavy lines and the starting windings in light lines. The wave diagram illustrates in an arbitrary manner, the "lead" of the starting coil currents, hence the "lead" of the starting coil flux with respect to the running coil currents and the flux.

The double-pole switch shown in the schematic illustration, provides the means of disconnecting the starting windings after the motor has started turning. In the larger motors this action is accomplished by an automatic centrifugal switch.

In both cases, that is, the capacity-starting type and the difference-inductance type, if we may call the latter by that name, the speed of the rotating field is due to the frequency of the line supply, just as in the case of the two-phase system, but the rotor speed is less, as established by the "slip."

Referring again to the starting windings in such motors, practically all small installations of the kind being mentioned in this text provide for continuous operation of this winding. By suitable design, the current-carrying capacity of the starting winding is ample to permit their presence in the circuit without overheating.

Capacitor Synchronous Motor

Perhaps it might be better to classify this type of motor as used in record changers as operating upon the principle of magnetic hysteresis. The reference to capacity in the caption identifies that the supply current is split into two paths as in the capacity start induction motor. The reference to synchronous indicates that the rotor speed corresponds to the speed of the rotating field.

Such motors employ a four-pole field magnet system with the field current split into two phases by the use of a capacity in one leg. The rotor is of somewhat different design than that used in the induction motor because of the basis of operation. Both the rotor and the field magnet assembly are shown in Fig. 26. As you can see the rotor consists of a series of laminated rings placed side by side and forming what would be a circular core of laminations of a magnetic material.

As in the case of all motors, the motion of the rotor is dependent upon the interaction between the magnetic field due to the rotor and the field due to the field magnets; but the development of the rotor field is

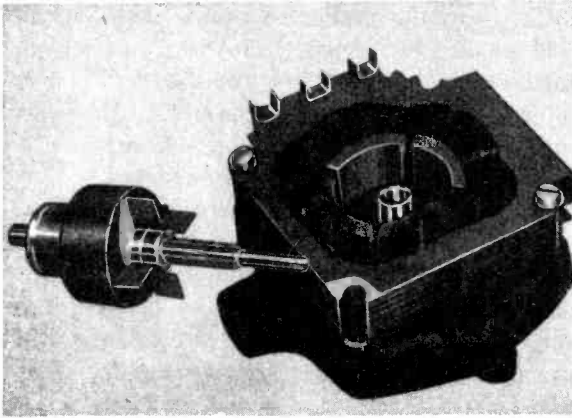


FIG. 26. A commercial capacitor synchronous motor in which the field current is split into two phases by the insertion of a condenser in one circuit. See Fig. 24. Note the laminated construction of the rotor.

somewhat different in this case than in the normal induction motor. In the hysteresis motor, magnetic poles are induced in the core by the flux lines emanating from the field magnets. Further, the magnetism induced in the rotor does not die out immediately when the inducing field reaches zero due to the decrease in current. Because of the magnetic lag present in magnetic materials, in other words, due to the hysteresis effect, the core retains some of the magnetic state after the inducing field has reached zero. Consequently, if an initial state of attraction between poles is created by the effect of the inducing field upon the rotor and then the polarity of the field changes, the polarity of

the rotor as a magnet is still what it was before the field polarity changed; hence a condition of repulsion action is created between the rotor poles and the field poles, so that the rotor continues revolving in the same direction.

As in the case of the induction motor, such a motor requires a revolving field in order to be self starting, hence the splitting of the phase, but it will operate with only two active poles, if the rotor is given an initial spin. This type of motor operates at synchronous speed under normal load. If, however, it is subjected to an overload so that the speed of rotation of the rotor is reduced, it operates as an induction motor. If the overload is reduced so that the rotor speed may again increase, it will increase in speed until it "locks in" with the speed of the rotating field, at which time it will again perform as a synchronous motor.

Since the speed of such a motor is greater than that required for the changer turntable, a reducing arrangement is used, which in its simplest form is a small rubber wheel acting as a friction drive for the turntable.

Eddy Current Motors

Hysteresis and eddy current motors are pretty much the same in general operating principles. Hence a brief description will suffice to explain the general action taking place.

Essentially a disc is located between excited electromagnetic pole pieces. Whatever is to be rotated is mechanically connected to this disc. By suitably arranging a rotating magnetic field, as for example by a split-phase method, poles of opposite polarity induce

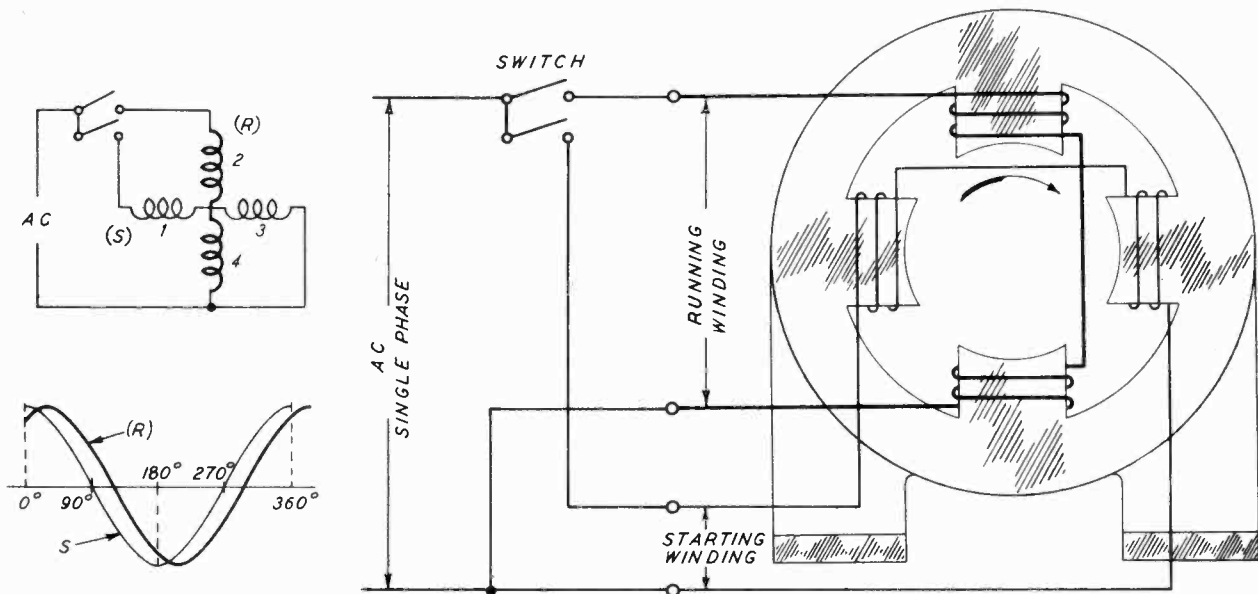


FIG. 25. In order to get a difference in phase, the inductance of the starting winding is made less than that of the running winding, and so the current in the former will lead that of the latter, resulting in a displacement of the two fields.

eddy currents in the disc. These eddy currents then set up their own magnetic field which reacts with the field of the pole pieces. Since the direction of these eddy currents and the resultant field is such as to tend to stop the rotation of the inducing field, a pull is developed between the inducing field and the field due to the eddy currents. As a result of the nature of the mounting of the disc, this pull is manifest in the form of a torque upon the disc. . . . As you can see, this is nearly the same as the basic copper disc-rotating magnet arrangement illustrated in Fig. 13, except that in this case the rotating field is created by splitting the phase of the power supply by one of the methods already described.

Universal Motor

The universal motor is a modification of the simple series d-c motor. A basic electrical representation of this unit would be like that of its d-c counterpart as illustrated in Fig. 9. . . . As stated in connection with the d-c motor, the basic magnetic effects created in the d-c motor by the application of direct current to both the magnets and the rotor remain the same in the a-c system, despite the fact that the current flow is reversed periodically. The reason is that the direction of current reverses simultaneously in both rotor and stator, so that the forces acting upon the armature coils always remains the same. This was shown in the two illustrations Figs. 8A and 8B depicting the manner in which the magnetic lines of force combine around a conductor which is carrying current for simultaneously reversed field as well as current flow.

However, the fact that alternating current is present in the motor as compared with direct current, does introduce certain modifications into the motor which is intended for universal use. The commutator and brush arrangement for the rotating mechanism is retained and this is one of the very few instances when commutator and brushes are used in an a-c motor. However, in contrast to a field of many turns and a rotor or armature of comparatively few turns as used in the d-c unit, the universal motor employs a field of greatly reduced turns and an armature of many more turns and more slots, which means more commutator segments.

The reason behind this change is the necessity for reducing the voltage drop across the impedance of the field winding. Were the usual arrangement as used in d-c units employed in the universal motor, the voltage drop across the impedance of the field winding would very materially reduce the voltage available for operation across the rotor. By reducing the number of turns in the field and making the armature with more slots and more turns, the least drop takes place across the field winding impedance, the maximum voltage is available across the armature, and the proper amount of magnetic reaction is developed so as to create the re-

quired amount of torque around the armature or rotor.

As it is, due to the reaction voltage developed across the field winding in the universal motor, less voltage is available across the armature, and the speed of this type of motor is less on a-c than it is on d-c. No doubt you must have noticed this effect if you have operated a universal motor on d-c and a-c supply lines.

Still another major difference between the normal series d-c motor and the universal motor is that of a change in the design of the various magnetic paths. Because alternating current supply may be used, it is necessary to minimize the effects of hysteresis and eddy-current losses. This is accomplished by using laminated materials instead of solid cores for the armature and the field magnets. Since such losses do not develop in d-c systems, solid forms may be used.

And yet another difference between the universal motor and the series d-c motor is found in the arrangement of the armature coils. This too is brought about by the behaviour of circuits when operated upon alternating current. . . . During normal operation of such a motor, there are times when certain of the coils upon the rotor are short circuited by the brushes, as shown in Fig. 27, that is, during those moments when the brush contacts two, rather than one commutator segment. When this happens, the shorted-circuited coils behave just as if they were short-circuited secondary windings of a transformer, for while they are upon the rotating armature, they still are within the main alternating field of the field magnets. Thus current flows through these coils and if not controlled would interfere with proper commutation by creating excessive sparking, and also would shorten the normal operating life of the brushes.

These bad effects are partly overcome by the use of so-called "preventive" leads, which really are resistances which join the coil ends to the commutator segments. Such resistors are not used in d-c units.

MAINTENANCE OF MOTORS

AFTER all is said and done, this is the most important portion of the section on motors, for it is here that the man who uses this Manual may look for troubles and remedies. But no matter how complete the listing, it is at all times impossible to cover every single ailment, and in the final analysis, general knowledge coupled with commonsense will prove to be far more valuable than a specific tabulation.

We said in the early part of this text that troubles in modern fractional horsepower motors of the kind used in record changers and recorders are comparatively few, for since the majority of these devices employ strictly a-c motors which have relatively few moving parts, the number of parts which may go bad or which may wear out are therefore anything but numerous.

However, some a-c motors, particularly those of the universal character, do make use of a commutator and brushes. Of these two items, the commutators give very little trouble. As to brushes, however, they do wear out, and no matter how well-made the motor may be, there comes a time when troubles arise as a result of the impaired performance of the brushes. Thus it seems most sensible to start this discussion by speaking about motor brushes.

It is by means of the brushes which make contact with the rotor or armature commutator that electric current is fed into the armature windings, and since the brush contacts are not stationary—that is, they make *momentary* contact with individual commutator segments—it stands to reason that the nature of this contact is important if freedom from sparking is to be obtained. It is true that there are a number of conditions which create sparking that are not associated with the brushes themselves, as for example excessive load upon the motor or shorted coils, but there are a number of conditions which are directly associated with the brushes and which can cause sparking.

Inasmuch as the most perfectly arranged brushes will eventually have to be replaced, it is imperative to realize that proper bedding of the brushes to the commutator is necessary. By proper bedding is meant that the portion of the brush which makes contact with the commutator, is formed so that the distribution of current through the brush takes place over the entire area of the brush surface in contact with the commutator segment. Poor bedding of the brushes results in a high current density on one point on the brush, and this is to be avoided.

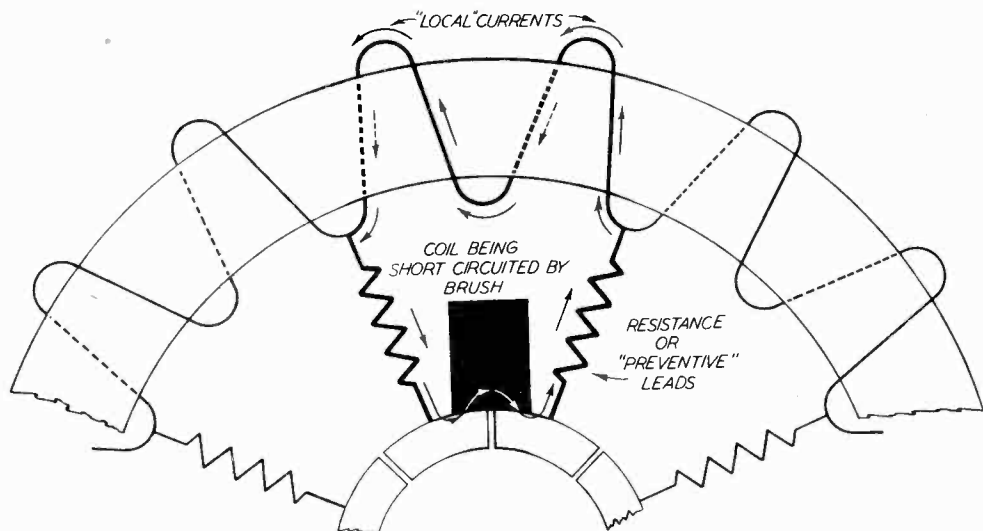
Looseness of the brush in its holder is another condition which will cause sparking, for it means that perfect contact between electrical connection to the brush holder and the brush itself is not attained. Incorrect alignment of brushes, that is, orientation of the brushes

with respect to the neutral plane of the armature, will unbalance the armature electrically and cause sparking. This is more commonplace with brushes which are mounted upon arms that can be moved, than those which are rigidly attached to the frame of the motor.

Continuity tests can be applied to show up the quality of brush contact on commutator type motors—that is, to establish if the connection between the brush and the commutator is good or intermittent—by disconnecting the motor from the power line and applying a voltage source of low voltage rating in series with a voltmeter across the motor. Twirling the rotor shaft will indicate the nature of the brush contacts by the steadiness of the voltage indication. Under normal conditions there will be but slight fluctuation of the meter pointer as the various commutator segments move under the brushes. If the pointer swings widely or if fluctuations are erratic, it is a sign of poor brush contact with the commutator. It is, of course, possible that the trouble lies in the commutator; that is, there may be high spots on the commutator, more than likely in the mica separators between the commutator segments. Or the commutator, because of previous sparking, has become badly pitted; in which case it will be necessary to send the entire armature assembly to a repair shop in order to have the commutator turned down to a smooth finish; or, if the pitting is not too bad, the commutator can be smoothed with sandpaper or glasspaper. Emery cloth should not be used because the grains are electric conductors, and if they stick to the mica separators between the commutator segments, they will form electric conducting paths and thus interfere with the function of the commutator, as well as the normal operation of the motor.

Brushes should be replaced if they become cracked or broken, or if for some reason full area contact to the commutator becomes impossible because the brushes have worn away. If inspection shows that but a small portion of the brush protrudes from the brush holder,

FIG. 27. In order to keep sparking to a minimum in universal motors, resistances are inserted in the connections between the coils and the commutator segments, as explained in the text.



replacement should be made at that time rather than delaying replacement for a later date. In altogether too many cases the need to replace the brush is forgotten. Brush lengths when new may vary from about $\frac{1}{2}$ to $\frac{3}{4}$ inch on the different kinds of commutator motors, and should be discarded if they wear down to about half their original length. If permitted to wear down to a length that does not leave sufficient brush body within the holder, brush vibration or "chatter" as well as poor contact between the brush and the commutator segments, may develop. As a rule, the springs inside brush holders or sleeves are designed to have sufficient tension only with brushes of a certain length, and while they may expand sufficiently to provide a contact between a very short brush and the commutator, such contacts will not be as good as they should be.

As to the process of bedding new brushes, it is necessary to form a circular concave shape at the end of the brush, so that it will fit the commutator. This can be done by fastening (temporarily, of course) a short strip of fine sandpaper around the commutator, and oscillating the rotor shaft back and forth against the new brush or brushes which have been properly inserted into the brush holders. The sandpaper will apply and form the proper initial curvature to the brush ends. The final "shaping" of these brushes will be automatically effected by the normal wear of the commutator against the brushes during regular motor operation. Brushes which have been in service for quite a while, but are not worn away nor otherwise damaged, may be cleaned and readjusted for further service. The glaze or hardened surface which appears upon the face of the brush can be scratched away with a pen knife or a razor blade. A small piece of fine sandpaper wrapped around a circular object which has the same diameter as the commutator can be used to reshape the brush face. In fact, this is an alternate method of shaping new brushes to fit the commutator.

Oil should never be present on brushes or brush holders, since it may seriously interfere with electrical efficiency, as well as cause increased accumulation of dust. Brushes need no lubrication. Wiping with a kerosene moistened cloth will remove all oil or grease which may have accumulated on the face of the brush.

Closely associated with the brushes is the commutator, hence while commutator-type motors are limited primarily to the universal classification it may be a good idea to consider them next in line. As far as commutator troubles are concerned, major troubles can seldom be repaired in the average shop handling record changers and recorders. In practically all cases it is necessary to send the entire assembly to a shop which specializes in such work. Minor troubles on the other hand come within the province of the average radio repair shop, hence can be considered here.

In order to inspect a commutator properly, it is necessary to disassemble the motor. When this has been

done, the commutator should be examined to establish whether it is tight and true in its shaft mountings. The segments should be examined for displacement or possible "scoring"; and the insulating strips of mica between the commutator segments should be examined for embodied metal or carbon particles. Wearing away of the brushes during operation takes the form of a fine carbon or graphite powder which often settles upon the insulation between commutator segments and if allowed to accumulate will eventually form a short-circuiting path between the segments and thus interfere with proper operation of the motor.

Coil connections and the coils themselves should also be examined for possible looseness or breaks. The proper fit of the rotor core in its shaft mounting should be noted, for slight looseness can seriously damage the coils and insulation during the operation of the motor. All in all a thorough physical check-up of the rotor is as important as that of the record changer mechanisms. A slight looseness of the commutator or rotor can be corrected by cautiously tightening the mounting "nuts," being careful not to displace the commutator position relative to the core. Caution must also be observed so as not to damage the insulation of the coils and connections, for the clamping arrangement which holds the rotor on its core, is such as not to permit adjustments; the rotor must be sent out for repair or replacement. Slight commutator "scoring" or scratch marks and "burrs," can be eliminated or corrected by wrapping a strip of very fine sandpaper around the commutator, and turning the commutator at uniform speed so as to obtain an even abrasive action around the entire commutator. This should be done with the rotor out of the motor. Extensive scoring and "burn-out" spots caused by heavy sparking necessitate sending the rotor out for repair, for such a condition requires that the commutator be "turned-down" on a lathe so as to form a new even surface. Commutators which show a heavy "wear-groove" should be repaired which means that the motors should not be continued in operation.

If any of the insulation strips between commutator segments become displaced, so that they rise up above the commutator surface, they must be either pushed down, if that is possible, or the protruding surface must be cut away by means of a sharp knife or razor blade. In order to push this insulation down below the surface of the commutator, it is necessary to loosen the commutator assembly ring or insulated mounting nut. As a rule this is not recommended so that the other method of correcting the trouble is suggested. If, however, the commutator can be loosened, the insulation should first be pushed down between the commutator segments, for it may be possible to accomplish the required condition without cutting away any of the insulation. If the commutator segments become loosened

through operation, re-alignment is necessary. It is suggested that such work be given over to some one who is experienced; in other words, the latter should be sent to a regular repair shop. That the commutator should be perfectly clean and have a uniform surface is very important for high segments, protruding insulation, or any form of eccentricity will cause the brushes to bounce and produce arcs.

That's about all that we deem it prudent to say about the adjustment of brushes and commutators. In fact we will even go so far as to say that in anything other than a trifling defect, this in connection with the commutator, the wisest thing to do is to take the unit into a motor repair shop for service. It will prove cheaper in the long run.

COMMONPLACE TROUBLES

A MOTOR is like any other electrical device in that specific continuity of circuit is necessary in order that the device operate. However, unlike other devices which come into the hands of the radio serviceman, very little information is available concerning such things as ohmic resistance of windings and the reaction of motor windings; consequently, it is useless to speak about the measurement of resistance as a means of determining the condition of the various circuits within a motor. This does not, of course, eliminate the possibility of making different types of continuity tests for they do serve a purpose; however, because of the limited servicing facilities available in the average radio service shop as far as motor maintenance is concerned, about the only form of continuity test that really means anything and which comes within the province of the radio repairman is that to establish whether or not current is flowing in a circuit or if the proper voltage is being applied.

If we break down the various classifications of troubles which exist in motors of the type being discussed here, they would amount to three. These are,

1. The motor does not start
2. The motor runs hot
3. Mechanical noise

Suppose that we consider these in the order in which they were presented.

Motor does not start:

In this case it is necessary to correlate the possible troubles with the type of motor. What we mean by this is that there may be certain items which are subject to scrutiny as possible causes for the creation of this condition, as applicable to a universal motor and not applicable to an induction motor. These must be borne in mind as the various contributing causes are considered.

The supply voltage is at all times an important item for if it is too low, the motor will not start because of the drag of the load. In fact, it may not start even without any load, hence, one of the important things to do, if not the most important item, in order to check why a motor does not start, is to measure the line voltage at the motor terminals. As a general rule, tolerances in motor voltages run approximately plus and minus 10%. If the voltage at the motor terminal seems normal yet the motor does not start but instead there is a hum, apparently from the motor, either the load is too great for the motor or some part of the motor mechanism, reduction gear mechanism, or turntable is jammed and prevents the motor from turning over. The fact that a hum is audible and seems to emanate from the motor is evidence of the fact that power is being applied to the motor. Whether or not this is correct is something else, but at least it is known that current is flowing through the motor windings.

The next logical step in order to identify the reason for not starting with voltage being applied, is to remove the load from the motor. An alternate method to establish if something in the drive arrangement is jammed or if the motor bearings are frozen, is to remove the supply voltage and to try and turn the motor by means of the turntable, or if the turntable has been removed from the recorder or record changer, to check the motor itself and see if the rotor can be turned. In those instances where reducing gears are used it may be necessary to open this case and check the condition of these gears for jamming. In some cases this may be somewhat difficult to do for in many installations the reduction gear and motor are one assembly. However, since the original parts were put together in the plant, it is possible to disassemble the two units and the first step should be the drive reduction gear mechanism.

Inasmuch as it is possible to have line voltage at the motor terminals, without necessarily having proper continuity through the motor windings, it is necessary to use whatever convenient means are available for establishing if current is flowing through these windings. If a current meter of the proper type is available, it can be inserted in series with one side of the supply voltage line and a motor terminal. This meter must first of all be of the proper type to accommodate the power being supplied, that is ac or dc. Second it must have a current rating, several times the normal current requirements of the motor when running under full load. The reason for this is that if the motor is locked so it cannot turn, the power consumption of the motor is increased above that when the motor can turn freely. Thus a motor which would normally require a .5 to 1 ampere meter for current checking, requires an ammeter rated at about 5 amperes full scale.

If the ammeter indicates the flow of current into the motor, the next step is to take the motor apart and check to see if the freezing of the rotor is due to bearing trouble. In the case of the majority of record changer motors, the bearings are of simple kind and more than likely will not freeze. In the case of universal motors any number of items, as for example too much tension on the brushes, lack of lubrication as to bearings, a sprung armature shaft, are among those which will tend to bind the rotor and prevent it from revolving. In addition, if any foreign particles have lodged in between the armature and the field pole pieces, that too may cause the rotor to stop and this applies as well to the induction motor as it does to the universal, hysteresis or any other type which is being used. Troubles due to foreign particles or to too much tension on the brushes can be repaired by the radio shop. But troubles of the other type, which require special machinery, should be taken care of by those who are qualified technically and have the equipment to do the work.

A very simple and effective method of establishing whether or not current is flowing through a motor which is not turning over, and measuring equipment is not available, is to check manually for heat being developed in the winding of the motor. A motor which is carrying current but which is not turning over, will become quite hot rapidly; that is, if it does not blow a fuse even before its temperature rises appreciably.

In the case of split-phase motors, trouble in the starting circuit may prevent the motor from starting. However, such a motor will run if started initially although it is possible that when under load the motor will stall. This depends entirely upon the design of a motor, that is, the extent to which the presence of the starting coil in the circuit contributes to its operation. Normally in the larger classifications of motors, these starting coils are disconnected from the circuit, and in the small record changer type of motors, the starting coil is left in the circuit and is always in operation. Inasmuch as the majority of split-phase induction motors used in record changers employ a condenser in one leg, trouble in such a starting circuit is invariably associated with this capacity and its connecting leads.

Since the condenser used in such split-phase systems is of the paper dielectric kind, normal tests applicable to condensers of this type are perfectly satisfactory. The fact that the condenser is used in connection with a motor does not introduce any special consideration into the test.

Short-circuited windings in either the stator or the rotor, or both, depending upon the type of motor involved, will prevent the motor from running. These can be checked by anyone of the methods already described, hence this reference is nothing more than a

supplementary listing of a condition which will prevent the starting of the motor.

Motor Runs Hot

We have already made some references to conditions which will cause a motor to run hot. Proper lack of lubrication is, of course, a very important item and the following should be of definite value.

In the majority of small motors which are used in record changers, the bearings are of very simple type and the means of lubricating the moving parts is in the form of oil-soaked felt washers which either surround the rotating shaft or make contact with it so that the oil gets into or between the moving parts. In some of the more elaborate motors as used in the recorders, specific lubricating holes are provided through which oil is caused to flow into the various bearings. As a rule, in the simple type of bearing arrangement, those which employ oil-soaked felt washers, the manufacturer of the motor at the time of production impregnates these washers sufficiently so that they can be used satisfactorily for long periods of time without any further oiling. If, however, oiling is necessary, a very thin motor oil such as SAE 10 or lower should be used. Some manufacturers specify that these oil-soaked felt washers provide proper lubricating for about one thousand hours of operation. When oiling is necessary, it does not take more than a few drops of the type of oil mentioned.

It is, of course, necessary to realize that those motors which employ such impregnated felt washers, must be dismantled from the motor board and taken apart in order to soak the washers. Motors of this type do not have lubricating holes. In the case of those motors which have lubricating holes, it is not necessary to remove the motor from the mounting board for lubrication. At times, however, it may be necessary to seek out the proper lubricating holes. In some cases these holes may be sealed with a screw plug and it is necessary to remove this plug in order to insert the oil.

As to conditions responsible for the motor running hot, the following should be known: If the bearings are too tight, yet not tight enough to freeze the shaft, the temperature at that point will increase and this increased heat will naturally be radiated throughout the unit and thus cause a rise in temperature. Short-circuited coils in either the stator or the rotor will cause the motor to run hot. While it is possible to approximate the location of the shorted coil by virtue of the fact that it will be hotter than other coils, we do not recommend, as stated before, that such coils be removed and rewound by the radio repairman. Another condition which contributes, or may con-

tribute, to the motor running hot, is when the rotor is rubbing against the stator pole. Such a condition can be created by incorrect alignment of the rotor or side plate. As a rule, such a condition is accompanied by noise, that is due to the actual physical contact between the rotor and the stator pole.

Mechanical Noise

Mechanical noise is a major problem. As you can probably appreciate a new motor should run very quietly, but there are, of course, conditions associated with the motor, yet which are not all directly in the motor, which will contribute to the creation of noise. Consequently, in order to isolate the origin of such mechanical noise, it may be necessary to proceed in various ways, depending entirely upon not only the construction of the motor, but also upon the construction of the various drive mechanisms whereby the rotation of the motor is conveyed to the turntable. Very often a bad case of motor noise may appear to exist, whereas actually it is not as bad as it sounds. The fact that it is very loud is due primarily to the manner of mounting the motor to the mounting board. If the motor is rigidly fastened to the mounting board, any vibration in the motor will be conveyed to the mounting board which by itself will act as a sounding board and in that way amplify the motor noise. Proper mounting will in most cases remedy this situation: the absence of direct contact between the motor mounting support and the mounting board. An example of proper mounting is given in Fig. 28.

Then again, noise may seem to originate in the motor yet it actually originates in the reducing-gear mechanism if such is used; hence, if the driving arrangement involves a number of elements between the motor and the turntable, it is necessary, in order to establish the point of origin of the noise, to separate these various devices. In this instance, as well as that previously mentioned, it is imperative to check the noise without the use of the mounting board. This means that the motor and the gear assembly must be removed from the mounting board. If the noise which originates in the motor is not excessive and is amplified when the motor assembly is mounted upon the board, then it becomes necessary to check the means of mounting. Often times mountings as shown become rigid instead of remaining loose as they should be.

If particles of dirt or other foreign matter find their way into the spaces between the rotor and the field magnet poles, the result will be intermittent noise. To eliminate such noise it is necessary to take the motor apart. Previous handling of the rotor may have created a nick or burrs that are high enough to make contact with the stator pole pieces. If such is

found, this can be removed by means of sandpaper or emery cloth. In the case of the induction type rotor, which usually is a solid piece, an emery cloth can be used. You will recall that this type of abrasive is not satisfactory for use upon commutators or upon commutator type armatures.

Mechanical noise in the form of vibration may be due to a number of different conditions. One of them is loose bearings; another is too much end play, and a third is a rotor which is not running true in its bearings. Improper centering of the rotor or armature in the flux gap will result in a non-uniform torque being applied to the motor. This is very important when reduction gear devices are used with the motor for it results in the non-uniform turning motion of these reduction gears and invariably causes a chatter.

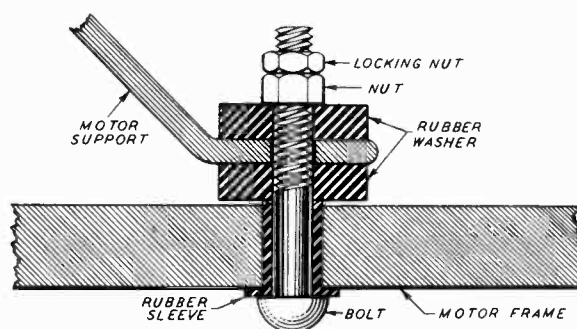


FIG. 28. In order to keep the vibrations of the rotating motor away from the motorboard, rubber is used between the motor support and the motorboard as indicated.

Noise of various kinds such as buzzing will result if any of the accessories employed in the motor are not tight in their mountings or supports. This applies to the laminations as well as to all other parts. If the laminations are not tight, they will tend to move under the varying magnetic stress of the applied current and resultant fields. In some cases such buzzing sounds would seem to originate from the laminations and may indicate that the polarity of one of the field windings is wrong. As you can readily understand, this seldom is the case in a new motor but is a possibility in one which has recently been repaired.

General Considerations

As a rule, the permissible rise in temperature of a motor is between 60 to 100 degrees above the temperature of the surrounding air. As stated before, permissible tolerances in applied line voltage are plus and minus 10% and about 5% plus or minus in frequency. When measuring operating voltages, they should be determined with the motor functioning un-

der full load. Here again a 10% variation is permissible.

Anyone who is interested in more specific standards covering fractional horsepower motors, we refer them to the National Electrical Manufacturers Association which has published a bulletin identified as "Motor & Generator Standards."

If it becomes necessary to clean those parts of the motor where the lubricant has become gummy, the best method to pursue is to take the motor apart and to clean those parts with kerosene.

As a matter of fact, such periodic cleaning of the motor is advisable after perhaps 500 hours of operation. Of course, if the performance of the device indicates that such cleaning is necessary, it should be done irrespective of how many hours the motor has been in use. Although, we have referred specifically to the motor, the comments also apply to the gears and the bearing in the reduction gear housing, if one is used with the motor.

As to the power consumption of motors of the type being considered in this volume, the average among those that are used on record changers is approximately 22 watts and the minimum to maximum range is from about 11 to approximately 40 watts. As to the normal speed of motors which are classified as synchronous and already adjusted by means of the drive arrangement to rotate the turntable at approximately 78 rpm, the normal range of such rotation is from about 77 to 81 rpm. With respect to the speed of induction motors, and for that matter some which are identified as capacitor-synchronous motors, the range is from about 1240 to approximately 3600 rpm. As to the motors which are used in recorders, their power consumption ranges from about 60 to about 85 or 90 watts under normal operating conditions.

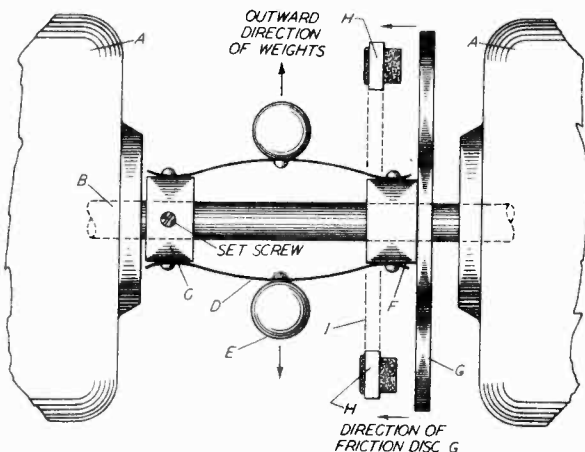


FIG. 29. When the motor exceeds a certain speed, the governor balls E are forced outwards and so pull the friction disc G up against the pads H, which have a braking effect that persists until the motor speed is back to normal.

SPEED REGULATOR DEVICES AND SPEED REDUCTION DRIVES

INASMUCH as certain types of electrical motors vary in accordance with the line voltage, and since practically all motors revolve at speeds which are far in excess of that of the turntable, it is necessary to use certain devices whereby the speed of the motor is maintained constant irrespective of line voltage variations and whereby the speed of the motor is reduced to that required for the rotating turntable. To maintain constant speed recourse is had to what is known as a "governor." In order to reduce the speed of the motor to that required for the turntable, various arrangements of gear mechanisms called speed reduction drives, are employed. Both of these are discussed in this chapter.

The most widely used device for automatic speed regulation is based upon the well-known "fly ball" governor originally used on steam engines. On motors of various types and manufacture, differing designs or physical arrangements of governors may be found; but all are based upon the same fundamental principle. A simple explanation of this basic principle is the following:

The basis of operation is the use of physical force to shift the placement of the two balls which comprise the essential part of the governor. These balls are attached to two flexible springs, which in turn are mounted upon a fixed rotating collar and a sliding collar. Attached to the sliding collar, is a friction disc. This friction disc is caused to move up against two "braking" pads which tend to slow down the rotation of the shaft to which is attached the fixed collar carrying the governor ball springs. Just what we have in mind is illustrated in Fig. 29.

Referring to this illustration, A is the motor or gear housing and B is the motor or gear shaft. Attached to this shaft is the permanently fastened collar C. Being attached by means of set screws to the rotating shaft, it naturally turns with this shaft. Mounted upon this shaft but at the other end, is another sliding collar F to which is attached the friction disc G. As you can see, the two governor weights are fastened to two springs D, each of which terminates at one end in the fixed collar C and at the other end upon the sliding collar F. Also attached to the assembly is a stationary frame I bearing two braking pads, indicated as H in the illustration. The direction of the friction disc is towards the braking pads as the movement of the governor weight pulls the sliding collar in towards the stationary collar.

As the motor speeds up, physical force causes the weights to fly outward and revolve in ever increasing circles, being restrained only by the relative stiffness of the springs D, which, as they distort their shape in an outward curve, cause the sliding collar F to slide

longitudinally along the shaft B. Thus, the revolving friction disc G comes in contact with the oil-saturated felt friction pads H, which are rigidly mounted on a stiff annular ring or prong bars. The pressure of the friction disc G against the pads H gives a braking action, which serves automatically to restrict the motor speed within certain narrow limits required to give proper turntable speed.



FIG. 30. A worm gear has been cut in the shaft of the rotor of this commercial motor. This worm drives the turntable through a gear on the turntable shaft. See C and D of Fig. 35.

The relative position of the structure supporting the friction pads H is longitudinally adjustable by means of a screw and sliding rod, cam and lever, or linkage of some kind; either by an adjusting screw or short lever reaching through the housing, or by a manually-operated speed-regulator lever protruding towards an outer edge or corner of the motorboard beyond the turntable. (These are not indicated in Fig. 29.) The latter usually has associated with it a graduated scale or "fast/slow" markings, either mounted on the motorboard or stamped in the metal. The speed-regulator lever is sometimes arranged so that it can be readjusted, relative to a different definite position for friction pads H so that it can indicate normal turntable speed on the scale in the event that the unit is moved to a location of differing average voltage (100/110, 120/125, etc.), or current (a-c, d-c) where a universal motor is used.

Some record changers using universal motors, are provided with rheostats, the scale being graduated for the various voltages, currents, and frequencies. This gives a coarse speed adjustment over a wide a-c or d-c voltage range, as well as for the several a-c power-line frequencies; while the speed-regulator lever gives the fine adjustment by re-setting the governor limits. With this arrangement, a particular record changer can be universally operated on many different kinds of power-supply lines: 110/125 volts and 200/250 volts d-c or a-c; 25, 40, 50, 60 cycles; etc.

Some a-c motors are provided with "dual windings," each stator pole having two coils whose leads are brought out in individual groups to a terminal block for multi-voltage operation. The coils are series connected for 200/250-volt lines, for instance; and connected in parallel for 110/125-volt supply. Also, some universal motors are provided with a fixed resistor and terminal block or switch for the same purpose. The connections are arranged so that for 200/250-volt operation, the resistor is in series with the motor; while it is "shorted" by a link on the terminal block or by the switch for 100/125-volt supply. This same scheme is also used for switching from a-c to d-c operation, the resistor serving to reduce the voltage applied to the motor terminals from the d-c line.

Speed Reduction Drives

Since record-changer mechanisms generally derive their operating power from the same motor that rotates the turntable, it would be useful to review briefly the various types of turntable speed-reduction drives—sometimes called "transmissions"—before the discussion of the actual mechanism-power "take-off" methods themselves.

A widely-used type of drive is the worm and gear variety as adapted from spring-wound motors; a typical example being illustrated in the photograph of Fig. 30. The worm gear on the motor shaft engages a pinion gear on the turntable drive shaft, all being enclosed on a gasket-sealed grease or oil-filled metal housing, to which the motor is rigidly attached. Both shafts are usually perpendicular to each other, revolving in sleeve bearings arranged to be self-lubricating from the oil or grease inside the housing. The exposed end of the turntable-drive shaft is long enough, in this case, to serve also as the record-spindle and turntable mount. In another gear-drive arrangement, illustrated in Fig. 31, an "open" type of

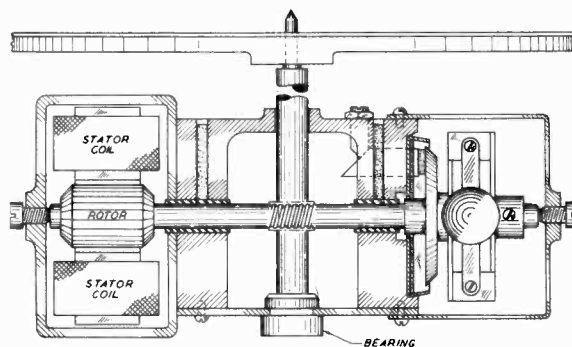


FIG. 31. At the left is the motor proper on the shaft of which is a worm which drives the turntable. The speed is controlled by the governor at the right.

frame is used to house the motor and governor (if provided), as well as drive-gears, shafts, and bearings, oil and grease being applied periodically to bearings and gears directly.

On some kinds of record changers, the record-spindle is stationary; since it may be arranged to have a particular function in changing records. On these, the turntable-drive shaft in the reduction-gear housing may be in the form of a long sleeve (upon which the pinion gear is mounted) and which revolves on a "stud" bearing in the lower part of the frame. The upper part, protruding above the frame, serves as the turntable mount, being fitted with a pin or "nub" to engage a slot in the turntable hub. The record spindle is either an elongation of the stud bearing (being integral with it), or separately inserted through the turntable and drive-shaft (sleeve)—resting down upon the stud, and prevented from turning by "stepped" shoulders cut in the corresponding ends of each.

The motor and gear housing (including the governor, when so provided) are supported as a unit under the motorboard by mounting "lugs" or brackets—either separately attached to the gear-housing or motor frame, or being cast as an integral part. This is attached directly to the motorboard, or to a sub-panel further down beneath the record-changer mechanism. The mounting is usually arranged to be somewhat flexible, to prevent transmission of motor vibration to the motorboard and turntable, by means of rubber "grommets" or "washers."

Flexible couplings are sometimes used for the same purpose. The pinion gear is then mounted on a short shaft, the end protruding through the gear housing, in turn driving the turntable by means of this flexible coupling. This is illustrated in Fig. 32, while the details of a typical flexible coupling are shown in Fig. 33. It will be noted here, that the turntable is supported by a thrust bearing mounted on the motorboard. Where no coupling is used, this thrust bearing

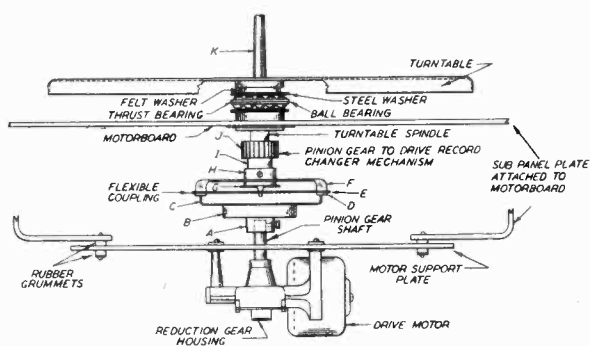
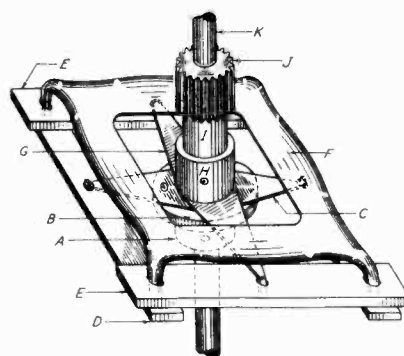


FIG. 32. In this system of turntable drive, the motor is hung off the motorboard with rubber washers inserted to take up vibrations. A flexible coupling further reduces the possibility of introducing vibrations to the mechanism. See Fig. 33.

is usually omitted; the gear housing or sub-panel being arranged to thrust support the turntable directly, either through the spindle shaft or a "hub" sleeve or "collar."

As some record-changers are designed to handle $33\frac{1}{3}$ rpm records as well as the more conventional 78 rpm type, two-speed drives of various kinds are in use. One of these, arranged to form the complete turntable-hub assembly, is based upon the "planetary" principle, in which driving members rotate within each other. Change of speed is obtained by holding one member, which revolves at one speed, from turning during the second speed by means of a latch controlled by the speed-change lever. This is illustrated in Fig. 34.

FIG. 33. Details of the flexible coupling shown in the assembly of Fig. 32. The motor drive arm C is connected to the rubber strips D. The rubber strips E are held to D by the frame F. The turntable drive arm G is supported by E, which provides the flexibility.



The turntable shaft or spindle A, driven from the motor reduction gearing and thrust supported by its housing, revolves continuously at 78 rpm; regardless of the turntable speed. A pin B, extending through this shaft, engages a slot in the hardened-steel lower cup-shaped hub C of the turntable to provide a positive drive for that member. The upper hub, integral with the turntable, fits over the spindle and is thrust supported in the depression of lower hub C so that the turntable can revolve independent of record-spindle A.

The upper part D of the outer surface of C is accurately shaped and ground to a definite size and forms the inner "race" for the three equally-spaced hardened-steel balls E. These are held tightly between this inner race and a hardened-steel ring F, the inner surface of which being accurately shaped and ground to form the outer ball race. This ring F is split at points G for assembling convenience, being clamped tight by a nut and bolt through the lugs of a clamping ring around it. A three-hole steel ball-locating ring H, which is integral with the turntable, forms the spacing member for the three balls.

The outer ring F is free to rotate independently of the turntable and spindle A. Its rotation is controlled by a latch I, pivoted on the lugs which are

an integral part of the clamping ring. A spiral spring J normally holds one end of latch I against a notched disc K firmly fastened to the turntable. When latch I is in its normal position, it engages one of the notches in disc K, locking F to the turntable, which is equivalent to locking the ball races of F and C together through the balls, since the ball-locating ring H is integral with the turntable. Thus, outer ring F will revolve with lower hub C and the 78-rpm rotation of the turntable shaft A is imparted to the turntable.

The sliding speed-change lever L, mounted on the main panel or motorboard, is arranged so that its notched inner end will engage and hold the lower end of the turntable latch I when the lever is pushed inwards towards its 33 1/3-rpm position. Thus, when pushing in on lever L to change turntable speed, latch I turns slightly around its mounting on outer ring F so that the upper end of I becomes disengaged from the notches in disc K, and F stops rotating, since latch I is an integral part of F. As the lower hub C is still revolving at 78 rpm, friction against the balls E causes them to turn and travel slowly along the ball race of the stationary outer ring F, carrying locating-ring H along with them and causing the turntable to revolve at the slower speed. The required 33 1/3-rpm speed

is obtained through the proper relationship between the circumferences of the steel balls E and the formed ball race D on the lower hub C.

It will be noted that spring-actuated turntable-latch I engages the V-shaped notches on disc K only when the sliding speed-change lever L is in its "out" or 78-rpm position. Latch I can lock into any of these notches to give positive 78-rpm turntable speed, after the turntable has gained sufficient momentum, the shape and proportions of the notches being designed to allow latch I to "ratchet" around disc K, passing over several notches when starting or changing speed, until full speed is reached.

Illustrated in Fig. 35 is another type of two-speed drive, which operates upon the same principle as the speed-change transmission on automobiles. Gear worm C, mounted on the motor shaft B, engages worm pinion-gear D, causing countershaft E to revolve continuously. Gears F and G, fastened to E, are engaged by gears H₁ and H₂ respectively; according to which speed is desired, being arranged so that when H₁ engages F, H₂ is disengaged from G and vice versa. H₁ and H₂ are integral with the grooved hub H₃ and are key mounted to the turntable drive shaft J, being arranged to slide along an extended key-

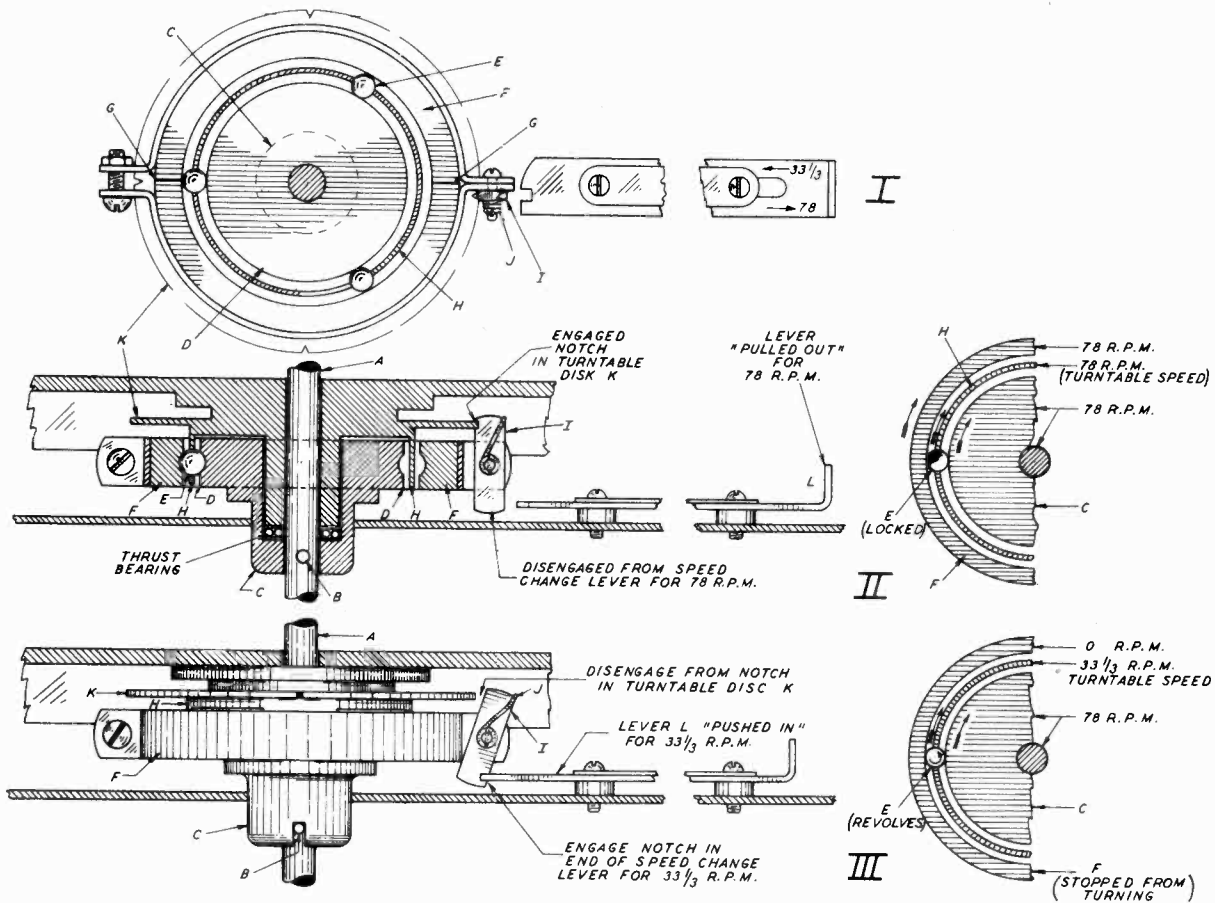


FIG. 34. A two-speed turntable drive that is based upon the planetary principle. When the latch I is in a notch of K, the turntable rotates at 78 rpm; when I is disengaged the turntable rotates at 33 1/3 rpm.

way I between limit collars K_1 and K_2 . Shaft J is thrust supported at L_1 or L_2 .

When the speed-shift lever (not shown in illustration) is moved to change the turntable speed, it turns speed-change spindle O, connected to it directly, or through a quadrant-sector gear and pinion or other coupling linkage to magnify the lever "throw." The space on the motorboard is limited; and when the lever moves in a small arc from one speed position to the other, spindle O will revolve through one-quarter, one-half turn or more due to the "magnifying" ratio of the coupling linkage.

Illustration I of Fig. 35 shows the lower gears F and H_1 in mesh for the first speed position. When spindle O turns to shift the gears for the second speed, step cam N_1 also turns, since it is rigidly attached to O. The step on N_1 thrusts upward against the symmetrically-stepped lift N_2 , opposing the downward force of spring P, causing N_2 to slide upwardly along spindle O. As shifting-fork M is integral with N_2 , it also moves upward, causing gear unit $H_1-H_2-H_3$ to slide upwards along the keyway on shaft J, since the prongs on M are in engagement with hub H_3 through its groove. Thus, gear H_2 engages gear G while gear H_1 has become disengaged from gear F and the turntable revolves at the second speed. Spring P serves to keep N_2 always in contact with N_1 and to force N_2 downwards when changing back to the first speed, thus automatically shifting the gears back to the first speed when the lever is so moved.

Some other types of two-speed drive based upon the planetary principle, previously discussed, have

the unit arranged on or inside the motor or gear-reduction housing, differing in physical appearance and design, using discs or toothed wheels, as well as hardened-steel balls, but all operating along similar lines.

Some of the friction-type drives discussed in the following paragraphs are arranged for two speeds. The principle is illustrated in Fig. 36, in which the motor shaft carries a small rubber-tired drive wheel A. This drives the turntable through either of the two intermediate rubber-tired friction wheels B or C, according to the speed desired.

The relative ratios of the circumference (or diameter) of wheel A to that of either B or C, and in turn to that of the turntable, give the desired speed reduction. The difference in diameters of C and B, of course, depends upon the difference between the two speeds. Wheels B and C are mounted upon a frame D, which pivots around a bearing on the motorboard, and through which the motor shaft may protrude. A speed-change lever (not shown) shifts D through a linkage and "holding" ratchet or latch, moving either B or C into the proper position for the particular speed required. Depending upon the particular arrangement, B and C may revolve continuously, being always in contact with A, or only when either is individually shifted into respective "speed" position, being brought into contact with wheel A and the turntable at the same time.

Single-speed friction-type drives are arranged to drive the turntable in various ways: either through friction against the underside rim directly or by a separate drive-disc mounted integral with the turn-

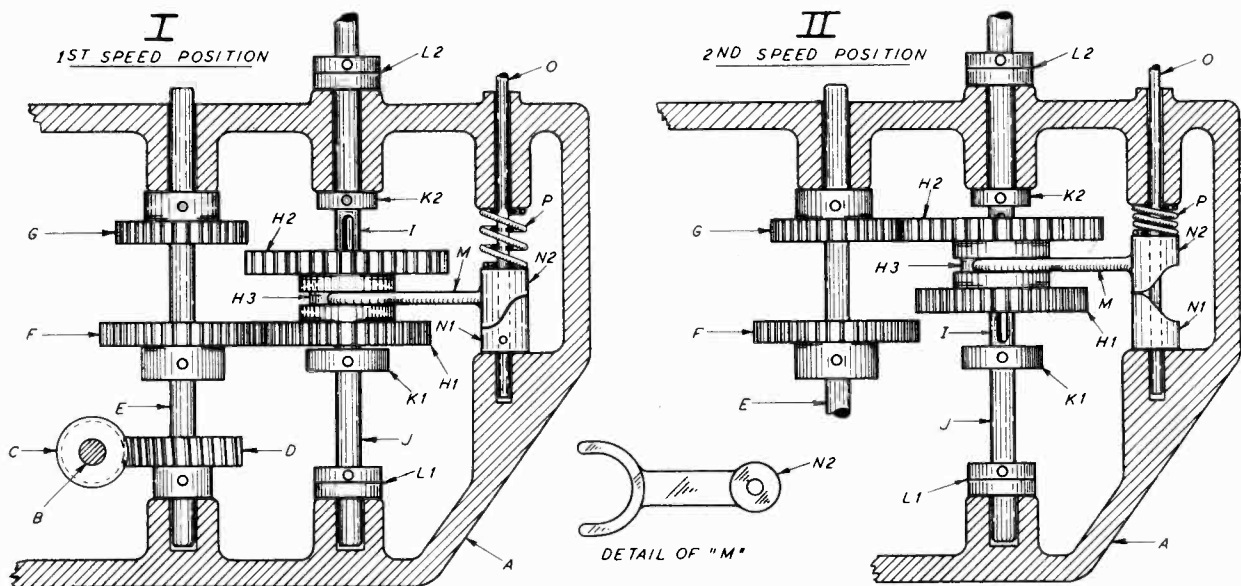


FIG. 35. A type of two-speed drive which functions on the principle used in the transmission of automobiles. In the first-speed position, where gear F is driving H_1 , the turntable shaft J rotates at 78 rpm. In the other position, where G is engaging H_2 , J rotates at $33\frac{1}{3}$ rpm. See text for other details.

table or the spindle. In the former, a rubber-tired drive wheel mounted on the motor shaft, protruding up above the motorboard underneath the turntable, bears directly against the underside rim of the turntable or against an intermediate drive-wheel that in turn rotates the turntable (similar to the two-speed drive just described). As shown in Fig. 37, the intermediate drive-wheel B revolves on a stud bearing on the motorboard, A being the motor-shaft drive-wheel.

In some cases and especially when a comparatively high-speed motor is used, the motor shaft bears directly against the intermediate drivewheel, the motor-shaft drive-wheel A not being used. This, of course, gives a greater speed reduction for the same size intermediate. This scheme is used also on the other kind of friction-drive just mentioned, in which the separate drive-disc is mounted integral with the turntable or spindle.

Fig. 38 shows one form in which a rubber-tired drive-disc is bolted or riveted to the underside of the turntable. An auxiliary rubber-tired idler wheel is frequently used on this type of drive to improve the frictional contact of the motor shaft against the drive-disc rubber tire. It also relieves the motor bearings of radial stress, the motor usually being mounted in a flexible manner in addition, so that the motor will tend to be "self-aligning." The idler wheel is mounted on a lever, center pivoted to the motorboard, and held against the motor shaft by means of a tensioned coil spring at the other end of the lever.

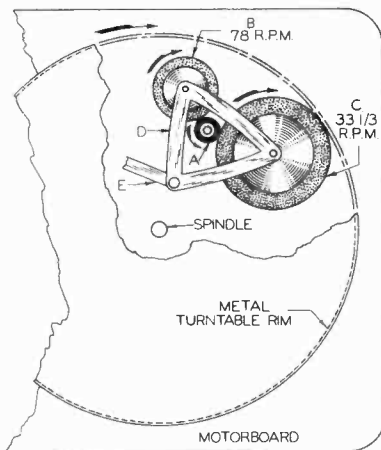


FIG. 36. The small rubber-tired wheel A is on the motor shafts and drives both B and C at the same time. Either one of these engages and so drives the turntable at the speeds indicated.

Record-Changer Mechanism Drives

Although greater torque is needed to drive the record-changer mechanism when operating through its various phases of the record-changing cycle than that needed to drive the turntable only (with its record load) during reproduction of the recording, the speed of operation can be comparatively slower. Therefore, the same motor usually serves for both purposes on

most record changers, the mechanism being driven through speed-reduction devices of various types.

The most commonly used form employs a pinion gear that is firmly attached to the turntable spindle or drive shaft, underneath the motorboard; such as that shown in Fig. 33. This pinion gear engages and

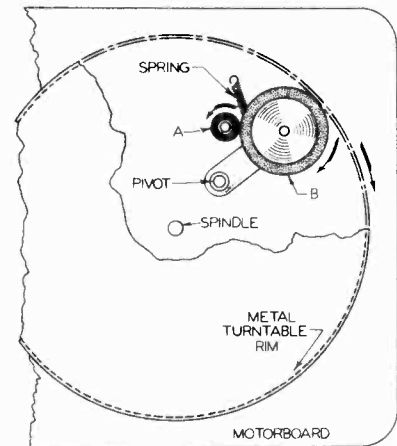


FIG. 37. The rubber-tired wheel A is on the motor shaft and this drives the rubber-tired wheel B that in turn makes contact with the rim under the turntable and so drives it.

drives a large gear, often referred to as the "main" or "drive" gear. This gear has a very large diameter (and many teeth) in contrast to the pinion gear, thus giving a large speed-reduction ratio and sufficient force to operate the record-changer mechanism. (On some record-changers, this main gear is integral with the cams which direct and control the motions of the various levers and linkages.)

Another type of gear-drive employs a worm gear on the turntable drive-shaft (or on the motor shaft) instead of the pinion gear, which drives a large gear to transmit motion to the record-changer mechanism cams and linkages. Also, in one instance, a special type of multi-groove cylindrical cam—similar in appearance to a large gear worm—is driven from a short turntable shaft underneath the motorboard transmitting motion to the mechanisms through a series

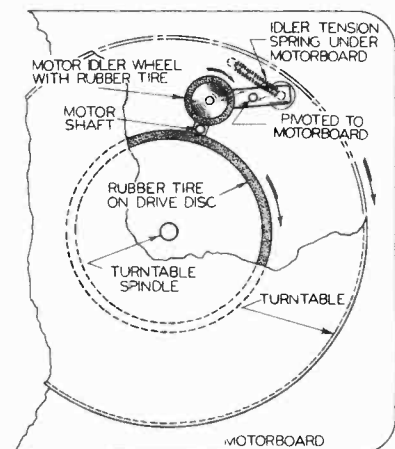


FIG. 38. The rubber-tired drive disc fastened to the under side of the turntable is driven by the motor shaft, which is maintained in contact with the drive disc by pressure of the idler wheel.

of "cam-followers" and levers. In another type a camshaft (carrying the mechanism operating cams) is driven, through a ratchet wheel and pawl, by a worm and gear reduction drive from the motor shaft. The ratchet wheel is engaged by the pawl, when released by the trip mechanism, to cause camshaft rotation.

According to the design of the particular types of record-changers, the main gear or cams may revolve continuously, as long as the turntable revolves, or only during the record-changing "cycle." In the former case, cam-followers or other pertinent parts of the mechanism, are caused to fall into engagement through actuation of the "trip" devices after reaching the end of record reproduction. In the latter, several different schemes are used.

In one of these, called a "mutilated gear," a short section of the main-gear periphery is without teeth, so that the main gear remains dis-engaged from the continually-revolving turntable-shaft pinion during record reproduction. In another scheme, the turntable-shaft pinion is clutch mounted to the turntable shaft, so that it only rotates during the record-changing cycle, the pinion and main gear always being in mesh but not revolving during record reproduction.

Instead of gear drives, power take-off on some record-changers is by friction drive from the underside turntable rim or through belts and pulleys from

the turntable spindle. In the former, a small rubber-tired friction wheel is caused to contact the turntable, through actuation of the "trip" devices at the conclusion of record reproduction, and is held free by a "latch" or other device at all other times. Speed reduction is obtained through a small size double worm-and-gear drive, enclosed in an oil filled housing that is arranged to rotate slightly (around the shaft of the second "driven" gear) to allow free movement of the friction wheel.

In the other scheme mentioned, in which power take-off is through belts and pulleys, the speed reduction and torque increase are gained through the high ratio between pulley diameters. A small-diameter pulley wheel, associated with the turntable hub, is belt connected to a large-diameter pulley. The shaft, upon which this large pulley is rigidly attached, also carries another firmly mounted small-diameter pulley, which in turn is belt connected to a fourth large-diameter pulley. Thus a double speed reduction is obtained from the 78-rpm turntable speed to give a very slow speed to the fourth pulley, which drives the cams that direct and control the operation of the record-changer mechanism levers and linkages.

Additional details on these are included in the chapters on the operation and adjustments of the various types of record-changer mechanisms.

Cook, A. L., Elements of Electrical Engineering

Croft, T., Practical Electricity

Hausmann, E., Swoope's Lessons in Practical Electricity

Veinott, C. G., Fractional Horsepower Electric Motors

Chapter II

RECORDERS AND PHONOGRAPHS

PERHAPS it is carrying coal to Newcastle to discuss the operating principles of recorders in a volume of this type, but since it is possible that those men who are interested in automatic record changers have not used recorders, we feel that a brief discussion of the highlights is worthwhile. It is also possible that the serviceman who is called in to make adjustments on an improperly operating recorder may be asked ques-

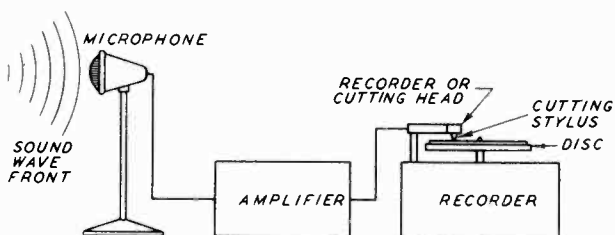


FIG. 1. Sound waves are transformed into electrical energy in the microphone; these are amplified and are transformed into mechanical energy in the cutting head. The cutting stylus is actuated and cuts the equivalent of the sound waves in the record groove.

tions by the owner and what we say in these pages may be of some aid.

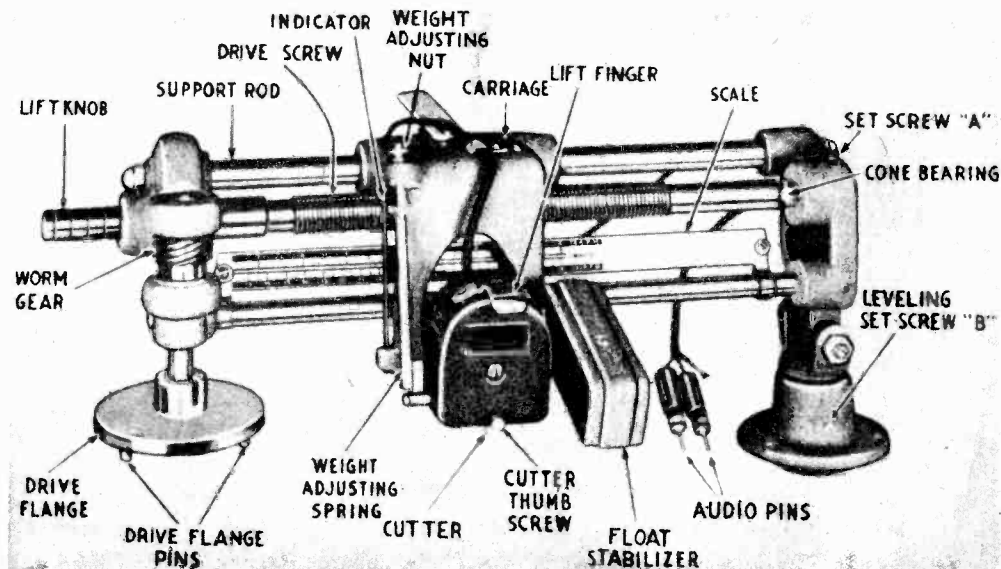
In the fewest words, the function of a recorder is to translate sound into a semi-permanent record upon a phonograph disc. This is done by first converting audible sound impulses into electrical impulses in the microphone, amplifying these electrical impulses to

the proper level, and then converting them into the mechanical movement of a cutting stylus, whereby a spiral groove, governed in shape by the amplitude and frequency of the electrical impulses, is inscribed upon a record. Thus a number of energy conversions take place: from sound to electrical in the microphone; from electrical to mechanical in the recording head, and from one kind of mechanical motion into another in the recording head and cutting stylus. This sequence of events is shown in diagrammatic form in Fig. 1.

As to the general structure of the complete recorder mechanism, the electrical system is shown in Fig. 1. The mechanical arrangement embraces the means of rotating the record blank upon which the grooves are cut and the means whereby the cutting head is caused to travel across the record. The first of these is accomplished by means of a motor-governor arrangement whereby the turntable upon which the record blank rests is caused to rotate at a definite speed. Modern practice has adopted two speeds for recording as well as reproduction; one of these is 78.26 rpm, usually referred to as 78 rpm, and the other is 33 $\frac{1}{3}$ rpm. Practically all home recorders are of the 78-rpm variety, whereas commercial recorders are arranged to function at either one of the two speeds mentioned. It is true, however, that a few home-recorder units are equipped with both speeds.

Inasmuch as the turntable speed of reproducing devices is definitely fixed, it is necessary that the speed

FIG. 2. An example of a commercial overhead carriage recorder, the cutting head being driven straight across the record blank by the drive screw, which in turn is driven by the drive flange and the worm gear. Courtesy of RCA Mfg. Co.



of rotation of the recorder turntable be constant at either of the two values mentioned, if proper reproduction of the recording be obtained. Of course the reverse is also true, that is, since the recording is done at a certain speed of rotation, it is imperative that the reproduction be carried out at the same speed. To maintain this speed, is the function of the governor in those motor-drive arrangements which are not fixed in speed by the very design of the motor.

In addition to rotating the blank, an arrangement is provided in recorders whereby the cutter is caused to move across the record, thereby cutting the spiral groove of gradually diminishing radius. These cutter-feed arrangements are of three types, representing efficiency and cost. The most elaborate, used in the more expensive systems, is what is known as the "overhead carriage" and is represented in Fig. 2. The path of the stylus is straight across the record and is shown in Fig. 3. A less expensive system is shown in Fig. 4 and can best be identified as the "swinging arm" type.

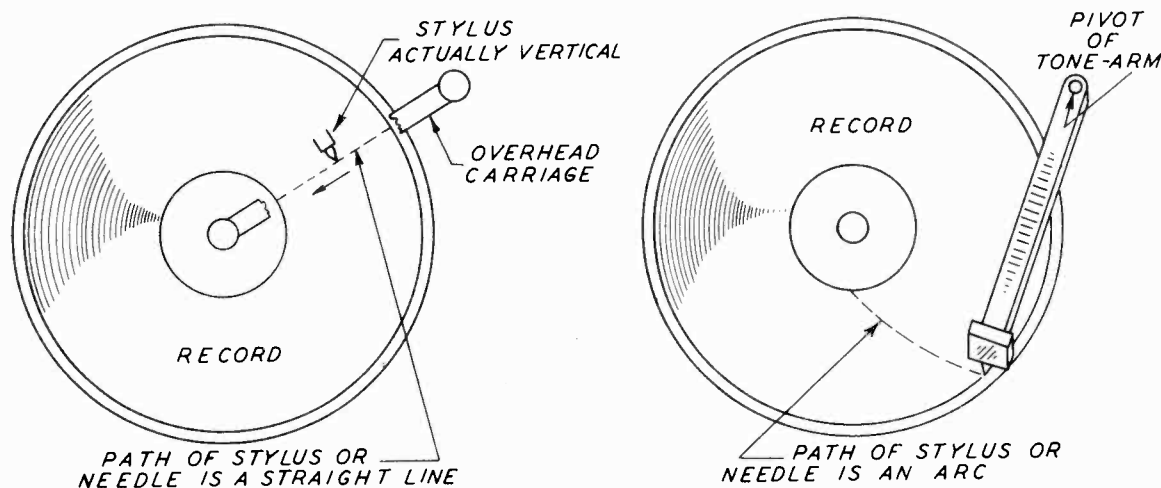
Bearing in mind that choice of these types is associated with cost, the first is by far the closest approach to the ideal, followed in turn by that shown in Fig. 3, and then by that shown in Fig. 4. Actually the last is perfectly satisfactory for everyday use, as evidenced by the fact that it is employed in virtually all inexpensive recorders, whereas the first is the kind used in the more elaborate systems. There are various modifications of these two systems, but these special details need not be discussed here, because they are shown upon the various manufacturers' pages later in this volume.

With respect to comment concerning efficiency of the type of cross feed used to move the cutting head,

there are certain reasons why a straight-across motion is preferable to movement in the form of an arc. . . . When a recording is made, the *cutting needle*, about which you'll hear more later, goes through two motions. One of these is the downward motion due to the weight of the cutting head and the other is a side-to-side motion due to the movement of the armature within the cutting head. In order that best recording be accomplished, there exists a requirement which stipulates what the angle between the cutting needle and the record blank should be, as well as the position of the cutting stylus face with respect to the record blank. This last requirement is that the face of the cutting tool be directly in line with the radius of the record at the point of cutting. This is shown in Fig. 5. To maintain this position at all times, it is necessary that the cutting head move straight across the record, as shown in Figs. 2 and 3.

When the cutting head swings in an arc, as in Fig. 4, the required condition as stated is obtained only at one point. At all others the face of the cutting tool makes an angle with the radius of the disc. By lengthening the arm which supports the cutting tool, the arc made by the cutting head as it travels across the record, is kept as flat as possible. This is the condition in the recorders which employ this type of feed arrangement.

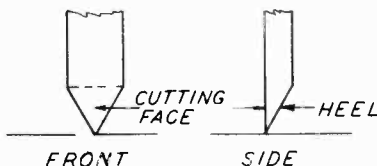
As to the actual feed arrangement, a worm screw geared to the motor and also to the cutting arm or head moves the cutting head across the record at a certain speed, thus determining the pitch of the spiral groove cut into the record. While the average number of grooves per inch is between 92 and 100, some recorders, as stated in the manufacturers' bulletins, cut as many as 120 lines per inch. The number of lines



FIGS. 3, left, 4. The dotted lines show the paths followed during recording; that of Fig. 3 is the straight-across method, using the mechanism of Fig. 2, and that of Fig. 3 is the swinging-arm method, which is more commonly used.

or grooves per inch cut into the record blank during recording does not in any way limit the use of such a record upon a record-changer turntable, for if the original recording is of sufficient depth, the pick-up needle will continue tracking. (By "tracking" is meant

FIG. 5. Front and side views of a cutting needle. The cutting face should be in the same line as the radius of the record.



that the needle will remain in the groove.) The depth of the cut, the significance of which is discussed later, has a great bearing upon such tracking, as well as upon a number of other conditions which contribute to satisfactory use of the recording.

Direction of Groove

Record grooves may be cut in one of two directions: from the outside of the record towards the center, which is known as "outside-in" and is typified by the commercial recordings which are sold to the public for use on phonographs, automatic-record changers, and the like; and the "inside-out" type of recording which is used for special records such as are employed in some talking-motion picture installations, broadcasting, and the like. In these latter records, the recording starts on the inside of the blank, near the center, and progresses outwards.

As a rule, most of the inexpensive recorders employ the outside-in arrangement for all recording at 78 rpm and the inside-out arrangement for all recording at $33\frac{1}{3}$ rpm. This, however, is not a rigid rule, in that outside-in cutting can be done at $33\frac{1}{3}$ just as readily as at 78 rpm. Just which is used is, of course, a matter of design determined by the manufacturer and is stated in the service notes. As you can appreciate, a change from outside-in to inside-out cutting requires the reversal of the motor and the feed screw; or if the direction of rotation of the motor is held constant, a reversing gear arrangement is required in order that

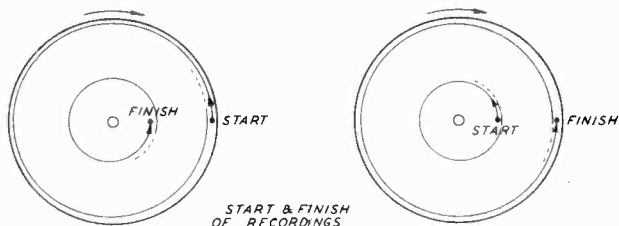


FIG. 6. In the left illustration is the "outside-in" type of recording and on the right is the "inside-out" type. In each case the turntable has a clockwise rotation.

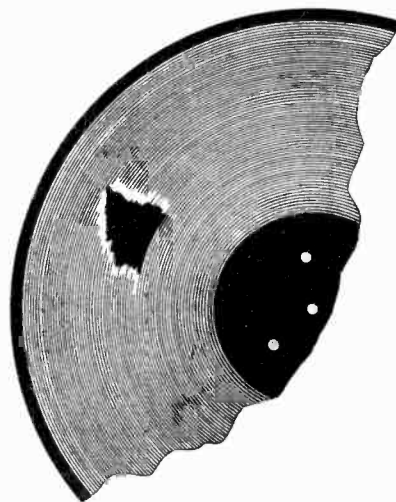
the feed screw cause the cutting head to move in the proper direction. As to the records used on automatic record changers, only one type can be used, namely those recorded by the outside-in method.

The Record Blanks

Concerning the blanks used on recorders, several types are available, although two are the most popular, with one of these in greatest demand. The most popular type of record blank is that known as the "acetate" blank, which consists of a metal base upon which is baked a special type of lacquer coating or surface. This is the recording surface. This material is soft enough to be cut with a cutting stylus, yet is hard enough to withstand the wear of repeated playbacks without undue rapid changes in the character of the grooves cut during the original recording. Of course, every playing of the record wears away some portion of the groove, but when properly handled, the record will be useable several hundred times, provided that the original recording was satisfactory.

The other type of home-recording blank is the solid metal disc, invariably of aluminum. This type is not as good as the coated disc, but neither is it as expen-

FIG. 7. When the stylus comes to a high spot it digs into the blank, indicated by the white spots along one edge of the ungrooved portion, which is the part skipped over. The white spots on the opposite side indicate where the stylus digs into the record when it lands.



sive. Various types of pressed paper recording blanks are also available, but of the types mentioned, this is the least popular for recordings that are to be kept for quite some time and repeatedly played back. When it is necessary to make a copy of a home recording, recourse is had to what is known as "dubbing," wherein the record is played back upon one device and the signal developed in the phono pickup, is amplified and fed to the cutter of another recorder.

Concerning discs suitable for home recording, it may be helpful if we mentioned its requirements, although it is true that some of them are not visible to the naked eye. Starting with the coated disc, it is essential that the disc be perfectly flat. Any attempt to

record upon a disc which is not flat, will result in a ruined recording. In fact, the record is useless if it has even a small high spot or low spot, unless the position of this spot is such that sufficient useful recording area is available ahead of the spot or beyond the spot, depending upon the direction of the recording, so that what is to be recorded can be inscribed upon the record before the bad spot is reached. Recording with a high spot results in a record something like that shown in Fig. 7. One portion of the record, that which follows immediately after the high spot, will not be cut because the cutter will "bounce" off the record after it passes over the high spot.

To attempt to straighten a slightly bent record is useless because it cannot be done without impairing the surface and even if that is not a consequence, it is too difficult to do a job like that unless proper equipment is available. Such work should be left to the manufacturer of the disc. To try to cut such a record blank with a valuable recording, something which can be duplicated only with difficulty, is indeed poor economy.

A material which is suitable for proper cutting must, as we stated, be hard enough to maintain its condition after numerous playbacks, yet it must be of such material that will cut smoothly and will not tear as the cutter plows through it. If the material tears—that is, leaves rough edges—it will be productive of much noise. Incidentally, as you will learn later, this is also a function of the cutting tool or stylus, but since the record material itself is capable of contributing a great deal to surface noise, this condition is mentioned.

Proper recording requires that a smooth surface be available. This means that the coating upon the disc must be smooth and of the same thickness throughout as well as be free from air holes. Inasmuch as it is impossible to check for the presence of air holes other than by visual examination for air bubbles, much dependence must be placed upon the manufacturer of the blank. However, a cursory examination of the blank is possible. The entire surface must feel smooth to the touch.

It is also of significance to mention that while virtually all types of surfaces will take a "cut," the proper kind not only possesses proper frequency characteristics, by which is meant that the material cuts smoothly and easily for very rapid vibrations of the cutting tool, but that the ingredients do not act as harsh abrasive substances which wear away the cutting tool rapidly. It is for these reasons, as well as noise conditions, that the coated record blank is superior to either the pressed paper or the aluminum disc. It is also imperative—and this is another one of those conditions where the user must have faith in the advertiser—that the coating upon the blank, be of even consistency throughout its depth, as well as be of sufficient depth. Since the average proper depth of

cut is about .0025 to .003 inch, there must be ample material left beneath the bottom of the groove.

On the whole such a coated record is not volatile, but the shavings, that is, the material cut out when the recording is made, is highly volatile and should be kept away from open flames.

Recording blanks are available in various sizes from 6 inches to 16 inches. However, only the 6-, 8-, 10- and 12-inch types are usually used for 78 rpm recording, whereas blanks used for $33\frac{1}{3}$ rpm recording are the 10-, 12- and 16-inch variety.

Because of the limitations, to be explained later, of the spiral radius nearest the center of the disc, the recording times of the 78-rpm discs are approximately as follows:

6 inch	about 1 minute, usually less
8 "	about 2 minutes
10 "	about 3 to $3\frac{1}{4}$ minutes
12 "	about 5 minutes

In the case of the $33\frac{1}{3}$ -rpm records, the recording times are:

10 inch	about $3\frac{1}{2}$ minutes
12 "	about $7\frac{1}{4}$ to $7\frac{1}{2}$ minutes
16 "	about 14 to 15 minutes

The Cutting Head

We have already mentioned that the cutting head is the device whereby the electrical equivalent of the sound fed into the microphone is converted into mechanical energy. In order that this transformation of energy, from electrical to mechanical, be accomplished without altering the characteristics of the sound, certain requirements must be fulfilled. To show just what these are, it may be best to discuss the manner in which cutting heads function while they are performing this transformation of energy from one kind to another. What we shall discuss, however, relates strictly to the cutting head and for the present does not include the needle, although it is true that the cutting needle or cutting stylus is really an extension of the cutting head armature. Just what we mean by this will be clarified later.

One of the requirements of proper recording is the presence of the full range of frequencies which comprise the original sound as well as the correct amplitude relationship between these frequencies. While it is true that the amplifier system between the cutting head and the microphone, as well as the microphone itself, are parts of the system and can introduce their own effects, very much of the success attained in the inscription of the proper frequencies upon the record blank depends upon the operating characteristics of the cutting head. Thus the frequency response range of the cutter is important.

Just what this frequency range should be, is hard to state and there is a difference of opinion among recording engineers, for there are ways of compensating or equalizing the frequency characteristics of the cutter by suitable accentuating and attenuating networks in the amplifier. However, the majority of cutters in use have a frequency response up to about 6000 cycles, with higher cut-off limits in the better types of units. At the low end, response goes down to about 60 cycles, but here again, it is a matter of cost. Of course the ideal cutter from the theoretical viewpoint would be one which was capable of handling the full range of frequencies from say 30 cycles to 10,000 cycles, but such a frequency range is seldom if ever found in home recording systems, because the general design of the electrical system, as well as the recording blank. By limiting the frequency range of the cutter used with the usual home recording outfit to about 6000 or perhaps 7000 cycles, greater freedom from amplification of surface and needle noises is obtained, and the cost of the devices is kept reasonable. The range of frequencies handled by commercial recording systems is greater than that found in home recording units, being as high as 9000 to 10,000 cycles on the high end and as low as from 30 to 40 cycles on the low end. In the case of home-recording units, the low-frequency limit is between 60 and 100 cycles, being much closer to the higher figure than to the lower.

While it is a fairly simple matter to obtain flat overall frequency-response characteristics in audio amplifiers, the same condition does not hold true in the case of a recording cutting head. Yet certain definite requirements are sought in commercial recording, hence special provisions are made in the amplifying system which precedes the cutting head in the form of accentuating and attenuating networks, to correct for the response of the cutter. Inasmuch as the frequency-response characteristics of home recording units are not identified other than with the low and high frequency limits, particularly as it relates to the cutter, the average unit must be accepted as is. In the case of commercial units, the manufacturer supplies the required data, even to the extent of stating the setting of the various amplifier controls, as for example in the Fairchild units shown in this volume.

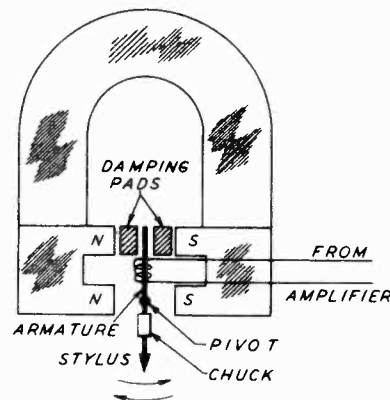
As to kinds of cutters, two are in general use. One is known as the magnetic cutter and the other is known as the crystal cutter. As to principle of operation, they differ greatly, but as to application, they are very similar. In Fig. 8 is shown an illustration of a magnetic cutter assembly. Essentially, this is a movable armature surrounded by a coil of wire, with the entire assembly located between the pole pieces of a permanent magnet. As you can see, the armature is pivoted at one end, the lower end, and the upper end is free

to move from side to side under the influence of the electric current which is caused to flow through the armature winding. The electrical impulses which actuate the cutter are secured from the amplifier connected between the recorder input system, which in most instances is a microphone, and the cutting head.

When an alternating voltage is applied across the terminals of the armature coil, current flows through the winding and a magnetic field is created around the coil. At the same time the armature also is magnetized. Thus we have present in the unit a magnetic field due to the permanent magnet as well as one due to the alternating current. These two fields react upon each other and apply a force to the movable armature. As a result of the manner of pivoting the armature, the only possible motion of this lever is from side to side. Any extension to this armature, as for example the cutting stylus which is inserted into the lower end of the armature, would therefore also move from side to side, but in a direction opposite to that of the upper end of the armature.

When current flows in one direction through the winding, the coil is magnetized so that the upper end of the armature is North. Hence this end will be repelled by the N pole of the permanent magnet and will be attracted to the S pole of the permanent magnet. Hence the upper end of the armature swings to the right, whereas the lower end swings to the left. Of course, you realize that since the lower end of the armature is pivoted, it does not move to the same extent as the upper end.

FIG. 8. A magnetic cutter assembly. This consists of a pivoted armature in a coil which can be energized by amplified signals from a microphone. The upper part of the armature swings in the field set up by the permanent magnet.



If the lower end were free to move, just as the upper end, that is, if the pivoting was done at the center of the armature, the upper end being N would swing to the right and the lower end, being magnetized S, would swing to the left. When the current through the coil reverses, the magnetic poles created around the coil also change and the upper end of the armature becomes S and the lower end becomes N. The result is that the upper end of the armature now swings to the left, for the upper end of the armature now is S and is attracted to the N pole of the magnet,

thus causing whatever is connected to the lower end of the armature to move to the right.

Thus the electrical energy present in the amplifier is converted into mechanical energy in the form of motion of the cutter-head armature and motion of whatever is connected to the armature. The frequency of motion of the armature is, as you can readily appreciate, determined by the frequency of the current flowing through the coil. The exact nature of movement of the armature is also determined by the characteristics of the current through the coil, that is, whether it is a sine wave or a complex wave.

Taking this action as a whole, you now can understand how, when a cutting stylus is attached to the lower end of the armature and a record is passed beneath this moving stylus, a wavy line will be inscribed upon the surface as shown in Fig. 9. This is an important point to remember for you will later have reference to two motions on the part of the cutting needle. It is this side-to-side motion of the armature which results in the stylus cutting the modulating groove into the record blank. This is called "lateral" cutting.

In connection with this side-to-side motion of the armature, it stands to reason that being a mechanical element, there would be a tendency for the armature to swing past whatever position is set by the amount of attraction of the armature due to the current amplitude. To prevent such action, damping elements are used. These are located in various ways around the top end of the armature, the exact design depending upon the cost of the magnetic cutter; the more expensive the device, the more elaborate this design, for it does have a very material effect upon the general performance of the unit, particularly in connection with frequency responses.

In the simplest of devices, these damping elements consist of two rubber pads located as shown in Fig. 8 by the cross-hatched lines and identified as DP. In the more elaborate units, particularly in commercial recorders, oil damping is used. In this arrangement, the upper end of the armature is extended into an oil

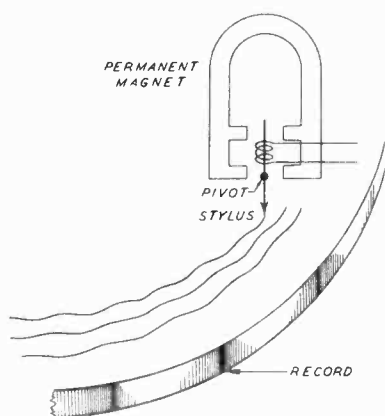


FIG. 9. When signal currents flow through the armature coil of a magnetic cutter, the pivoted armature moves from side to side and the stylus attached to its lower end inscribes a corresponding groove in the record blank.

chamber. The extension of the upper end of the armature moves against the oil.

Figs. 8 and 9 show simple versions of a magnetic cutter. The finished article is more complicated, as you can appreciate, but the basis of operation is as has been outlined. From the mechanical angle, very little service work can be done by the average service organization, other than proper centering of the armature between the pole pieces. In some units a screw adjustment is provided for that purpose; where none is available, such adjustment requires opening of the unit. As to other defects, they may be loss of magnetization by the permanent magnet; hardening of the damping pads so that they do not give sufficiently during the movement of the armature; loosened pads which jam the armature; in general various mechanical defects. In addition, the armature coil may open, but repair of such a winding is not recommended; it is suggested that it be replaced entirely. The construction of some units may be such that disassembly of all the parts cannot be done with ease. When this is the case, it is best to replace the entire unit, rather than to attempt to do a machining job to correct a defect.

Some of the manufacturers represented in this volume offer service suggestions relating to adjustments on such recording ends. The serviceman will be wise who limits his service work to the extent stated by the manufacturers.

The Crystal Cutting Head

The other type of recording head or cutting head is the crystal. Although not as popular as the magnetic type of cutting head, it is used in many installations. In principle it is markedly different from the magnetic unit, but in action it performs the same job. As to which is preferable, we have no opinion to render for each has good and bad features of its own. However, it cannot be denied that up to this writing, the magnetic type of cutting head seems to enjoy greater favor in the expensive commercial installations than the crystal unit. This is by no means a reflection upon the crystal cutter as used in home recording units, for in that category of instruments, there seems little to choose between the two types.

The operation of the crystal type of recorder cutter is based upon a phenomenon associated with quartz crystals. If a slab of this crystal is subjected to an electromotive force, certain conditions are created. The crystal will expand, bend, twist or vibrate depending upon the arrangement of mounting and the axis of the crystal. Whichever is attained depends upon the operating conditions created. In the case of the recorder cutter the twisting action is desired and this is accomplished by mounting one or two slabs of crystal, depending upon the cost and characteristics desired, between supporting members, in such a manner that

one end of the assembly is free to twist. This is shown in Fig. 10.

The cutting stylus is attached to that end which is free to move torsionally. When an alternating voltage is applied to the sides of the crystal, the torsional motion of the free end of the crystal moves the cutting stylus from side to side, in a manner similar to that

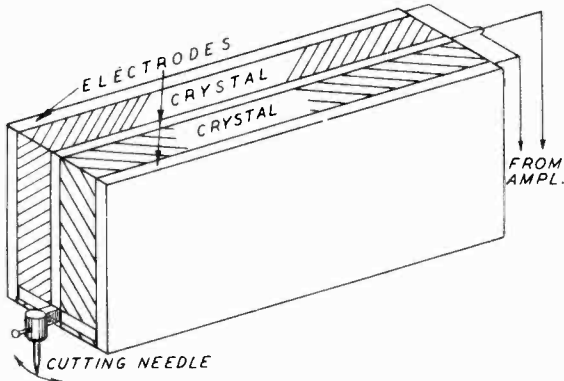


FIG. 10. Basic assembly of a crystal cutter. When the electrodes are energized, the crystals undergo a twisting movement in accordance with the signal voltages applied to the crystal faces from the amplifier. These twisting vibrations cause the cutting needle to have a side-to-side movement and so cut a groove, such as that in Fig. 9.

of the magnetic cutter. If this cutter is permitted to act upon a moving record blank, a wave type groove is cut into the blank, the contour of this wave being representative of the alternating voltage applied to the crystal. The larger the amplitude of this voltage, the greater the twisting action, hence the wider the inscribed groove. The flexure of the crystal is a direct function of the voltage applied. Temperature affects this condition, but only slightly.

Design details differ in the various models, but the basis of operation is as has been outlined. As to service troubles in such devices, there is very little that can be done in the average service shop in the event that one of these units goes bad. Any attempt to cement a bimorph crystal (double crystal) will seldom result in success, so that it is better not to try it.

Slight mechanical defects, such as a loosening of the various screws and support elements can be easily repaired, but defects associated with the crystal should not be attempted.

Unlike the magnetic unit, temperature has some effect, but even this is not much of a problem in daily use, because temperatures in excess of 125°F are needed in order to cause damage and these are seldom encountered in daily use. However, in the event that the location of the system is such that temperatures of this amount may be experienced, the possible results should be recognized.

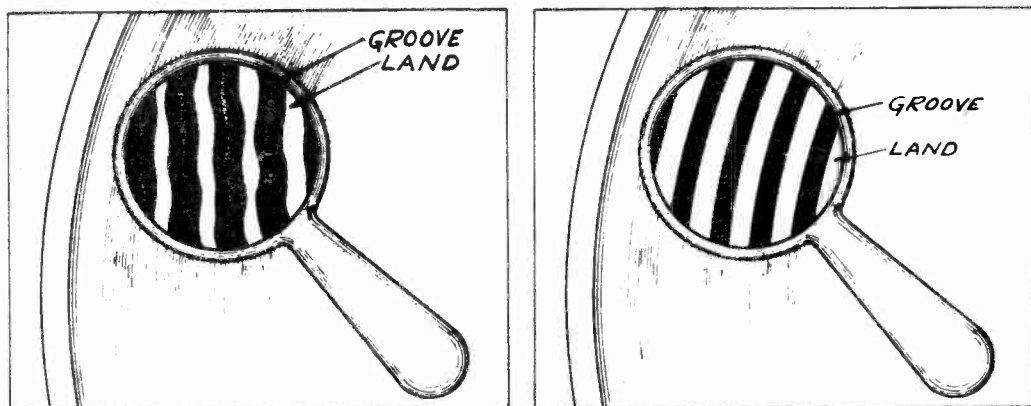
As is to be expected, since the crystal cutter is in competition with the magnetic cutter, its frequency response range is in line with the magnetic type of unit.

In all of this discussion concerning the motion of the moving elements within the cutting head, it should be understood that the head itself does not swing from side to side. That motion is limited to the moving elements within the cutting head. In fact any tendency towards such motion on the part of the complete head is a defect and calls for definite correction.

The Groove

Two methods of recording upon phonograph discs are available; which means that there are two kinds of grooves. One of these recording methods is that which is standard today, namely the "lateral" or side-to-side recording, wherein the audio voltages applied to the cutting head cause the cutting stylus to swing from side to side and inscribe a wavy line upon the disc. An example of this is shown in Fig. 11. To indicate the difference in the type of groove which is cut with the audio signal applied, that is "modulated," and without any signal applied to the cutter, or "unmodulated," compare Figs. 11 and 12; the latter being an unmodulated groove. Note that the action of the signal applied to the cutting head is to widen the groove and to reduce the "land" area existing between grooves.

FIGS. 11, left, 12. A modulated groove is indicated in Fig. 11 by the black wavy lines, the "land" or material between the grooves, being white. The groove of Fig. 12 has been cut with a recorder without sound input. Courtesy of J. P. Seeburg Corp.



The other method of recording is known as the "hill and dale" or vertical. This differs from the lateral in that the depth of the cut varies in accordance with the modulation. This is in contrast to the width being the variable in the lateral system. In the hill-and-dale system the width is constant, whereas in the lateral arrangement the depth of the cut or groove is maintained constant. There are certain advantages to the hill-and-dale method, namely better frequency response, as well as the ability to put much more on to a record, because it is possible to cut more lines per inch, but the system is limited to special apparatus and is not commercially used.

Concerning the character of the groove used in lateral recording, there again we have two types, namely the sharp V and the V with rounded bottom, as shown in Figs. 13A and 13B. Both are used in practice, although in the commercial records the rounded bottom type of cut is standard. The sharp V cut is usually made with steel needles which have a sharp point like 13A' whereas the rounded bottom kind of cut is made with special needles using sapphire tipped, special alloy tipped, or diamond tipped cutting stylii, all equipped with a slight radius at the tip as shown in Fig. 13B'.

From the practical viewpoint there is no difference in the kind of recording possible with one type of groove as against the other, with the result that steel needles are still in use. The original selection was founded upon the fact that the material available for home-recording blanks was much harder than the wax disc used for commercial blanks and required a sharper cutting tool in order to produce a clean cut. Today, however, special tipped stylii are available as already mentioned and the only justification for the use of the steel needle is its low expense. In comparison with the

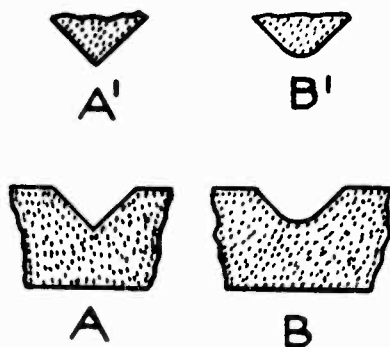


FIG. 13. A groove with a sharp V bottom is shown in A and that in B has a rounded bottom. The shape of the needle that cut each of these grooves is shown in A' and B' respectively. Courtesy of J. P. Seeburg Corp.

other types of needles, it has a very short life, some of them being suitable for about 60 minutes of recording time, whereas others are good for about 4 or 5 10-inch records. Sapphire-tipped needles on the other hand are good for many hours of cutting time, as are the alloy tipped ones. Diamond-tipped cutting stylii have a very long life.

Depth and Width of Groove

You will recall that we spoke about the depth and width of the groove when we mentioned the basic cut. Both of these constants of the groove, if we may call them that, are of great importance. In the first place the depth of groove, which is associated with needle pressure, has a great bearing upon the quality of reproduction, assuming everything else normal. It also has much to do with the ability to play back the record properly. In other words upon it, with everything else equal, depends successful recording . . . Let's consider this subject in the order in which the various associated points of importance were mentioned.

We said that the width of the groove was determined by the side-to-side swing of the cutting-head needle, which motion originates in the application of the alternating voltage to the cutter head unit. The stronger this voltage the greater the swing of the cutting tool. Now, if you examine Figs. 13A and 13B, you can readily understand how the depth of the cut also determines the width of the groove. If the cut is very shallow it will approach a groove condition which is the equivalent of no modulation, for unless the depth of the groove is sufficient, only the tip of the point will be cutting through the blank material. Some side-to-side motion will be present even at the tip of the needle, but by no means will it be representative of the full amplitude of the signal voltage applied to the cutter system.

When such a record is played back, music and speech sound very "thin" and there is marked distortion as the consequence of unfaithful reproduction of the relative intensities of the different frequencies. Needle scratch is high in comparison because the signal level is insufficient to override the noise.

Another very important condition is created by a shallow cut. If the depth of the groove is insufficient, the needle of the playback pick-up will not ride the groove; instead it will jump out and slide across the face of the record or jump from groove to groove. This is particularly important when playing back home recordings. The material used for such blanks is very much softer than commercial records and one such incident of a sliding needle is capable of ruining a complete record. Then again, it is possible that the tone arm of the playback unit does not ride as freely as it should. When the groove is not deep enough, even a small amount of excessive friction at the swivel of the tone arm will cause the needle to jump out of the groove.

Still another condition associated with the depth of the groove is generally successful recording. If you glance at Figs. 11, 12 and 13 and bear in mind the side-to-side motion of the cutting needle during the time that a signal is being fed to the cutter head, you can readily appreciate how the groove width will

vary with the signal level, being limited to a fixed minimum by the width of the cutting tool point. It is this basic condition which established the amount of land or uncut area between the grooves, as in Fig. 12. If the cut is made deeper, the width increases, even if there is no modulating voltage applied to the cutter, for a greater portion of the cutting tool is digging into the blank material.

Now, if we add to this, the additional cut due to the side-to-side motion of the cutting stylus, we arrive at a condition where for loud signals one groove cuts into the next as in Fig. 14. If this happens, the playback needle will skip from groove to groove. Then again it is possible that the side walls of the groove may not have been broken through sufficiently at the time of recording, but they are so thin that the first or second playback breaks them down and the recording is useless.

The relationship between the depth of the cut, the width, and the land between the grooves is so important that no worthwhile recordings should be made without first making a test cut unmodulated and actually examining the nature of the cut. For best results the land area between the grooves when unmodulated should be about 50-50. Slight deviations either way are permitted, although some people prefer a drift towards a 40-60 combination, the greater percentage being the groove. Some manufacturers consider the visual inspection of test cuts or recordings so important as to make available as a part or as an accessory of their apparatus, a small magnifying glass with which these test cuts can be viewed.

Still another important point relating to the depth of the cut is that if the cut is too deep, it may be possible to penetrate right through the coating material and dig the needle into the metal base. This not only ruins the recording, but is a sure way of damaging the stylus. While it is true that certain types of needles can be resharpened, that is no justification for carelessly digging into the metal base of the coated record.

Supplementing what has already been said, it might be well to add that while manufacturers of record blanks try to maintain a uniformity of thickness of coating, all are not the same, so that any one adjustment of cutter head pressure, which means depth of cut, which may be satisfactory for one record, is not necessarily satisfactory for another blank, unless it is definitely known that all of the blanks being used are alike . . . A test cut should be made when new blanks are being used and also when a cutting needle is changed.

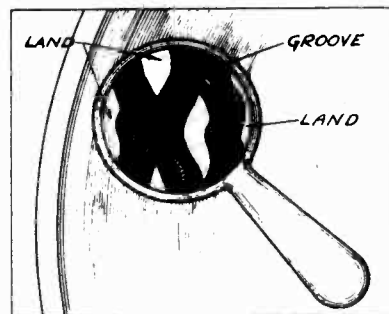
In view of the fact that steel needles wear away quite rapidly, it may be necessary to increase the needle pressure each time the steel needle is used, after the first cutting. This, however, should not be done without examining a test cut. The special tipped needles, since they have a very much longer life need

not be readjusted for quite some time, because they hold their cutting edge very well.

In all of the references to depth of cut, we have not spoken about what may happen if too deep a cut is made with low signal level. This may pass unnoted even after a visual examination, for there will be land remaining between the grooves, but another undesired condition will be created. This is the slowing down of the turntable speed as the consequence of the drag of the cutting tool. Such a condition ruins the recording, unless means is available in the playback mechanism to adjust the turntable speed to be equal to that of the recorder while the recording was made. This, however, is difficult for the speed of the recorder is slowest when the drag is at the outer limits of the disc and becomes less and less as the center is approached, so that a confusing condition is created. The user cannot seem to account for the fact that the first portion of the recording is bad but seems to improve as the grooves towards the center of the record are being approached.

Still another condition which is associated with the depth of the groove is that best described as "double talk" or "echo" effects. This is due to having cut so deeply that the walls of the groove are so thin that the side to side movement of the cutting needle, while cutting one groove tends to alter the shape of

FIG. 14. When too loud a signal is impressed on the cutting head, the lateral movement of the needle is excessive and one groove is cut into the space that the next will occupy. This results in the playback needle jumping from one groove to the next. *Courtesy of J. P. Seebury Corp.*



the other side of the wall separating the groove being cut from the groove already cut. This may also be occasioned by too much signal level at the recording head, resulting in too great a swing of the cutting stylus and reduction of the land area between grooves to a very thin wall, which undergoes the same effects as previously mentioned.

Advance Shoe Recording

Actually the advance shoe is a small accessory available upon some professional type recorders rather than a form of cutting, but in order to include the name

in the caption of this paragraph we associated it with recording. The purpose of this advance shoe is to maintain the depth of cut uniform regardless of variations in the record, in the thickness of the record blank, etc. This advance shoe which may be a ball is located near the cutting stylus, and when adjusted to a certain height permits the needle to penetrate only to a certain depth. The advance shoe rides on the uncut portion of the record. An example of its use is to be found in the Fairchild recorder discussed on that manufacturer's pages elsewhere in this book.

Adjusting Needle Angle

There is general agreement among those whose business is recording equipment design and technique, that the adjustment of the cutting-needle angle with respect to the record being cut, is very important, but there seems to be some difference of opinion as to just what this should be.

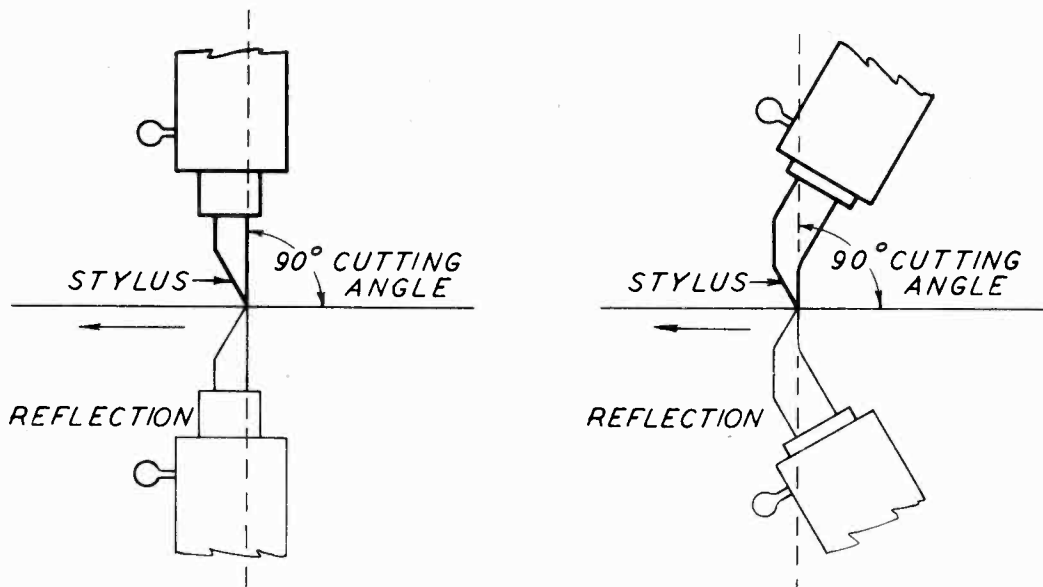
For example, the majority of people agree that the face of the cutting stylus should be set at 90 degrees with respect to the surface of the record and that a line drawn along the face of the needle and its reflection in the record should be perfectly straight. Just what is meant by this is shown in Fig. 15, wherein a straight type of cutting needle is used. In the event of an offset type of stylus, the same condition holds, although this may call for a readjustment of the cutter head position so as to create the desired condition. This is shown in Fig. 16.

On the other hand, if you will look through the service notes concerning records published in this

volume you will find several references which do not agree with the aforementioned. You will find some comments which alter this setting from as little as 5 degrees to as much as 16 degrees. Since each manufacturer is referring to his specific unit, it seems most logical when adjusting the cutting angle with that manufacturer's equipment to use his recommended cutting angle. Some of the cutting heads have screw adjustments which move the entire head, whereas others move only the chuck and moving mechanism within the head.

To quote one manufacturer, Seeburg, "When using steel recording needles with a V point, the cutting angle must never be more than 90 degrees and should be less if the recording blanks are uneven or warped. The more expensive needles which have radii at the tip can be used at a cutting angle of 90 degrees *provided* the blanks are of good quality and perfectly flat. It will sometimes be found possible to have a slightly quieter groove under these conditions. . . ."

The cutting angle has a decided influence upon not only the kind of cut but upon the noise qualities of the cut. If the cutting angle is greater than 90 degrees, as shown in Fig. 17, the stylus is digging into the record and may result in a number of effects. It may chatter or bounce as it is moving across the surface of the disc. . . . It may hiss and even give forth a squaling sound, both of which when evident in the cutting, will be evident in the playback. Reducing the depth of the cut or eliminating the chatter by raising the cutting head is not necessarily the remedy, although it may cure the trouble. What is required is to establish the correct angular setting, which under all reasonable conditions is a close approach to the 90-

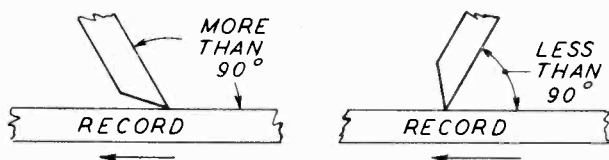


FIGS. 15, left, 16. In some cases, it is recommended that the straight line drawn from the face of the needle should make a 90 degree angle with the record and that the reflection of the needle's face should be in the same straight line as the face. This holds for both the types of needles shown.

degree setting, unless otherwise noted in the manufacturer's bulletin.

If the cutting angle is less than 90 degrees, as shown in Fig. 18, so that the needle is being dragged across the surface, it may give rise to a hiss. At the same time, such an adjustment requires more than the normal amount of pressure in order to secure the proper depth of cut. Any change in adjustment from Fig. 16 to 17 or 18 obviously requires readjustment of the tone-arm pressure.

Because some manufacturers employ different methods of illustration and identification than others and some readers may wish to correlate these data with that of other manufacturers, it might be well to state that our reference to the angle between the cutting tool and the disc, is that existing between the front part of the tool and the disc. We call that the



FIGS. 17, left, 18. If the cutting angle is greater than 90 degrees, as in Fig. 17, then the stylus may bounce or chatter as it moves across the record. A hiss may be introduced if the cutting angle be less than 90 degrees, as in Fig. 18, for here the stylus is being dragged across the surface.

face. This face usually is on the opposite side from the flat side of the cutting tool shank which is inserted into the cutter head chuck. At any rate, irrespective of the design of the cutting stylus shank, the cutting angle is that described. The face of the cutting tool faces opposite to the direction of rotation of the disc. This is illustrated in Figs. 15 and 16 as well as in Fig. 19.

Recording Needles

Cutting heads supplied with modern recorders are arranged to accommodate a variety of cutting stylii. In a few instances, due to some special design features, the manufacturer of the recorder supplies needles with his machine and states that best results are obtained with the needle which he supplies. When such is the case, it is so stipulated in the service notes.

In general, however, the average recorder will accept that stylus which is available of which there are four basic types, which differ in the material of which they are made, the period of useful life, hence the price. The most commonplace needle is that made of carbon steel which has been hardened and ground to a V shape, such as shown in Fig. 19. Although we understand that carbon steel is very hard, the friction

developed in cutting a record is considerable with the result that the useful life of the cutting edge of such a needle is not very great, being between 30 to 60 minutes of cutting time under normal conditions. Cost varies between 10 and 50 cents.

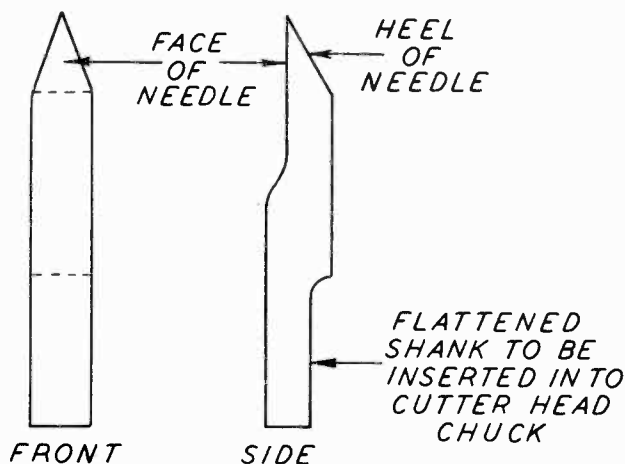


FIG. 19. Front and side views of a cutting needle with the various parts identified.

Such needles being ground to a sharp point cut more easily than others which have a slight radius at the time, that is, as long as their cutting edge lasts, hence require less needle pressure than the other varieties.

The second type of needle is that which employs an alloy insert as the cutting edge. This is somewhat more expensive than the first and has a longer operating life because it is capable of retaining its cutting edge for a longer time. Its shape is like that shown in Fig. 20A. It differs in that instead of making a sharp V cut like that shown in Fig. 13A, the point has a slight radius and the type of cut is like that shown in Fig. 13B. Since the needle point presents a greater

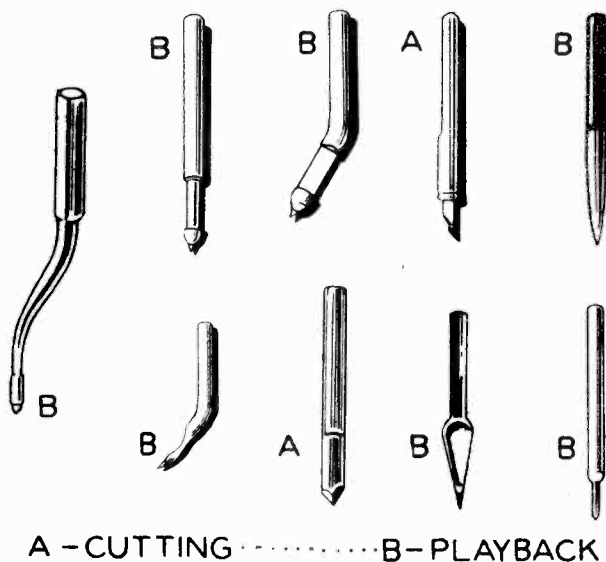


FIG. 20. Different types of needles.
Courtesy of Duotone Co., Inc.

area to the record while cutting, it requires somewhat more pressure upon the needle. On the other hand, it is much quieter in operation, that is, it is productive of a smoother cut, hence less surface noise. . . . And last, but by far not the least, is the important point that these needles can be resharpened and their cutting edge restored. This does not apply to all of them, it all depends upon the brand and when such rehonoring is possible, the manufacturer stipulates it in his literature. Cost varies between 50 cents and \$2.50.

The third type is like the second, that is in appearance, although it employs an entirely different material for its cutting point. This is a sapphire insert. The sapphire being second in harness to the diamond, is very popular as a cutting stylus and with proper treatment affords a useful operating life of about 15 hours of cutting time, after which period it can be resharpened. This is about three times the life of the average alloy-tipped needle. Cost varies between \$4.50 and \$7.50.

Last and by far the best uses the diamond-chip insert as the cutting edge. This kind of cutting tool has almost an indefinite life, for the diamond is the hardest of all substances. Naturally it is the most expensive of all of the cutting tools. Some suppliers say that a diamond-chip cutting needle is good for recording 1000 aluminum records and several times that many for coated records.

Of special interest in connection with such cutting needles, is the strange condition that despite their hardness, they must be treated with extra special care. One of the greatest dangers is to drop the cutting head upon the record blank, thus banging the needle point upon the record. Despite the hardness, they are very brittle and will break or chip off. Being microscopic in size any damage will not be visible to the naked eye, and examination must be made with magnifying glasses. But when put to use, a minute chip is sufficient to ruin the recording.

The Shaving

By shaving is meant the material cut out of the disc during the recording process. The character of this material can be used to judge the conditions of recording as well as the condition of the cutting stylus. The same is true of the groove cut in the record.

Generally speaking the shaving should be dark, shiny, and straight. If it is not, something is wrong. If it is gray and the grooves cut in the record are lighter than the unrecorded portion of the disc, it is a sign of cutting with an improper edge; the edge is not as sharp as it should be. A kinky or wavy thread, although of the proper shade to indicate a sharp cutting edge, is a sign of incorrect cutting angle.

One of the problems of recording is the disposal of the thread cut out of the record during recording.

This can be an aggravating thing when cutting from outside-in, for unless the thread is disposed of properly, it may bunch up beneath the cutting needle or it may wind itself around the turntable spindle and pull upon the needle, thus making a non-uniform cut. Theoretically, the design of the cutting head inclusive of the needle chuck and the proper placement of the needle within the chuck, should throw this thread in towards the center of the disc. . . . But this does not always happen. . . . If no automatic means of removing it is available, it becomes necessary to use a soft brush as the recording is being made, for gently brushing the thread in towards the center.

If however, as the result of either negligence or because of some condition relating to improper setting of the cutting needle, the thread bunches up underneath the needle during a recording, nothing can be done other than to fervently wish that everything will turn out all right. Sometimes it does, but in most cases it does not; but to attempt to raise the cutter head and to remove the thread or to attempt to brush the thread away is inviting trouble, for more than likely pressure will be put upon the needle and the recording will be damaged.

The shavings can be used to estimate depth of cut. Considering the normal depth of about .002 to .003 of an inch, the shaving should be dark and about the thickness of the human hair. If the cut is too shallow, the shaving will be very silky and even gray in color. If the cut is too deep, the thread will be very black and thick.

As we stated earlier in connection with these shavings the positioning of the cutting tool in the cutter head chuck is supposed to take care of the gathering of the shavings. Sometimes this can be aided by the use of a round shank cutting needle and turning the needle slightly off line so as to cast the thread in towards the center. This can be done, when necessary with a flat-shanked cutting needle by filing the needle shank at a slight angle, at that point where the needle meets the set screw. This type of correction can be carried out by "shimming" the shank of the cutting needle with a wedge-shaped piece of metal placed between the shaft and the set screw which holds the needle in the chuck. The amount of shift of the cutter is very slight, several degrees, towards the *inside*. Very often the trouble is due to incorrect placement of the needle in the chuck. What seems to be correct placement is not so because of slight unevenness in the screw at the point of contact with the needle shank, or an unevenness in the flat portion of the needle shank.

Trouble Patterns Visible Upon The Record

The pattern which appears upon a recording blank after the recording has been completed is oftentimes

an excellent indicator of the defect existing in the system, although not necessarily of where the trouble is located. Visible patterns of wheel spokes radiating outwards from the center indicate alternating light and heavy cutting, due to some impulse which is recurrent at definite portions of the disc rotation cycle. Any form of physical vibration or non-uniform motion will cause such a condition. Thus a worn or dirty drive mechanism, chattering gears, non-uniform speed of the motor armature are contributing causes.

Heavy recording on one side of the disc indicates a departure from level mounting of the entire assembly. It is very important that the entire recorder mechanism be perfectly level, and that the rotation of the turntable be constant and that it be true. Improper governor action may contribute to this effect.

Moire or V-shaped patterns upon the disc indicate the presence of vibration or hum occurring at certain intervals, yet not necessarily during the entire recording.

Uneven spacing of the grooves is due to friction in the mechanism which moves the cutting head across the record. This can be caused by any number of things: dirt, strands of shavings, lack of lubrication.

Other troubles which may appear periodically without creating a definite pattern upon the disc so as to afford a clew are:

Loose elements inside the cutting head

Hardened damping pads

Swinging cutter head

Periodical physical shock of the entire recording assembly due to a shift in the position of the mounting upon which it is resting

Induction of momentary hum into the microphone leads

Intermittent in amplifier system

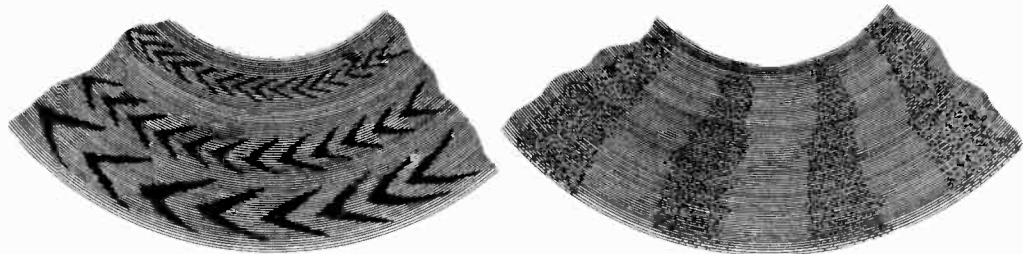
Variation in motor speed during sudden changes in line voltage

Improper action of governor

Slippage of the record.

In the accompanying illustrations are shown the recorded effects of some of the more common defects.

On the left is a typical moire pattern, which is generally caused by some sort of vibration or hum introduced at regular intervals. The pattern on the right is formed by light and heavy cutting caused by some sort of mechanical vibration.



Minimum Diameter of Recording

There exists a very interesting detail of recording, which should be of interest to the man who wants to utilize every inch of available space upon a recording disc used at 78 rpm. For that matter the same applies to the normal use of $33\frac{1}{3}$ -rpm records, because it involves the same kind of condition, as well as equipment.

Many people who have made recordings have noted what appeared to be a strange phenomenon, wherein the quality of reproduction seemed to fall off badly as the reproduction of the recording near the center of the disc was played back. This is a definite condition which exists unless corrective measures are instituted, which incidentally are seldom available with home-recording equipment, hence home recording should never be made with groove diameters less than 4 inches.

The reason behind the change in quality, particularly the loss of high frequencies, is that the reproducing needle cannot properly follow the high-frequency undulations inscribed upon the record when the diameter of the groove is less than 4 inches. And the reason why it cannot follow it is that the radius of the tip of the needle will not fit into the cuts made in the walls of the groove. These cuts made in accordance with the movement of the cutting needle under the high-frequency electrical impulses are crowded together to such an extent that the needle just touches the high points or slides over them and the voltage generated in the pickup is not representative of the true amplitude or frequency.

This pinching of the inscribed wave comes about as the result of the difference in speed of travel of the disc beneath the cutting needle at various distances from the center of the disc. For example, in Fig. 21 is shown a segment of the record, actually a quarter of the whole record. If the cutting needle is going to trace a groove at a distance of $5\frac{1}{2}$ inches from the center at a speed of 78 rpm, over this quarter segment it will make a groove $8\frac{5}{8}$ inches long. However at a distance of 2 inches from the center of the record,

the groove traced by the cutting tool would be only $3\frac{1}{8}$ inches, yet the time elapsed to trace these two grooves would be exactly the same. Obviously then, the speed of travel of the disc beneath the cutting tool is a function of the diameter of the circle being inscribed; the smaller the diameter, the slower the speed of the cutter.

Now, if it takes about .32 second for the cutting tool to make the outer groove $8\frac{5}{8}$ inches long, it would be possible to record about 2000 individual cycles (approximately) of a 6000-cycle wave. The waves cut into the groove would occupy a certain space. Now if we consider the inner groove, that cut at a distance of 2 inches from the center, the time required to cut the groove $3\frac{1}{8}$ inches long would still be .32 second and if we desired to record 2000 individual cycles of a 6000-cycle tone, the reduced length of the line cut would force squeezing of the individual cycles. This is what happens and to an extent which does not provide sufficient space for the reproducing needle to get into the lines cut in the walls for each of the cycles.

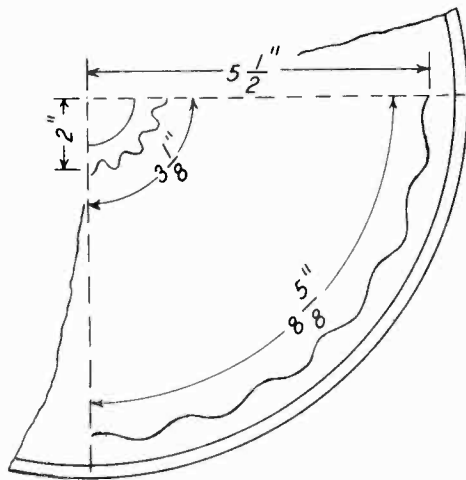


FIG. 21. The quality of a recording is better in the outer grooves than it is in the inner grooves, because the cutting of high frequencies is spread over a greater length of groove near the outside of the record. The needle can follow them better than those near the center of the record.

The result is distortion, in fact the needle may not track at all. The reproducer needle can follow the various bends of the individual cycles when they are stretched out in the outer groove, but not very readily when they are compressed in the inner groove, particularly if the diameter of the inside grooves is less than 4 inches. In the case of $33\frac{1}{3}$ rpm, the equivalent minimum diameter should be about $7\frac{1}{2}$ inches.

General Considerations

There are other phases of recording which we are not discussing in this portion of this volume because much excellent material of that character is to be found

among the manufacturers' pages listed elsewhere in this book. We recommend their reading.

Pickups

The electric phonograph pickup is a part of the recorder as well as the record changer and while it has a function which is just the opposite of the recorder

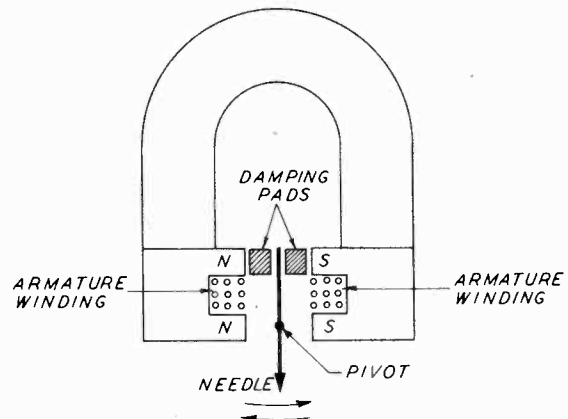


FIG. 22. Assembly of an electromagnetic pickup, which functions just opposite to the magnetic cutter, see Fig. 8, for here the mechanical motion of the pivoted armature induces a voltage in its winding, which is amplified and transformed into sound in the loudspeaker.

cutter, the basic principle of operation is pretty much the same. Whereas in the recorder head electrical energy is converted into mechanical energy, the reverse is effected in the pickup. This is true in the electromagnetic unit as well as in the crystal unit. Suppose that we discuss the magnetic type first.

One basic electrical law states that if a coil is subjected to a varying flux, an electromotive force will be induced, the direction or polarity of which will be determined by the direction of the flux lines. This principle is utilized in the magnetic pickup. In Fig. 22 we show a simple form of the magnetic pickup. An armature is pivoted between the poles of a permanent magnet. As the needle, which is held fast in the needle-chuck, moves back and forth in the process of following the groove walls, the armature in turn is forced to vibrate in the magnetic field. As the needle moves toward the outer portion of a groove, the top part of the armature approaches, say the North pole of the magnet while the bottom part of the armature approaches the South pole. The flux through the coil wound around the armature consequently increases so that the voltage at the terminals of the coil also increases. When the needle moves in the opposite direction, that is, toward the inside of the groove, the armature approaches the mid-position and the magnetic flux through the coil decreases, until at mid-position the flux is neutralized. As the needle continues moving in this same direction the

top of the armature approaches a South pole while the bottom of the armature approaches a North pole. The flux through the coil again increases but in the opposite direction from the case first mentioned, so that the voltage induced in the armature-coil is also of reversed polarity. Since the armature is compelled to vibrate at an audio-frequency rate, the voltage at the terminals of the armature-coil is an audio-frequency voltage, which, after amplification, may be delivered to a loud-speaker. The resulting sound is a reproduction of the original sound which was recorded on the record.

Although not invariably the case, magnetic pickups usually have a low impedance, ranging from about 50 to 500 ohms. Consequently, a magnetic and a crystal pickup are not interchangeable. If it is found necessary to employ a magnetic pickup, it must be remembered that a suitable step-up transformer must be connected between the pickup and the amplifier.

In the case of the crystal cutter we have already learned that the application of a voltage to the faces of crystal results in a deformation of the crystal. The reverse is also true, namely, if a crystal is twisted or bent, a voltage will appear on the faces of the crystal, the polarity of this voltage depending upon the direction of the bending or twisting. It is this principle which is employed in the crystal pick-up. A phonograph needle is held in a chuck which is mechanically connected to a crystal. As the needle vibrates in accordance with the audio-frequency undulations in the record groove, this motion is transmitted to the crystal to force it to bend or twist first in one direction and then in the other. Consequently an audio-frequency voltage appears on the faces of the crystal, this voltage varying in accordance with the original sound recorded on the record. Crystal pickups are high-impedance devices and may therefore be connected directly to the input circuit of a vacuum tube without the intervention of an impedance matching transformer.

Various defects may occur in pickups. In the magnetic type, loss of magnetization of the permanent magnet will result in a reduction of the output voltage. With age the damping blocks may become hard so that the pickup becomes unresponsive to the needle vibrations. Foreign particles may get in the air-gap and cause a fuzziness of reproduction. Further defects are an off-centered armature and an open-circuited or short-circuited pickup coil. Some of the foregoing defects in magnetic pickups may be corrected by the serviceman. In the case of crystal pickups, however, it is inadvisable to make any attempt to repair the crystal, it being preferable to replace the defective crystal with a new cartridge.

Recently a new type of pick-up unit has been marketed by the Philco Corp. This consists of a source of light, a tiny mirror attached to the permanent jewel stylus, and a selenium photoelectric cell, these being

arranged as shown in Fig. 23. As the jewel or needle follows the variations in the record groove, a lateral or side-to-side motion is given to it, which in turn is imparted to the mirror. Light from the lamp is reflected in corresponding varying amounts from the mirror to the selenium cell, wherein it is transformed from light energy into electrical energy. In other words, the flow of current from the cell is varied in accordance with the sound waves engraved in the groove of the record.

Several interesting problems arose in the development of this unit. Inasmuch as the light energy from the lamp is translated into sound, the usual 60-cycle source could not be used, as this would superimpose a

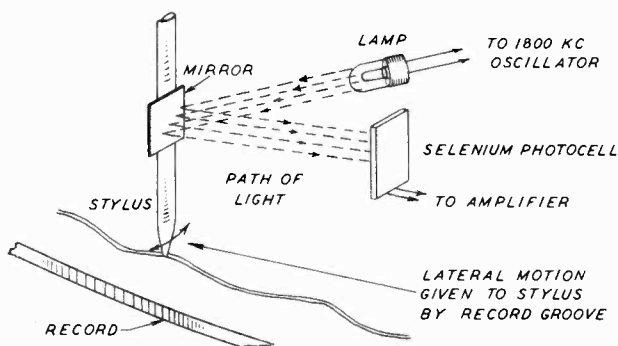


FIG. 23. Light energy from the lamp falls on the mirror attached to the pick-up needle and is reflected in varying amounts to the selenium photocell, where it is transformed into electrical currents which are amplified.

hum of the same frequency onto the recorded music. This problem was overcome by energizing the filament of the gas-filled lamp from an 1800-kc oscillator, this frequency being, of course, far above the audible range.

The mirror had to be as small as possible in regards to size and weight, so that the inertia of the vibrating jewel could be kept at a minimum. A mirror, such as is commonly used in moving-coil galvanometers, was mounted on a small block swinging on an axis that floats on a pair of flexible bearings.

Frequency Test Records

Frequency test records are useful tools for demonstrating the overall response of the amplifier and its associated equipment. Different types are made by both Columbia and RCA-Victor, and the characteristics of these records will be found below.

RCA-Victor No. 84522 is a 12-inch record, the A side of which is continuously variable from 10,000 to 30 cycles. In order to make for easy identification of the different frequency ranges a buzzer signal is injected at 10,000, 9000, 8000, 5000, 4000, 2000, 1000, 500, 200, 100, 50, and 30 cycles. The recording is of the constant velocity type for tones above 1000 cycles,

and of the constant amplitude type for tones below 500 cycles. The *B* side of the record contains two continuous constant-frequency test tones having an accuracy of 0.2%. The frequencies are 433 and 1000 cycles when played at 33.3 rpm, or 1000 and 2300 cycles when played at 78 rpm.

The Speedy-Q No. 7884 is a 10-inch record having a frequency range of 5000 to 50 cycles with a verbal statement of the frequency at the 1000-cycle reference tone and at 5000, 4000, 3000, 2000, 1000, 750, 500, 300, 200, 150, 100, and 50 cycles. This record is supplied with a supplementary chart which indicates the frequency response for various needles and pickups.

Columbia Audio-Tone No. 1 has a frequency range from 7000 to 50 cycles, with a verbal statement of what the frequency is at 7000, 6500, 6000, 5500, 5000, 4500, 4000, 3500, 3000, 2500, 2000, 1500, 1000, 700, 500, 400, 350, 300, 250, 200, 180, 160, 140, 120, 100, 90, 80, 70, 60, and 50 cycles.

Columbia No. 10001-M is a warbled frequency record having a range of 10,000 to 100 cycles.

Columbia No. 10002-M is a recording of a noise spectrum and has a sweep-frequency band which in 12 seconds covers the 10,000 to 40 cycle band.

Columbia No. 10003-M has a frequency range of 10,000 to 50 cycles.

Output Level Indicators

The purpose of an output level indicator is to enable the operator to record at a sufficiently high level so as to obtain adequate response when playing back, without at the same time recording at so high a level that over-cutting occurs with consequent destruction of the groove walls. There are three principle types of output level indicators: the neon flasher, the visual indicator tube, and the sound level meter.

The double flasher neon type of output level indicator is indicated in Fig. 24, which is employed in the Fada Model RE187. The normal operating range of a-f voltage for the cutter is between 60 and 70 volts. Neon tube N_1 , however, strikes at about 55 volts, so that it will continue to flash as long as the recording is above the minimum level. Neon tube N_2 has a resistor connected across it so that as a result of the voltage divider effect it will not flash until the a-f voltage has exceeded its proper range. The single flasher type of output level indicator employs only a single neon tube and the constants are adjusted so that proper operation is indicated when the tube flashes intermittently and for short periods of time.

One form of the visual indicator type of output level indicator is illustrated in Fig. 25. The two arrow-headed leads are connected across the a-f voltage at any suitable point and the circuit constants are designed so that the eye is just closed for normal output level of recording. Undue overlapping of the sectors indicate that excessive voltage is being fed to the recorder.

A sound level meter, as exemplified in Fig. 26, is employed in the Fairchild Model 219-2 recorder. The sound level meter is comprised of a 6H6 diode rectifier, a resistor, a condenser, and a 0—1 millimeter which is calibrated in decibels. The output voltage is increased to the normal operating level, and excessive a-f voltage is indicated when the meter reads too high.

Shielding

Recorder amplifiers possess a considerably greater gain than is the case of amplifiers in home receivers. This additional gain is needed to make up for the low sensitivity of the microphone. In order to avoid the possibility of hum and noise voltages, this higher gain

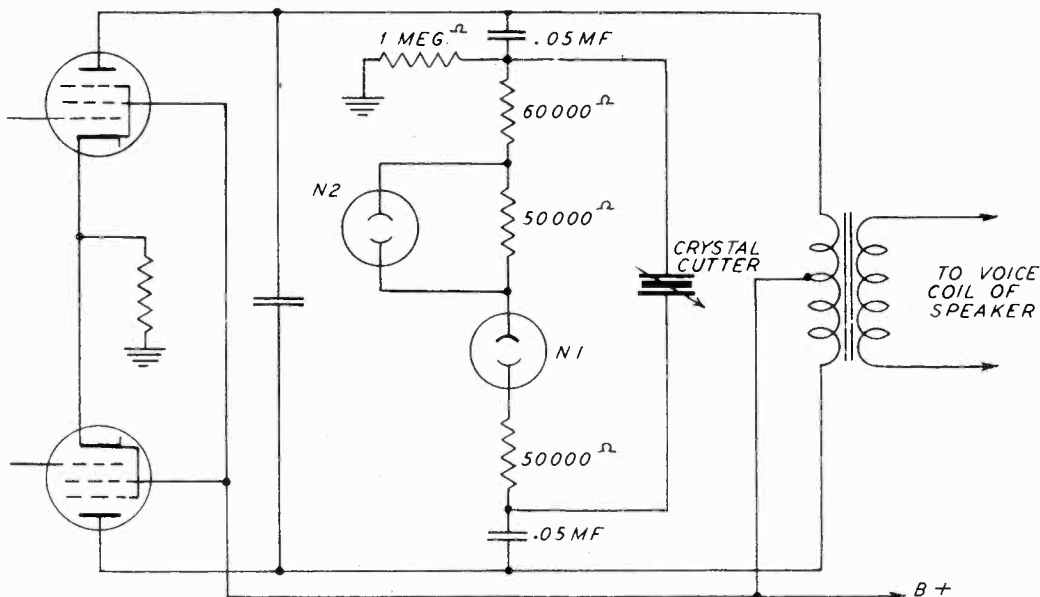


FIG. 24. The neon lamp N_1 strikes at about 55 volts and is a minimum indicator, while N_2 , having the 50,000-ohm resistor across it, will not flash until the a-f voltage has exceeded its proper range of about 70 volts.

necessitates the careful shielding of the input leads of the first tube. Considerable care is taken in the layout of the amplifier to make the input grid lead short, not only for the prevention of the pick-up of hum and noise voltages, but also so that the capacitance between the conductor and its shielding does not cause ex-

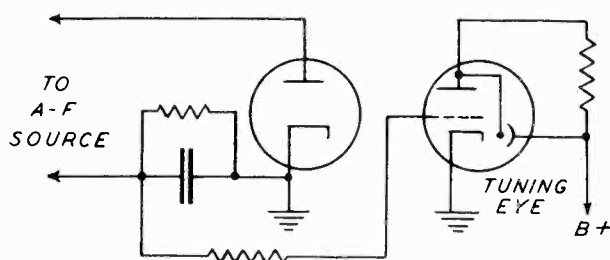


FIG. 25. When the tuning eye just closes in this indicator circuit, the a-f voltage is at the proper value, which, if exceeded, is shown by an overlapping of the shadows.

cessively high-frequency attenuation. The inverse-feedback leads are also frequently shielded in order to prevent undesired interaction with other circuits.

Equalization

A considerable loss in high-frequency response occurs at the inside of the record due to the fact that the linear velocity is much less here than it is at the outside of the record. Accordingly, it is desirable to increase the gain near the inside of the record so that the recorded sound may possess a brilliancy which is comparable to that at the outside of the record. It should be remembered, however, that very high frequencies cannot be reproduced with the full intensity level of the original sound. This is due to the fact that with increasing frequency the needle-point diameter of the pick-up needle approaches and may even exceed the wavelengths of such high-frequency tones.

PHONOGRAPH NEEDLES

THE subject of phonograph needles is in so highly controversial a state as to make it impossible to make definite statements regarding them. In the absence of quantitative data, the following comments are to be considered as tentative and are intended as a practical guide rather than as ultimate truths.

Material

Phonograph needles are made of metal (such as steel, chromium, or a rare-metal alloy), fiber (such as cactus or thorn), or jewel (such as diamond or sapphire). Since the material of which a needle is made has considerable bearing on record-wear, frequency

response, and needle scratch, we shall comment briefly on the various types.

Considering now only those pickups in which the needle is not an integral part of the pickup, the steel needle probably gives almost as good a frequency response as a chromium needle. The ordinary steel needle, however, should not be used for more than a single side of a 12-inch record or for more than two sides of a 10-inch record. This is due to the fact that commercial records incorporate an abrasive material whose function is to wear down the needle so as to make the needle better fit the groove. After this is accomplished, however, the abrasive action continues with the result that the needle develops a cutting edge which causes excessive record wear. A shadowgraphed needle, namely, one which has been examined by projection to determine that it initially possesses no irregular edges or breaks, may be used for two sides of a 12-inch record. Since the steel needle has such a short life, it obviously should not be used with a record changer, since the large number of sides played will result in excessive record wear.

Of the metallic needles, chromium needles have perhaps the best frequency response. In addition they may be used with automatic record changers, since each chromium needle is good for about 24 record sides. Chromium-plated needles are, however, dangerous to use, since any unevenness in plating will result in uneven needle wear and this, in turn, will result in excessive record wear.

Fiber needles may also be employed with record changer equipment, since certain types of them will play from eight to ten sides before they require re-sharpening. Fiber needles do not have as good a frequency response as steel needles and this becomes progressively worse as the needle becomes duller. To some this may not be too important since the loss of high frequencies also results in decreased needle scratch.

Sapphire needles not only have a very good frequency response but have, in addition, a long life, since they are good for about 2000 record sides. Once a

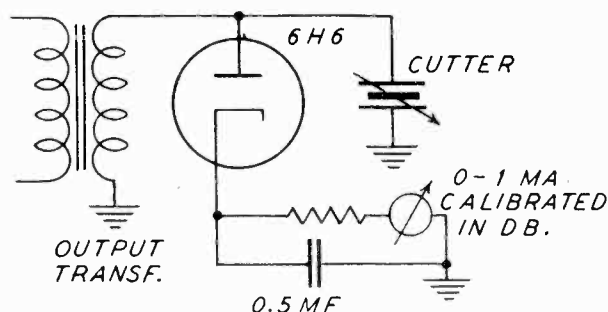


FIG. 26. The milliammeter, calibrated in decibels gives direct indications of excessive a-f voltage.

sapphire needle which has been used for quite some time is removed from the needle chuck it should never be used again, for extremely excessive record wear would result in consequence of the needle not being placed back exactly in its original position. (This applies more strongly to steel and chromium needles.) If, due to a fall or other cause, the sapphire needle should become chipped, records will be destroyed due to the sharp cutting edge.

Play-back Needles

Play-back needles should be either shadowgraphed straight-shank steel, or else the trailing type. The difficulty with the straight-shank needle is that it may jam in the groove. The trailing needle, which has a bent shape and a blunter point, avoids the difficulty of jamming, but suffers from a rather poor frequency response.

A play-back needle which has too sharp a point will rapidly wear out the bottom of the groove and will also give poor frequency response. On the other hand, a needle with too blunt a tip will be incapable of following the undulations of the record groove.

Never use for play-back, a needle which has previously been used on a commercial recording, for excessive record wear would result. After the first playing the record should not change appreciably in color.

Such change in color indicates excessive record wear and indicates that the needle should be replaced.

Experience indicates that the most practical solution to the problem of play-back needles is the selection of a sapphire point. It is the most expensive of the general run of needles, but best in the long run because it eliminates all of the worries due to possible defects in cheaper needles which require frequent replacement. Considering the usual value of home recordings, any step taken to preserve the character of the recording is worthwhile.

Concerning sapphire-tipped play-back needles, there seems to be some discussion at the time of this writing concerning a change in the radius of the grooves cut into records and the radius of the tip of such play-back needles. Whereas it was generally understood that play-back needles with a tip radius of .0025 inch were satisfactory, it seems that after a period of use of pressing matrixes, the width of the groove in the finished record is increased, so that a larger radius is required upon the needle tip to prevent bottom of the groove travel. According to *Radio Service Dealer*, who is the source of these data, newly manufactured sapphire play-back needles have a tip radius of about .0027 inch and this seems to cure the distortion which was experienced with some records. The increased radius remains satisfactory for some of the older records which had grooves with the smaller radius.

Chapter III

AUTOMATIC RECORD CHANGERS

WE HAVE gathered in this volume a representative collection of data covering virtually all of the automatic record changers manufactured in the United States over the last ten years. In this group are to be found numerous varieties including such general types as "drop," "ejector or throw-off," "turnover," and the combination of the "drop-ejector" type.

By drop type is meant a mechanism whereby the stack of records is supported on two or more oscillating shelves, which are capable of slicing off the bottom record, which then slides down the spindle to the turntable. This arrangement is capable of playing only one side of each record and after the stack has been completed, manual "flopping" of the records is necessary in order to prepare them for the next playing. The majority of the automatic record changers sold during the past few years are of this type.

Incidentally, as you can see after examination of some of the service notes contained in this volume, any attempt to just "flop" the records and place them back upon the record changer would not result in the proper playing sequence. To overcome this difficulty both Victor and Columbia have announced albums of records which are intended to be used on such record changers. These records are arranged so that the renditions are in sequence upon the different records rather than upon the front and back of the same record. For example, in a four-record album for the drop type of changer, the sequence of playings upon the individual records is

- 1 — 8
- 2 — 7
- 3 — 6
- 4 — 5

Another type of automatic record changer is known as the "ejector or throw-off," wherein the record is actually pushed off the turntable into a sort of a hopper where the used stack is formed. In this type of changer, which incidentally never approached the popularity of the drop variety, are employed several different arrangements, which are native to the individual manufacturers, but in general, certain similarities exist among them all.

For example the stack of records instead of being located upon shelves above the turntable, are located upon the turntable. The spindle is movable in that it can slide down into the assembly below the turntable to the extent necessary to permit the approach of the

ejector arm and its contact with the top record already played. This means that the spindle recedes the amount equal to the thickness of the record, thus permitting the ejector arm to slide off the top record, but the remaining records are held in place by that portion of the spindle projecting above the turntable. An example of this arrangement is the RCA record changer identified herein as being used in the U-109 receiver. As we stated, this specific arrangement is not the only kind that is used in ejector type machines. There are various ways in which the record is cast off.

It was mentioned above that in the case of a series of records constituting an album, the second part of a selection was not on the back of the record on which the first part was recorded when the series was to be played on a drop type of record changer. The same is true in the case of the ejector or throw-off type, but here the arrangement is again different, and if when you consider the difference in the way the unplayed records are initially arranged on the record shelves in the drop type and on the turntable in the ejector type, you will see the necessity for the different sequence. The sequence for the ejector type is as follows:

- 1 — 5
- 2 — 6
- 3 — 7
- 4 — 8

Another type of record changer is known as the "turn-over" which is typified by some of the Capehart units. In this interesting arrangement the records to be played—there can be 20 of them at a time—are stacked horizontally in a hopper. When a record is to be played, this stack turns up on end and when in a diagonal position, the bottom record slides out upon the turntable. To prevent the rest of the records from falling, a frame which normally surrounds the turntable moves up to hold the outside records in place. . . .

After the record has been played, it is picked up off the turntable and carried back towards the stack, which again is up-ended. However, before it reaches the stack, a reversing arm comes into play. This reversing arm holds the vertical record momentarily against the record stack. Then the stack is tilted slightly and the reversing arm lets go, thus permitting the record to slide down again upon the turntable. . . . Now the record is reversed, for that side which was played was the side nearest the stack, and when the record slides again upon the turntable, the played side

is on the bottom and the side to be played is upon the top.

After the second side has been played, the record is lifted, but this time the reversing arm does not come into play. Instead the record is moved back upon the top of the stack and the next bottom record slides onto the turntable.

A recent development in automatic record changers is that device which is a combination of the ejector and drop types and is a double-side player. This is saying quite a lot and means that the placement of the record upon the rotating turntable is by means of a drop from record shelves. The ejection of the record after both sides have been played is by ejection into a hopper, although the mechanism is different from that previously described. In this unit, the entire turntable assembly is upon a swivel which tilts, as shown in Fig. 1, so as to permit the record to slide off onto a recess chamber after both its sides have been played.

As to the playing of both sides, this is done by means of two separate pick-ups, located upon a single tone-arm. One pick-up makes contact with the upper face of the record when the top side is to be played and after this playing is finished, the upper pick-up is lifted and the lower pick-up comes into position. However, since the direction of rotation of the groove upon the underside of the record is opposite to that upon the upper side when the record is held in one position, the change in pick-ups is also accompanied by a reversal in the direction of rotation of the turntable.

The location of the record in playing position is shown in Fig. 2. As you can see the unplayed records are stacked upon the shelves. When a record is dropped into playing position, it contacts the turntable, which, unlike the conventional, has a diameter equal to only the diameter of the label in the center of the record. This is evident in the service notes which describe the RCA Model RP-151. One motor is used to operate the turntable and another motor is employed to perform the various cyclic operations associated with the tone-arm, record changing, etc.

So much for the general description of the basic types of record changers as identified by how the record reaches the turntable and what happens to it after it has been played.

Mechanisms in Automatic Record Changers

It would be very nice if we could say that all record changers are alike. Unfortunately we cannot say that because it is not so, although, as you will learn after examining the service pages contained herein, many are alike, for in numerous instances the same record changer is sold to a number of different receiver manufacturers. However, there still remains a variety of changers with which the average serviceman must become familiar, if he is going to do this type of service work.

At first thought it may appear that the suggestion to become familiar with all types of record changers is a

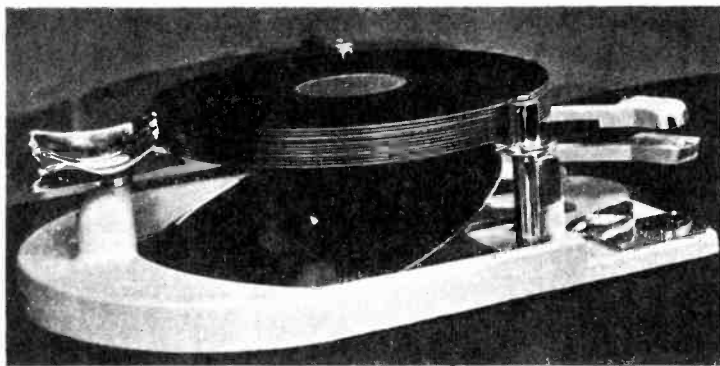


FIG. 1. When both sides of the record have been played by the pick-ups, shown swung out of the way to the right, the entire turntable mechanism tilts and the record slips off the short spindle into a receptacle. Courtesy of RCA Mfg. Co.



FIG. 2. A new record has been dropped from the pile supported by the record shelves and the pick-up is shown just at the edge of the record.

Courtesy of RCA Mfg. Co.



tremendous task. Actually it is not so because the amount of familiarity needed is more in the form of general information rather than specific actions. Work upon automatic record changers is greatly expedited by the service notes which many manufacturers supply and when such notes are available and they are fairly complete, the functions of the various linkages are easily identified. However, there are times when such complete service notes are not available.

Because of the lack of such operating data in more than a few instances we feel the need for a logical method of approach when an individual faces a new record changer for the first time and has very little data with which to work. We have found that one of the reasons why men have experienced complications when servicing record changers is that they try to observe too many actions at the same time. It just cannot be done; a definite breakdown of motions is essential, otherwise a great deal of time will be wasted.

As we stated before, all record changers are not alike, yet certain basic mechanical similarities exist, not necessarily in the exact way in which a certain motion is attained, but rather in the motion which is needed. For example, the manipulation of the tone-arm must be the same in all cases, because all changers play like sized records, must start at the same point and end at the same point on the record in order to start and end the cycle. In completing this cycle many motions are involved and while it is true that various ways may be employed to accomplish these motions, the fact remains, nevertheless, that like motions must be completed.

Furthermore since it is the playing of the record which starts the tone-arm cycle, that is, when the pick-up needle reaches the last groove upon the record, and this is the same in all changers, it is possible to select the tone-arm as the key point of observation. And since when the pick-up needle starts moving across the record grooves, or is in the first record groove at the start of a record, most of the parts of the record changer mechanism are not moving,—this setting of the changer is the best starting point.

Because the operation of record changers involves a definite sequence of movement of the different parts, observation of the motion of the parts must be along certain lines. First is observation of those parts which are moving as the result of the existing motion and second, is the motion of those parts which are *getting set* to perform a certain function later.

For example when a record is being played, there is no driving force which is actuating the travel of the tone-arm, other than the fact that the pick-up needle is tracking in the record groove and as the record rotates the needle follows the groove and the tone-arm swings with it. However, at the end of the needle travel, that is when it reaches the last groove upon the

record, the next required operation is that the tone-arm be lifted from the record. This means that some linkage, set off by the final position of the tone-arm at the end of the playing, must go into action. Hence there must be some motion associated with the actual movement of the tone-arm in its swing across the record, which is being set into position to trip when the tone-arm has reached its furthestmost position at the end of the playing of the record. For example in one General Industries job, this motion is the gradual shift in the position of a lever shaped something like a shepherd's stick. This lever is coupled to the tone-arm swivel. As the tone-arm swings, it changes the position of this lever. Finally when the record is finished, this lever is in such a position that when the needle gets into the oscillating groove upon the record, the hooked end of the lever trips that mechanism which raises the tone-arm off the record and carries it back to the starting point.

In another job, one of the RCA units, a lever linked to the tone-arm swivel trips a pawl, which in turn is coupled to two mechanisms. One is a cable attachment which raises the tone-arm; the other is a grooved cam arrangement, whereby the entire tone-arm is swung back to its starting point.

Now, the descriptions of mechanisms given here are not intended as an attempt to describe the entire actions, but rather to lead up to the statement of how the observations should be made upon a strange changer. In other words, commonsense dictates that it is impossible to follow all movements at the same time, hence one motion at a time must be observed. Such is the case in point. . . . Since the end of a playing of a record means that soon after, either the record will be ejected or thrown off, or another record will be dropped into place, certain parts associated with the ejector mechanism or with the record dropping mechanism, also are in motion. . . . But these are not of interest at the moment, for we are still concerned with what happens to the tone-arm. The motion of the tone-arm, starting from the first groove in the record, across the record during playing, and then raised off the record after the playing is finished, is just one half of the cycle. . . . The tone-arm, while raised, must be carried back to the starting point and again lowered to the record for a new playing. . . .

It is necessary, as we said, to find out how the tone-arm gets back to its starting point and is again lowered to its playing position. When that operation is observed, the study of the operating cycle of the tone-arm is completed.

We realize solely from experience that such a description can be presented more rapidly than its actual fulfillment in practice. . . . It may be necessary for an individual to watch a half-dozen such cycles at slow speed before he grasps just what is happening. . . . The

slow-speed motion can be attained by rotating the turntable by hand. . . . It may be necessary to remove the turntable time and again so as to note what has happened to those parts which may be located below the turntable. This may be a nuisance, but you just cannot avoid such manifold operations, for if the description of the operating cycle is not furnished by the manufacturer, the serviceman must dig out everything for himself.

After the parts associated with the tone-arm motion have been identified, the next item should be the "Reject" button arrangement. This is the mechanism whereby the playing of a record can be stopped at will and the record changed. The reason for selecting this item as the next in line is because it is so closely associated with the mechanism which comes into play when the pick-up needle has reached the last groove upon the record. . . . The reject button does the same thing that is done by that system which is associated with the tone arm as it moves across the record while playing. In other words, the record "Reject" button does the same thing at any point along the record, as is done when the pick-up needle has reached the last groove in the record. And since the trip mechanism associated with the tone-arm has been identified, it is a relatively simple operation to follow the linkages between the "Reject" button and the tone-arm trip.

While all of these motions are being observed, other things are happening too, but again we reiterate, that *only one thing should be watched at one time*. . . . Whatever else is happening—let it happen. If you try to examine two different motions, all that develops is confusion.

After having checked the tone-arm cycle and the "Reject" button system, the next system to establish is that associated with the record drop or record throw-off, whichever type of unit is being considered. Since by far the majority of record players are of the drop type, we might just as well speak about the operation of the record shelves. These parts, as has already been mentioned, support the stack of records and slice off the bottom one.

Inasmuch as this operation must be performed simultaneously with the proper movement of the tone arm, there must be some association between the mechanism that moves the tone-arm and that which rotates the record shelves. At the same time, commonsense dictates that the new record cannot be placed into playing position *until after* the tone-arm has left not only the record, but has actually moved out of the way of the descending record, that is in between the record upon the turntable and the stack. This means that somewhere in the system, a set of wheels or linkages, whichever are being used, are being made ready to swing the shelves at the proper time. To identify what is happening, only the record-shelves mechanism should be observed, nothing else.

In the event that the changer is of the ejector type, record shelves are not used, hence the system to be checked after the entire tone-arm cycle has been observed, is the means whereby the ejector system is brought into play. This system, like the record shelves, can come into operation *only after* the tone-arm is out of the way, so that two processes exist which should be looked for. One is what we can perhaps call the priming system, that is, the movement of those parts of the ejector system which are being put into operating position by the motion of the tone-arm before it reaches its final position and then the actual ejecting process.

Strangely enough, that assembly of levers, wheels, and gears which makes up the works of a record-changer unit, has two basic functions: to manipulate the tone-arm properly and to handle the record, so that after these two operations have been observed, it just about covers the lot with one addition, namely the changeover over from 10-inch to 12-inch records. . . . If you give this subject a little thought, you will realize that the change from 10-inch to a 12-inch record introduces but one difference, namely the positioning of the tone arm when it *returns to the record* to start a new playing. In other words, whatever the device which is tripped by the presence of a 12-inch record in the stack, limits the distance of travel of the tone-arm from its furthestmost position away from the record upon the turntable towards the record. When a 12-inch record is on the turntable, having fallen off the stack, the travel of the returning tone-arm is shortened by about 1 inch.

Thus when investigating the action, we seek that agency which is associated with the return of the tone-arm to the record as well as the mechanism set into play by the 12-inch record trip upon the record shelf. . . .

Summarizing what has been said about the method of investigating the drop type of record changer so as to learn about its operation when service notes are absent, the routine would be as follows, which incidentally applies to other changers as well:

1. Tripping mechanism at the end of playing of a record
2. Method of carrying tone-arm back to starting point
3. Lowering of tone arm and return to starting point of 10-inch record
4. Operation of reject button
5. Operation of record dropping mechanism (record shelves)
6. Operation of mechanism which determines tone-arm return for 12-inch record.

Troubles in Record Changers

The troubles in record changers can be divided into four parts. The first is that which involves the electrical power system, inclusive of the motor, governor, and whatever gear-reduction assembly is used. The second is the electrical system involving the pick-up. The third is the mechanical system involving the records themselves and this includes improper tracking. The fourth is the mechanical system of the changer itself.

To list all of the troubles which may be experienced in these systems is a difficult matter because of a number of conditions. In the first place, since all changers are not alike in the manner in which various motions are accomplished, it is impossible to state in a general way any trouble which is peculiar to any one unit, for if we do, it is necessary to take cognizance of how that motion is accomplished. Therefore, it seems most feasible to depend upon the service notes which the manufacturers supply and happily, information relative to such troubles is to be found in practically all service notes, even if the operating cycles are not given.

About the only comments that can be made as general information are those which refer to the motors and drive arrangements, the electrical pick-up and records. As to motors and drive arrangements inclusive of the governors, they are covered in another section of this text. The same is true of the drive arrangements as well as the governors. As to such things as friction drive wheels, about the only things that can be said is that since the drive is by friction, the contact between the driving and driven surfaces must be dry, so that proper friction will exist. At the same time it must be clean for the presence of anything which will prevent smooth, even turning will be transmitted to the entire system as a periodic jar. . . . If for any reason the drive arrangement is not dry and free from foreign substances, such as grease, slippage will develop and this means not only a loss of driving power but erratic operation as well.

Concerning pick-ups, the operating principles have been dealt with, as have a few troubles. But since the tone-arm also is associated with the operation of the pick-up, as is the tracking of the needle in the groove, freedom of motion of the tone-arm is important with the further assurance that slippage between the tone-arm and the action of that device which is set to trip by the tone-arm motion, does not exist. Also, and this applies more to home-recorded records than to commercial records, the groove in the record is what determines to the greatest extent the ease of tracking. The grooves must be deep enough to keep the needle riding in them, otherwise the tone-arm assembly will slide right across the face of the record or jump from groove to groove.

A trouble associated with records and which may cause a mechanical difficulty by jamming the separator knives of the record shelves, is excessive thickness of the record as well as a rough edge. Both of these troubles are quite common. The rough edge can be rubbed smooth with sandpaper and the excessive thickness also can be remedied by sandpapering the edge so that the shelf knife edge can get between the records. Another commonplace trouble is chipping of the records. This is due to bending of the separator knives upon the record shelves. The remedy is to straighten the knives. How these knives are taken apart is a matter of individual design of the record changer assembly.

Concerning the mechanical assembly of the record changer, a few general statements are possible. In the majority of cases, actual remedies depend upon the construction of the unit and for this we refer you to the manufacturers' service notes.

It is often possible to clear a jam in the mechanism by rotating the turntable in a direction opposite to its normal direction of rotation. To do this the power should be shut off and the turntable rotated by hand. However, before this is done, it may be possible to locate what is at fault by the process of elimination, that is to rotate the turntable (by hand) in the proper direction, starting at the beginning of the tone-arm cycle, as previously outlined, and note how far the mechanical system can function before the jammed parts stop operation.

In connection with mechanical troubles, it will prove valuable to remember that mechanical problems are not like electrical problems. . . . The defects are visible. And as far as defects are concerned, they invariably are of certain types, depending upon the kind of mechanical device involved. . . . For example, in the case of gears which are supposed to mesh and turn, gears which are too loose may jam just as readily as gears which are too tight, because the loose gear may get out of line. Gears with burred edges and broken teeth will jam. If lubrication is required, the lack of it may freeze a gear.

If a lever is connected to a pin set into one of the gears, the condition of this lever may stop the gear from turning. The lever may be bent out of line or it may have risen slightly from its normal plane and in that way is applying a force that is out of line with what it is supposed to be. If levers are moved so as to trip a stationary pin or a rotating pin a number of conditions may contribute to the failure of the lever to contact the pin. Either the lever or the pin may be bent out of line; the end of the lever which contacts the pin may be worn away sufficiently so that the contact is not firm enough to trip the mechanism, but instead slides off. It is possible that whatever rotates the pin into position to be tripped by the lever

is being delayed by friction and does not meet the pin at the right time.

In all of these operations it is important to remember that when a changer is being checked, its position may be correctly level, yet when the changer is installed into its normal place in a radio receiver, it may be out of line, so that some part which may be loose is permitted to swing out of correct line and thus cause a jam.

Springs are quite common in record changers and defects may be due to improper return of these springs to their correct condition, at rest or when stretched. Granted that the amount of tension applied to these springs is not supposed to be enough to affect the performance of the spring, the fact remains that it often does.

Push rods which are force-fit into place often come loose and if tripping devices are either attached to them or associated with them, any tendency for this rod to turn, may so displace that point which acts upon the tripping device, as to miss engaging the tripping device completely.

Of the most important considerations of mechanical devices is not to force motion in the device in the direction it is supposed to move. If this is attempted, some kind of damage is inevitable. In isolated cases, it may free the trouble, but this is rare indeed. . . . In fact mechanical devices should never be forced. . . . Just remember that during normal operation all parts of the changer function smoothly and evenly and that if forcing is necessary, something is wrong.

Last, but by far not the least, always bear in mind that certain parts of rotating or sliding machinery must be lubricated—not all—*just some*. . . . The customer as a rule forgets all about this during the time that he has the equipment. He thinks about it after something has gone wrong. . . . Lubrication is such a simple matter that most of us are prone to overlook its necessity, particularly when we hear of such things as “it need not be lubricated for 500 hours.” . . . Yet lack of lubrication is one of the most commonplace causes of troubles. . . . Make certain that you check the points which have to be lubricated in accordance with the manufacturer’s instructions. . . . Don’t lubricate friction drive wheels !

Chapter IV

RCA Model RP-152-C Record Changer

The cycle of operations of a "drop" type record changer can be roughly divided into these phases:

Lifting pick-up from record upon the completion of the reproduction

Moving pick-up away from turntable

Separation and release of bottom record from stack on shelves

Return of pick-up to turntable

Lowering pick-up to first groove in newly dropped record

It should be borne in mind that while these phases can be considered as being separate and distinct, yet more than one may be occurring simultaneously. For example, while the pick-up is being moved off to the side from beneath the stack of records, the shelves supporting these records have started to turn preparatory to slicing off and dropping the bottom record at the proper instant when the pick-up is clear of the descending record. In the following series of photographs you will see how some of these phases of the record-changing cycle overlap, yet because one part of the mechanism may be jammed or out of adjustment and so affect just one of the phases, they may be considered separately.

This particular "drop" type record changer was chosen for analysis inasmuch as it is typical of many now in the field, as far as the record-changing phases are concerned. It will also be found that its record-changing mechanism will be alike or very similar to many that you are called upon to service. True, you will find variations in regards to motors, turntable-driving mechanisms, and in the levers, cams, pawls, etc. of the changer itself, but taken by and large their functions are similar to those described pictorially below. Once the functionings of the different parts of the mechanism of one of these changers are understood, it is logical that you should have an easier time diagnosing troubles in others.

In order to get a general picture of the functioning of the record changer as a whole, let us first run briefly through the several phases. The pick-up, starting at the outside groove of the record, is carried towards the center inasmuch as the record groove is a spiral. When the pick-up has arrived at the inner groove, a lever attached to the shaft of the tone arm carrying the pick-up, has shifted from its initial position so that it trips a release that starts up the record-changing cycle, the mechanism of which has been idle during the travel of the pick-up across the record groove.

As the tone arm has to be moved off to the side of the turntable out of the way of a descending record from the stack supported by the shelves, it is raised up off the record by means of a wire cable running through the hollow pedestal on which the tone arm turns. This pedestal is turned sufficiently so that the tone arm is swung off to the side. While this is occurring the two sets of shelves, supporting the stack of unplayed records, begins to turn and by the time the tone arm is out of the way, the upper pair of shelves has "sliced" off the bottom record which slides down the spindle onto the record that was just played.

Now the pick-up, still above the playing surface of the new record, starts back towards the turntable and stops just over the outer blank strip onto which it descends. While this is occurring the record shelves have been turning back to their original positions, supporting the stack of unplayed records on the upper shelves. The pick-up is slid across the blank space of the record into the outside groove by means of a spring that exerts just enough force to effect this short slide and no more, because if too much force were exerted by the spring the pick-up might jump the first two or three grooves.

The particular record changer described below is designed to play either 10- or 12-inch records, accommodating 8 of the former or 7 of the latter. (The manufacturer does not recommend that the two different sizes be played in mixed sequence.) The above description applies to the smaller diameter record. It can be seen that in the case of a 12-inch record, the pick-up must be returned to a point approximately an inch further away from the center of the turntable than when a 10-inch record is to be played. This change of initial placement is brought about by a tripping lever projecting up from the motorboard at the side of the turntable. This trip is of such a size that a 10-inch record misses it when it is descending from the record shelves onto the turntable, but the extra inch radius of the larger size record engages the trip on the way down and pushes it away from the turntable. The new position of the lower end of the trip under the motorboard limits the travel of the mechanism that controls the return of the pick-up to the record's edge, so that the pick-up descends to the record sooner than in the case of a 10-inch record. The trip or locating lever remains in the extended position during the playing of the record and returns to its normal position during the early part of the succeeding record-changing cycle.

As far as the adjustments of the record-changing mechanisms are concerned, they are slightly different for individual changers and will be found covered in the service data contained elsewhere in this book. Here we are interested mainly in the functioning of the mechanism itself. You will see that some of the following illustrations are paired: one view of the bottom of the motorboard corresponding with certain positions of the tone arm and record shelves during different phases of the record-changing cycle. From these you

can obtain an idea of just how the different levers, cams, pawls, etc. shift or are shifted throughout the progress of the cycle as outlined in the above paragraphs. Of course, if you have a record changer of this type "in the flesh," so much the better. Then you can place the pick-up near the inside end of the groove of a record on the turntable, which can be slowly turned by hand, and watch the mechanism while comparing its progress with the illustrations below. This is an ideal way to get a complete picture.

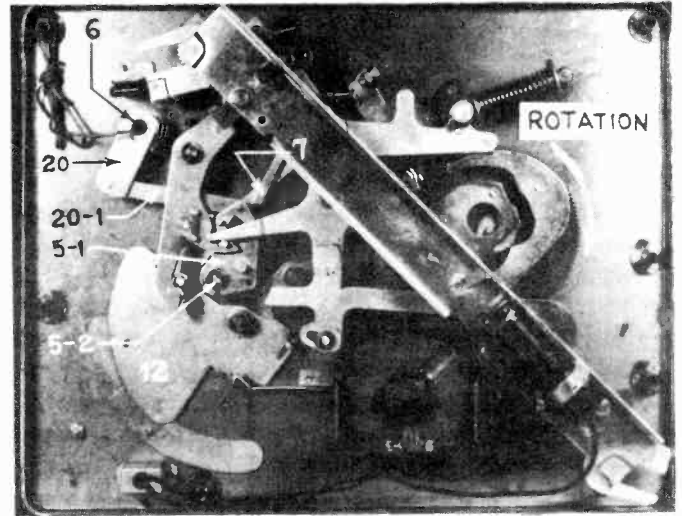


FIG. 1. The pick-up needle is in the outer groove preparatory to the playing of the record. The record supporting shelves are in their normal position to support a stack of 10-inch records. This is check point No. 1.

FIG. 2. Bottom view corresponding to Fig. 1. The following parts of the mechanism are actuated by the moving of the tone arm, attached to the hollow shaft 6, towards the center of the record: lever 20; link 20-1; friction clutch plate 5-1, and trip finger 7. This is check point No. 1.

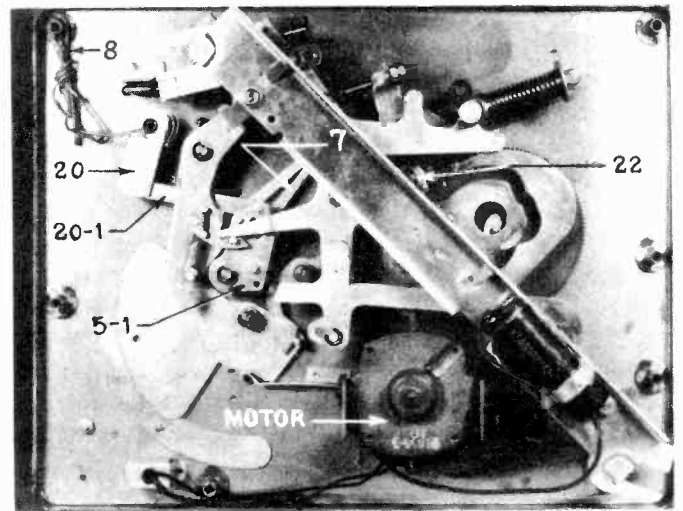


FIG. 3. The pick-up is here half way across the record. This is check point No. 2.

FIG. 4. Bottom view corresponding to Fig. 3. The following parts have moved to new positions: 20, 20-1, 5-1, and 7. Compare these with their positions in Fig. 2. This is check point No. 2.

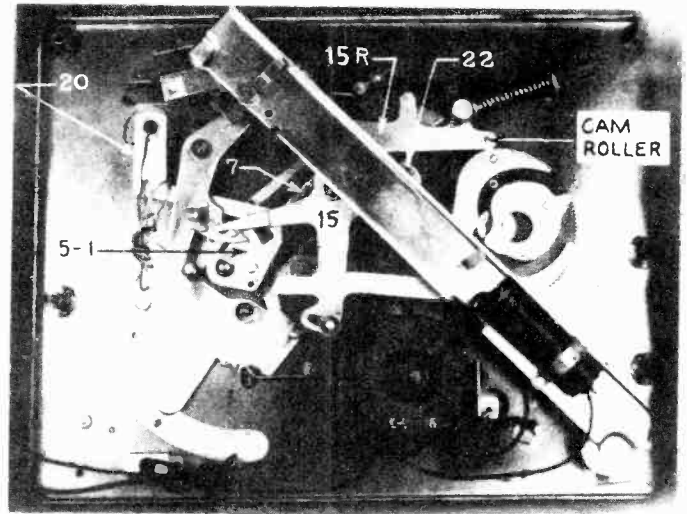


FIG. 5. The pick-up has reached the end groove of the record, which shifts trip mechanism (see Fig. 6) to start record-changing cycle. This is check point No. 3.

FIG. 6. Bottom view corresponding to Fig. 5. The trip finger 7 has shifted trip pawl 22 into tripping position through friction clutch (not shown) on upper side of friction clutch plate 5-1. This is check point No. 3.

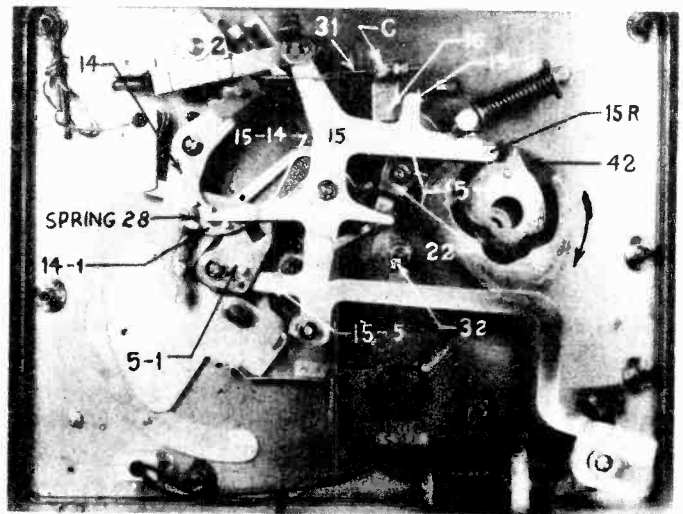


FIG. 7. Start of vertical motion of tone arm to lift pick-up from the record. This is check point No. 4.

FIG. 8. Bottom view corresponding to Fig. 7. Trip pawl 22 has been turned further by the tripper dog on motorboard side of main gear 42 which is continually revolving. Pawl 22 shifts main lever 15 so that cam-follower roller at end of 15-R enters cam slot on 42. The arm 15-14 frees latch 14-1 and arm 15-C starts to pull back on lever 16, to which is attached the pick-up lift cable 2. This is check point No. 4.

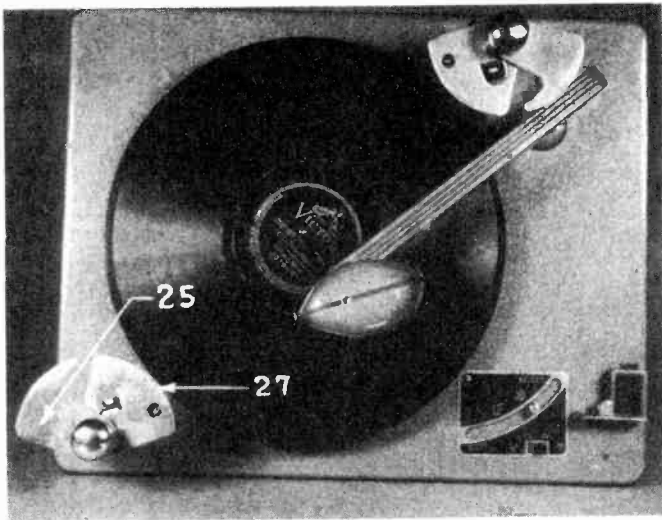


FIG. 9. Pick-up at top of its lift. The record shelves have partially turned. This is check point No. 5.

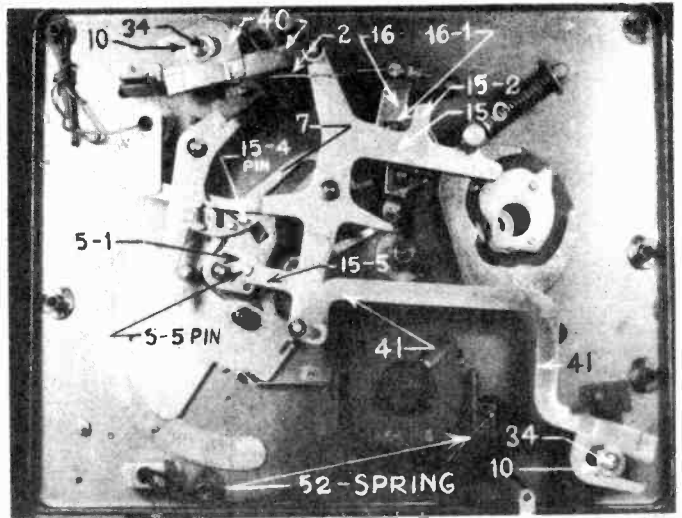


FIG. 10. Bottom view corresponding to Fig. 9. Lever 16 has moved to extreme right, having thus pulled pick-up to its maximum lift by cable 2. Arm 15-5 contacts stud pin 5-5 on plate 5-1 which shifts the tone arm away from the center. The end arms of the main lever 15 pull back on the toothed links 40 and 41 and so actuate the gears 10 that turn the record shelves. (See also Fig. 21.) This is check point No. 5.

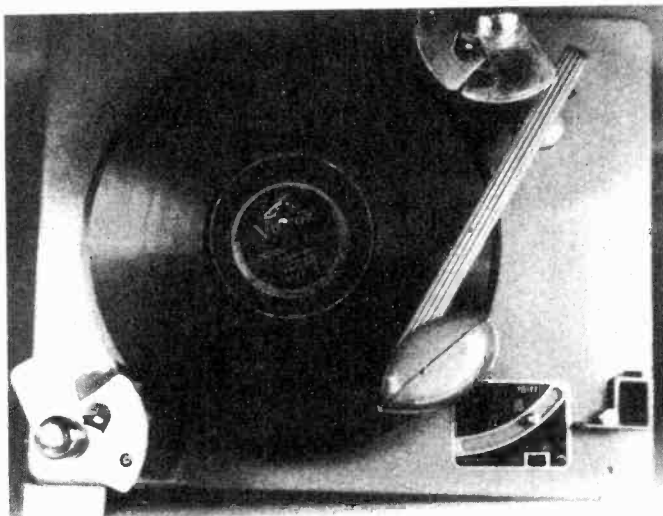


FIG. 11. The tone arm has traveled about half way to position shown in Fig. 13 and it is still raised above the record. The record shelves have turned further. This is check point No. 6.

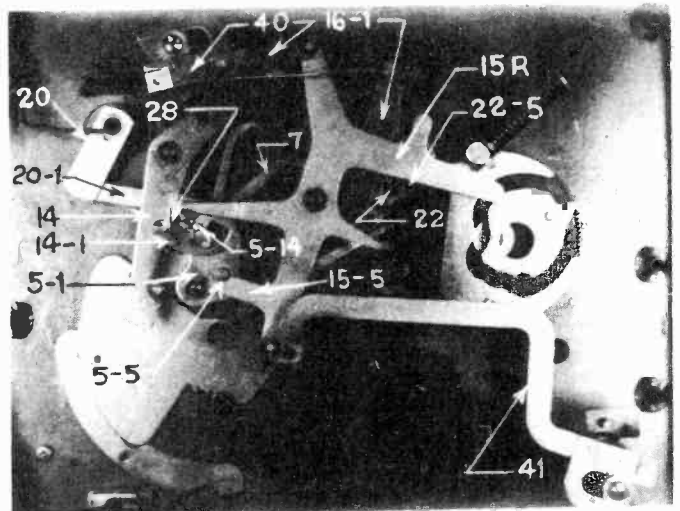


FIG. 12. Bottom view corresponding to Fig. 11. The friction-clutch plate 5-1 has been pushed partially outwards (thus moving the tone arm) so that pin 5-14 becomes latched to link 5-1 by latch pawl 14-1 and so with locating lever 14. The record shelves have been turned further by the inward movements of the toothed links 40 and 41. This is check point No. 6.

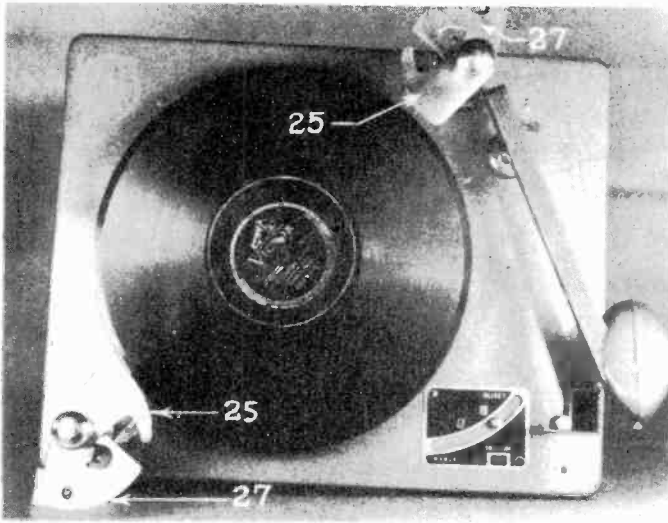


FIG. 13. The tone arm is now entirely out of the way of a record that has dropped on to the spindle from the lower of the pairs of record shelves 27, which are here at the end of their travel. When the record falls from the lower shelves, the rest of the unplayed records are supported by the upper halves of the shelves 25. This is check point No. 7.

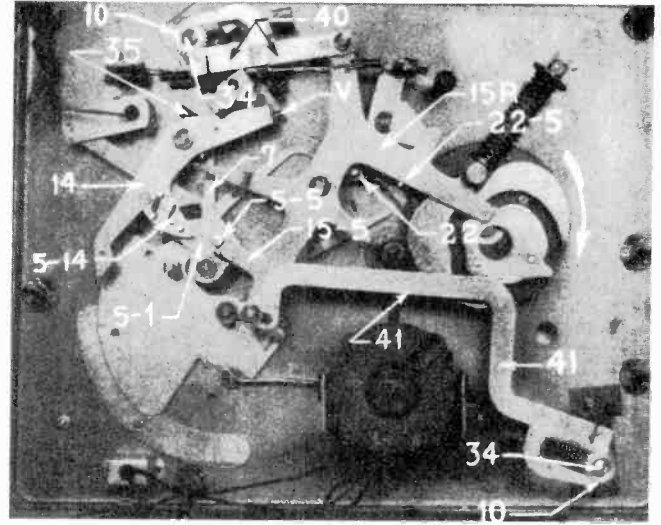


FIG. 14. Bottom view corresponding to Fig. 13. The friction-clutch plate 5-1 has been moved to the end of its travel, thus shifting the tone arm to its extreme outward position. The locating lever 14 is pushed in the same direction by the pin 5-14. The trip finger 7 has returned to its outer position and trip pawl 22 has been returned to its original position by the main lever 15 pushing on the pin 22-5. The record shelves have been turned to the end of their travel by the rack gears and pinions 40 and 41 and 10. This is check point No. 7.



FIG. 15. The tone arm has returned to a position just over the outer rim of unplayed record. Record shelves have just started to return to their normal positions. This is check point No. 8.

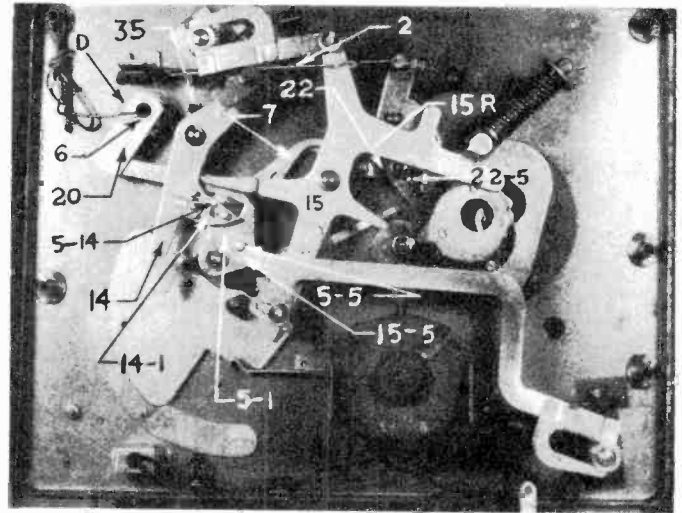


FIG. 16. Bottom view corresponding to Fig. 15. The main lever 15 has started to move back, retracting arm 15-5 from the stud pin 5-5. The tone arm, still held above the record by the tension of lift cable 2, has been returned by the locating lever 14 being pulled by spring 35. Lever 14 moves clutch plate 5-1 inwards by latch 14-1. Links 40 and 41 have started to move back and so turn the record shelves. This is check point No. 8.



FIG. 17. The pick-up now rests on the outer ungrooved surface of record. Record shelves are about half way back to their normal positions. This is check point No. 9.

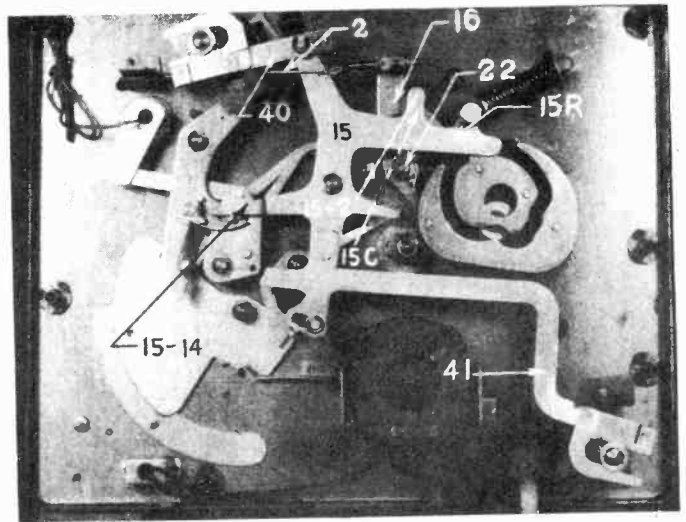


FIG. 18. Bottom view corresponding to Fig. 17. The main lever 15 has been moved further. The pin 15-2 on arm 15-C has released lever 16 which takes tension off the lift cable 2, thus allowing the pick-up to return by gravity to surface of the record. The record shelves are being returned towards their normal positions by the action of 40 and 41. This is check point No. 9.

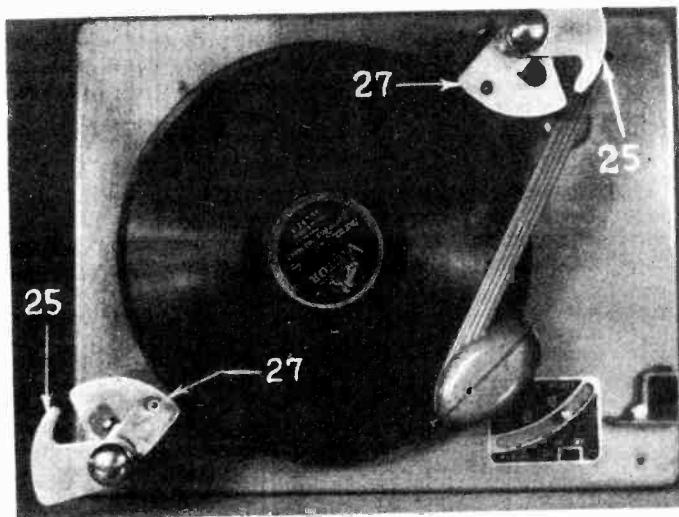


FIG. 19. The pick-up is now in the first groove of unplayed record. Record shelves have returned to their normal positions, with the remainder of stacked records supported by the lower shelves and the upper shelves clear of the edge of the bottom record. This is check point No. 10.

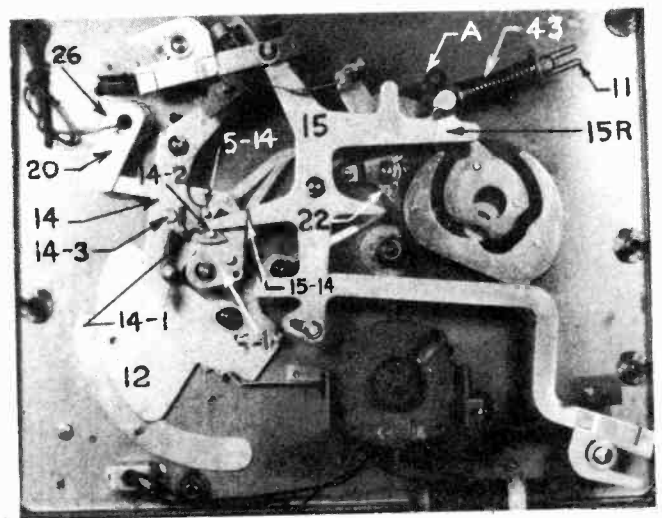


FIG. 20. Bottom view corresponding to Fig. 19. The main lever 15 has returned to its out-of-cycle position, being pushed beyond the cam by the projection of the cam at the end of 15-R and held there by the spring 43. The arm 15-R holds latch pawl 14-1. The starting spring 26 causes pick-up needle to travel across the outer blank space of record into outside groove. Links 40 and 41 have returned to their normal positions. This is check point No. 10.

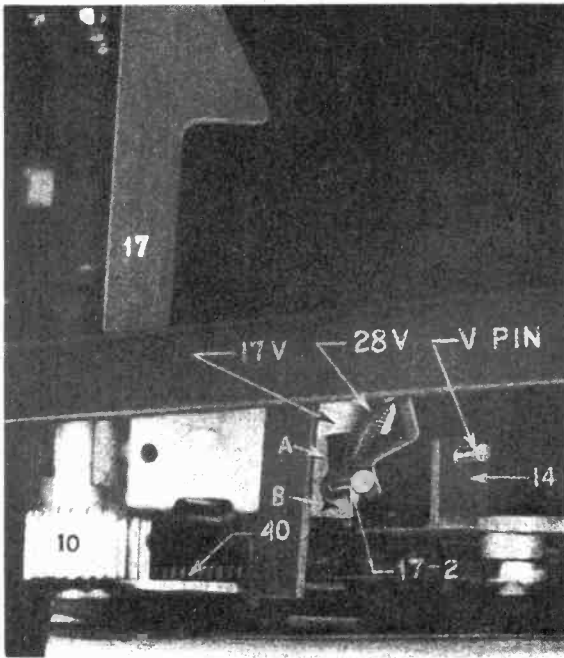


FIG. 21. The position of the record-discriminating lever 17 determines whether the pick-up returns to the rim of a 10-inch record or a 12-inch record. The spring 28-V is partially removed to show the step end, A and B, of 17, and the latch pawl 17-V pushed up.

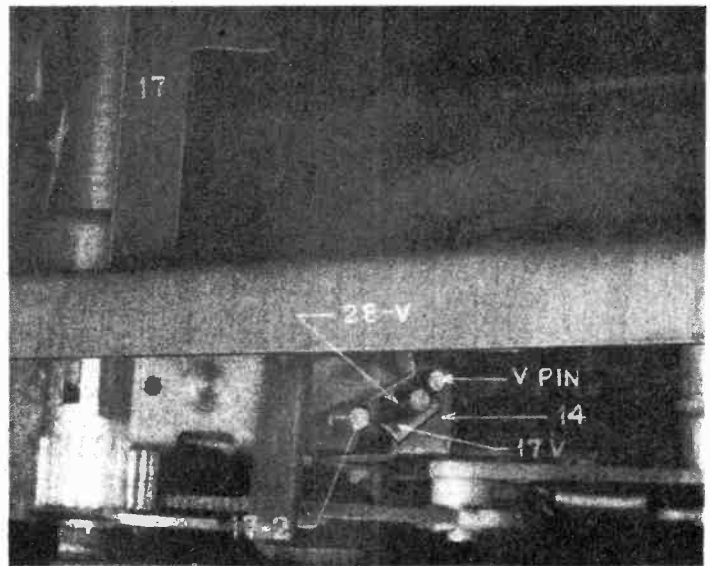


FIG. 22. The lever 17 is in the vertical (10-inch) position. Pin V, on the turned-up end of 14 (see Fig. 14), passing above the latch pawl 17-V, on lower end of 17, as it nears upper step A on 17 just before pick-up is lowered onto record edge near the end of the cycle. See Fig 16.

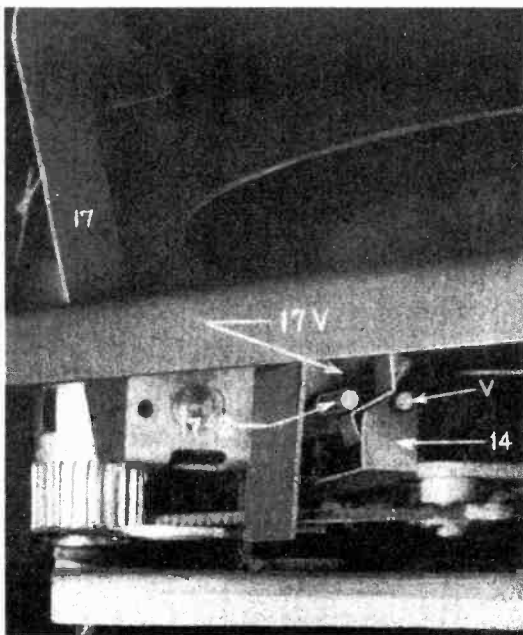


FIG. 23. The lever 17 is in the slanted (12-inch) position into which it has been pushed by a descending 12-inch record. The pin V is passing under latch pawl 17-V which it pushes up as it nears the lower step B in the same part of the cycle described in Fig. 22.

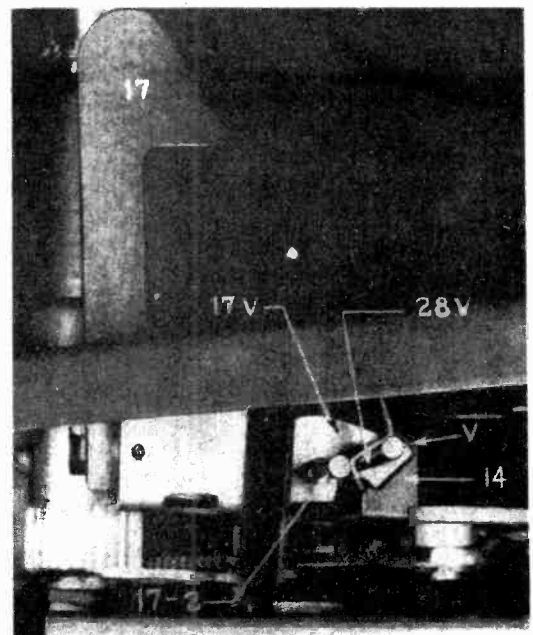


FIG. 24. During the phase of the cycle covered by Figs. 11 and 12, the pin V on 14 slides along the end of the latch pawl 17-V as lever 14 begins to move away. This causes a downward force to be exerted on pin 17-2, which shifts 17 back into its normal vertical position. This view shows 17 about half way back to this vertical position and pin V nearly disengaged from 17-V.

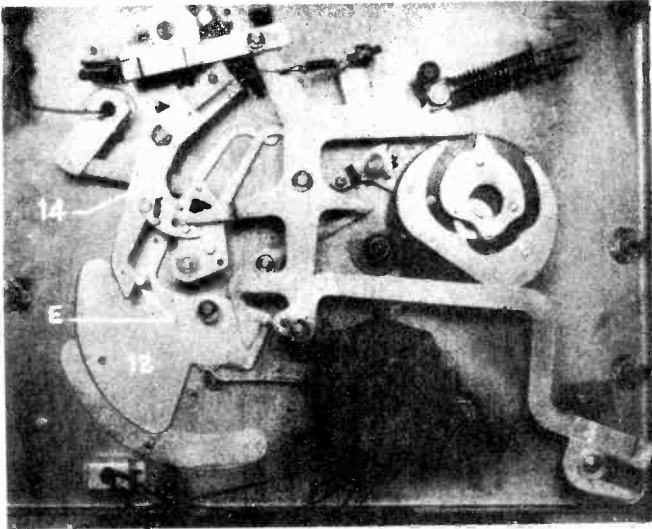


FIG. 25. Bottom view when manual index lever is set for 12-inch records. Compare the angle of lever plate 12 with its position in Fig. 20 and the relative positions of the eccentric stud E with locating lever 14. The movement of 14 being limited here by E, brings the pick-up needle down on the rim of a 12-inch record, instead of when 14 is controlled only by 17 (Figs. 18 and 22) when pin V stops against the step A (Fig. 21) and the pick-up travels further towards the center and stops on the rim of a 10-inch record.

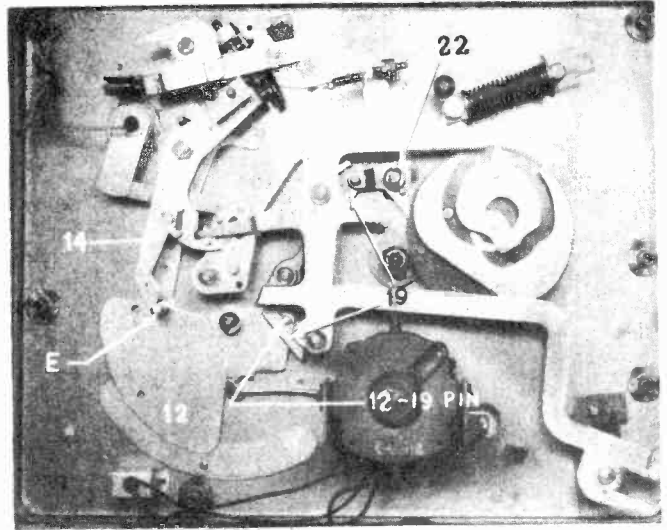


FIG. 26. Bottom view when manual index lever is set for "Manual" operation. Compare position of plate 12 with Figs. 20 and 25. Stud pin 12-19 releases lever 19, which is pulled by a spring (not shown) so that its long side swings up against the pin on trip pawl 22 locking this in its out-of-cycle position.

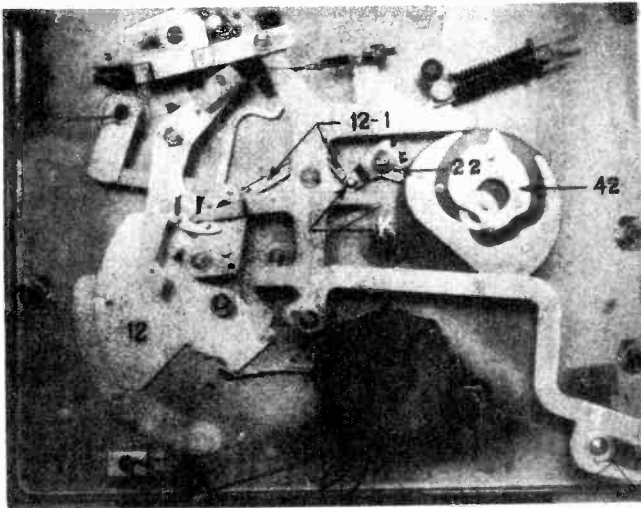


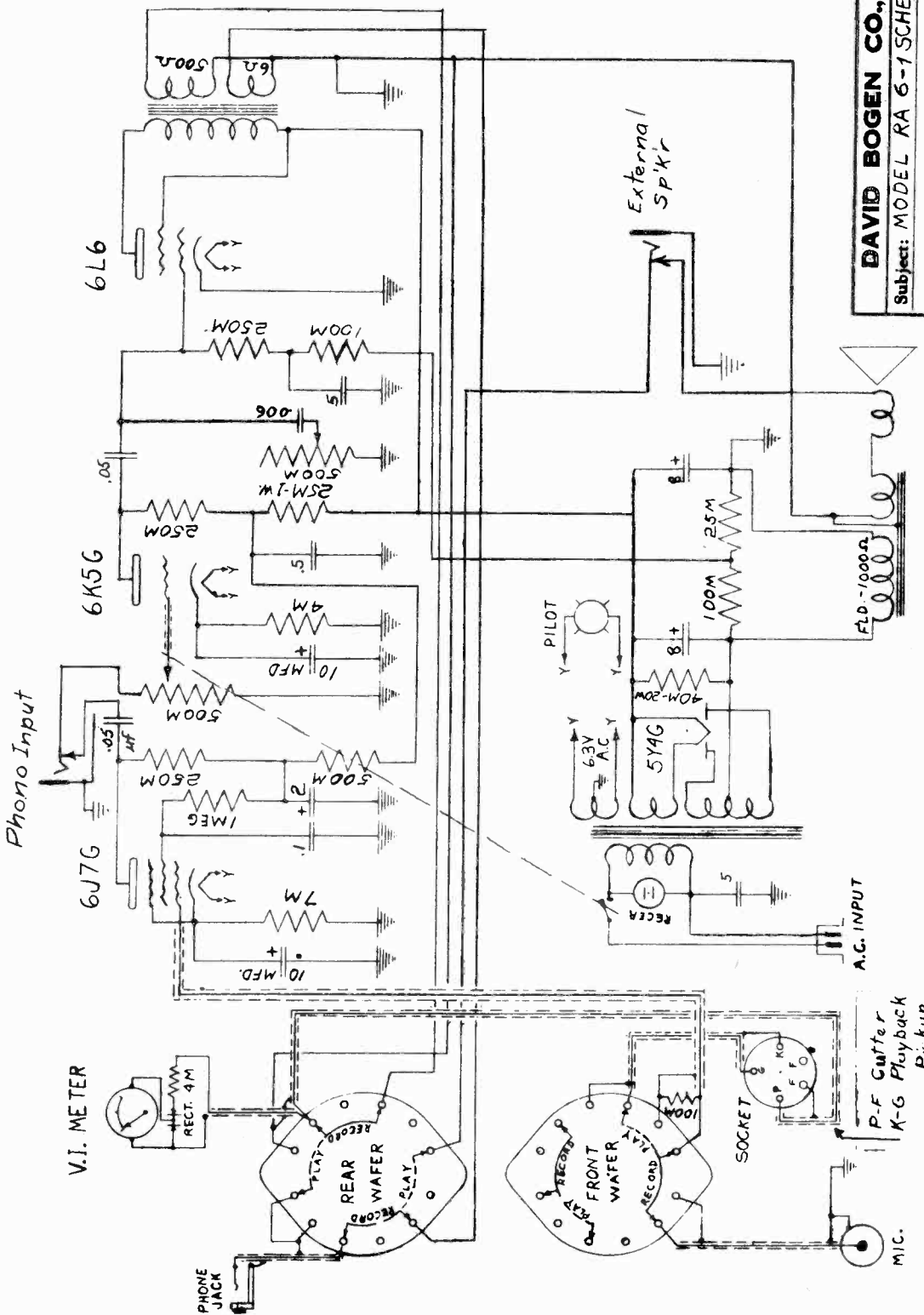
FIG. 27. Bottom view when manual index lever is held in the "Reject" position, so that a new record will be dropped onto the one on the turntable before the latter has been completely played. The curved arm 12-1 of 12 moves against pin K on trip pawl 22, which is shifted into its trip position, so that the tripper dog on the upper side of the main gear 42 will start the record-changing cycle. The spring 12-2 forces the plate 12 back into the 10-inch position when the button on top of the motor-board is released. This spring also holds 12 in any one of the other three positions.



FIG. 28. This shows the tone arm in the rest position with the record shelves have been swung outwards manually so that the played records on the turntable can be removed.

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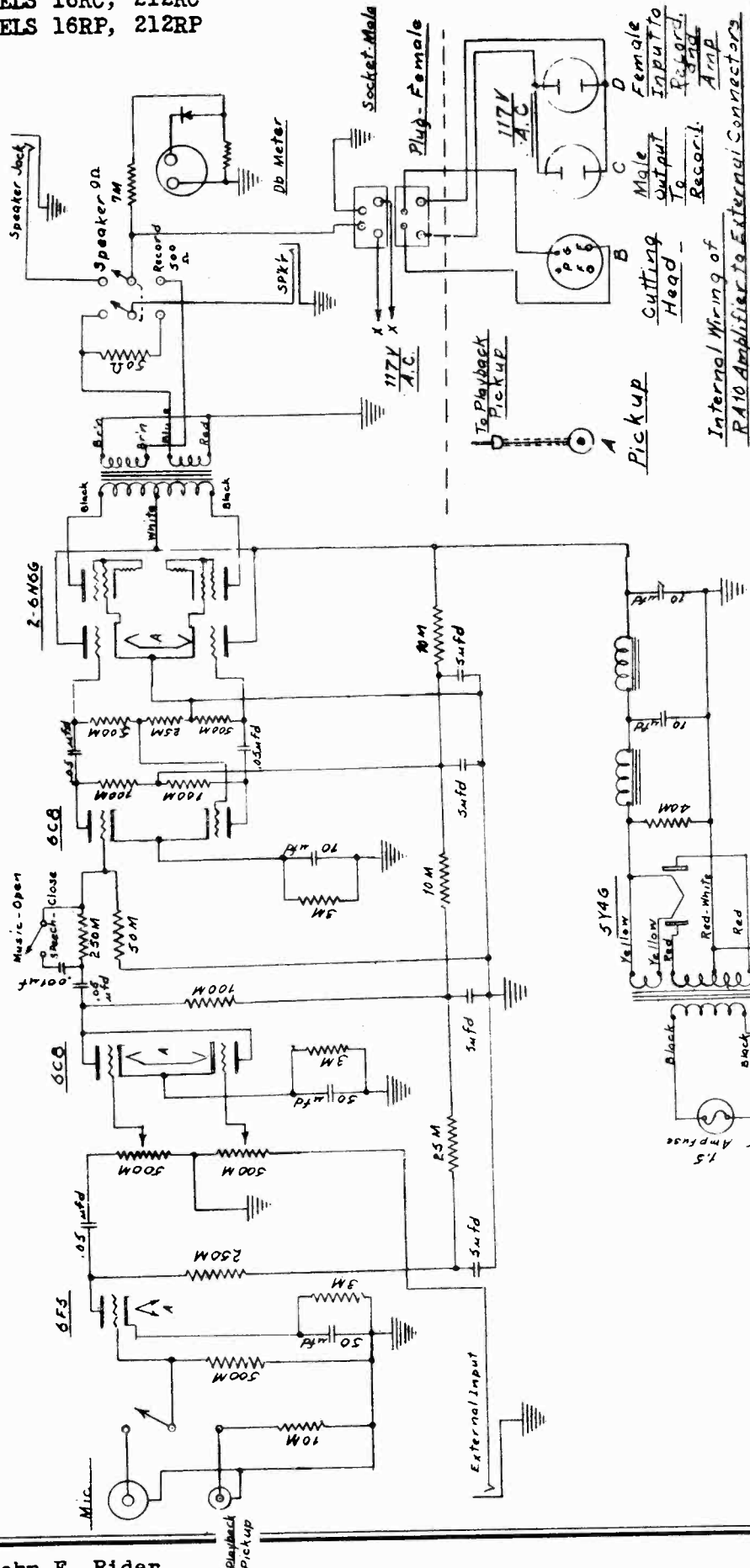
MODELS RA6, RA10
 MODELS 16RC, 212RC
 MODELS 16RP, 212RP



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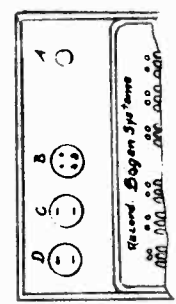
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Subject: Schematic RA10	Project No.	Job No.
Project:	Drawn By: C.T.	Scale:
	Checked By: Ben Warler	Date: 4-27-32
	Approved By: J. Rider	Engineering Dept., NEW YORK CITY

Internal Wiring of
 RA10 Amplifier to External Connectors



RA10 Amplifier In Case

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MODELS RA6, RA10
MODELS 16RC, 212RC
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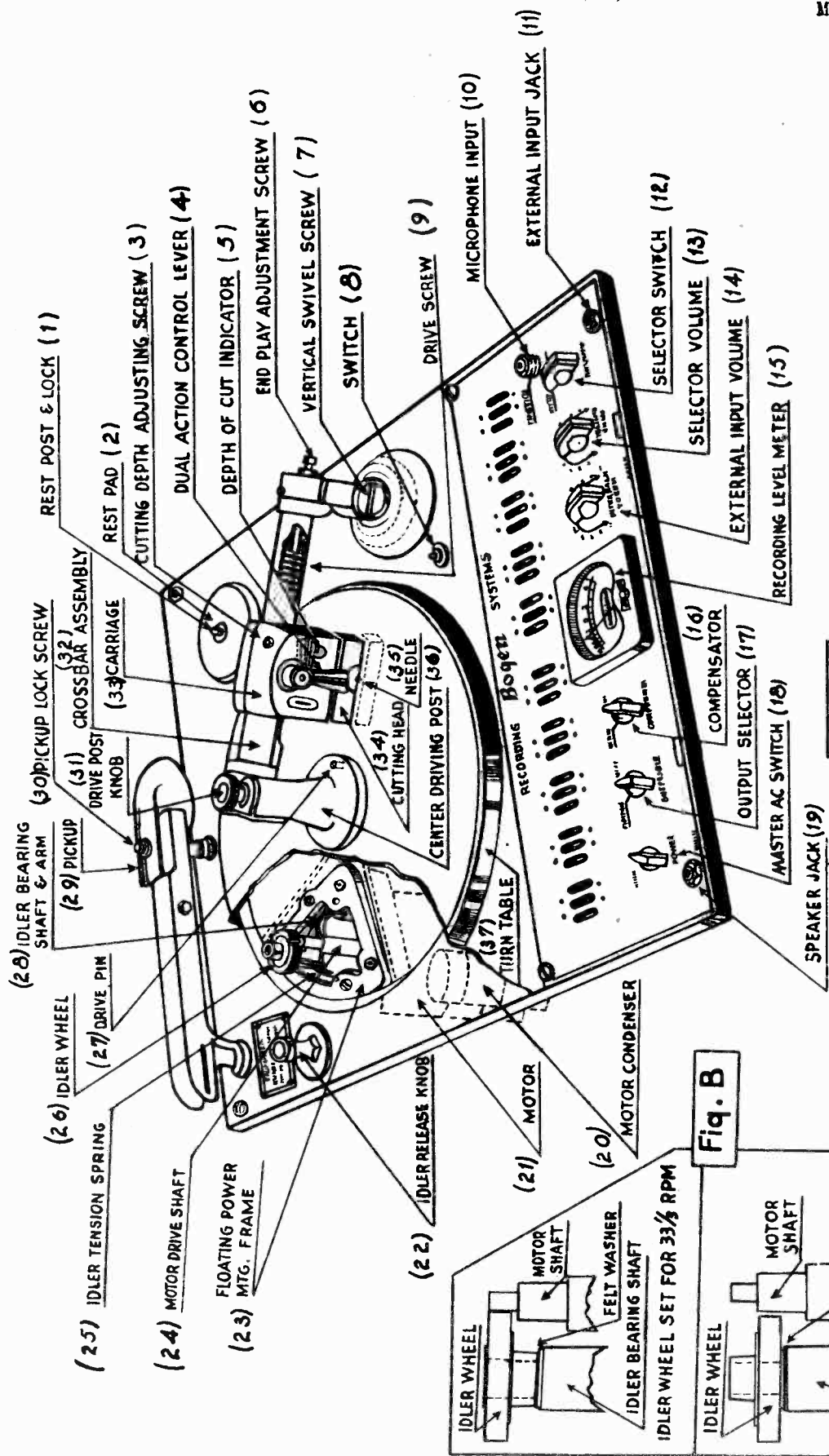


Fig. A

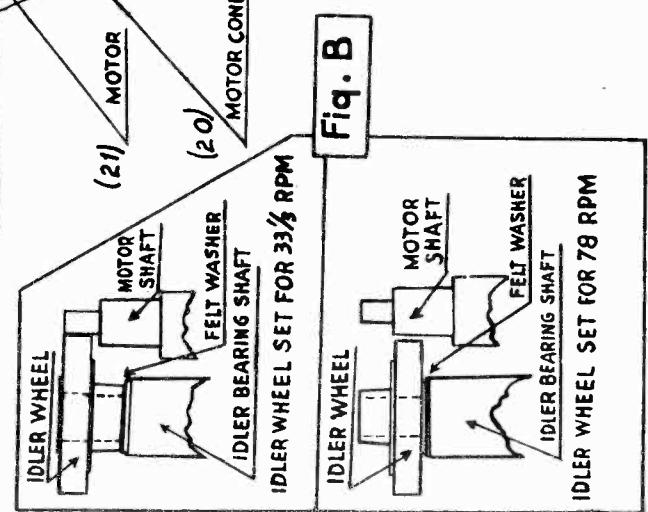


Fig. B

MODELS RA6, RA10
MODELS 16RC, 212RC
MODELS 16RP, 212RP

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INSTRUCTIONS

Bogen Models 212RC and 16RC Recording Systems
Bogen Models 212RP and 16RP Portable Recorders
Bogen Models RA6 and RA10 Recording Amplifiers

Bogen recording systems are composed of two units - either a 12" or 16" recorder and the Model RA10 recording amplifier, housed in one compact portable carrying case. With the Models 212RP and 16RP an external amplifier is recommended, such as Bogen Models RA10 or RA6.

Power Consumption:-

Model 212RP - 36 Watts
Model 16RP - 117 watts
Model 16RC - 192 watts
Model 212RC - 110 watts
Model RA6 - 70 watts
Model RA10 - 75 watts
For 110 volts AC 60 cycle operation.

An AC cord and plug is provided and connection is made by means of an AC male flush receptacle built in on base plate of 16RC or 212RC recorders. On Models 16RP and 212RP, the AC receptacle is mounted on the side of the case. External connections to amplifiers are described under "Amplifier" heading.

Preparing Recorder for Operation:-

On Models 212RC or 16RC, remove speaker cover from lower section of case by means of slip hinges and set on side. Pickup and crossbar assembly are locked for portability or transportation. Unhook pickup lock screw (30) Fig.A by turning knob to left until pickup can be lifted free. Unhook crossbar assembly (32) Fig.A by turning drive post knob (31) Fig.A until assembly can be lifted free of rest post (1) Fig.A.

Set dual action control lever (4) Fig.A on outtinghead carriage (33) Fig.A to up or horizontal position. Always keep lever in this position only lowering it to record.

Set recorder for 33-1/3 or 78 RPM, at whichever speed it is desired to record. On the Models 16RC or 16RP speed change is accomplished by rotating speed change control knob, which is located on base plate in lower left hand corner (9) Fig. C. Turn knob pointer to either 33-1/3 or 78 RPM as desired and indicated by engraved plate under knob.

On Models 212RC or 212RP, speed change is effected by reversal of idler drive wheel, located under turntable (26) Fig. A.

Before making speed change on Models 212RC or 212RP, make sure to release the idler wheel from engagement with the motor shaft and turntable rim. This is accomplished by means of the idler release knob, located in the upper left hand corner of the base plate (22) Fig. A. Lift the knob and turn all the way to the left to position marked "OFF" on indicating plate, press knob down before releasing it to make certain that it falls into locking slot provided.

After idler release has been set make speed change on Models 212RC or 212RP as follows:-

Slide cutting head carriage (35) Fig.A all the way over toward center post

(35) Fig.A. then lift and swing the entire crossbar assembly (32) Fig. A. over to the right out of the way so that when the turntable (37) Fig.A. is lifted by inserting two fingers in the holes of the turntable, it is possible to lift the turntable without striking the cutting head carriage. When the turntable is removed, note rubber idler wheel located on the left in back of motor shaft (26) Fig.A. Motor shaft is machined in two steps (24) Fig.A. If idler wheel is set to engage lower step or larger diameter of motor shaft, the recorder is set for 78 RPM (Fig.B.) If 33-1/3 speed is desired, merely lift idler wheel and reverse it, replace on its bearing shaft so that it will engage with upper step or smaller diameter of motor shaft (Fig.B.).

CAUTION: - Handle rubber idler wheel gently as the rubber is ground very accurately and it may be deformed by unnecessarily rough handling.

Replace turntable carefully. Turntable shaft will slide freely if inserted properly. Never apply force but rotate gently and lower slowly into place. After replacing turntable turn idler release knob (22) Fig.A. to "on" position, ready for recording.

Setting Cutting Needle:-

To insert cutting needle, (35) Fig.A., slide cutting head carriage all the way back to the point nearest the hinge of the overhead crossbar assembly. (7) Fig.A. Lift the overhead assembly upright all the way over and turn the assembly to a convenient position. In this position the underpart of the cutter (34) Fig.A. is visible and accessible and the needle may be easily fastened into place.

All cutting needles have a flat surface on the upper end of the shank, which fits into the chuck of the cutter. Insert the needle so that this flat side faces toward, and is locked by the needle thumb screw (35) Fig.A. After needle is inserted, lower crossbar assembly over rest post at the right of turntable (1) Fig.A. This is the resting position for assembly when not recording. (Refer to paragraph "Recording Blanks" for further details regarding needle setting for different recording blanks.)

To Record:-

Place a standard acetate or Phonoflex record blank on the turntable, making sure that the record lies flat. 1/16" thick blanks should be used since the recorder is adjusted at the factory for these blanks. Thicker or thinner blanks are not recommended, but if it is desired, refer to "Raising or Lowering Turntable" under section "Mechanical Data", for necessary adjustments.

Remove crossbar assembly from rest post and swing over to turntable center pin, in position shown in Fig.A. Lower crossbar assembly to fit over center pin and offset drive pin. (2) Fig.A. Turn drive post knob (31) Fig.A. on top of crossbar assembly until it falls into proper engagement with offset drive pin. This will place center post (36) Fig.A. of crossbar assembly flat on the record. Make sure this center post is down perfectly flat against record surface before recording.

If recorder is set for "inside-out" recording, slide cutting head carriage (33) Fig.A. all the way over toward the center of the record. Then slide carriage back to the right just far enough to permit the cutting head to clear the center post base (36) Fig. A when cutting head is lowered. If recorder is set for "outside-in" recording, slide cutting head carriage to a position where cutting needle will be about 1/4" in from edge of recording blank when cutter is lowered for recording. In either case, crossbar assembly and cutting head are now in correct position for recording.

DAVID BOGEN CO., INC.

MODELS RA6, RA10
MODELS 16RC, 212RC
MODELS 16RP, 212RP

Amplifier - Model RA10 built in Models 212RC or 16RC Combinations (Fig. A) Turn amplifier Master switch (13) Fig. A, located on extreme left of amplifier panel to "ON" position. Permit amplifier tubes to heat properly for about thirty seconds. Amplifier is then ready to record. Familiarize yourself with all controls on amplifier panel first (Fig. A.)

To record from microphone, proceed as follows: First, make certain that volume controls marked "Selector Volume" (13) Fig. A, and "External Input Volume" (14) Fig. A, are turned all the way to the left to the "Off" or "0" position before making any other adjustments or connections. Turn switch marked "Selector" (12) Fig. A, to position marked "Micro". Turn switch marked "Output" Selector to position marked "Record". Turn compensator switch (16) Fig. A, to "Speech", if voice is to be recorded or to "Music" if music is to be picked up by microphone. Connect microphone by means of lock type screw connector to microphone connector (10) Fig. A, provided on upper right hand corner of amplifier panel marked "Microphone". Turn "Selector Volume" control to proper recording level which is indicated by the swing of the needle on the meter (15) Fig. A. To determine proper level place microphone before the person making the record and have him speak a normal tone. Advance the selector volume control until the needle swings to "0" on the scale for maximum peaks. If the average swing of the needle goes beyond "0" the volume is too high, and should be reduced by turning the control down toward the left. If the needle barely swings on the lower end of the meter scale, then the volume is too low and the control should be advanced toward the right until the proper needle swing is attained. After recording level has been determined, make sure cutting head carriage is set ready for recording as described above in paragraph "To Record". See that idler release knob is in the "ON" position, then turn motor switch (8) Fig. A. "ON" to start turntable rotating. Slowly lower dual action control lever on cutting head carriage all the way down to its full stop. If cutting head lever is lowered rapidly, the blank record may be damaged and the carriage may skip one thread of the lead screw. Lower control lever slowly. (For adjustments for depth of cut, etc., refer to "Adjustments"). When through recording, turn control lever upward in a counter clockwise direction all the way to its stop until it assumes a horizontal position. Then slide carriage to extreme left of cross-bar, turn motor switch off, lift cross-bar and swing it over to rest post on the right. Before sliding carriage, make sure that control lever is raised to horizontal position to avoid damaging lead screw. (9) Fig. A. After recording collect cut thread from record and roll into a ball. If acetate blank was cut, dispose of thread in metal container, as thread is inflammable. This precaution is not necessary with Phonoflex. NOTES: Recording level meter operates only in "Record" position of "Output Selector Switch". If microphone is used close by recorder while recording, feedback may occur. This is denoted by a squeal or howl. To remedy, merely remove speaker plug while recording.

To Play Back: - On Models 212RC and 16RC, first connect speaker by means of cable and plugs provided, connecting plug to prongs on speaker. Insert male plug in jack on lower left hand corner of amplifier panel marked "Speaker" (19) Fig. A. Turn "Selector" switch to "Playback Pickup", turn "Output Selector" to "Speaker" position. Insert playing needle in "Playback Pickup" (20) Fig. A, and place pickup on record at point where recording was started. (See "Notes") Turn motor switch on and then adjust "Selector Volume" to desired volume level for reproduction. If ordinary commercial records are to be played, remove offset drive screw on the turntable before placing record on table.

Radio Recording or Dubbing:-

To record from radio, an external input jack (11) Fig. A, is provided on lower right hand corner of amplifier panel. Connect two wires from voice coil of radio loud speaker to ordinary telephone plug and insert plug in jack marked

"External Input". Turn selector volume control to "0" position. Turn "External Volume Control" slightly on, then select radio program desired. Proceed as in Paragraph "To Record From Microphone" setting "Compensator" switch to "Music" or "Speech" as desired, and "Output Selector" to "Record" position. Adjust recording level meter for proper volume level as described in paragraph above marked "To Record From Microphone" but use control marked "External Input Volume" to adjust needle swing on meter to proper level. Place crossbar assembly in recording position and record as described previously. To make a recording of a commercial record (dubbing) the procedure is the same as described for radio recording, except that an external phonograph player is used to play the record to be copied or recorded. Connect external phono pickup (high impedance type only) to "External Input" jack by means of an ordinary telephone plug and proceed with all other adjustments as described for radio.

Public Address:-

Turn "Selector" switch to "Micro" position; turn "Output Selector" to "Speaker" position; adjust volume level with "Selector Volume" control and use microphone in usual manner to pick up speech or music whichever is to be reproduced. If microphone is used in same room as loudspeaker, indicated by a "howl" from the loudspeaker and is caused by the fact that the microphone is too close to the loudspeaker. To minimize this "feedback" keep microphone on side and away from loudspeaker as far as possible. To play records for public address use set recorder amplifier controls to position described under Paragraph "To Playback" and adjust volume to desired level with "Selector Volume" control.

Mixing:-

Mixing or fading of two different signals can be accomplished by means of the two volume controls marked "Selector Volume" and "External Input Volume". To mix when recording with microphone against a musical background, connect microphone in manner described under Paragraph "To Record From Microphone" then connect External Phono Pickup or other source of input signal for musical background to "External Input" jack. Adjust recording level meter for proper swing using both volume controls and proceed with recording in usual manner described above. Mixing can also be accomplished with recording in use by using the two volume controls on the amplifier panel simultaneously. Any external input device, except microphone, can be connected to "External Input" jack and is controlled by "External Input Volume" control.

Monitor:-

The loudspeaker serves as a monitor when the "Output Selector" switch is in the "Record" position. The signal being recorded is reproduced through the loudspeaker at a reduced volume level. Headphones can be used for monitoring if desired by plugging the headphones into the jack (19) Fig. A, in place of the loudspeaker.

IMPORTANT (Models 212RP and 212RC) Fig. A.

The idler release is provided to eliminate the possibility of flat spots developing on the idler wheel. Always turn the idler release knob to the "On" position when about to record. Make sure, however, that the "On-Off" AC power switch is in the "Off" position. Always use the AC power switch to start and stop the turntable when recording, leaving the idler release in the "On" position. When through recording, release the idler release from engagement with the turntable by lifting idler release knob and turning knob all the way to the left to position on indicator plate marked "Off". Caution:- Do not use the idler release as a start and stop switch when recording. Use it only to engage at the beginning of recording and to disengage when you are through recording.

MODELS RA6, RA10
MODELS 16RC, 212RC
MODELS 16RP, 212RP

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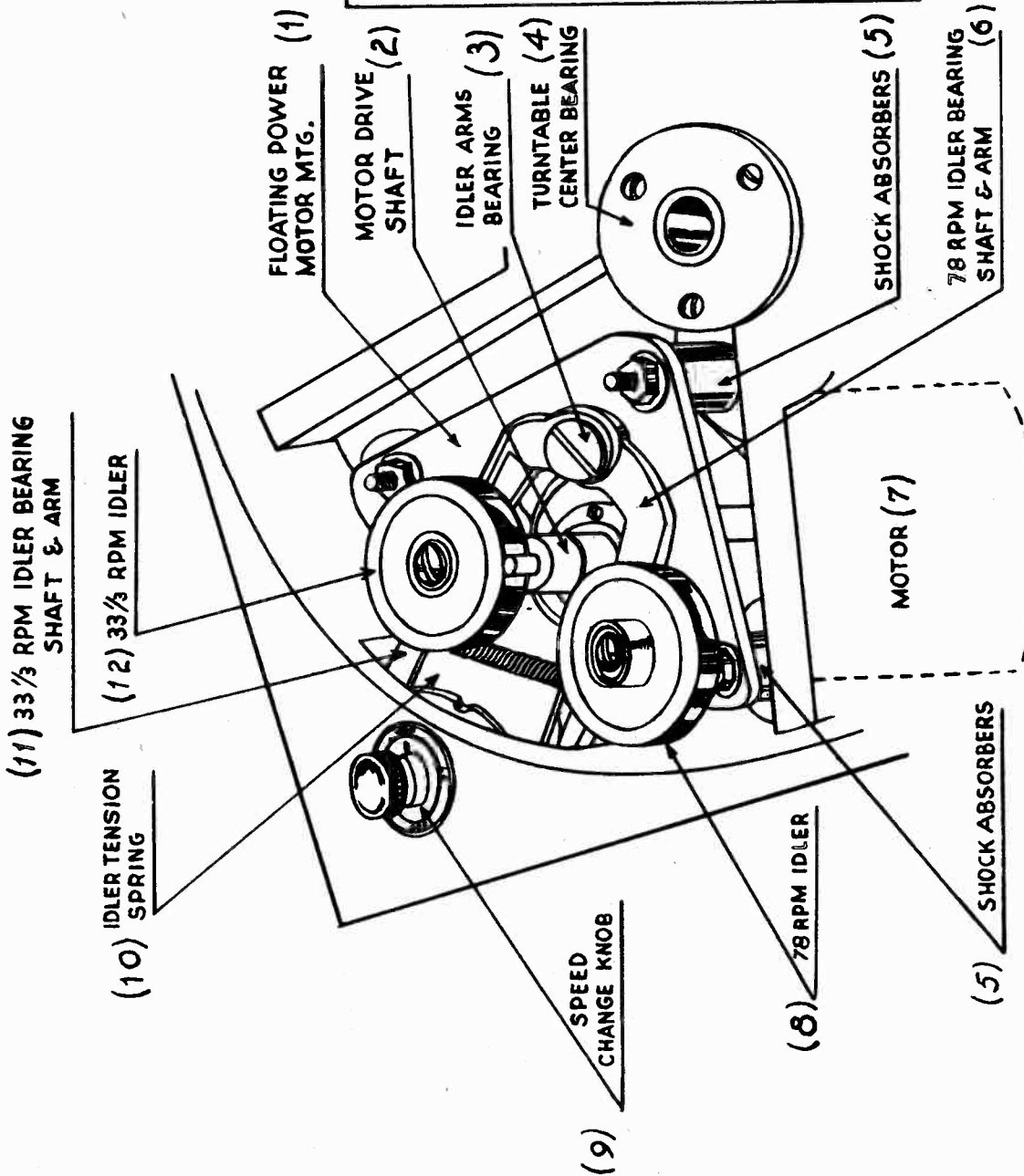


Fig. C

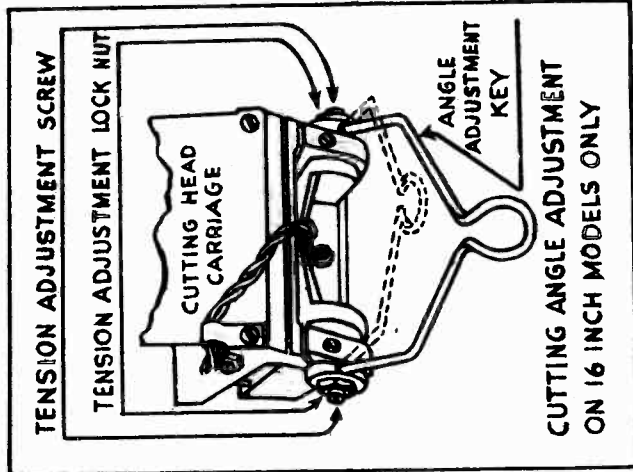


Fig. D

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MODELS RA6, RA10
MODELS 16RC, 212RC
MODELS 16RP, 212RP

When test or short recording is taken in order to save blank's space, it is not necessary to move carriage to its back stop to play back. At end of test recording, raise control lever, move cross bar assembly to rest post position, and play back. At end of play back, if carriage has not been moved, it is possible to continue the cut just where it left off in the previous cut.

The RA10 and RA6 recording amplifiers have been especially designed and built for these recorders and are recommended to assure best results. However, other Bogen amplifiers may be used. The schematic diagram indicates the impedances and connections. Note that the recorder playback pickup works into a microphone circuit.

IMPORTANT:

Always lower dual action control lever slowly.

Take care of Acetate shavings. They are inflammable.

Make sure that control lever is in horizontal position before lowering crossbar assembly over record blank.

When lifting crossbar all the way over to change needle or oil lead screw, make sure that carriage is either locked (lever down) or all the way to the right.

Bogen recorders compensate automatically for variation of drag and will not cause any "wows" due to change of motor speed unless the turntable has been accidentally bent out of true or if the "floating power" motor mounting has become loose either in shipping or for any other reason.

Other possible causes for "wows" are as follows:-

Record Slipping:-

This may occur if the offset drive pin (27) Fig.A. were removed to play a commercial record and it was attempted to record without replacing it. Always be sure that the drive pin is in place on the turntable before recording.

Overhead Drive Screw Binds (9) Fig.A.

It is possible that the crossbar assembly may be bent or twisted out of alignment thereby causing the drive screw (9) Fig.A. to bind. Adjustment of the drive screw is described under "Crossbar Assembly".

Motor Drive Shaft or Idler Wheel Binds:-

The recessed turntables on Bogen recorders prevent the possibility of record shavings falling underneath the turntable and becoming snarled or enmeshed in the motor drive shaft or idler wheel assembly. Nevertheless it is possible that over a period of time record shavings may work down and eventually become snarled in the motor shaft or idler wheel bearings (#24-26-28) Fig. A. or (2-3-6-8-11-12) Fig. C, causing binding at any one of these points resulting in "wows". If this occurs, carefully clean all shavings or foreign material from these points and make certain that all points are properly lubricated and move freely.

Slippage between Idler Wheel and Turntable on Motor Shaft Drive:-

All recorders are carefully adjusted for proper driving speed, motor torque and pressure. However, there is a remote possibility that these adjustments might be loosened or jarred out of alignment. Check idler wheels (26) Fig.A for 12" Models or (8-12) Fig. C. for 16" Models, making certain that no oil or grease is on the rubber surfaces of idler wheels which would cause slippage. Also check idler bearing arms (28) Fig.A. on 12" Models or (3-6-11) Fig. C. on 16" models to determine whether all parts move freely and are not binding. Check idler Tension Springs (25) Fig.A. for 12" Models or (10) Fig.C. for 16" models, to be certain that these springs are maintaining proper tension and have not loosened up or stretched, losing their spring tension, and that springs bring idler wheels into engagement with motor drive shaft and turntable rim when idler release knob on 12" Models is in the "On" position.

Recording Blanks:-
When cutting Acetate blanks, the needle should be adjusted to protrude 3/8 of an inch from the cutting head surface. It is recommended that sapphire needles be used for best results on Acetate, although steel needles are satisfactory. When cutting Phonoflex blanks, a short cutting needle should be used and it should be inserted all the way in as far as it will go before locking in position.

When cutting Phonoflex, the needle should protrude as little as possible from the cutting head surface.

It is recommended that steel needles be used for cutting Phonoflex. Steel needles should be changed after cutting the equivalent of three 12" double faced blanks.

ADJUSTMENTS:

To Change Cutting Depth - Insert small screw driver in hole (3) Fig.A. at right of cutting head carriage and turn to right for lighter cut -- to left for deeper cut. A depth of cut indicator (5) Fig.A. serves as a reference point to designate the depth of cut adjustment. The indicator moves up for a lighter cut and down for a deeper cut. Make adjustment on a blank record section as a test, varying the depth of cut until the desired cut is obtained. The cut thread is an indication of proper cut. If thread is dry and brittle the record is too dry and should not be used. Properly cut thread should gleam and should not crumble when handled. Only fresh record blanks should be used.

To Raise or Lower Turntable:-

Screw and nut under main turntable bearing -- 1/32" per complete turn. If this adjustment is changed, make sure that crossbar is horizontal to record blank within .006". (Refer to "Mechanical Data")

To Take Up Wear on End Play:-

Screw and nut at right end of square crossbar (6) Fig.A. When a "pattern" or imperfection of cut groove is visible, loosen nut and screw in end play adjusting screw by hand. Make adjustment carefully. Too tight an adjustment will cause the motor to slow down and produce "wows". Too loose will cause an uneven groove cut.

To Change from 78 to 33-1/3 RPM:-

Reverse idler drive wheel on 212RC and 212RP. To change from 100 lines per inch to others:- Standard recorders are supplied with lead screws for 100 lines per inch. Other screws available: -- 90, 110, 120, 130, 140 lines per inch. Full instructions supplied with lead screw.

To Change for Inside-Out Cutting:-

Standard 16" machines are supplied to cut inside-out. 12" Models are supplied to cut outside-in. To change either type machine for outside-in or inside-out, a set of special gears is available to order. Full instructions are supplied with gears.

To Change Cutting Angle:-

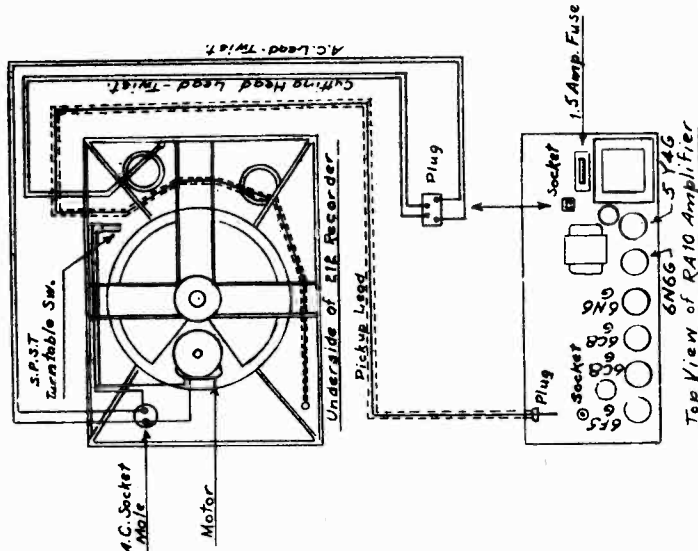
On Models 212RP and 212RC cutting angle can be changed by inserting needle further into chuck or bringing needle out further before locking in chuck. On Models 16RP and 16RC angle of needle can be changed by adjustment collars at the rear hinge of the cutting head. Fig.D. A wire cutting angle adjustment key is furnished with these models and should be inserted as shown in diagram Fig.D. into two holes provided on hinge collars. By moving these collars up or down, angle of cut can be changed.

NOTES:- Due to a new design principle of the pickup, in which the needle is the armature, needles of .068" must be used. Ten needles are supplied with the recorder.

MODELS RA6, RA10
 MODELS 16RC, 212RC
 MODELS 16RP 212RP

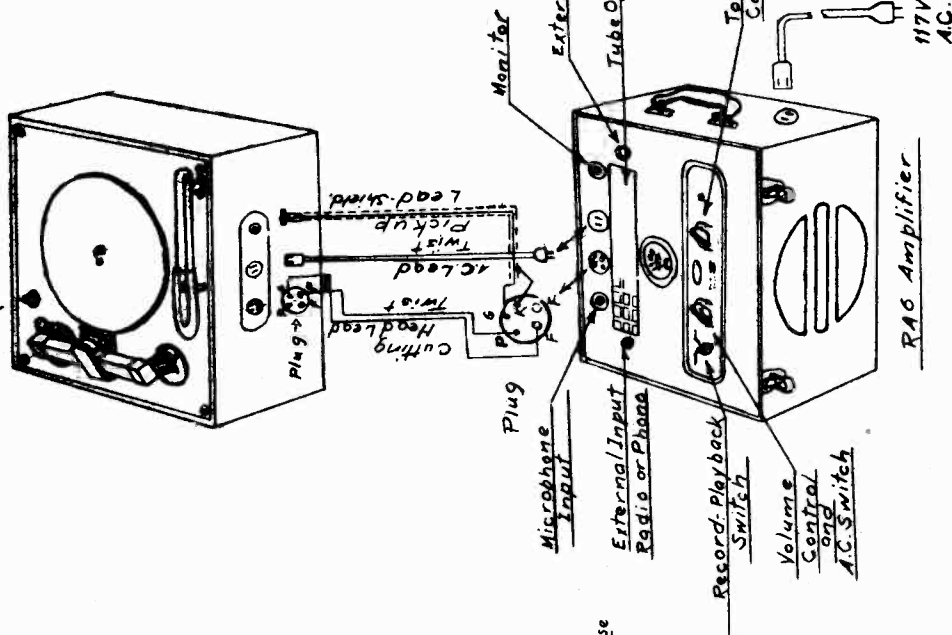
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Figure E



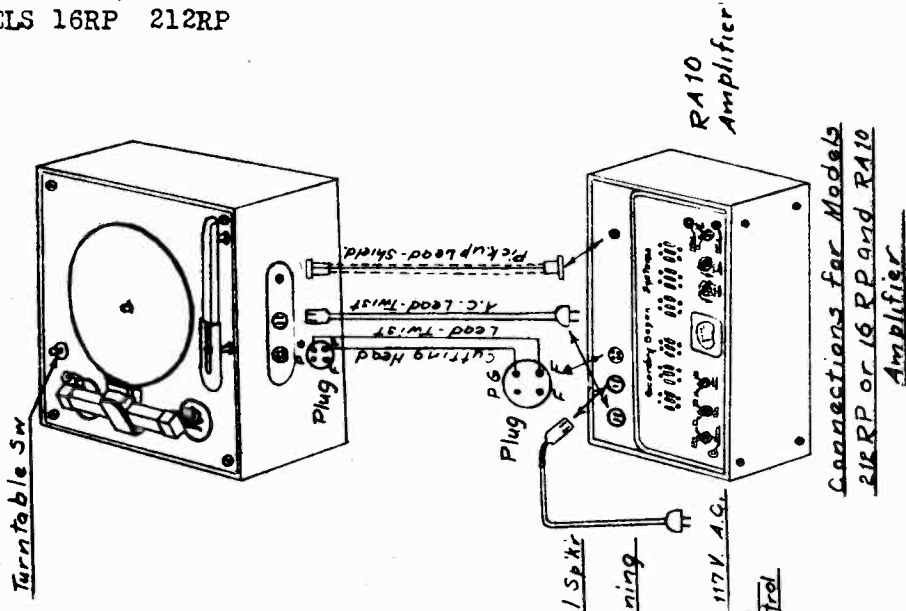
Internal Wiring Models
 16RC and 16RC
 Recording Systems

Figure F



Connections for Models
 16RP or 16RP and
 RA6 Amplifier

Figure G



Connections for Models
 212RP or 16 RP and RA10
 Amplifier

DAVID BOGEN CO., Inc.	
Subject: Interwiring of Recorders	
Project:	
Project No.	JOB NO.
DRAWN BY: C.T.	SCALE:
CHECKED BY: Ben Waller	DATE: 6-8-50
APPROVED BY: <i>[Signature]</i>	
ENGINEERING DEPT., NEW YORK CITY	

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MODELS RA6, RA10
 MODELS 16RC, 212RC
 MODELS 16RP, 212RP

the chromium plated knob pinned over the center post shaft, with the other hand.

Even when the control lever in the carriage is down, it should be easy to revolve the center post knob without any effort or binding.

The right-hand bearing of the lead screw (6) Fig. A, is probably the most delicate mechanical adjustment in the machine and the utmost care should be exercised before attempting to alter this adjustment.

As previously explained, this bearing consists of a conical hole drilled at the right-hand end of the lead screw into which the conical end of the steel screw is inserted. This construction is necessary to avoid any excessive friction caused by the thrust exerted by the lead screw in revolving and in view of its small surface will, from time to time, wear a trifle, thus causing a pattern in the grooves cut by the cutting head. This pattern takes the appearance of light and dark cuts into the records in groups of ten grooves but while this defect is not objectionable from an acoustical standpoint, it may, however, cause one groove to cut into the other in the event that the defect is too pronounced.

In order to correct it, it is necessary to secure a wrench to fit the nut which secures the bearing screw and to release this nut by turning to the left. Turn the bearing screw by hand without forcing it then secure it in place by tightening the nut again, making sure, however, that the adjusting screw does not turn. Test the adjustment by turning the center post knob and be certain that it revolves freely without any binding and make a test cut. When the adjustment is properly made, no pattern of the type previously described should appear.

Raising or Lowering Turntable:-

It has already been mentioned that the recorder is adjusted to cut 1/16" blanks. If a thicker record is used, a deeper cut will be obtained on the inside of the record and a lighter cut toward the outside edge. If a thinner record is used, a shallower cut will be obtained on the inside than the outside.

If, for any reason, it is desired to adjust the machine so as to cut either a thinner or thicker record, this adjustment can be made only by removing the recorder from the case and by turning the screw located at the bottom of the center main bearing. Care should be taken in loosening the nut first and it is advisable to remember that for every complete turn the turntable is lifted or lowered by 1/32".

All Bogen recorders are designed for needles protruding 3/8" from the cutting head plate for cutting Acetate blanks. In this position, it is possible to cut as far in as the cutting head carriage will permit, although this practice is not recommended in view of the fact that the quality is impaired a great deal at such small diameter of grooves.

When the needle protrudes 3/8" the proper cutting angle is automatically obtained. If a greater angle is desired, the needle should protrude more. If a vertical position is desirable, then shorter needles should be used and should protrude less than the amount specified. (Refer to "Changing Cutting Angle")

Pressure on the cutting head, which is the factor determining the depth of cut, may be changed by the adjustment provided for in the cutting head carriage assembly at the right of the control lever (3) Fig. A. The pressure indicator (5) Fig. A, located directly underneath this adjustment and protruding in a slot at the right of the control lever indicates the position of the pressure adjustment spring and it is only an indication as to the position of the spring.

In view of the many types of record blanks and their consistency, it is impossible to accurately calibrate this adjustment in any way because the same adjustment gives a much deeper cut in a "fresh" or "soft" nitrate blank than it would on a harder one.

"Flutter" or Cutting Head "Wow":-
 "Flutter" is evidenced by a ripple or flutter in the reproduction when a record is played back. This may be caused by the cutting head (3) Fig. A, becoming loose on its hinges which would permit a sideways motion on the cutting head. This can be determined by grasping the cutting head between thumb and forefinger and moving it from side to side to ascertain whether there is any looseness or play at the hinges in the rear of the cutting head. This should be checked with the control lever (4) Fig. A, in the down or vertical position, to permit the cutting head its maximum movement. If the hinge adjustment is correct, cutting head should move freely up and down but should have no wobble or play, sideways. To adjust cutting head loosen tension adjustment lock nuts (Fig. D.) as follows:

First insert screw driver in slot of tension adjustment screw, hold this steady without turning, then with a small end wrench loosen tension adjusting lock nut. Now turn tension adjustment screw to right 1/4 turn and then retighten lock nut keeping screwdriver in screw slot to prevent it being turned further than already set, until lock nut is tight. After adjustment is made, test movement of cutting head as described previously. Cutting head should move freely up and down with no play or wobble sideways. If cutting head moves up or down too stiffly, adjustment is too tight and this will result in a "wow". If adjustment is too loose, recording will still reproduce a "Flutter". Make adjustment of tension screw as described above to permit cutting head to move freely and easily up or down with no play or wobble from side to side.

Mechanical Data:-

The idler wheels are equipped with oilite bearings and require a very small amount of oil. Care should be taken in oiling to prevent the oil from coming in contact with the rubber. Idler wheels are mounted on a movable arm which automatically compensates for wear on the wheel and automatically increases or decreases the driving pressure as the load on the turntable increases or decreases. This feature minimizes "wows" due to changes in speed caused by varying loads on the turntable.

The overhead structure consists of a center post, a crossbar and a swivel. The lead screw is enclosed in a square protecting tubing. Revolving in the center post is a vertical shaft to which a worm gear is attached which in turn is engaged with a horizontal worm gear to which the feed screw is secured.

The lead screw which is enclosed in the square horizontal tube also has a bearing on its right-hand end consisting of a pointed steel screw and nut, which is visible at one end of the square tubing assembly.

The cutting head carriage slides over the square tubing and carries with it the cutting head assembly pivoted at the rear of the cutting head carriage. The lever, located in front of the cutting head carriage, controls both the engagement of the carriage with the lead screw and the lowering of the cutting head over the record at the time of cutting.

The cutting head carriage should slide freely over the square tubing crossbar and the proper friction is automatically obtained by a spring and pressure pad assembly enclosed within the carriage itself and no adjustment need be made to change this friction.

The felt padding with which the recorder is equipped will take up ordinary wear and the spring pressure pad previously mentioned will compensate as wear occurs.

Should the carriage rock a trifle, this should not be construed as a defect because, in cutting, the spring pressure pads will compel the cutting head carriage to assume its proper position and slide smoothly across the square crossbar without any impediment, or rocking.

Crossbar Assembly:-

The overhead assembly should turn freely and this can be tested by holding the center post in the left hand, lifting the overhead assembly and turning

MODELS RA6, RA10
MODELS 16RC, 212RC
MODELS 16RP, 212RP

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It should be remembered that no definite instructions can be given as to the depth of cut other than the fact that the shavings should be about the thickness of coarse hair. A light cut will offer less impediment to the motion of the cutting head and will result in better recordings; however, the cut should be deep enough to insure proper tracking when played back. Generally speaking, it is advisable to cut as lightly as it is possible for the pick up to follow and a little experimenting along these lines is essential for good recordings.

The phono playback pickup supplied with the recorder is of the symphonic type, having a microphone output and should be connected like a microphone to the make input and not to the phono stage.

Amplifier Connections and Data RA6:-
Figure F shows the connections and cables for the portable recorders, Models 212RP and 16RP, when used in conjunction with the Model RA6 recording amplifier.

The cutting head cable and pick up cable furnished with the RA6 amplifier are joined to one plug which is to be inserted at the amplifier. The cable separates to two plugs which are inserted into the recorder. The recorder receives its power from the amplifier and the amplifier connects to the AC supply line by means of the AC cable provided.

The RA6 amplifier has a power consumption of 70 watts, on 117 volts AC, 60 cycles.

Tubes Used: 1-6J7G, 1-6K5G, 1-6L6G, 1-6X4G.

Operation of RA6 Amplifier and Recorder:-

To Record From Microphone:-

Refer to Figure F in this description.

Connect microphone to connector provided on upper left of panel. Connect all cables as shown.

Turn amplifier on by rotating "Volume" control in a clockwise direction until a click is heard. Keep "Volume" control down, however, until ready to record.

Turn "Tone" control full on to the right in a clockwise direction. This is the brilliant position and is preferable in recording, as it is essential to record the entire frequency band.

Place "Record-Play" switch in "Record" position.

Turn "Volume" control to the proper recording level which is indicated by the swing of the needle on the meter. To determine proper level place microphone before the person making the recording and have him speak in a normal tone. Advance the "Volume" control until the needle swings to "0" on the scale for maximum peaks. The needle should not swing above "0" at any time.

After recording level has been determined, make sure cutting head carriage is set ready for recording as described in paragraph "To Record". Slowly lower Dual Action Control Lever on Recorder all the way down to its full stop. If lever is lowered rapidly, the blank record may be damaged and the carriage may skip one thread of the lead screw. Lower control lever slowly. (For Adjustments for depth of cut, etc., refer to "Adjustments".) When through recording, turn lever back counter clockwise to its horizontal position. Then slide carriage to extreme left of crossbar, turn motor switch off, lift crossbar and swing it over to rest post on the right. Before sliding carriage make sure control lever is in horizontal position to avoid damaging lead screw. After recording collect cut thread from record and roll into a ball, disposing of thread in a metal container, as it is inflammable. This precaution is not necessary with Phonoflex.

Monitoring during recording may be done with earphones by plugging into jack on upper right of panel.

To Play Back:-
Turn "Play-Record" Switch to "Play" position.

Insert recording needle in Playback pickup and place pickup on record at point where recording was started. Turn motor switch on and adjust "Volume" control up to desired level.

An external speaker may be used in place of the internal speaker by connecting a plug to the speaker leads and inserting it into the jack provided on the panel to the right of the tube opening. This will automatically cut out the internal speaker.

If a commercial record is to be played, remove the offset drive screw on the turntable.

The meter will not register on playback, but on recording only.

Radio Recording or Dubbing:-

To record from radio or to dub another record, an external input jack is provided on the panel to the left of the tube opening. Connect two wires from voice coil of radio loudspeaker to ordinary telephone plug and insert into this jack. Turn "Play-Record" switch to "Record" position. Tune radio to desired station and adjust for proper recording level as described under "To Record from Microphone". Proceed with recording as described in that section.

A record may be dubbed by plugging an external phonograph (High Impedance) into the dubbing jack and proceeding with recording as for radio.

Amplifier Connections and Data RA10:-

Figure G shows the connections and cables for the portable recorders Models 212RP and 16RP when used in conjunction with the Model RA10 recording amplifier.

The cables are furnished with the amplifier and their connections are clearly marked in the illustration. Please note that the recorder AC cable plugs into the receptacle on the amplifier, and the amplifier connects to the AC supply line directly.

The RA10 Recording Amplifier has a power consumption of 75 watts, on 117 volts AC, 60 cycles.

Tubes Used: 1-6F5G, 2-6C9G, 2-6N6G, 1-6Y4G.

The combination of the Model RA10 amplifier and either the Models 212RP or 16RP portable recorder is equivalent to the standard Models 212RC or 16RC complete recording systems. The operation of the complete combination unit is described in this instruction book on page 6 and this may be used in its entirety in the operation of the portable setup as illustrated in Figure G.

Service Note:-

The combination Models 212RC and 16RC have been designed so as to give quick and easy access to the tubes in the amplifier should it become necessary to do so.

The amplifier is fastened to the front of the case, which is hinged on the bottom. Removing two screws in the upper corners of the large control panel, and two screws on the SIDES of the case, near the front, allows the amplifier to swing forward on its hinges. All tubes are now accessible for test or replacement. Figure E shows the position of these tubes, as well as the plug and socket arrangement for the amplifier.

Should it become necessary to service the amplifier, it may easily be removed by disconnecting the sockets shown in Figure E, then removing the four mounting screws on the swinging front of the case. This front may be entirely separated from the case proper, as the hinges are slip type.

ISSUE A 1941
SERVICE MANUAL*Admiral*RECORD
CHANGER

OPERATING INSTRUCTIONS

SETTING

Briefly, the Operating Instruction Manual as supplied to the customer contains the following:

MOUNTING

The changer is held solid by three channel shaped nuts under the changer. Loosen, three complete turns only, but do not remove. Tighten again for reshipping.

CAUTIONS

Either twelve 10" or ten 12" records, not intermixed, may be played. A starting groove or eccentric inside groove are not needed for automatic operation.

Do not use force to start or stop changer mechanism.

Do not leave records on supports when changer is not being used as they will warp and cause trouble in changing. Keep all records in albums.

The last record in the stack will keep repeating until the changer is stopped.

The needle should never require replacing with normal use—Never drop the needle—Never remove and then replace the same needle.

The top of the record holder post may be turned to either the 10" or 12" position. When the record holder clip is snapped toward the center, the changer is set to play the size record indicated on the clip.

LOADING

The records are placed over the center post, resting on the offset of the post, in the center, and the record post on the outside edge. Snap the clip down on top of the stack of records.

STARTING

Turn knob to ON position, after changer has attained speed turn the knob to REJECT position and release, the entire stack of records will then play through.

REJECTING

Turn knob to REJECT and release. This may be done any time a record is playing.

UNLOADING

Turn knob to OFF, remove center post by pulling up, remove records, reinsert center post, turning until it drops into place.

THE CHANGE CYCLE

When the pickup (9) comes to the end of the record, screw (55) on the pickup mover arm (54) pushes against the trigger bracket (35F) at point (X) starting the change cycle. This could also be done by turning knob (12) which causes lever (52) to push bracket (35F) at point (X).

This releases starting bracket (30) at point (Y) and allows (30) to protrude at point (Z), thereby becoming, in effect, one of the missing teeth in the large gear (35). The motor is constantly revolving the turntable, pinion shaft (21), and pinion gear (21B) at the toothless part of (35). When bracket (30) is released it engages a stud at the bottom of pinion gear (21B), starting the large gear (35).

As the large gear (35) begins its one revolution for a complete cycle, the raising pin (60) is pushed up by the outside ridge of gear (35) to remain there keeping the pickup above the record surface, until the cycle is finishing when the pin (60) is allowed to come down.

As soon as the pickup is above the surface of the record, the roller of mover arm (54) is pushed by the cam on (35), to move the pickup out beyond the edge of the record.

At $\frac{1}{3}$ rotation of gear (35) the end of mover arm (54) enters the outside groove of the cam on (35) and also the end of the "Z" lever (63) is beginning to be pushed by pulley (35C). This "Z" lever (63), from $\frac{1}{3}$ to $\frac{2}{3}$ rotation of (35) is in the process of turning 135° and then back, shaft (4E) in the record holder post (4). As (4E) turns, its cam top pushes the record remover (4F) toward the spindle and thereby pushes

one record off the edge of (4B) and allows the record to fall on the turntable.

The $\frac{1}{4}$ remaining distance that the large gear travels is used to bring the pickup (9) back to the edge of the record and set it down at the correct place for either a 10 or 12 inch record.

This is preset by turning the post (4) which rotates size cam (40) to either the 10 or 12 inch position, locked in place by the pressure of the detent spring (44). As this cam is rotated, it pushes the size lever (73) to either of two positions, and by means of its funnel shaped bracket at the end, guides the size switch (33) on the revolving gear (35) to the proper position opening either the 10 or 12 inch track and, therefore, directs the roller on the mover arm (54) to travel the correct track on the gear cam (35) setting the pickup over the proper place on the record, 10 or 12 inch.

Also, in this final $\frac{1}{4}$ revolution the starting bracket (30) is being moved back to its starting position by hitting the reset piece on the separating plate (36). When (30) is moved back, it is again caught at (X) by trigger bracket (35F) ready to be released to start a future cycle.

As the larger gear (35) is approaching the completion of its one revolution, the pickup lift pin (60) is riding down the cam track and allowing pickup (9) to set down on the record.

Just as the gap on the large gear (35) meets the pinion gear (21B), and (35) stops, the detent spring (75) snaps against roller (35C) and holds gear (35) in this position completing the change cycle.

MODELS RC50, RC51,
RC52, RC53

CONTINENTAL RADIO & TELEV. CORP.

SERVICE ADJUSTMENTS

IF CHANGING CYCLE FAILS TO STOP

With the center post (3) out remove the large nut (2) in the center of the turntable (1) and lift off the turntable. Loosen the two screws (23) this will free the large cast gear (35). Push these screws to the point where the small gear (21B) is free in the blank part of the teeth in the large gear (35), but as far as possible from the starting teeth of the large gear when it is in the locked or stopped position. Tighten the screws (23) in the slots firmly and re-assemble the turntable and nut. Check and see if the starting lever (30) on the underside of the large gear (35) is cocked by trigger bracket (35F) when the large gear makes a complete revolution. If not, check springs (35A) and (35B). Spring (35A) pushes lever (30) to the engaging position when released by trigger bracket (35F) held against lever (30) by spring (35B).

PICKUP ARM ADJUSTMENTS VERTICAL MOVEMENT

To adjust the height of the pickup arm (9) turn the knurled screw (9I) on the underside of the pickup arm (9) directly above the pickup arm lift shaft (60). Turn the screw (9I) counter-clockwise to raise the pickup arm, and clockwise to lower the pickup arm.

HORIZONTAL MOVEMENT

If the pickup arm (9) does not come down on the record so the needle first touches the record about $\frac{1}{8}$ inch from the edge, an adjustment is required. The inside part of the large gear (35) has two tracks, the inner one for ten inch records and the outer one for twelve inch records. It is only necessary to set the pickup (9) for one size, either the ten, or twelve inch. Turn the large gear (35) around until the roller pin in the mover arm (54) is just about to leave one of the tracks. If the pin of the mover arm (54) is in the inside track a ten inch record must be on the turntable and if in the outside track a twelve inch record is required. Now loosen the two screws (57 and 59) that secure the pickup arm shaft (9D) to the mover arm (54) and turn pickup arm (9) to correct point. Tighten screw through the slot first (59) and then the set screw (57).

The pickup arm shaft (9D) has a small spring (58) fastened to it underneath the changer to push the needle over into the first groove on records without a starting groove. The force the spring (58) exerts is adjusted by moving the hook in the end of the spring (58) to another hole in the hook plate (62). Facing the underside of the changer with the plate (62) in the upper left hand corner, moving the hook in the spring (58) to a hole to the left will increase the tension, to the right will decrease the tension. If the needle jumps several grooves when pushed over the spring tension is too light, while if the arm does not move all the way over to the first groove more spring tension is required.

TRIP ADJUSTMENTS

The position trip adjustment is a screw (55) located near the end of the mover arm (54) underneath the changer. To trip earlier turn the screw (55) clockwise, to trip later turn the screw counter-clockwise. Lock adjustment with nut (56).

RECORD HOLDER POST ADJUSTMENTS

With the changer properly loaded the bottom record on the stack should rest for about $\frac{1}{8}$ to $\frac{1}{4}$ of an inch on each side of the top (4B) of the record holder post (4), if not adjust as follows: With the center post (3) out remove the large nut (2) in the center of the turntable (1) and lift off the turntable. Loosen the two screws (18) in the slots in line with the record holder post and the center. Push the screw heads (18) the required amount toward, or away from the record holder post (4) and tighten the two screws (18).

The top of the record holder post (4) is fastened by the shaft on (4A) inside the post to the size cam (4D) underneath, which has two rectangular holes into which snaps a spring arm (44). The pressure this arm

(44) exerts on the above size cam (4D) may be adjusted by the screw (45) which presses against the arm (44). The arm (44) should press firmly against the size cam (4D) so it will snap tightly into either of the two holes. When the spring arm (44) is in the rectangular hole farthest from the outside of the size cam (4D) the top of the record holder post (4) should be in the ten inch position. If the screw (45) is too tight it will be hard to turn the top of the record holder post (4). The size cam (4D) is fastened to the shaft of (4A) inside the record holder post (4) by two hex head set screws (41).

If both sides of the record pusher (4F) on the top of the record holder post (4) do not push against the lower record at the same time, loosen the two hex head screws (41) and turn the top of the record holder post (4) slightly to the proper position. Tighten the screws (41).

SETTING FOR 10 OR 12 INCH RECORDS

The edge of the size cam (4D) pushes against a knurled screw (71) on size change lever (73). This sets a switch (33) on the cam part of main gear (35), for the pickup (9) to drop for either a ten inch or twelve inch record by causing pin in the arm fastened to the mover arm (54) to travel through one of two tracks in the inside of the large cast gear (35). After adjustment is made tighten the lock nut (72) on the knurled screw (71).

RECORDS FAIL TO DROP

If a record fails to drop during a changing cycle, but the record pusher (4F) on top of the record holder post (4) is operating and the adjustments under "Record Holder Post" are correct, proceed as follows: Set the large gear (35) in the locked position and the top of the record holder post (4) in either the ten inch or twelve inch position. Loosen the single hex head screw (70) which secures a "U" bracket (69) to the inside shaft (4E) of the record holder post (4) underneath the changer. Turn the shaft (4E) slightly until the sides of the record pusher (4F) are about $\frac{1}{8}$ of an inch back of the edge from where the records drop. The hex head screw (70) should now be firmly tightened.

While the large gear (35) makes one complete revolution, during a changing cycle, the pusher arm (4F) should extend past the edge from where the records drop, and return.

NOTE I 50 CYCLE OPERATION

If operation is desired on 50 cycle current, a small spring (15), see parts list, must be added to the motor shaft in the following manner:

With the center post (3) out, remove the large nut (2) in the center of the turntable (1) and lift off the hand. Hold conversion spring (15) in the right hand turntable. Hold motor rotor with fingers of the left with the extension upwards. Hook lower end of spring (15) over edge of rotor shaft drive pulley and with a downward twisting effort in a direction to unwind or enlarge the inside diameter of the conversion spring (15) force down over entire pulley length. The extension which is provided for ease of assembly only, should then be sprung away from the pulley sufficiently to allow it to be snapped off with a pair of diagonals, at the spring surface so no protrusion will remain to impair operation of the drive pulley. The motor shaft pulley thus enlarged will provide proper turntable speed with the motor operating on 50 cycle current.

NOTE II

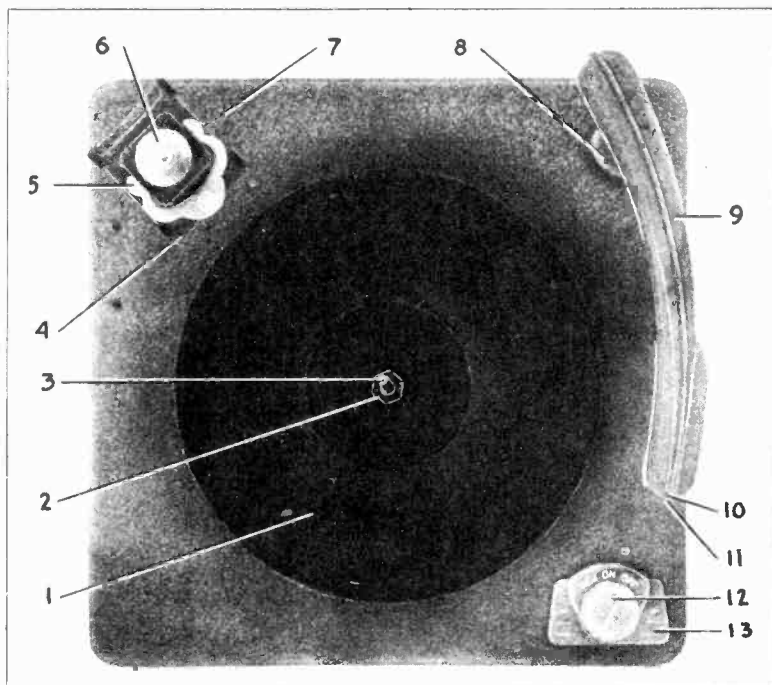
RC-50 is standard 60 cycle record changer with Alden type socket for A.C. connection.

RC-51 is standard 60 cycle record changer except spring bushing has been added to motor shaft to increase size and provide correct speed on 50 cycle. Same A.C. connection as RC-50.

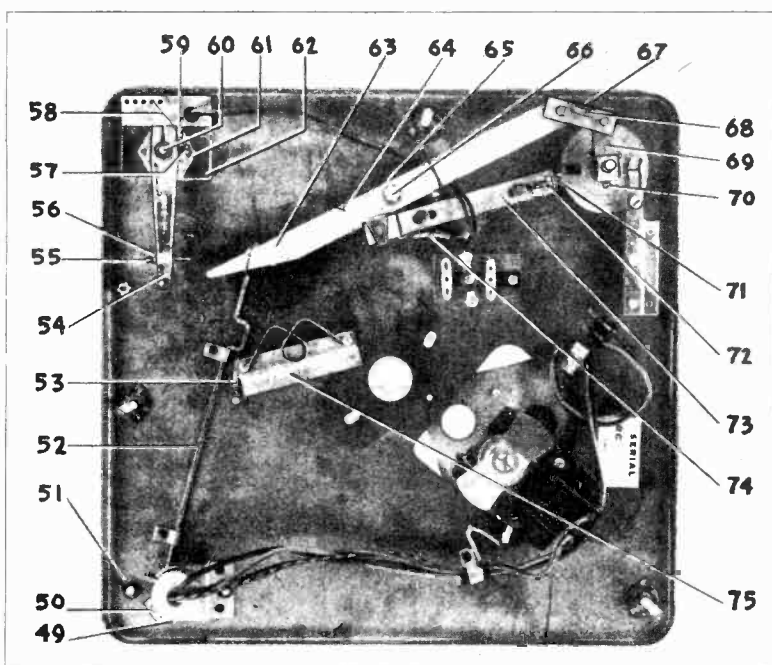
RC-52 is standard 60 cycle record changer with standard A.C. cord and plug.

RC-53 same as RC-52 except with 50 cycle bushing added as on RC-51.

CONTINENTAL RADIO & TELEV. CORP. MODELS RC50, RC51,
RC52, RC53



TOP VIEW - COMPLETE



BOTTOM VIEW
GEAR AND BEARING ASSEMBLY REMOVED

1	RC-6000T	Turntable only	\$1.70
2	RC-3025	Turntable nut	.15
3	GA-35	Offset center post	1.35
4	GA-31	Complete record changer post	3.00
5	RC-5003	Record clamp (Plastic)	.20
6	RC-5002	Record changer shelf cap (Plastic)	.15
7	RC-2003	Record shelf support post	.65
8	RC-2005	Pickup arm support post	.65
9	GA-32	Complete pickup arm assembly	7.75
10		Needle screw (Phillips type head)	.15
11	RC-6008	Lifetime needle	1.50
12	RC-5001	Knob (Plastic)	.10
13	RC-5000	Escutcheon (Plastic)	.20

49	P-2328	Spring washer	\$.05	
50	GA-15	AC switch lever and stud assembly	.25	
51	P-4626	Tinnerman clamps for mounting escutcheon (13)	½ doz. .05	
52	RC-4012	Reject lever	.10	
53	RC-4003	Reject lever spring	.05	
54	GA-27	Pickup arm mover assembly (with parts below to 59, inclusive)	1.50	
55	RC-7002	8-32x1" slotted screw, headless	.05	
56	RC-7024	Hex. nut (½ doz.)	.05	
57	P-2729	Set screw (½ doz.)	.05	
58	RC-4018	Lead in spring	.05	
59	RC-7016	8-32x¾" Fil. head screw (½ doz.)	.05	
60	RC-3034	Raising pin	.10	
61	P-1399	Horseshoe washer	.10	
61	RC-7029	Pickup arm support post mounting nut	.05	
62	RC-1030	Lead in spring, hook-plate	.05	
63	G-29	"Z" Bracket assembly	.30	
64	RC-4013	"Z" Bracket spring	.05	
65	RC-3027	"Z" Bracket mounting stud	.10	
66	P-206	8-32x¾" Round head screw	} (Set) .05	
66	P-993	Hex. nut		
66	P-214	Lockwasher		
66	P-269 A	Washer		
67	RC-1006	Lever link	.05	
68	RC-4001	Lever link spring	.05	
69	G-28	"U" Bracket assembly (complete with set screw)	.25	
70	P-2692	"U" Bracket set screw, only (½ doz.)	.05	
71	RC-7000	Size change adj. screw	} \$.05	
72	P-993	Size change adjusting lock nut		
73	GA-12	Size change lever assembly (complete with screw & lock nut)	.25	
74	RC-4002	Size change lever spring	.05	
75	GA-34	Wire detent spring and bracket	.25	

MOUNTING HARDWARE	
RC4010	Record changer mounting spring, ½ doz. \$.10
RC7017	Record changer mounting screw .05
P4781	Record changer mounting bracket .10
P4694	Record changer mounting bracket (Slide-A-Way only) .10

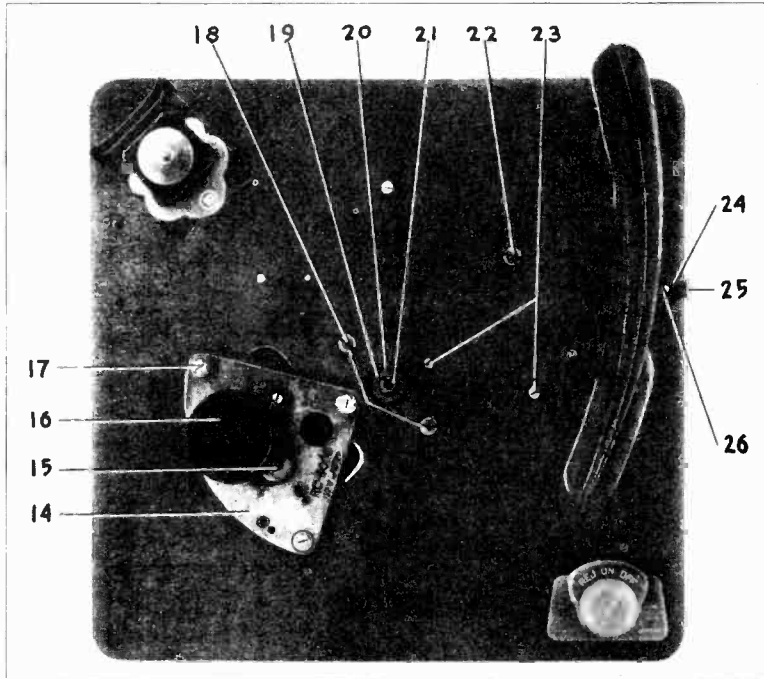
SLIDE-A-WAY PARTS	
P4692	Changer base \$3.20
P4528	Roller .15
P4529	Stud .10
P4548	Washers ½ doz. .05
P413	Hex nut ½ doz. .05
P424	Lock washers 1 doz. .05
P4693	Slide rail .30
P4523	Right door bracket .40
P4524	Left door bracket .40
P4526	Roller .15
P4527	Stud .05

All prices quoted are list.
All parts should be ordered through local Admiral Distributor.
Shipments are F.O.B. if ordered direct from the factory. When remitting in advance please include postage.
A handling charge of \$0.25 will be made on all orders under \$0.75 list.
Prices are subject to change without notice.

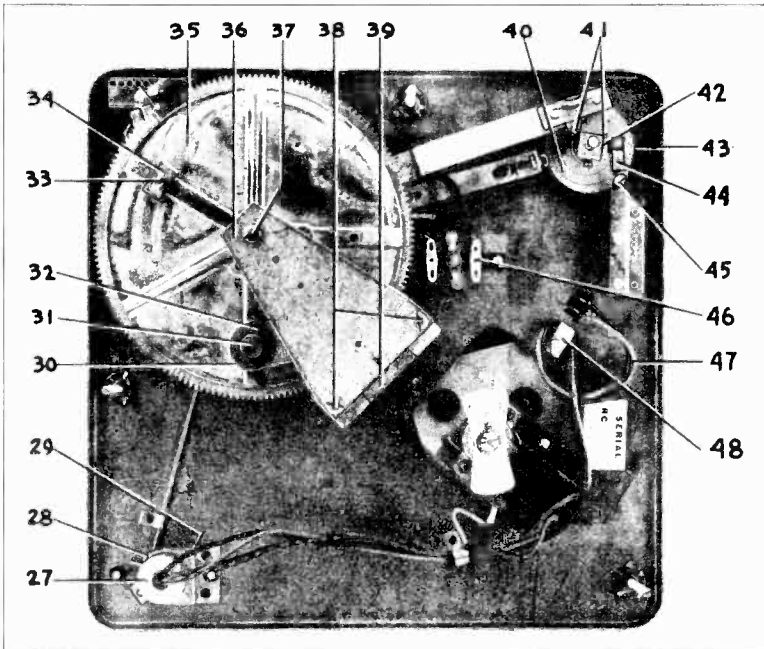
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODELS RC50, RC51,
RC52, RC53

CONTINENTAL RADIO & TELEV. CORP.



TOP VIEW - 1, 2, 3, REMOVED



BOTTOM VIEW - COMPLETE

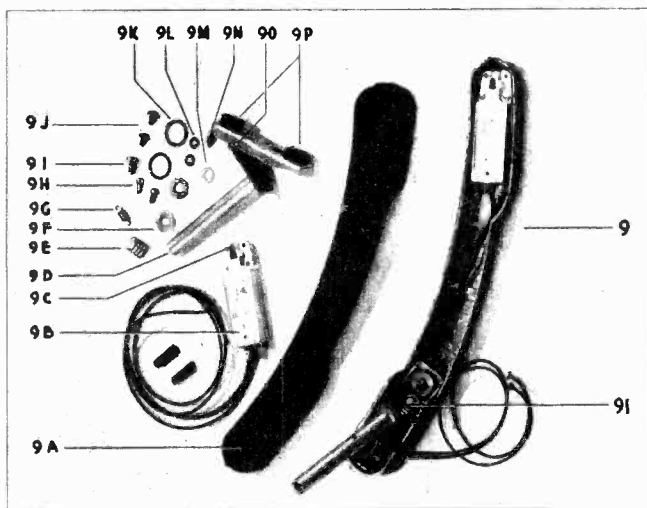
- 14 RC-6000 M Motor only, 60 cycle (Type I or II) Type I shown\$5.75
- 15 50 cycle bushing (Fits over motor shaft, see note I)15
- 16 Idler wheel 1.00
- 17 { P-1518 6/32x 5/8" mounting screws
P-1466 Lockwashers
P-269 Washers } (3 each) .10
- 18 RC-7006 10-24 x 3/8" mounting screws and lockwashers05
- 19 RC-7010 Cork washer05
- 20 RC-6003 Thrust bearing75
- 21 RC-3021 Pinion shaft45
- 22 RC-7027 10-32 - 3/8" mounting screw and lockwasher05
- 23 P-4080 6-32 x 1/4" Sems type mounting screws (Pr.)05
- 24 RC-1029 Arm rest10
- 25 RC-5004 Arm rest cap (Plastic) .. .10
- 26 { P-2437 6-32 x 3/8" round head screw
P-1466 Lockwasher (Set)
P-825 Hex. nut }05

- 27 RC-6002 AC switch and cover.....\$.45
- 28 RC-1011 AC switch mounting bracket05
- 29 RC-4015 AC switch lever wire spring05
- 30 GA-24 Starting bracket assembly25
- 31 RC-3015 Starting bracket mounting stud10
- 32 RC-1025 Starting bracket mounting washer05
- 33 RC-2007 Size switch10
- 34 RC-4007 Size Switch Mtg. Spring05
- 35 RC-2000 Large gear and cam (Springs [35A] and [35B] attached) 2.00
- 36 GA-25 Separating plate and reset bracket35
- 37 RC-7027 10-32 x 3/8" mounting screws and lockwashers (Pair)05
- 38 RC-7006 10-24 x 3/8" mounting screws and lockwashers (Pair)05
- 39 GA-33 Bearing assembly75
- 40 G-30 Size cam assembly (Complete with set screws)35
- 41 RC-7021 Hex head set screws (only) (1/2 doz.) .05
- 42 RC-3032 Spacer05
- 43 RC-7029 Mounting nut05
- 44 GA-13 Detent cam spring and bracket assembly (complete with screw & lock nut)30
- 45 { P-1098 Adjusting screw
P-825 Adjusting lock nut }05
- 46 RC-6006 Soldering panel05
- 47 { RC-6009 AC cable and Alden plug for RC50 and 51 (as shown), see Note II...
RC-4894 AC line cord and plug for RC52 and 53..... }35
- 48 P-1692 AC cable clamp05

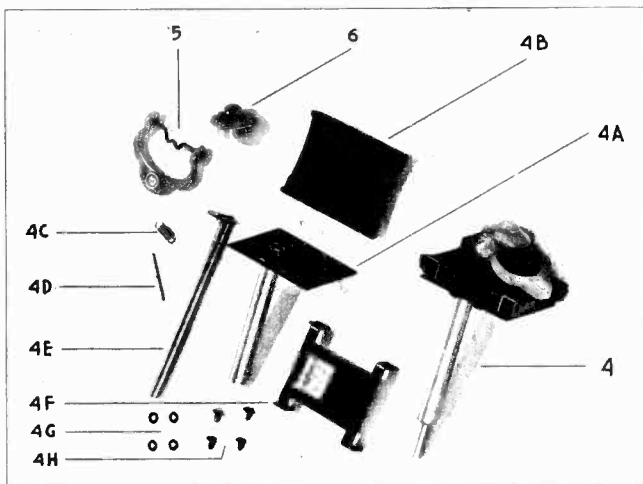
PRICES SUBJECT TO CHANGE WITHOUT NOTICE

CONTINENTAL RADIO & TELEV CORP.

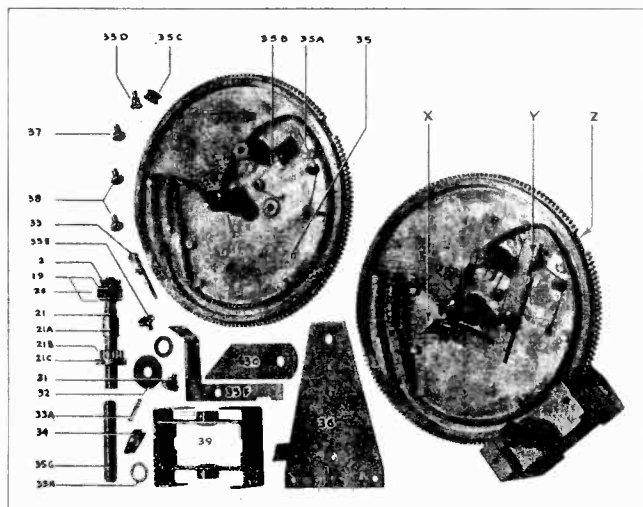
MODELS RC50, RC51,
RC52, RC53



- 9 GA-32 Complete pickup arm assembly\$7.75
- 9A RC-2004 Pickup arm casting..... .85
- 9B RC-6001 Pickup crystal cartridge 4.50
- 9C Needle screw only (Phillip's type head)..... .15
- 9D GA-21 Pickup lower mounting bracket and sleeve50
- 9E RC-4004 Pickup arm adjusting spring05
- 9F P-3423 Washer (1/2 doz.) .05
- 9G RC-4005 Pickup arm tension spring05
- 9H RC-7026 Mounting screw (Pickup crystal cartridge) (Pair)05
- 9I RC-7001 Pickup arm adjusting screw05
- 9J P-270 A 4-36x1/4" Screw (1/2 doz.) .05
- 9K RC-1023 Bakelite washer (1/2 dz.) .05
- 9L RC-7013 Lockwasher (1/2 doz.) .05
- 9M RC-7018 Pickup arm adjusting washer (1/2 doz.) .05
- 9N RC-1013 Pick arm upper mounting bracket10
- 9O RC-3008 Pickup arm pivot pin..... .05
- 9P RC-7008 Rubber grommet. (Pair) .05



- 4 GA-31 Complete record changer post 3.00
- 4A GA-17 Mounting shelf plate and sleeve..... .60
- 4B RC-2002 Record changer shelf..... .50
- 4C RC-4000 Record clamp spring..... .05
- 4D RC-3002 Record clamp spring pin..... .05
- 4E GA-18 Small cam and shaft..... .25
- 4F RC-1001 Record remover..... .25
- 4G P-7013 Lockwasher (1/2 doz.) .05
- 4H P-270-A 4-36x1/4" screw (1/2 dz.) .05
- 5 RC-5003 Record clamp (plastic)..... .20
- 6 RC-5002 Record changer shelf cap (Plastic)..... .15



- 2 RC-3025 Turntable nut.....\$.15
- 19 RC-7010 Cork washer (Pair) .05
- 20 RC-6003 Thrust bearing..... .75
- 21 RC-3021 Pinion shaft..... .45
- 21A RC-3024 Pinion gear ferrule..... .10
- 21B RC-2001 Pinion gear..... .20
- 21C RC-7007 Allen head set screw..... .10
- GA-22 Large gear assembly (with parts below to 35F, inclusive) 3.75
- 30 GA-24 Starting bracket assembly..... .25
- 31 RC-3015 Starting bracket mounting stud..... .10
- 32 RC-1025 Starting bracket mounting washer..... .05
- 33 RC-2007 Size switch..... .10
- 33A RC-3013 Size switch stud..... .05
- 34 RC-4007 Size switch mounting spring..... .05
- 35 RC-2000 Large gear and cam (Springs 35A and 35B attached) 2.00
- 35A RC-4008A Starting bracket spring..... .05
- 35B RC-4009 Trigger bracket spring..... .05
- 35C RC-3018 Ejector roller..... .10
- 35D RC-3019 Ejector roller stud..... .05
- 35E RC-3016 Trigger bracket stud..... .05
- 35F RC-1016 Trigger bracket..... .15
- 35G RC-3017 Large gear mounting post..... .20
- 35H RC-1023 Bakelite washer (Pair) .05
- 36 GA-25 Separating plate and reset bracket..... .35
- 37 RC-7027 10-32 x 3/8" mounting screws and lockwashers (Pair) .05
- 38 RC-7006 10-24 x 3/8" mounting screws and lockwashers (Pair) .05
- 39 GA-33 Bearing assembly..... .75

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODELS 28AZ, 31BF,
34BH, 48BF

CROSLEY RADIO CORP.

RECORDER WITH AUTOMATIC CHANGER

PARTS LIST

(Parts for FIG. 1

Item No.	Part No.	Description	No. Used	Item No.	Part No.	Description	No. Used
1	130659	Spindle Thrust Plate	1	27	130685	Clutch Spring	1
2	130937	Spindle and Feed Screw Housing	1	28	130686	Flat Washer	1
4	130662	Drive Gear Assembly	1	29	130687	Taper Pin	3
5	130938	Panel, Post and Stud Assembly	1	30	130688	Selector Shaft Drive Crank Assy. Post No. 2	1
6	130664	Selector Shaft Collar	1	31	130689	Drive Link Assy.	1
7	130665	Selector Shaft Crank Assy. Post No. 1	1	32	130690	Trip Rod	1
8	130666	Flat Washer	3	33	130691	Flat Washer	1
9	130667	"C" Washer	3	34	130692	Drive Gear Stud	1
10	130668	12" Set Link	1	35	130693	Switch Spring	1
11	130669	12" Reset Link Spring	1	36	130694	Switch Mounting Bracket	1
12	130670	Tone Arm Locator and Bushing Assy.	1	37	130695	Switch Retainer Bracket	1
13	130671	Tone Arm Booster Spring	1	38	130696	Switch	1
14	130672	Tone Arm Locator Shoe (12")	1	77	130939	Tone Arm Shaft	1
15	130673	Tone Arm Locator Shoe (10")	1	78	130698	Reset Arm Stop Washer	1
16	130674	Tone Arm Locator Spring	1	102	130940	Manual Control Slide	1
17	130675	Tone Arm Latch and Guide Bracket	1	103	130941	Clutch Lock Slide	1
18	130676	Tone Arm Latch Lever	1	104	130942	Locator Lock Slide Spring	1
19	130677	Tone Arm Lever Assy.	1	105	130943	Slide Latch	1
20	130678	Trip Lever Assy.	1	105	130944	Locator Lock Slide	1
21	130679	Tone Arm Lift Plate Assy.	1				
22	130680	Thumb Nut	1				
23	130681	Tone Arm Trip Shoe	1				
24	130682	Trip Lever Spring	1				
25	130683	Shielded Pickup Wire	1				
26	130684	Muting Switch	1				

(Parts List for FIG. 2

Item No.	Part No.	Description	No. Used	Item No.	Part No.	Description	No. Used
39	130699	Clutch Reset Pawl Spring	1	97	130947	Traverse Bushing and Blade Assembly	1
40	130700	Clutch Reset Pawl	1	98	130948	Traverse Lever Bracket	1
41	130701	Latch Lever Shoulder Screw	1	99	130949	Lock Nut	2
43	130702	12" Set Arm Assembly	1	100	130950	Recorder Arm Shaft Sleeve	1
79	130703	Engagement Clutch Cam Assy.	1	101	130951	Bearing Center Screw	4
80	130704	Tone Arm Reset Link	1				
81	130705	Tone Arm Lifter Link Assy.	1				
42	130945	Set Arm Return Spring	1				
96	130946	Traverse Arm Support Bracket	1				

(Parts List for FIG. 3

Item No.	Part No.	Description	No. Used	Item No.	Part No.	Description	No. Used
44	130706	Record Support Post No. 2	1	70	130719	Tone Arm Adjusting Screw	1
45	131024	Tone Arm Cartridge	1	71	130720	Adjusting Screw Lock Spring	1
46	130708	Tone Arm Swivel Bracket	1	72	130721	Thrust Wafer	1
47	130709	Tone Arm Mounting Bracket	1	73	130722	Thrust Washer	5
48	130952	Tone Arm Lifter Pin	1	74	130723	Ball Race Assy.	1
49	130953	Counter Balance Spring	1	75	130724	Rubber Bumper	1
50	130712	Spring Washer	1	76	130954	Turntable	1
51	130713	Roller	2	82	130726	Tone Arm Lifter Reset Spring	1
52	130714	Switch Return Spring	1	95	130955	Retractable Drive Pin	1
53	130715	Flat Washer	2	109	130956	Feed Screw and Gear Assy.	1
54	130716	Switch Reject Slide	1				
55	130717	Switch Collar and Reject Pin Assy.	1				
56	130718	12" Set Rod	1				

(Parts List for FIG. 4

Item No.	Part No.	Description	No. Used	Item No.	Part No.	Description	No. Used
57	130727	Control Knob	2	107	130967	Bearing Center Screw	1
58	130728	Selector Blade (10")	2	108	130968	Cartridge Pivot Screw	1
59	130957	Turntable Spindle	1			(Parts List for Fig. No. 5)	
60	130958	Tone Arm	1	89	130854	Cutter Cartridge	1
61	130731	Selector Arm No. 1	1	90	130970	Pressure Control Blade	1
62	130732	Special Washer	1	91	130855	Pressure Control Cam	1
63	130733	Drive Gear Stud Lock Nut	1	92	130960	Bearing Center Screw	2
64	130734	Switch Escutcheon	1	93	130969	Bearing Center Screw Lock Nut	2
65	130959	Switch Control Knob	1	94	130819	Tone Arm Adjusting Screw	1
66	130870	Motor Assembly	1	131236		Spring-Upper-Base Mounting	4
67	130737	Record Support Post No. 2	1	131237		Spring-Lower-Base Mounting	4
68	130738	Selector Blade (12")	2	131238		"U" Nut--For Mounting Bolts	4
69	130739	Selector Arm No. 2	1	130381		1/4-20 R. H. M. Screws	4
83	130961	Rubber Idler Drive Wheel	1				
84	130962	Manual Control Escutcheon	1				
85	130963	Manual Control Button	1				
86	130964	Recorder Arm	1				
87	130965	Pressure Control Knob	1				
88	130966	Recorder Arm Adjustment Screw	1				

PRICES SUBJECT TO CHANGE
WITHOUT NOTICE

FOR OPERATION AND SERVICE DATA
SEE SEEBURG JR (EARLY), (JR-1B)

CROSLY RECORD
CHANGER

CROSLY RADIO CORP.

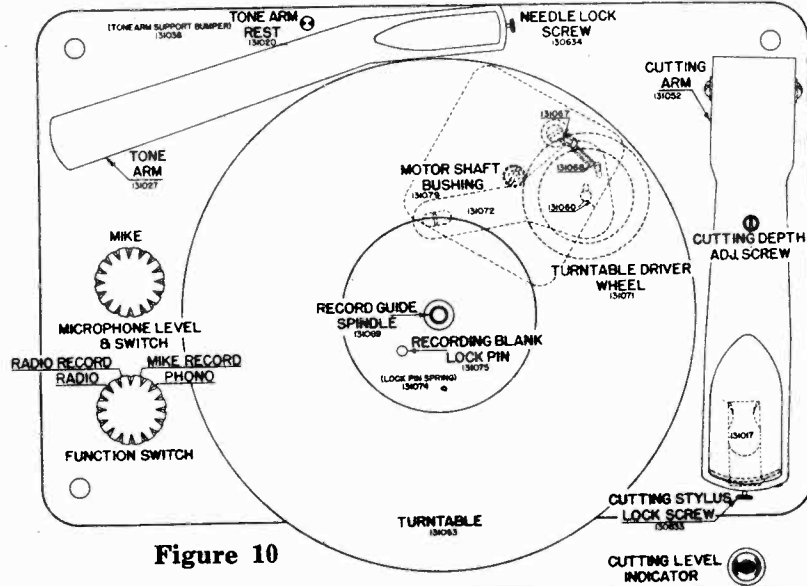
MODEL 33BG
RECORDER

Figure 10

CROSLY
MODEL 33 BG
RECORDER ONLYFOR OTHER DATA SEE **AUTOMATIC RECORD CHANGER**
SEEBURG MODEL J-1A **PARTS LIST**

Item No.	Part No.	Description	No. Used	Item No.	Part No.	Description	No. Used
1	130659	Spindle Thrust Plate	1	47	130709	Tone Arm Mounting Bracket	1
2	130660	Spindle Bearing Housing Assy.	1	48	130710	Tone Arm Lift Pin	1
3	130661	Drive Pinion	1	49	130711	Counter Balance Spring	1
4	130662	Drive Gear Assy.	1	50	130712	Spring Washer	1
5	130663	Panel, Post and Stud Assy. (Model 30)	1	51	130713	Roller	2
	131524	Panel, Post and Stud Assy. (Model 29)	1	52	130714	Switch Return Spring	1
6	130664	Selector Shaft Collar	1	53	130715	Flat Washer	2
7	130665	Selector Shaft Crank Assy. Post No. 2	1	54	130716	Switch Reject Slide	1
8	130666	Flat Washer	3	55	130717	Switch Collar and Reject Pin Assy.	1
9	130667	"C" Washer	3	56	130718	12" Set Rod	1
10	130668	12" Set Link	1	57	130727	Control Knob	2
11	130669	12" Reset Link Spring	1	58	130728	Selector Blade (10")	2
12	130670	Tone Arm Locator and Bushing Assy.	1	59	130729	Turntable Spindle	1
13	130671	Tone Arm Booster Spring	1	60	130730	Tone Arm	1
14	130672	Tone Arm Locator Shoe (12")	1	61	130731	Selector Arm No. 1	1
15	130673	Tone Arm Locator Shoe (10")	1	62	130732	Special Washer	1
16	130674	Tone Arm Locator Spring	1	63	130733	Drive Gear Stud Lock Nut	1
17	130675	Tone Arm Latch and Guide Bracket	1	64	130734	Switch Escutcheon	1
18	130676	Tone Arm Latch Lever	1	65	130735	Switch Control Knob	1
19	130677	Tone Arm Lever Assy.	1	66	130736	Motor	1
20	130678	Trip Lever Assy.	1	67	130737	Record Support Post No. 2	1
21	130679	Tone Arm Lift Plate Assy.	1	68	130738	Selector Blade (12")	2
22	130680	Thumb Nut	1	69	130739	Selector Arm No. 2	1
23	130681	Tone Arm Trip Shoe	1	70	130719	Tone Arm Adjusting Screw	1
24	130682	Trip Lever Spring	1	71	130720	Adjusting Screw Lock Spring	1
25	130683	Pickup Shielded Wire	1	72	130721	Thrust Wafer	1
26	130684	Muting Switch	1	73	130722	Thrust Washer	5
27	130685	Clutch Spring	1	74	130723	Ball Race Assy.	1
28	130686	Flat Washer	1	75	130724	Rubber Bumper	1
29	130687	Taper Pin	3	76	130725	Turntable	1
30	130688	Selector Shaft Drive Crank Assy. Post No. 2	1	77	130697	Tone Arm Shaft	1
31	130689	Drive Link Assy.	1	78	130698	Reset Arm Stop Washer	1
32	130690	Trip Rod	1	79	130703	Engagement Clutch Cam Assy.	1
33	130691	Flat Washer	1	80	130704	Tone Arm Reset Link	1
34	130692	Drive Gear Stud	1	81	130705	Tone Arm Lifter Link Assy.	1
35	130693	Switch Spring	1	82	130726	Tone Arm Lifter Reset Spring	1
36	130694	Switch Mounting Bracket	1	83	131083	3/16" Needle Screw	1
37	130695	Switch Retainer Bracket	1	84	131236	Upper Mounting Spring (Base)	4
38	130696	Switch	1	85	131237	Lower Mounting Spring (Base)	4
39	130699	Clutch Reset Pawl Spring	1	86	131238	"U" Nut for Mounting Bolts	4
40	130700	Clutch Reset Pawl	1	87	130981	1/4-20 R. H. D. Machine Screw	4
41	130701	Latch Lever Shoulder Screw	1	88	131102	Idler Wheel	1
42				89	131032	Spring—50 Cycle Motor Bushing	1
43	130702	12" Set Arm Assy.	1				
44	130706	Record Support Post No. 1	1				
45	131024	Tone Arm Cartridge	1				
46	130708	Tone Arm Swivel Bracket	1				

PARTS SUBJECT TO CHANGE
WITHOUT NOTICE

MODEL 33BG
RECORDER

CROSLEY RADIO CORP.

RECORDER AS USED IN MODEL 33 BG

PARTS LIST (Refers to Fig. 4 and Fig. 10)

Part No.	Description	Part No.	Description
131000	Retractable Pin Spring Washers	131048	Pickup Cartridge Hinge Damper Felt
131001	Motor Mounting Screw	131049	Tone Arm Post Complete
131002	Shakeproof Motor Housing and Bracket Lock Washer	130748	Cutter Head with Leads
131003	Hex Nut for Pivot Post	131051	Cutter Head Bumper Cork (Magnetic)
131004	Mounting Bracket Assy. Washer	131052	Cutter Arm Complete (Magnetic)
131005	Lead Clip Mtg. Screw Lock Washer	131053	10" Weighted Turntable (1/8" one piece T. T.)
131006	Motor Mounting Screw	131054	Mounting Bracket Assy. Screw Nut
131007	Retractable Pin Spring Screw (For 2 piece T. T.)	131055	Motor Plate Rubber Grommet
131008	Adjusting Screw (Follower Arm)	131056	Tone Arm Support Lock Washer
131009	Aux. Shaft Housing Mounting Screw	131057	Mounting Plate Grommet Sleeve
131010	Retractable Pin Spring Screw (For 1/8" one piece T. T.)	131058	Turntable Drive Disc Thrust Washer
131011	Aux. Shaft Housing and Motor Mounting Screw Washer	131059	Rotor Shaft Pulley Set Screw (1/2" Shaft)
131012	Cutter Arm Mtg. Screw Washer	131060	Turntable Drive Disc Clip
131013	Turntable Shaft Locking Screw	131061	Aux. Shaft Housing Assy.
131014	Pivot Saddle Plate Adjusting Screw Nut and Cutter Arm Holding Bracket Screw	131062	Lead Screw and Pinion Assy.
131015	Turntable Shaft Locking Screw Nut	131063	Lead Screw End Thrust Screw
131016	Adjusting Screw Nut (Follower Arm)	131064	Lead Screw End Thrust Screw Nut
131017	Cutter Arm Holding Bracket	131065	Motor Mounting Plate
131018	Follower Arm Complete	131066	Rotor Shaft Pulley (For 1/2" Shaft)
131019	Pivot Post Bushing	131067	Turntable Drive Disc Tension Spring Holder
131020	Tone Arm Support	131068	Turntable Drive Disc Tension Spring
131021	Base Plate Complete (Less Switch, Etc.)	131069	Turntable Shaft
131022	Pickup Cartridge Mounting Screw	131070	Aux. Shaft Housing Complete
131023	Pickup Cord Clip	131071	Turntable Drive Disc Complete
131024	Pickup Cartridge (ONLY)	131072	Turntable Drive Disc Mtg. Bracket Assy.
MG5-130570	Recorder Base Assy. Complete (110 V.—60 Cy.)	131073	Motor Mtg. Plate Complete
MG8-130570	Recorder Base Assy. Complete (110 V.—50 Cy.)	131074	Retractable Pin Spring (For 1/8" one piece T. T.)
131026	Tone Arm Assy.	131075	Retractable Pin (For 1/8" one piece T. T.)
131027	Tone Arm Complete	131076	Rotor Shaft Pulley (For 1/2" Shaft and two piece T. T.)
131028	Lift Lever	131077	Rotor Shaft Pulley Set Screw (1/16" Shaft)
131029	Tension Adjusting Screw Lug	131078	Rotor Shaft Pulley Support Ring
131030	Cutter Head Tension Spring	131079	Rotor Shaft Pulley (For 1/8" one piece T. T.)
131031	Cutter Arm Mtg. Screw	131080	Retractable Pin Spring (For two piece T. T.)
131033	Saddle Bushing Set Screw	131081	Retractable Pin (For two piece T. T.)
131034	Pivot Saddle Plate Adjusting Screw	131082	10" Weighted Turntable (two piece T. T.)
131035	Pivot Saddle Plate Assy.	130820	Motor—110 Volt, 60 Cycle
131036	Cutter Arm Holding Bracket Screw	130634	Needle Screw—Tone Arm
131037	Pivot Post Straddle Plate	130633	Needle Screw—Cutting Arm
131038	Tone Arm Support Bumper	131126	Spring—50 Cycle—Motor Bushing
131039	Pivot Post Return Spring	130628	Spring—Base Mounting (8 Req.)
131040	Lead Clip Screw	38085	Wing Nut—Base Mounting (4 Req.)
131041	Lead Clip	130625	Screw—Base Mounting (4 Req.)
131042	Tone Arm Post Washer	130626	Stirrups—Shipping Clamp (4 Req.)
131043	Tone Arm Washer	130901	Cutting Needle (1)
131044	Tone Arm Post Nut	131785	Motor Bushing—Change 50 to 60 Cycles
131045	Pivot Post Bushing Lock Washer	47339	Play Back Needles (Pkg. 10)
131046	Follower Arm Shaft Washer		
131047	Follower Arm Stop		

PRICES SUBJECT TO CHANGE
WITHOUT NOTICE

FOR OPERATION AND SERVICING
DATA SEE GENERAL INDUSTRIES
MODEL R-70

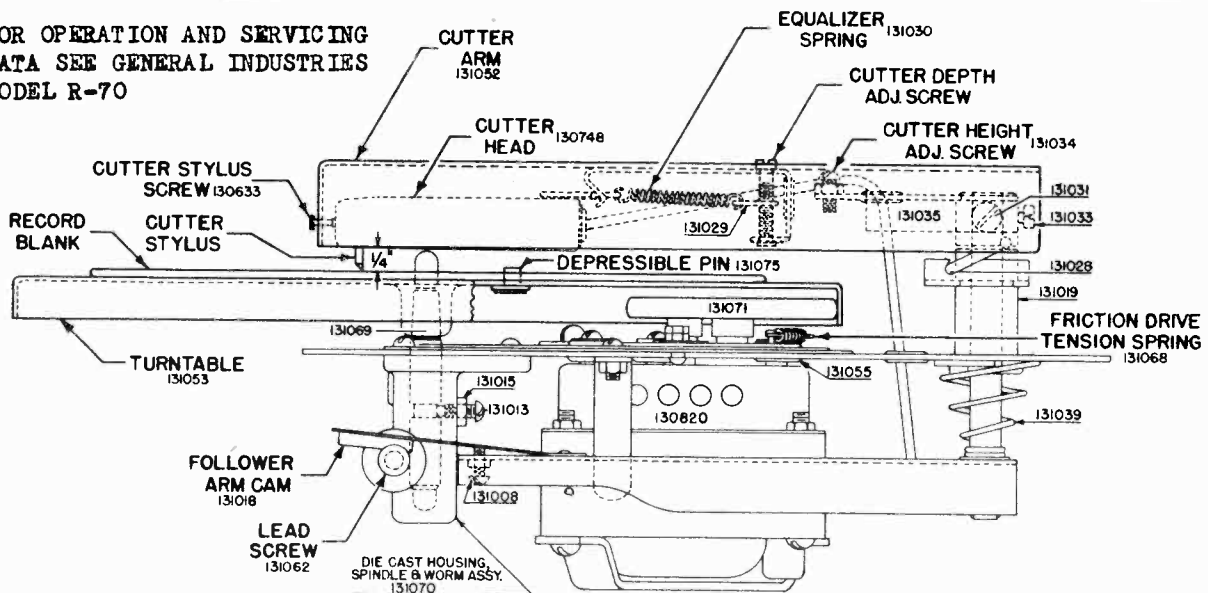


Figure 4

DETROLA CORP.

MODELS N-100, N-200

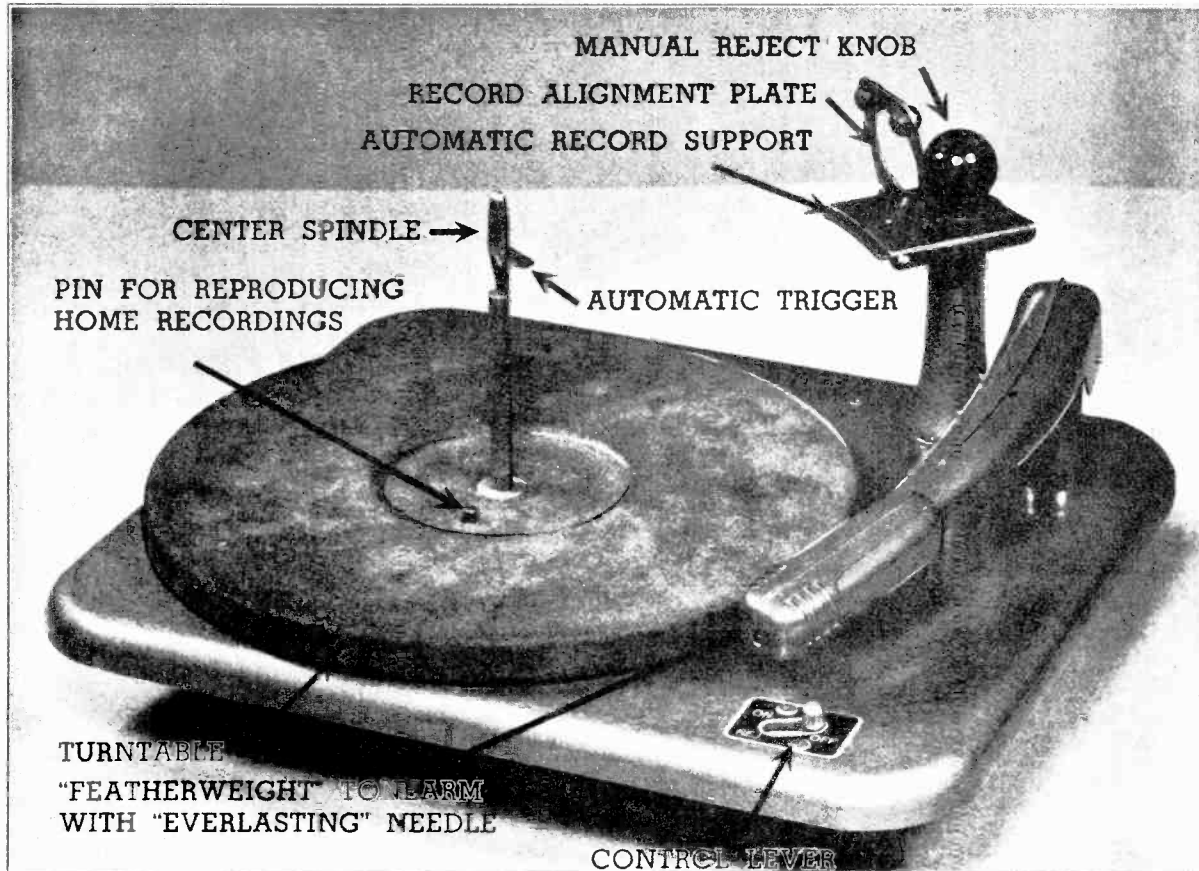


FIG. 2
NEW GEARLESS RECORD CHANGER

This machine will play and automatically change a series of up to twelve ten-inch records or a series of up to ten twelve-inch records. Any ten or twelve-inch record of the 78 R.P.M. type with either a standard eccentric or spiral stopping groove will operate this machine automatically.

Very old records that have not a standard eccentric or spiral stopping groove can be played semi-automatically by operating the **reject lever** at the conclusion of each selection.

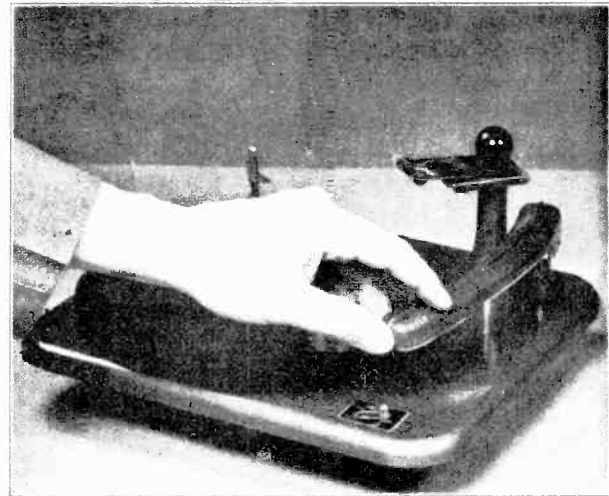


FIG. 3
PLAYS HOME RECORDINGS

To provide adequate protection for your most valued recordings and at the same time relieve you of the necessity of changing needles, this machine was designed to use an **"EVERLASTING"** needle in conjunction with its **"FEATHERWEIGHT"** tonearm. This needle will faithfully reproduce many thousands of recordings with minimum wear of your records.

The **turntable** has a pin for reproducing home recording discs at a constant speed. This machine operates on 110 volt—60 cycle current only.

FOR AUTOMATIC OPERATION

1. Turn **automatic record support** for the size of record to be played—10-inch or 12-inch—and flip the **record alignment plate** away from the turntable.
2. **Tonearm** should be moved to engage notch marked "A" (automatic) on base of **tonearm**. (See Fig. 3).
3. Place a series of up to twelve ten-inch records or a series of up to ten twelve-inch records on **center spindle** and **automatic record support**. Flip **record alignment plate** on to records.
4. Move **control lever** to "ON" position, hold for about 1/2 second to start automatic operation, then release.

THE AUTOMATIC REJECT OPERATION

If, while playing a record, you desire to skip the remainder of the recording and pass immediately to the next record of the series, move the **control lever** to "REJ" (reject) position, then release.

THE MANUAL REJECT OPERATION

If you desire to skip a number of records:

1. Lift the **tonearm** off the record and place in its normal or rest position, clear of the records.
2. Turn the **manual reject knob** clockwise, then release, dropping one record. Repeat until desired record is obtained, then carefully replace needle on edge of record.

TO REMOVE RECORDS

Always drop all the records from the **automatic record support** (see "manual-reject operation") before removing the records from the **spindle**.

1. Flip **record alignment plate** away from records.
2. Remove **tonearm** to its normal or rest position.
3. Lift records vertically.

TECHNICAL SERVICE DATA

1. There is no strain on the mechanism when the **tonearm** is accidentally rotated during its cycle. Merely return the **tonarm** to engage its proper notch—"H" for playing home recording discs or "A" for standard records.
2. The **height-gauge** prevents vertical shocks from reaching the mechanism. Rotate the **height-gauge** until the needle is approximately 1/16 inch below the top surface of the turntable.
3. The set screws for adjusting the **tonearm** are **above** the motorboard. If it is necessary to loosen these screws while servicing, reset as follows: Tighten one set-screw, turn on the motor, allowing the changing cycle to proceed until the tonearm starts to drop, at which point turn off the motor, stop the turntable before the tonearm has completed its drop and loosen the set screw. Then, while holding the tonearm over the record so that the needle is midway between the outer edge of the record and the beginning of the recording, tighten the set screws.
4. The automatic record support can be turned in either direction when adjusting for 10-inch or

TO PLAY HOME RECORDINGS

To play a home recording disc, up to 10 inches in diameter, move **control lever** to "OFF" position, then:

1. Turn **automatic record support** for a 12-inch record.
2. **Tonearm** should be moved to engage notch marked "H" (home recording) on base of **tonearm** (See Fig. 2).
3. Move **control lever** to "ON" position and allow **tonearm** to go through its record changing cycle. If the home recording disc is 10" in diameter, the **tonearm** will fall correctly on the record; but for smaller records, the **tonearm** must be placed on the record by hand.
4. At the conclusion of the home recording selection, either return the **tonearm** to the rest position by hand or move the **control lever** to "REJ" position, then release.

SEMI-AUTOMATIC OPERATION

Old records that have neither a standard eccentric nor spiral finishing groove do not operate the automatic trip mechanism. They may be played, either in a series or singly by moving the **control lever** to the "REJ" position at the conclusion of each selection.

- 12-inch records. The record support post is gauged in production so that the distance from the edge of the automatic record support when adjusted for playing 10-inch records to the nearest edge of the center spindle is 4 27/32 inches.
5. The record changer is adjusted in production so that the automatic mechanism is tripped when the needle is between 1 21/32 and 1 3/4 inches from the edge of the center spindle. This adjustment is made by carefully bending the bracket that is formed down out of the tonearm trip lever (the tonearm trip lever is the 3/4 inch wide steel strip with knurled end under the sub panel which rotates with the tonearm). Bending this bracket away from the tonearm bearing will cause the automatic mechanism to be engaged when the needle is at a greater distance from the spindle and bending the bracket towards the tonearm bearing will cause the engagement to occur when the needle is at a lesser distance from the spindle.
6. When replacing the four speed nuts that fasten the bottom strap, drive the three small speed nuts up tight with a hammer, but replace the large

speed nut on the center spindle firmly with the fingers.

7. The three main bearings are made of "Oilite" bronze. They contain an oil supply sufficient for the life of the machine. After two years of normal use add three drops of oil to the two felt washer reservoirs on the main motor bearing, a drop on the rubber tired motor idler pulley bearing and two drops on the ball thrust bearing at the bottom

of the center spindle. Operation of any record changer below normal room temperature will result in reduced turntable speed and consequently poor reproduction.

Keep the rubber belt and the rubber tire of the motor idler pulley free of grease, oil, and dirt. A cloth dampened with naphtha is recommended for cleaning these rubber parts.

CAUTION

WARPED RECORDS

To prevent warpage, do not leave your records on the supports when the machine is not in use. We suggest that you keep your records in an album or cabinet in order to keep them flat and free of dust.

Badly warped records will slide while playing and reproduce poorly. You can flatten your warped records by pressing them between flat surfaces for several days in a warm place.

DO NOT MIX RECORDS

Do not mix 10-inch and 12-inch records in a series or stack.

THE NEEDLE

We have provided you with a fine needle of special steel. Together with the crystal it forms the one delicate part of this machine and deserves care.

Never leave the needle resting on a record or the **turntable** when the machine is not in use. If needle becomes damaged by accident, replace immediately. Never replace a used needle in the **tonearm**—because the needle assumes the contour of the record groove and readjustment will cause excessive wear of your records. Flat of needle should be parallel to head of **tonearm**.

REPLACEMENT PARTS

N-149-S	Tonearm complete (including tonearm lift assembly)
N-155-S	Tonearm lift assembly
L-26-S	Crystal (Wireless changers use L-24)
	Needle
	Shielded pickup cable
<hr/>	
N-167-S	Manual reject knob (including lockwasher and dress washer)
N-148-S	Cam for same
N-161-S	Record alignment plate (including rubber bumpers and spring)
N-129-S	Cam shoe and shaft assembly (including spring)
<hr/>	
N-168-S	Turntable
N-160-S	Motor complete
	Rubber tired motor drive pulley (including washers and hairpin)
N-165-S	Switch
<hr/>	
N-132-S	Center spindle and Oilite bearing assembly, hairpin cotter, bottom strap and belt guide.
N-173-S	Ball bearing race
N-171-S	Felt washer
N-172-S	Thrust washer 2 Req.
N-188-S	Rubber belt
N-140-S	4½ inch diameter drum and bearing
N-137-S	Master cam assembly (including spring brake)
N-118-S	Tonearm trip assembly (including spring and 'C' washer)
N-122-S	Ratchet release assembly (including spring, washer and hairpin)
N-187-S	Speed nut (center spindle)
N-174-S	Speed nut (strap support) 3 Req.

MODELS F26-2, F26-3,
F29-2, F29-3

FAIRCHILD AVIATION CORP.

Model F26-2 Recorder consists of

- 1 Unit 199-2 Portable Recorder Mechanism
- 1 Unit 214-3 Cutterhead
- 1 Unit 219-2 Portable Recording Amplifier

Model F26-3 Recorder consists of

- 1 Unit 199-3 Portable Recorder Mechanism
- 1 Unit 214-3A Cutterhead
- 1 Unit 219-2 Portable Recording Amplifier

Model F29-2 Recorder consists of

- 1 Unit 199-2 Portable Recorder Mechanism
- 1 Unit 220-2 Auxiliary Portable Recording Mechanism
- 2 Unit 214-3 Cutterheads
- 1 Unit 219-2 Portable Recording Amplifier

Model F29-3 Recorder consists of

- 1 Unit 199-3 Portable Recorder Mechanism
- 1 Unit 220-3 Auxiliary Portable Recording Mechanism
- 2 Unit 214-3A Cutterheads
- 1 Unit 219-2 Portable Recording Amplifier

The outline drawing illustrates the cable connections required to set up either a single turntable recorder, Model F26-2 or F26-3, or a double turntable recorder, F29-2 or F29-3.

Place the two recorder mechanisms side by side as close together as possible. Stand the recorder amplifier trunk at the right of the group; the trunk should stand upright with the control panel facing the operator.

OPERATING PROCEDURE

A. As a Public Address Amplifier

1. The Unit 219 Recorder Amplifier is required only.
2. Connect microphone cable into MICROPHONE socket. (Be sure impedance of microphone and amplifier are properly matched.)
3. Connect power cable into A. C. LINE socket.
4. INPUT selector switch to MICROPHONE.
5. OUTPUT selector switch to LINE.
6. SPEAKER VOL. to MAX.
7. POWER switch ON. Red warning lamp will light indicating that power is on. After about thirty seconds to allow amplifier tubes to warm up, the equipment is ready for operation.
8. Set VOLUME and TONE controls to whatever position gives the desired sound and tone quality from the speaker on the amplifier trunk.
9. If the microphone is too close to the loud speaker, it will be necessary to keep the volume control turned down; otherwise, a howl will be heard in the loud speaker due to acoustic feedback between the microphone and the speaker. Separation of the two will permit using a high sound level. Placing the diaphragm of the microphone at right angles to the speaker and off to the side of the speaker will minimize this effect.
10. As many as ten additional speakers can be added to the installation. Connect speakers to the 500 LINE jack on the amplifier panel. Set OUTPUT selector switch to LINE position.
11. Note that the internal speaker has an independent volume control SPEAKER VOL. which can be set to MAX., intermediate, low or OFF positions. Therefore, the amplifier can be used in a separate room from the other speakers. The VOLUME control may be set to the level required for the outside speakers. The internal speaker volume can then be adjusted to desired level and used to monitor the outside speakers.

B. Playing Back Records

1. Plug PICKUP CABLE and RECORDER CABLE into respective sockets on Recorder Amplifier Panel.
2. Connect power cable into A. C. LINE socket.
3. INPUT selector switch to P. U.
4. OUTPUT selector switch to LINE.
5. SPEAKER VOL. switch to MAX.
6. POWER switch "ON". Red warning lamp should light to indicate that equipment is turned on.
7. Insert type needle recommended for record in Pickup and firmly secure needle in place with set screw.
8. Turntable motor switch ON.
9. Lower Pickup needle into record groove.
10. Set VOLUME and TONE controls for desired volume and tone quality.
11. Extra speakers can be used by following instructions given in Item A-10 above.

C. Microphone Recording

1. Connect power cable into A. C. LINE socket.
2. INPUT selector switch to MIC.

MODELS F26-2, F26-3,
F29-2, F29-3

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3. SPEAKER VOL. switch to OFF if microphone is used close to amplifier to prevent feedback between microphone and speaker.
4. OUTPUT switch to REC.
5. POWER switch ON.
6. TONE control at 2.5, although position will vary depending on recording conditions. After some practice, recordist will use his own judgment.
7. Adjust VOLUME control while speaker is talking into microphone so that average peak swings of the CUTTER LEVEL meter needle reach the "0" reading in the meter scale, while occasional momentary peaks may hit plus 4 to 6.
8. Carry out instructions on Recording Procedure on Turntable Mechanisms in Paragraph E below.
9. When extra external loud speakers are used in an auditorium to reinforce the speaker's voice while simultaneously recording the speech, the Recording Equipment is usually kept in an adjacent room. The program is monitored by the amplifier's built-in loud speaker. The external speakers are connected into the 500 LINE jack on Amplifier Control Panel. The OUTPUT selector switch must be at BOTH. The cutterhead and the external loud speakers share the output power in this switch position.

If the recording equipment is in the same room as the microphone, a pair of headphones can be used to monitor the recording. Plug headphones in the PHONE MONITOR jack.

D. Radio or Broadcast Recording

1. Connect power cable into A. C. LINE socket.
2. Connect plug from 500 ohm output of radio set or broadcast line into 500 OHM LINE jack.
3. INPUT selector switch to LINE.
4. SPEAKER VOL. switch to MAX. or any other volume position desired by recordist.
5. OUTPUT switch to REC.
6. POWER switch ON.
7. TONE control at 2.5, although this position depends on recording conditions. It should be set to whatever position gives best results in the opinion of the recordist.
8. Radio Program must be carefully turned in on radio set to exact resonance. Adjust VOLUME control so that average peak swings of the CUTTER LEVEL meter needle reach the "0" reading on the meter scale. Occasional momentary peaks may reach to plus 4 or 6.
9. Carry out instructions on Recording Procedure on Turntable Mechanism in Paragraph E below.

When extra external speakers are to be used simultaneously with recording, the extra speakers must be connected into 500 LINE jack on Amplifier Control Panel and the OUTPUT selector switch must be set to BOTH. In this position, half of the amplifier output is fed to the cutterhead and the other half to the external speakers.

E. Recording Procedure on Turntable Mechanism

1. Plug Pickup Cable and Recorder Cable into respective sockets on Recorder Amplifier Panel.
2. Place blank disc on turntable. If disc has stop pin hole then fit it over corresponding stop pin on turntable, screw on clamping nut to prevent slipping.
3. Set turntable speed knob for either 33-1/3 or 78 RPM.
4. Select desired pitch and direction of cut. A pitch of 118 will be used in general. Consult Recording Time Chart for recording time for each pitch at 78 and 33-1/3 RPM.

On acetate-coated discs, cut from inside to outside. This is the general practice to avoid the difficulty of keeping the shavings from interfering with the cutting of a record. A brush, C199-A34, can be supplied to mount on the turntable to clean off the shavings should it be necessary to cut "outside-in".

5. Throw turntable motor switch ON. When equipment is cold, it is good practice to allow a ten minute warm-up period so that the parts are thoroughly lubricated, warmed up and running smoothly.
6. Invert cutterhead to insert cutting stylus. If aluminum discs are to be recorded, insert diamond stylus in front hole on cutterhead. For acetate-coated discs, insert steel or sapphire stylus in rear hole. CAUTION: Avoid stripping thread on stylus set screw.

MODELS F26-2, F26-3,
F29-2, F29-3

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F. Continuous Recording - Double Turntable Operation

1. See outline drawing for the set-up on the Recording Amplifier and the two turntable Mechanism Assemblies for making continuous recordings.

The circumstances prevailing during a continuous recording will be that of one turntable recording nearing completion while the second turntable has a fresh side of a disc clamped upon it. The second cutterhead on the Auxiliary Recorder Turntable is placed ready to start cutting as soon as a slight pause in the program is anticipated, whereupon the power is switched to the second cutterhead.

2. The operation is similar to the Single Turntable Mechanism Procedure outlined in Paragraph E above. The Left Turntable must be completely set up in readiness for making a recording before the record on the Right Turntable is finished. The Left Turntable should be rotating with the cutterhead directly over the starting groove on the blank disc. When there is thirty to sixty seconds recording time left on the Right Turntable, drop the cutterhead stylus on the Left Turntable disc, cutting several blank grooves until there is a momentary break in the program, such as a pause or the introduction of a new speaker. At this appropriate moment, throw the Cutterhead switch from RIGHT to LEFT, which starts the recording on the Left Turntable and finishes the recording on the Right Turntable. The Right Turntable is then unloaded and made ready for a blank disc before the recording time is finished on the Left Turntable.

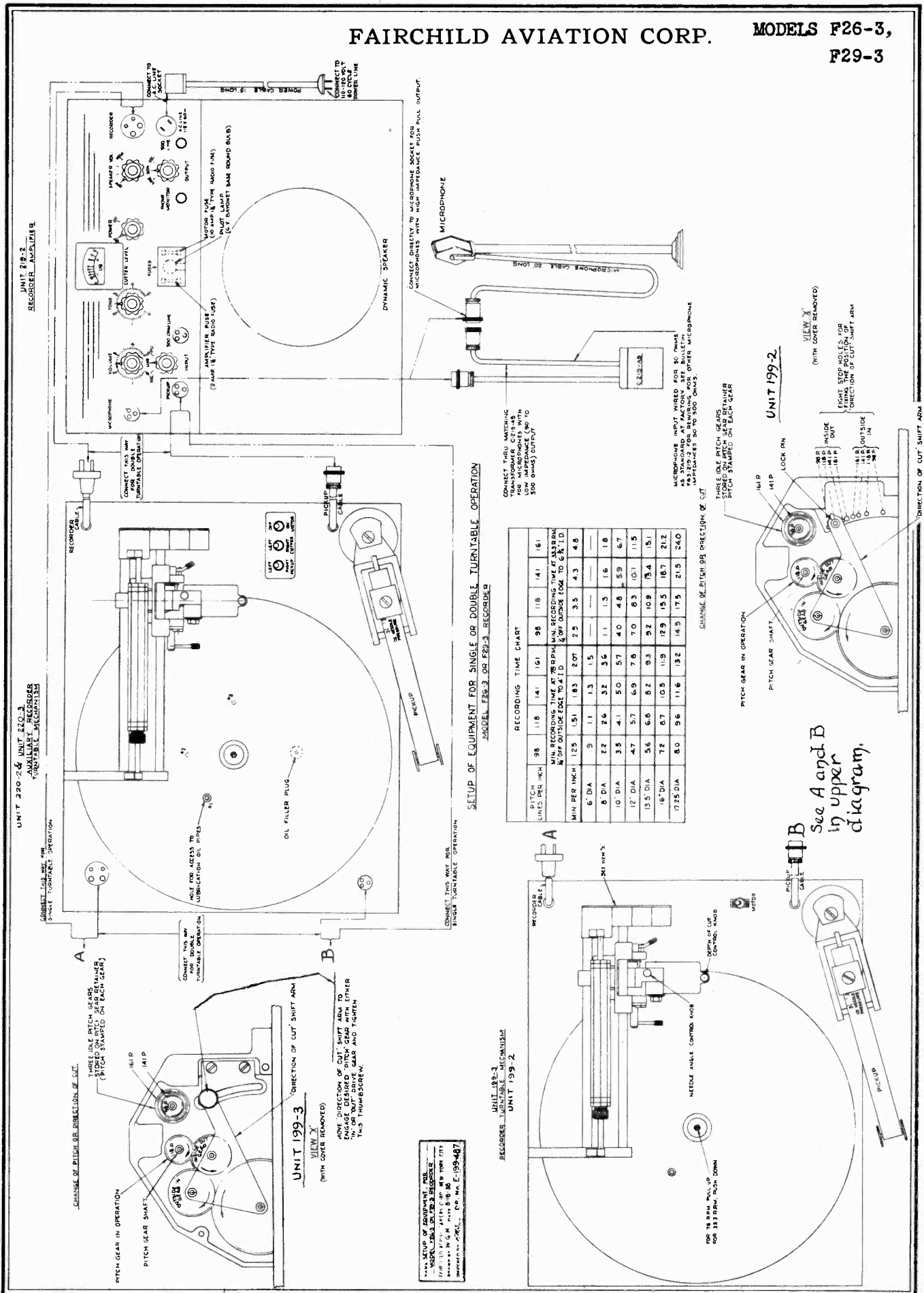
G. Duplication of Records

1. Set up the two turntable mechanisms and recording amplifier as in outline drawing.
2. In this description, the left turntable shall be selected for playing back the master record into the input of the recording amplifier. The duplicate record shall be made on the right turntable. The turntables can be used in a reversed manner, if desired, by reversing the position of the PICKUP and the CUTTER switches as stated in the text under Item 6 and 7 below.
3. INPUT selector switch to P. U.
4. SPEAKER VOL. to MAX. or any intermediate position desired.
5. OUTPUT selector switch to RECORD.
6. PICKUP switch at LEFT.
7. CUTTER switch at RIGHT.
8. POWER switch ON.
9. TONE CONTROL at 2.5, although position will vary depending on recording conditions. Recordist may use his own judgment after some practice, setting this control to get best results.
10. Carry out instructions "Recording Procedure on Turntable Mechanism" in Paragraph E above on the right hand turntable.
11. Place master record on Left Turntable, insert type of playback needle recommended for the record in the Pickup and firmly secure needle in place with set screw.
12. Left Turntable motor switch ON.
13. Lower Pickup into the record groove.
14. Adjust VOLUME control so that average swings of the CUTTER LEVEL meter needle reach "0" with occasional peak swings reaching plus 4.
15. It is desirable not to record the harsh clicking noise which occurs when the Pickup is lowered into the master record sound track at the beginning of the duplicating operation. This can be avoided by playing the first part of the master record with the equipment as set up above except that the cutter is not in operating position on the blank disc. Adjust the volume control to the position which gives the correct operating level on the CUTTER LEVEL meter, and make a note of the dial reading on the VOLUME scale.

Turn VOLUME control to zero, lower cutterhead on right turntable into operating position, lower pickup gently into starting groove of master record and gradually raise the VOLUME control up to the setting previously noted. In this manner the duplicated record can be free from any disturbing noises introduced in the duplicating process.

FAIRCHILD AVIATION CORP.

MODELS F26-3,
F29-3



UNIT 219-2
RECORDING MECHANISM

UNIT 220-2 & UNIT 220-3
AUXILIARY RECORDER
TURNTABLE MECHANISM

UNIT 199-3
RECORDING MECHANISM

UNIT 199-2
RECORDING MECHANISM

SETUP OF EQUIPMENT FOR SINGLE OR DOUBLE TURNTABLE OPERATION
MODEL F26-3 OR F29-3 RECORDER

RECORDING TIME CHART									
PITCH	98	118	141	161	98	118	141	161	161
LINES PER INCH	MIN. RECORDING TIME AT 78 RPM (MIN. RECORDING TIME AT 150 RPM MIN. OFF OUTSIDE EDGE TO 4.10 IN. OFF OUTSIDE EDGE TO 6.34 I.D.)								
MIN PER INCH	1.25	1.51	1.83	2.07	2.9	3.5	4.3	4.6	4.6
6" DIA	9	11	13	15	15	15	15	15	15
8" DIA	22	26	32	35	41	48	59	67	71
10" DIA	39	47	57	63	76	93	111	126	135
12" DIA	47	57	69	76	93	111	130	150	162
13.5" DIA	56	66	80	88	107	128	151	175	191
16" DIA	72	87	105	115	139	165	195	225	240
17.25" DIA	80	96	116	127	155	185	215	245	260

See A and B
in upper
diagram.

FAIRCHILD AVIATION CORP.
1700 170 AVIATION AVENUE, CHICAGO, ILL. 60646
MODEL F26-3 & F29-3 RECORDER
RECORDING MECHANISM
PART NO. F26-3-199-2
REV. 1-5-58

MODEL 199/220

FAIRCHILD AVIATION CORP.

FAIRCHILD UNIT 199/220 RECORDING MECHANISM

Handling and Packing - This is a piece of precision equipment containing finely machined parts closely adjusted for performing accurate work. While it is sturdily built and good for many years of service with proper care, a hard "jolt" or two in handling may necessitate an expensive trip to the factory for repairs or readjustment. Therefore, please observe the following points in handling:-

In carrying the cases for short distances by hand, AVOID BUMPS AND ALL SHOCKS.

In STORING for any length of time exceeding an hour or two, LAY THE RECORDER FLAT, TURNTABLE UP, as in operation. In transporting in any vehicle carry in this same position removing turntable if roads are rough and storing it in top of trunk. Carried in this manner on the cushions of the automobile seat secured by strap to avoid falling between seats, Several of our recorders have been carried over 50,000 miles during a period of eighteen months with little or no difficulty in hundreds of exacting demonstrations. However, the operator was very particular to avoid sudden shocks to the trunks through careless handling. There is no reason why you cannot do as well by exercising the same care.

Remove cutterhead and always fasten securely in the place provided when moving recorder about.

Secure the cutterhead carriage by a rubber band. Be sure it does NOT engage the feedscrew to avoid stripping the threads.

When corresponding please mention the unit number and the serial number of the equipment which you are discussing.

Application - The Fairchild Unit 199 or Unit 220 Recording Mechanism has been designed primarily for portable field service to meet the requirements of direct recording and the playback of recordings. The equipment is extremely flexible; usable either indoors or outdoors and set up in a few minutes with plug-in connectors.

For recording and playback the unit is provided with cables and plugs for instantaneous hookup to the Fairchild Unit 219 Amplifier. This combination provides a complete, self-contained, portable outfit for the direct recording of voice, music and sound and for the direct playback of this recording.

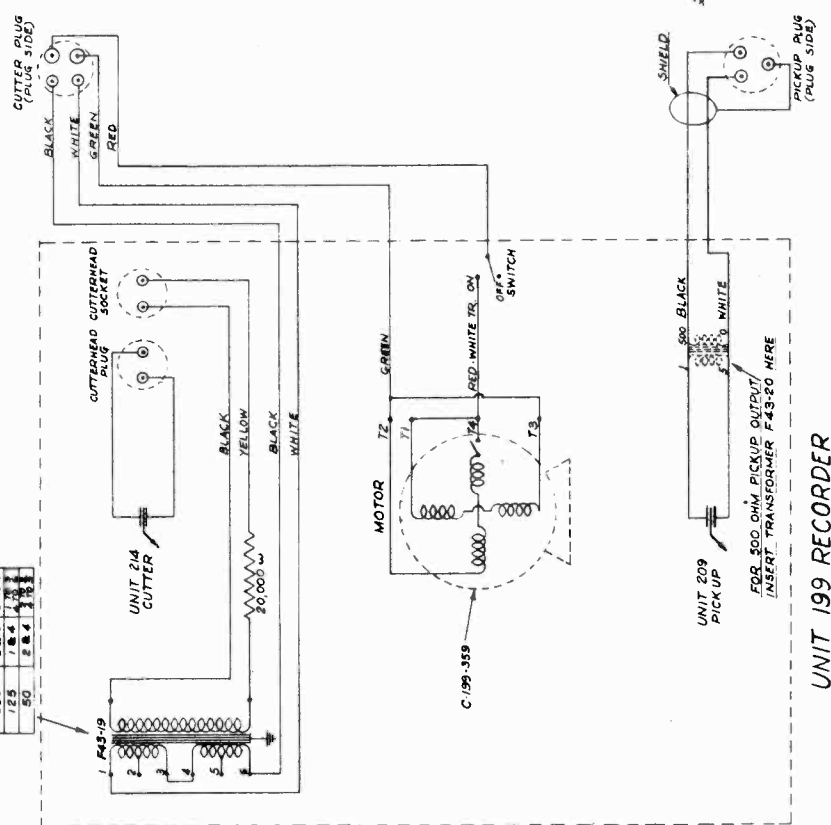
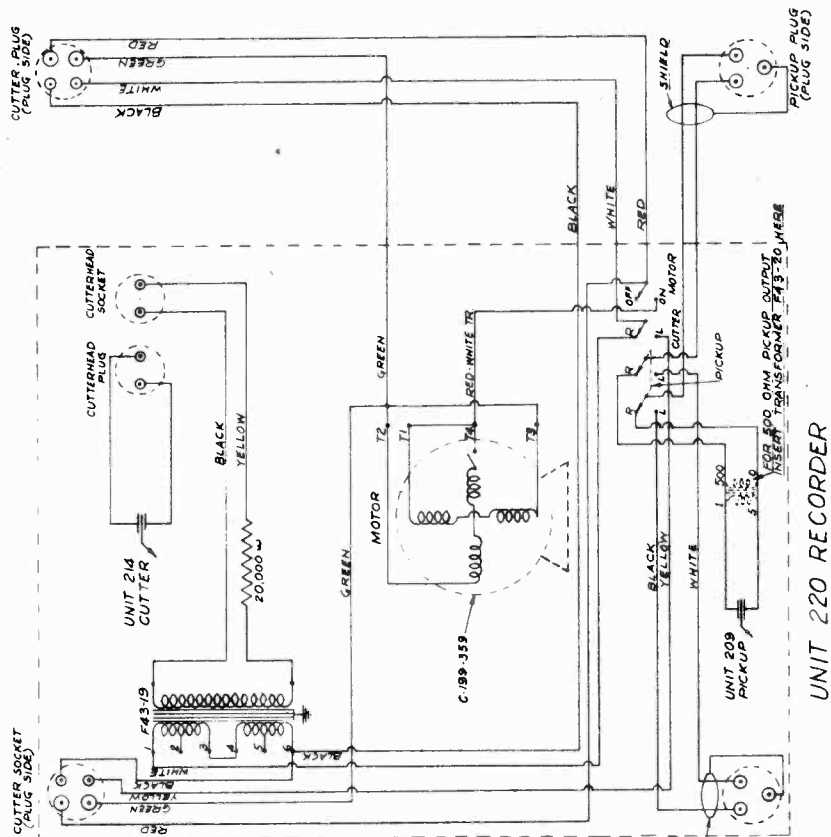
The Unit 199 or Unit 220 Recorder is supplied with a Unit 214-3 Cutterhead and matching transformer F43-19 for operation on a 500 ohm line at 20 db. power level.

The Unit 220 Auxiliary Recording Mechanism differs from the Unit 199 Recording Mechanism only in this respect - a pair of selector switches is added on the panel to instantaneously switch from left to right cutterhead and from left to right pickup; a pair of input sockets is added on the panel to connect the cutterhead cable and the pickup cable on the Unit 199 Recorder to the control switches on the Unit 220 panel.

The recording mechanism is contained on a single aluminum panel 17 x 21 inches. The panel may be removed from the trunk and flush mounted for permanent studio installation.

FAIRCHILD AVIATION CORP.

MODEL 199/220



IMPEDANCE	CONNECT	JOIN
500	1 & 2	3 TO 4
333	1 & 3	3 TO 4
250	1 & 4	2 TO 3
200	2 & 3	3 TO 4
125	1 & 4	2 TO 3
50	2 & 3	1 TO 4

NAME SCHEMATIC DIAGRAM
 UNIT 199 AND UNIT 220 RECORDERS
 FAIRCHILD AERIAL CAMERA CORP. NEW YORK CITY
 DRAWN BY H.A.G.H. DATE 7-6-38
 CHECKED BY DR. NO. E/199-484

For notes covering the lubrication of these recorders, see Model 3 of this same type.

CORRECTIONS: Interchange Numerals 3 and 4 on F43-19 Transformer Terminals.

General Adjustments -

1. Turntable Speed - The sixteen pound turntable is driven by an 1800 R.P.M. synchronous motor through a 54 to 1 gear and worm. It rotates at 33.3 R.P.M. when the shift pin, extending through the turntable shaft, is pressed down. It rotates at 78 R.P.M. when the pin is pulled upward. The "OFF-ON" switch on the right of the panel operates the turntable driving motor. Always shut off the motor when shifting speeds to avoid unnecessary strain on gear drive assembly.
2. Pitch - The record may be cut at a pitch of 98, 118, 141 or 161 lines per inch. The removable cover plate on the right side of the overhead feed-screw mechanism encloses the four pitch gears. The pitch is stamped on the gear shoulder. The desired pitch gear is locked on end of feedscrew shaft by means of slot in gear and cross pin on feedscrew. The spare gears are stored on the gear retainer pin provided for that purpose. Consult the Recording Time Chart for data on the recording time available at 33.3 or 78 R.P.M. at pitches of 98, 118, 141 and 161 lines per inch.
3. Direction of Cut - The record may be cut either "inside-out" or "outside-in". On acetate coated discs it is recommended that cutting direction be from inside to outside to avoid the difficulty of keeping the shavings from interfering with the cutting. A Brush C199-A34 can be provided to mount on the left front corner of the recorder panel to clear off the shavings should it be necessary to make "OUTSIDE-IN" cuts.

Direction of Cut Lever is accessible by removing the cover plate on the right side of the overhead feedscrew mechanism. The desired direction of cut is set by engaging either the "IN" or "OUT" gear on the gear shift lever with the pitch gear on the feedscrew.

4. Stylus Angle of Cut Adjustment - The Angle of Cut Screw on the cutterhead support casting permits adjusting the position of the cutterhead for the required stylus cutting angle.
5. Depth of Cut - The cutterhead supplied with the recording mechanism has a Depth of Cut Control Knob for controlling the depth of cut when recording on acetate or similar materials,
6. Turntable Stop Pin and Clamping Nut - There is a removable stop pin on the two inch diameter of the turntable to prevent discs provided with suitably located stop pin holes from slipping while recording. The stop pin may be removed with a screwdriver when recording on discs which do not have these stop holes. A clamping nut with a right hand thread is supplied for holding disc securely to turntable.

The removable record stop pin may get mislaid when removed from turntable. To prevent this possibility, it may be secured in threaded hole approximately one inch above "OFF-ON" switch.

7. Feed Screw Engaging Lever - The feed screw engaging lever on the left side of the cutterhead carriage when moved forward causes the feed clutch to engage with the feed screw. This operation moves the cutterhead carriage across the record surface at the desired pitch and direction of cut previously set by the recordist.

FAIRCHILD AVIATION CORP.

MODEL 199/220

8. Cutterhead Lowering Lever - The cutterhead Lowering lever, on the right side of the cutterhead carriage, when moved forward causes a cam to lower the cutterhead on the record surface.
9. Cutterhead Locknut and Washer - The cutterhead must be held firmly on the carriage casting with the spring washer and the shoulder screw. The outline drawing clearly shows this method of assembly. When properly tightened, the cutterhead can be rotated from the recording position back to a position where it is convenient to inspect or replace the recording stylus.
10. Pickup - The Fairchild Unit 209 Pickup has an adjustable counterweight and calibrated scale for varying the needle pressure from one to three ounces. In playing back acetate or aluminum records a two ounce pressure is generally satisfactory. When a steel needle is used on aluminum records, use only a one ounce pressure.
11. Record Time Scale - The record time scale shows the recording time in minutes for each pitch and turntable speed, cutting "inside-out" or "outside-in". The left end of the scale shows the turntable speed (78 or 33.3 RPM) for the respective scale and the right end shows the pitch of 98, 118, 141, or 161. The numerals along the graduation of the scales indicate the minutes of recording time. Rotate the scale into that position corresponding to the pitch gear and the turntable speed which you intend to use.

Before recording and while turntable is not rotating, lower the cutterhead so stylus bears on outer diameter of record about a quarter inch from edge. Align Record Time Scale until index pointer on carriage lines up with desired recording minutes on scale. Slide cutterhead toward center of disc until index pointer is at "zero". This locates the starting groove for a record which has the required recording time, pitch and turntable speed, while still utilizing the outer part of the record where the quality of reproduction is the best.

MAINTENANCE ADJUSTMENTS - The Fairchild Recording Mechanism has adjustments provided at all important points. These are carefully set at the factory and locked at the position for best operation. Readjustments may be required from time to time either on account of loosening due to moving the equipment around or to general wear.

1. Vibration - Excessive vibration can be reduced by realigning the motor cradle suspension beneath the panel. The motor cradle is supported on four springs. The height of each spring is adjustable by means of a stud and locknut. The adjustment is very critical, only a fraction of a turn being required to make a considerable difference in the vibration level.

The rubber coupling connecting the motor to the drive may cause vibration if it is torn or if the cement loosens between the rubber and the collar. There are two end thrust adjustments on the two speed drive, the worm end thrust setscrew and the gear end thrust setscrew. These may be readjusted after a period of time to remove vibration arising from wear in the gear and the worm assembly.

2. Grouping - Grouping may be removed from a record by the correct adjustment of the feed screw and carriage. The feed screw is provided with an end thrust screw and locknut which presses a steel ball against the left end of the feed screw. The right end of the feed screw bears against a thrust washer backed up by a spring which keeps the feed screw thrust directly against the steel ball under all operating conditions. See that ends are fully lubricated and set end thrust screw until there is no perceptible end play in the feed screw; also with feed screw clutch engaged and pitch gear removed, the feed screw must rotate without any binding spots. The carriage assembly rolls along the two guide rods on three rollers. There are four set screw adjustments beneath the two front rollers to restrict the carriage motion to a transverse motion only. These hardened ball surfaces bear on the undersurfaces of the front guide rod one hundred and twenty degrees from the roller contacting surface. The set screws are set up so that carriage is exactly centered on front guide rod and carriage rolls smoothly past the highest spot which may be on guide rods. The set screws are locked by putting Duco Household Cement on the threads. This adjustment is critical and was made at the factory. It should not be disturbed unless the replacement of parts has made it necessary.

Lubrication: The recording mechanism must be lubricated at regular intervals to insure smooth, quiet operation and long life of the operating parts. Use a high grade light machine oil.

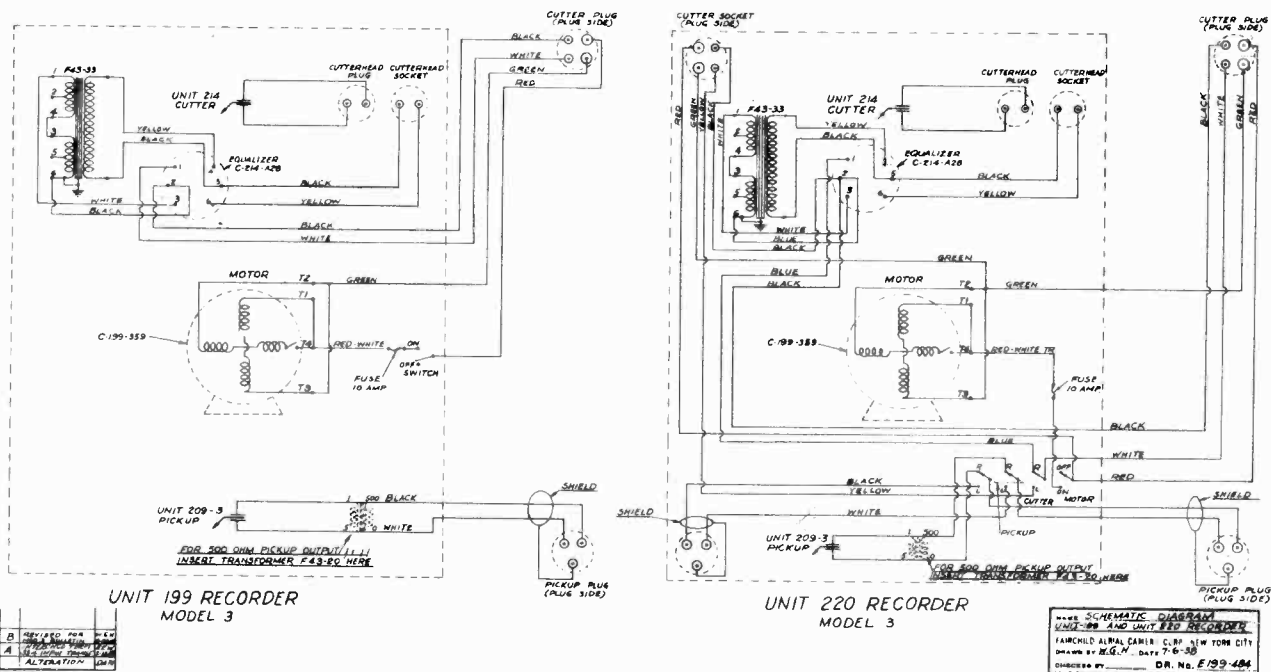
Under normal operating conditions the equipment should be oiled regularly every month. A more frequent lubrication may be necessary when the equipment is in continuous operation.

1. Motor - The front and rear bearings of the motor are lubricated through two oil pipes located at the bottom of the gear pitch housing. Remove the cover on the end of the gear pitch housing; there are two red tipped oil pipes just below the slotted opening in the panel. Lubricate each oil pipe every month with about ten drops of oil.
2. Drive Shaft Bearing - The drive shaft which operates the overhead feed screw runs in a bearing which requires lubrication. This oil pipe is located in the pitch gear housing; it is directly behind the large diameter drive gear; the tip of the oil pipe is painted red. Squirt about ten drops of oil in this pipe every month.
3. Pitch Change Gears - With the pitch gear cover removed and the mechanism operating, oil the bearing and gear teeth of the large drive gear, the "IN" and "OUT" gears and the pitch gear on the feed screw; push the "Direction of Cut" arm in and out several times while applying a few drops of oil to the bearing on which it slides.
4. Feed Screw Carriage - A general lubrication is necessary on the bearing and engaging surfaces of the overhead feed screw carriage mechanism. Maintain a light film of oil on the surfaces of the guide rods and the feed screw. The cutter carriage rolls along the guide rods on three

FAIRCHILD AVIATION CORP.

UNITS 199/220

MODEL 3



The notes covering the general and maintenance adjustments of the Model 199/220 Recording Mechanism also apply to this model. See index for this information.

rollers which are packed with sufficient grease so as to require lubrication only at intermittent intervals; an occasional few drops of oil will stop any squeaks from these rollers. The cutterhead support arm moves vertically on a ball bearing adjustable hardened cone seat; this pivot point must be kept frictionless by applying a few drops of oil on each bearing. The feed screw clutch rides against a machined face on the cutterhead casting; these faces should preferably be lubricated with a light bodied bearing grease although machine oil will serve the purpose; also maintain an oil film on the thread engaging surface of this clutch.

5. Two Speed Drive - The two speed turntable drive mechanism should be lubricated every month; there is a hole in the turntable which gives access to an oil cup and two oil holes (painted red). The turntable should be removed every six months and the breather cap nut removed on the top face of drive to check the oil level. Use Esso #1 or an equivalent grade of oil and fill until level is 1 3/4 inches below top face of drive cover as measured with a small rod.
6. Pickup - The pickup arm moves vertically and horizontally on four ball bearing adjustable hardened cone seats. Apply a drop of oil in each bearing every month.

**MODELS 214-3,
214-3A**

FAIRCHILD AVIATION CORP.

APPLICATION - The Fairchild Unit 214-3A Cutterhead has been designed for direct lateral recording of sound at 33-1/3 or 78 revolutions per minute on aluminum discs, plasticized cellulose nitrate or "acetate-coated" aluminum discs, plasticized thermo setting phenolic resin discs or gelatin composition discs.

This cutterhead may be mounted on the Fairchild Unit 199 and Unit 220 Recording Mechanisms. For Unit 199 Recorders bearing serial numbers 610 and below and Unit 215 Recorders, serial numbers 59 and below, it is necessary to use the Unit 214-3D Cutterhead which has an adapter bracket attached for setting the cutting angle of the cutterhead.

The cutterhead may be used on other makes of recording mechanisms by replacing the mounting ear on the back of the cutterhead with an adapter machined to mount on the feed carriage assembly. The outline drawing below shows general mounting dimensions required on the cutterhead.

It is recommended that the cutterhead be used with matching transformer F43-19 for connection to a 500 ohm output amplifier. A power level of 20 decibels (0.6 watts) will drive the cutting stylus at an amplitude of 0.002" at 1000 cycles.

It is recommended that the cutterhead be used with the matching network F43-33 and C214-A28 for connection to a 500 ohm output amplifier. A power level of 24 decibels (1.5 watts) will drive the cutting stylus at an amplitude of 0.001" at 400 cycles per second (2.5 inches/second stylus velocity).

The Unit 246-247 Fairchild Recording Amplifier is especially recommended in recording with this cutterhead when the ultimate in performance is required and the equipment is intended for a permanent installation.

The Unit 219 or 295 Fairchild Recording Amplifier is recommended for recording when the equipment must be portable and used out in the field.

"FLOATED" AND "ADVANCE SHOE" CUTTING - There are two methods of recording in common use - the "floated" and the "advance shoe" cutterhead. Either method may be used when the cutterhead is mounted on the Fairchild Unit 199-3 and Unit 220-3 Recording Mechanisms.

In either case a perfect recording is dependent on the quality of the disc selected for recording. Discs that are warped or have a pronounced nonuniformity of the surface such as pits, bubbles, bumps or hard spots may result in defective records.

The "floated" cutterhead requires a stylus pressure of about three ounces maintained by a spring adjustment and a stylus angle of 0 to 3 degrees normal to the record. The various types of record materials have different cutting characteristics so that the stylus pressure and angle should be adjusted to give the cleanest and most quiet cut. The depth of cut is dependent entirely on whether the record surface is flat and the material of uniform hardness and thickness. The cutterhead will plough through the "ups" and "downs" of the disc surface producing deep and shallow grooving with consequent variations in surface noise. On badly warped discs the stylus may bite into the aluminum undersurface and ruin the stylus. "Wows" are also the direct result of an uneven record surface.

The "advance shoe" on the cutterhead reduces these hazards considerably, especially on warped discs. The depth of cut is fixed by the distance between the riding surfaces of the advance shoe and the stylus point. The shoe pressure of twelve ounces helps to keep a uniform depth of cut despite the presence of hard and soft spots on the discs.

However, failures due to uneven coating or excessive warping cannot be entirely eliminated by the advance shoe. Your disc supply is of the utmost importance. Discs supplied by Fairchild are inspected with reference to warping, thickness of coating and surface irregularities. They are supplied with the requirements of the Fairchild Recorder in mind. They cost no more than other discs which may or MAY NOT consistently produce good recordings.

STYLII - The Cutterhead has two stylus holes in the stylus chuck. The front hole is 19 degrees off normal to the recording surface for embossing aluminum discs with a polished diamond stylus. The rear hole is 6 degrees off normal for cutting "acetate-coated" and similar type discs with a steel or sapphire cutting stylus.

The cutterhead is designed for use with a standard cutting stylus (5/8" long and 0.064" to 0.065" diameter). The "advance shoe" has sufficient travel for stylus lengths from 9/16 to 11/16 inches to permit using resharpened stylus.

We recommend Fairchild stylus for use with this cutterhead. Although others may be used successfully, ours are manufactured and inspected to specifications. Each sapphire and diamond is individually tested for surface noise and an inspection certificate is supplied.

FAIRCHILD AVIATION CORP. MODELS 214-3, 214-3A

The life of a sapphire stylus, depending on its care and use may range from zero to fifteen or more hours of cutting time. Used on old dry discs or others with particles of foreign matter in the coating, the cutting edge may be dulled quickly. Cutting through to the aluminum will necessitate resharping before the stylus can be used.

The steel stylus may produce as fine a recording as the sapphire for up to 60 minutes recording time. Ordinarily the sapphire is at least four decibels quieter than the steel. Most recordists prefer to change the steel stylus after every fifteen minutes recording when the disc is for broadcast or pressing purposes.

The diamond stylus used for aluminum recording has an indefinitely long life. With reasonable care, repolishing the diamond should not be necessary unless the stone is accidentally chipped.

RECORDING ON ACETATE - Successful recording on acetate requires careful attention to details; otherwise, a large percentage of records will be spoiled. Nearly three quarters of a mile of shaving must be removed from a sixteen inch disc at 118 lines per inch. In order to cut a smooth, polished groove on the entire record, the cutting stylus must have a precision cutting edge which does not dull too quickly. If this is not up to standard then the surface noise will be objectionable and the high frequency response will be limited. The stylus must be properly mounted and the disc surface lubricated to preserve this fine cutting edge. The following recommendations are offered from actual recording experience. It is believed to be the best technique for consistently obtaining satisfactory recordings.

1. **LUBRICATION** - When recording on acetate, lubricate the disc before cutting with a thin coat of oil (Record Lubricant VJCOY) applied with a pad of lintless cotton cloth held on the rotating disc, working from inside to out. This is recommended for the following reasons: it provides a comparatively frictionless surface for the advance ball to ride on; it cleans the surface of dust, grit or shavings that might damage the cutting needle or collect under the advance ball; and, perhaps most important of all, it prevents the shavings from sticking to the disc and increasing the chance of "balling up" around the stylus.

Only a VERY light coat of lubricant is needed. Too much makes the record "messy"; it collects dust and grit. NEVER use oil if recording is intended for processing and pressings. The oil interferes with plating processes. INSTEAD, use a liberal application of the Record Fixer VJCTD evenly applied with a clean lintless pad. This dries quickly, leaving a slight white deposit which does not interfere with plating. DO NOT apply this Record Fixer until immediately before recording since the record surface becomes much harder after standing for any length of time after such treatment.

2. **THROW** - The stylus may be set about 5 degrees from the normal position (cutting face normal to sound track) so as to throw the shaving slightly toward the center. The amount of throw varies with the diameter at which you may be cutting. At the five-inch center, where test cuts are usually made at 33.3 R.P.M., if shaving throws about 1/4 inch it should be sufficient - less may be perfectly satisfactory. Round shank styli are preferred to those with flats on them as the former may easily be turned to throw the shaving as desired.

To gauge the stylus throw requires considerable skill. The tendency is to install the stylus with a larger throw angle than necessary. In this case, the cutting edges of the stylus are not normal to the groove. Only one side of the groove is completely polished by the cutting edges of the stylus and causes an unnecessarily high surface noise.

A stylus can be supplied with a flat on end of shank; the face of the stylus is ground at the correct angle to this flat to plow shavings toward center of record; the cutting edges are lapped parallel to this flat to maintain cutting edges normal to the groove, polishing both sides of the track. This stylus requires less skill to install and insures minimum surface noise.

3. **CUTTING ANGLE** - Adjustment of the position of the cutterhead is easily made so that the angle of the stylus may be varied to suit various individual requirements. This is accomplished by the control screw pressing on the seat at the rear of the head which, when turned clockwise, raises the front end of the cutterhead. Under usual recording conditions best results are obtained when the nose of the cutterhead is between zero and 1/16 inch lower than the rear. (Equivalent to stylus angle of 6 to 0 degrees from normal to the record). This may vary with different styles of cutting styli. Cutting styli that first tests may indicate to be noisy often become quiet when the angle is properly adjusted.

4. **DEPTH OF CUT** - The depth of cut must be carefully adjusted on the sample test cuts. If too shallow a cut is made, the sound groove will not be deep enough for the pickup to track in. On the other hand, too deep a cut will increase the chance of penetrating the acetate coating (from .003" to .007" thick), cut into the metal under-surface and ruin the cutting stylus.

Adjustment for depth of cut may be made with the Advance Shoe Control Knob. Each full turn of the knob advances the shoe by 0.00056 inches. The knob has eight vertical index lines spaced forty-five degrees apart. Therefore, turning the knob equivalent to one index line increases the depth of cut by 0.0007 inches.

5. **SHAVINGS** - With a good cutting stylus in proper adjustment and a satisfactory disc, little trouble need be experienced with the shavings on Fairchild Recorders. If the shaving starts to pile up, leave it alone; it will usually clear up of itself. This is hard to realize for operators of other recorders who have ruined many recordings because of shavings. Sometimes you may assist the clearing up process by blowing the shaving toward the center. Any touching or jarring of the cutterhead in this instance may ruin the groove. A specially designed brush, C199-A34, is available for mounting directly on the front right corner of the Unit 199 and Unit 220 Recorder Mechanisms to take care of the shavings. This is absolutely necessary if you wish to cut from the "outside-in".

6. **RECORDING LEVEL** - Recordists accustomed to other types of cutting heads are often inclined to record at too low a level to avoid a "repeat". This results in a higher surface noise than is necessary. The volume indicator may swing to plus 24 and even plus 26 decibel on occasional peaks with no danger of "repeats" at 118 lines per inch. The only limitation is the quality which may break down or become generally unsatisfactory if the level is maintained above plus 24 decibel for more than the momentary peak. Do not be continually monitoring the volume control trying to hold a constant level. This destroys the natural dynamic volume range of the voice or music when played back. Rather, establish through a preliminary test the loudest level and set the volume control to peak at plus 24 or even plus 26 decibel; then move the dial only as much as may be necessary to avoid too much surface noise during extremely low level passages.

7. **SOFT DISCS** - Occasionally the recordist will encounter soft discs, particularly when recording outdoors in the summer. It may be necessary at times to experiment with sample record materials which are very soft. In these cases the advance shoe will score the record surface when the normal twelve ounce pressure is used. Attach the Stylus Pressure Spring (on the Unit 199/220 Recording Carriage) and reduce the stylus pressure to about six ounces.

8. A dull stylus may cause the shaving to ball up. If in the midst of a recording, the only course open is to trust to chance it will "turn out all right" or switch over to a spare recorder and finish the recording on another disc.

9. Do not record closer than 1/4 inch from the edge of the disc. Otherwise perfect discs may be rough at the edge. This is especially true of discs that are manufactured by the "whirled" coating process.

10. Recordings intended for processing and pressings **MUST** be made on over-size discs. A 16 inch pressing requires a 17 $\frac{1}{4}$ inch disc. The recorded portion **MUST** end, however at not over 15-3/4 inch diameter.

OPERATING SEQUENCE ON ACETATE RECORDING WITH "ADVANCE SHOE" - The sequence of operation which it is desirable to carry out when recording on acetate and using the "advance shoe" method is as follows:-

1. Select a disc which is reasonably flat and free from bad surface defects.
2. Select a recording stylus which has preferably been checked for surface noise. Experienced recordists prefer to file away their recording stylii by serial number and log the surface noise and actual recording time. By systematically keeping this data in leisure moments, it is possible to maintain a consistent standard of performance and predict when it is necessary to discard or resharpen a dull stylus. This practice minimizes the embarrassing discovery, only after an important recording is already started, that a stylus is bad.
3. Swing cutterhead to inverted position. Insert stylus fully into rear hole. Secure stylus firmly with the clamping screw after the cutting face has been set with the desired amount of "throw". A convenient tool for holding the stylus and making this throw adjustment accurately is shown in Figure 1. It may be easily made up or purchased from Fairchild.
4. Turn Advance Shoe Knob clockwise until advance shoe will definitely prevent stylus point from touching record when cutterhead is swung back to the recording position.
5. Lubricate the surface of the disc with the oil lubricant.
6. Swing the cutterhead around to slightly past the horizontal position. ^{3A} The Angle of Cut Screw must butt against the stop on the rear of the cutterhead. The advance shoe should rest on record surface (not rotating). Turn Angle of Cut Screw clockwise until the stylus of the cutterhead is vertical to the disc or slightly dragging.
6. Swing the cutterhead around to slightly past the normal horizontal cutting position. The Angle of Cut Screw must butt against the stop on the rear of the cutterhead. The advance shoe should rest on record surface (not rotating). Turn Angle of Cut Screw clockwise until the undersurface of the cutterhead is horizontal with the disc or slightly nosed up.

FAIRCHILD AVIATION CORP. MODELS 214-3, 214-3A

7. Start a test cut on the five-inch diameter at 33.3 R.P.M. Turn Advance Shoe knob counter-clockwise until the stylus barely scratches the record surface. This is the "zero depth of cut". Turn the knob counter-clockwise equivalent to from 2.75 to 3.00 index lines engraved on the Advance Shoe Knob. Each index line is equal to increasing the depth of cut by 0.0007 inches. The recommended depth of cut is 0.002 inches. This may be checked by measuring the shaving with a micrometer. However, the experienced recordist can usually judge the cutting depth by observing the shaving. Notice whether the shaving has the proper throw. Place pickup (connected to amplifier and speaker) in the blank groove and carefully listen for minimum surface noise while slowly turning the Angle of Cut Screw clockwise. The optimum angle is about three degrees dragging for the average styli and record material. However, there is a difference in the cutting characteristics of some record blanks and it is advisable to adjust the stylus for minimum surface noise, particularly when using unfamiliar brands of record materials or styli for the first time. Make any necessary readjustments during the test cut to secure the best result.

7. Start to make a test cut on the five-inch diameter at 33.3 R.P.M. Turn Advance Shoe knob counter-clockwise until the stylus barely scratches the record surface. This is the "zero depth of cut". Turn the knob counter-clockwise equivalent to from 1.75 to 2.25 index lines engraved on the Advance Shoe Knob. Each index line is equal to increasing the depth of cut by 0.001 inches. The recommended depth of cut is 0.002 inches. This may be checked by measuring the shaving with a micrometer. However, the experienced recordist can usually judge the cutting depth by observing the shaving. Notice whether the shaving has the proper throw and the stylus is cutting quietly. Make any necessary adjustments during the test cut to secure the best result.

8. The preliminary adjustments are completed and the cutterhead may be raised by lever on right side of cutterhead carriage mechanism. Start the recording on a six and a half inch diameter, cutting about three full revolutions with blank grooves before raising the amplifier volume control to the recording level.

OPERATING SEQUENCE ON ACETATE RECORDING WITH "FLOATED" CUTTERHEAD - The above procedure is for using the "Advance Shoe" method of cutting. For those recordists who prefer the "Floated" method of cutting, the following recommendations are offered.

First observe the suggestions in paragraphs one to six inclusive. Then attach the Stylus Pressure Spring and turn its control Knob (on the Unit 199/220 Recording Carriage) counter-clockwise until the stylus pressure is three ounces (measured by a small four ounce spring scale fastened to nose of cutterhead). Note that the advance shoe has been deliberately left in a position to protect the cutting stylus during these early adjustments.

Raise the cutterhead off the record surface. Turn Advance Shoe Knob counter-clockwise until protective shoe permits stylus to ride freely on record. Gently lower the cutterhead and make a test cut on the five inch diameter at 33.3 R.P.M. Readjust the stylus Pressure Spring Knob if necessary to get the desired cutting depth. Observe whether the stylus is cutting quietly during this test cut and readjust stylus angle if necessary. Make any necessary readjustments to secure the best results.

The cutterhead may then be raised after satisfactory recording adjustments are attained on the test cut. Start recording on a six and a half inch diameter. Cut about three full revolutions with blank grooves before raising the volume control of the amplifier to the proper level.

OPERATING SEQUENCE ON ALUMINUM RECORDING - The embossing of aluminum requires much less skill and practice than acetate. Although it is possible to record a wide frequency range on aluminum the surface noise is objectionable for high quality work. The higher frequencies can be reproduced by using a steel needle in the pickup and a needle pressure of about one ounce but the record is badly worn after only a few playings. Normally the records are played back with the thorn needle (code "VKDCL" or "VKDEK") to get longer record life and lower surface noise, despite the fact that frequencies about four thousand cycles per second are not reproduced.

The following recording sequence is outlined for recording on aluminum:-

1. Select a disc which is flat and free from bad surface defects. When the disc is warped take the trouble to bend the disc until it seats flat on the turntable.
2. Swing the cutterhead to the inverted position. Insert the stylus fully into front hole. Secure stylus firmly with the clamping screw. Turn Advance Shoe Knob to raise the advance shoe clear of the record surface.
3. Lubricate the surface of the disc with a light film of oil Lubricant (Code VJCOY) if the record blank is not of the pre-lubricated type.

4. Swing the cutterhead around to slightly past the normal horizontal cutting position. The Angle of Cut Screw must butt against the seat on the rear of the cutterhead. Turn Angle of Cut Screw clockwise until the underface of the cutterhead is horizontal with the disc.

5. Make several test cuts on some waste aluminum records to find the best position to mount the stylus for minimum surface noise. A diamond may have one or two slight imperfections on the highly polished ball-shaped stylus point which forms the record groove. Rough edged particles of aluminum inbed themselves in these indentations and tear into the side walls of the record groove which causes a high noise level on the record. Therefore, it is desirable to orient the diamond in the stylus chuck to avoid these occasional bad spots in the recording stylus.

6. Once these adjustments are made to your satisfaction, a large number of aluminum records may be cut without the necessity of any further stylus or angle of cut adjustments.

CHECKING SURFACE NOISE, EFFICIENCY AND FREQUENCY RESPONSE - The recordist should adopt some method of checking a recording installation periodically for surface noise, efficiency and frequency response. The following paragraphs outline the inspection routine used at our factory. A beat frequency oscillator, output level indicator with a plus 36 to a minus 20 decibel range, and an RCA #23 constant frequency record are required for making these measurements.

Drive the recording amplifier with the beat frequency oscillator. Maintain a plus 20 db. level across the 500 ohm side of the matching transformer at all test frequencies. Cut inside-out on a 10 to 14 inch diameter at 33.3 R.P.M. Record successively frequencies of 1000, unmodulated groove, 50, 200, 400, 1000, 2000, 3000, 4000, 5000, 6000. Record each frequency including the unmodulated groove for about fifteen seconds with about a three second silent period between each frequency.

1. **EFFICIENCY** - The efficiency of the cutterhead is measured by comparing the 1000 cycle per second groove of the test record with the 1000 cycle per second groove on the RCA 23B Record. First play the RCA 23B Record at 78 R.P.M. and adjust the playback amplifier output level to plus 20 decibel across a 500 ohm resistive load. Next play the 1000 cycle per second groove on the test record and observe the decibels above or below the 20 decibel reference level. This reading indicates the cutting efficiency in decibels of the cutterhead in terms of a representative 0.002 inch amplitude 1000 cycle per second groove at 78 R.P.M. when a 20 decibel level is maintained across the cutterhead. Normal cutterheads will be within three decibels of this reference level. If the level is below 8 decibels the crystal is cracked and must be replaced.

2. **NOISE LEVEL** - The noise level is measured by comparing the unmodulated groove on the test record with the 1000 cycle per second sound groove on the RCA 23B Record. First calibrate the pickup and playback amplifier for plus 30 decibel output across a 500 ohm resistive load using 1000 cycle per second groove on RCA 23B Record played at 78 R.P.M. as representative 0.002" amplitude groove. Then playback the unmodulated groove on test record with the calibrated pickup and amplifier. Read the noise level in decibels below this representative level.

The noise level on the surface of the turntable (-44 db. below plus 30 db. playback reference level on Unit 199/220 Turntables) will ordinarily mask the actual surface noise of good recording styli and acetate discs at 33.3 R.P.M. particularly on diameters under ten inches. When interested in the relative superiority of disc material and cutting styli, record the blank groove at a speed of 78 R.P.M. so that the surface noise due to cutting is above the vibration level of the turntable.

Noise level measurements will depend entirely on the record material, stylus and its adjustment. It also increases with record diameter and turntable speed.

Normal readings on acetate records on a twelve-inch diameter should be from -40 to -44 db. below the plus 30 db. playback reference level at 78 R.P.M., from -45 to -50 db. at 33.3 R.P.M.

Normal readings on aluminum records on a ten inch diameter should be from -24 to -26 db. below the plus 30 db. playback reference level at 78 R.P.M., from -32 to -36 db. at 33.3 R.P.M. When using a thorn needle instead of a steel needle for playback these readings will be from 4 to 6 db. lower.

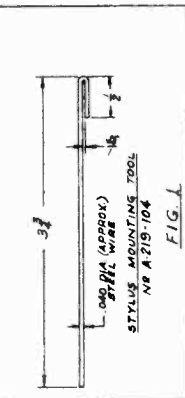
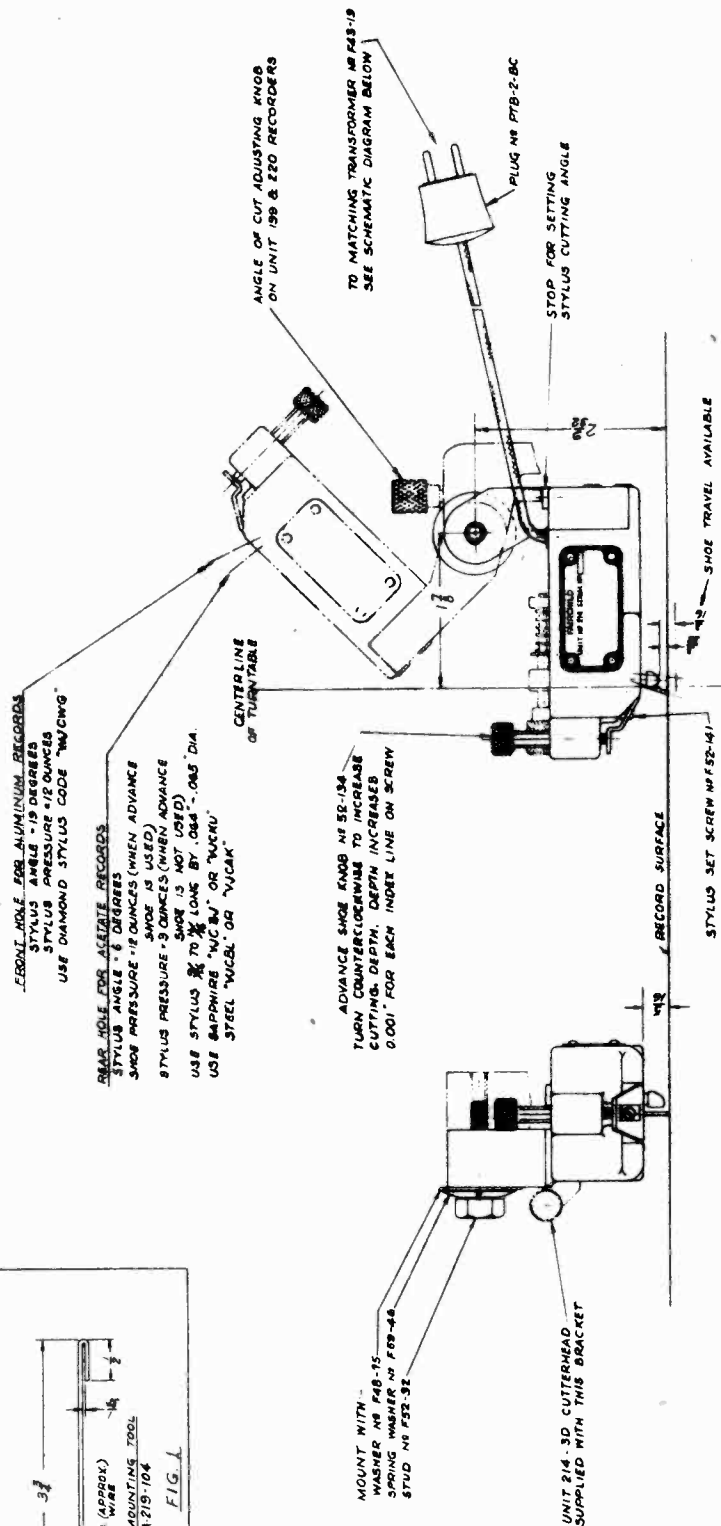
3. **FREQUENCY RESPONSE** - Playback the 1000 cycle per second groove on the test record with the pickup and playback amplifier calibrated at plus 20 db. level across a 500 ohm resistive load. Observe the output level indicator readings at the other test frequencies in decibels above or below this zero reference level.

Normal average readings should be as follows when the Unit 199 Recorder and the Unit 219 Amplifier is used for this measurement.

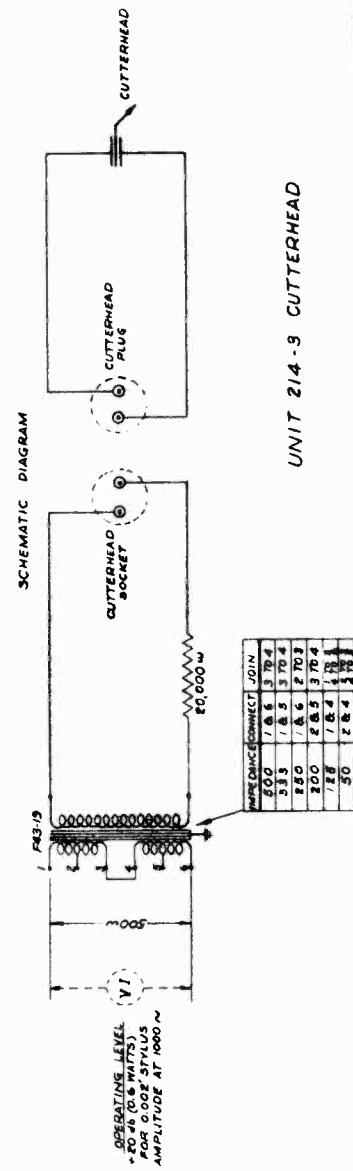
Frequency	1000	50	200	400	1000	2000	3000	4000	5000	6000
Level	0(+20)	-16	-8	-4	0	+2	+8	+4	+1	-5

3. **FREQUENCY RESPONSE** - The frequency response is measured by comparing the width of the diffraction pattern on the test record with calipers. The pattern should be uniform in width between 400 and 8000 cycles (within twenty-five percent of the 1000 cycle pattern). Each successive frequency pattern below 400 cycles should be about half the width of the adjacent higher frequency pattern.

NAME INSTALLATION AND GENERAL DATA
 UNIT 214-3 CUTTERHEAD
 FAIRCHILD AVIATION CORP.
 DRAWN BY: W.G.M. DATE: 7-13-38
 CHECKED BY: F.M.S. D.P. No. D-214-77



CORRECTION: Interchange Numerals 3 and 4 on F43-19 Transformer Terminals.

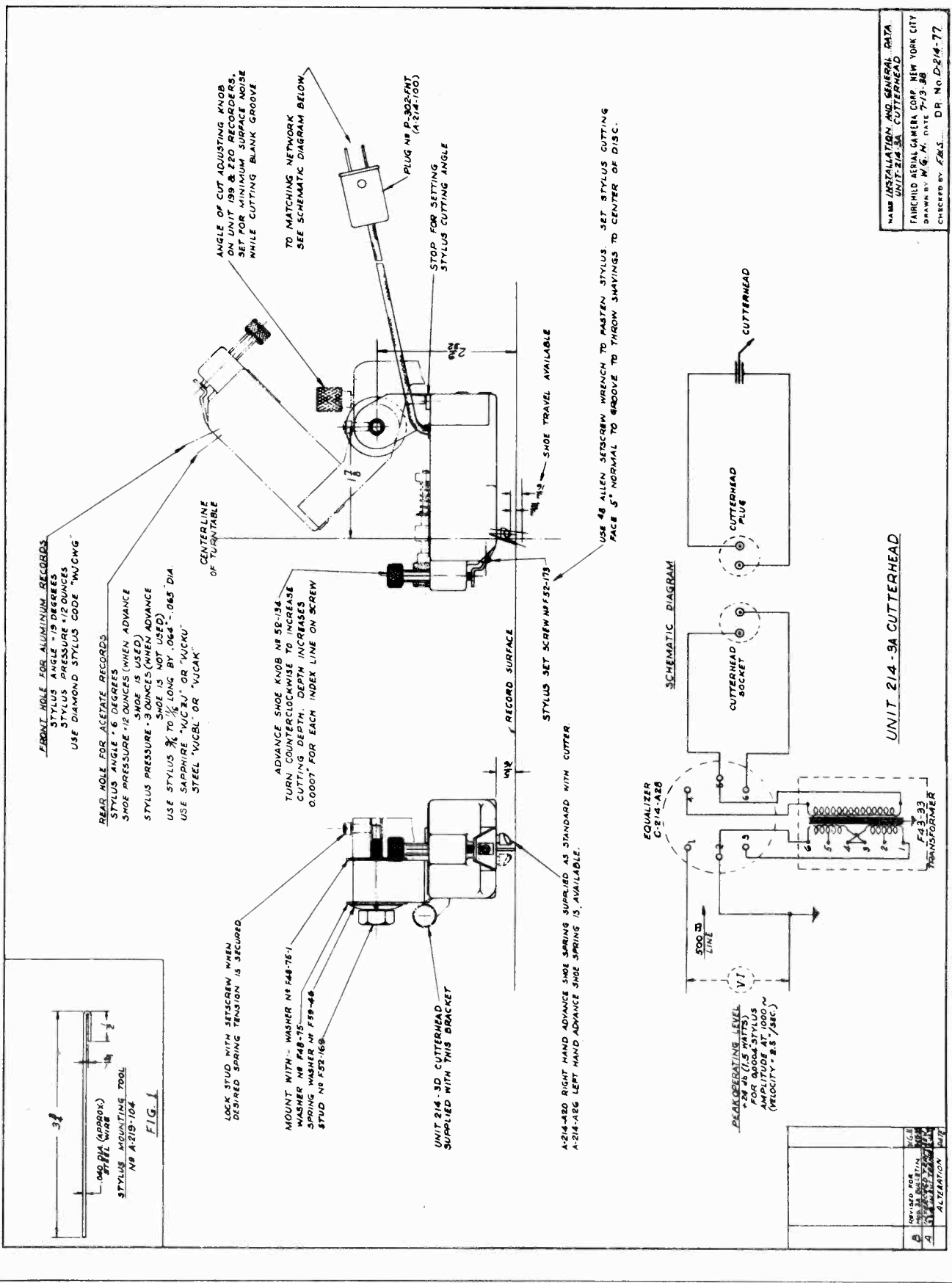


UNIT 214-3 CUTTERHEAD

MODEL 214-3A

FAIRCHILD AVIATION CORP.

NAME INSTALLATION AND GENERAL DATA
 UNIT 214-3A CUTTERHEAD
 FAIRCHILD AERIAL CAMERA CORP. NEW YORK CITY
 DRAWN BY M.G.M. DATE 7-13-58
 CHECKED BY F.M.S. DR. NO. D-214-77



UNIT 214-3A CUTTERHEAD

REV	DATE	BY	DESCRIPTION
1			ORIGINAL
2			ALTERATION

FAIRCHILD AVIATION CORP.

Overall Gain - 50 ohm Mic. to 500 ohm Output	105 db.
150,000 ohm Pickup to 500 ohm Output	70 db.
500 ohm Line to 500 ohm Output	65 db.
Frequency Response within 1 db.	50 to 10,000 c.p.s.
Distortion - @ 500 ohm "RECORD" Output Secondary	2.0% @ + 20 db.
	5.0% $\frac{1}{4}$ + 26 db.
Noise level below 20 db. (0.6 watts)	
Mic. Input	-35 db.
Pickup Input	-60 db.
Line Input	-60 db.
Input Power	120 watts, 105/125 volts, 50 to 60 cycles
Fuse Protection	2 amperes
Input Impedance	50, 125, 200*, 250, 333, 500* ohms and bridging balanced center tap high impedance. *Balanced center tap.
Output Impedance	7.5, 250, 500 ohms
Tube Complement	4-6C6 (F type); 2-6B5; 1-6H6; 1-5Z3
Weight	47 lbs.
Trunk Dimensions	19 $\frac{1}{2}$ " width; 18 $\frac{3}{4}$ " height; 8 $\frac{3}{4}$ " top depth; 13 $\frac{1}{4}$ " bottom depth.
Rack Panel Size	19" width; 17 $\frac{1}{2}$ " heights; 18 $\frac{1}{4}$ " mounting centers
Clearance behind Panel	6 inches

INPUT CIRCUITS - The amplifier is provided with three screw type receptacles for Microphone, Pickup and 500 Ohm Line input connections. The plugs to fit them are Amphenol Type MC3M plugs. The three position Input Selector Switch located centrally with respect to these three input receptacles is provided for selecting these inputs.

1. The Microphone receptacle is for connection to any standard microphone. The overall gain is such that it is unnecessary to use extra preamplifiers for picking up sound from large orchestras or sound several feet away from the microphone.

The microphone input transformer has 50, 125, 200, 250, 333 and 500 ohm inputs available. The 200 and 500 ohm primaries are of the "balanced center-tap-to-ground" type. The standard wiring to the microphone receptacles as shipped from the factory is 50 ohms. This input transformer is encased in a high permeability case to reduce hum pickup from stray magnetic fields and it is located off the chassis and mounted in the rear left corner of the trunk to reduce hum pickup to a minimum.

The various input impedance taps are accessible by removing the top cover of the transformer held on by four screws. Relocate the leads for desired input impedance in accordance with connections shown on the schematic diagram. A high impedance push-pull input for crystal microphones or when using amplifier as a bridging device is available by removing control panel from amplifier and soldering jumpers from the respective two microphone receptacle input terminals to the 6C6 input tube grids.

MODEL 219-2

FAIRCHILD AVIATION CORP.

2. The Pickup receptacle is for connection to the Fairchild Crystal Pickup or any similar high impedance device with an output from -40 db. to -10 db. The two output connections must be carried in a grounded shielded cable; neither side of device should be grounded.

3. The 500 Ohm Line receptacle is for connection to any 500 ohm line, with one side grounded and with a -20 to 0 db. level. In the event that a connection must be made to a "balance center-tap-to-ground" line, use the Microphone receptacle as the input. Revise the input transformer connections either to match this line or use the amplifier as a bridging device as described above. It may be desirable to insert a 40 db. attenuator between the source and the amplifier in order to have a smooth range of control in the Volume control.

OUTPUT CIRCUITS - The output transformer has been designed with two separate secondaries to supply a 7.5 ohm and a 500 ohm load simultaneously; the 500 ohm secondary has a 250 ohm tap for connection to two 500 ohm loads in parallel. A switch "LINE-BOTH-RECORD", a four position "SPEAKER" attenuator and three output receptacles are provided to take care of various output load requirements.

The monitor speaker is located on the main panel and plugs into the chassis by means of a standard five hole socket. Output level to the speaker is controlled by means of the four position "SPEAKER" control which inserts an attenuator network in the voice coil circuit. This control is provided to permit playing the speaker at a lower output than the level being maintained at the 500 ohm secondary which is usually driving a recording cutterhead at a plus 20 db. level.

The "LINE-BOTH-RECORD" switch will supply either an output signal to a 500 ohm recording cutterhead, to an outgoing 500 ohm line or to both simultaneously. This latter condition is occasionally necessary where an audition may be required while the recording is in progress. The switch connects the amplifier 500 ohm output secondary to the "RECORDER" 4 prong, socket or to the "500 OHM LINE" jack when in the respective "RECORD" and "LINE" positions. In the "BOTH" position the "RECORDER" 4 prong socket and the "500 OHM LINE" jack are connected in parallel to the 250 ohm tap on the output winding.

The "MONITOR" jack is wired to the 250 ohm output secondary. A high or low impedance headset may be plugged into this jack when it is desirable to use a headset rather than a loudspeaker for monitoring.

OUTPUT LEVEL INDICATOR - The Output Level Indicator is a milliammeter and a 6H6 tube rectifier. The dial scale is calibrated in decibels and the zero reading is equivalent to a plus 20 db. level (0.6 watts) across a 500 ohm resistive load. The indicator has a damping and speed approximating the standard general purpose instruments in commercial use. When replacing the control panel after service and inspection take care not to short the binding posts on the rear of the indicator against the chassis. A protective insulating pad is provided on the rear of this instrument and it should not be omitted.

POWER SUPPLY DATA - This amplifier has its power supply integral with the chassis for operation on a commercial 50 to 60 cycle, 105 to 125 volt A.C. line. The total wattage required is 120 watts. The amplifier is protected with a 2 ampere fuse. This fuse (radio type 1-1/4" long) is accessible by removing the four screws holding the illuminated nameplate. The fuse holder marked "A" is the amplifier fuse. There is also a fuse holder marked "M" rated at 10 amperes on the right side. This fuse protects the 115 volt connection to the large pins on the RECORD receptacle brought out on the control panel for a power connection to motors on associated equipment, e.g. the Fairchild Unit 199, Unit 220 or Unit 219F Turntables.

The "OFF-ON" switch controls the power supply to the amplifier and the external motor circuits. The pilot lamp (Mazda bayonet base, round bulb, 6/8 volts) serves as a warning when the equipment is turned on.

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MODEL 219-2

A small 4-hole socket is located on the top deck of the amplifier chassis for supplying 6.3 volts, 1.5 amperes A.C. and 250 volts, 10 milliamperes D.C. to operate a small external radio tuner or preamplifier.

RACK MOUNTING - The amplifier, speaker and control panel are mounted on a 17-1/2 x 19 inch standard size rack panel. The complete panel may be rack mounted when desired by removing the six large knurled thumb screws holding the panel to the tray sticks of the trunk. The input transformer, which is connected to the amplifier chassis with two shielded cables, should be mounted on the rack at any convenient location. Care should be taken to mount it so that hum is not picked up from the amplifier power supply or from any other stray magnetic fields from equipment already mounted on the rack.

MAINTENANCE - In the event that the equipment fails to function in the normal manner check all input and output circuits for continuity. If a casual general inspection does not indicate the trouble turn the amplifier off, remove the tubes from the sockets and check them in a reliable tube tester. In case of a failure not traceable to either faulty input or output circuits or to tubes make a systematic point to point voltage test. For this test the tubes should be in their respective sockets and the power turned on. The voltage readings can be conveniently made by merely unscrewing etched control panel on the amplifier. This leaves the entire under-chassis wiring open for inspection. The voltage readings should agree with the values given on the schematic diagram within ten percent.

The majority of service failures merely require tube replacements in amplifier equipment. It is advisable to have a set of spare tubes set aside for this emergency. Before storing them away the tubes should be carefully checked in the amplifier for normal gain, for freedom from microphonics and for absence of extreme background noise.

TUBE REPLACEMENT - When it is necessary to make tube replacements the following points should be considered for the most satisfactory operation. For the input 6C6 stage use a pair of matched tubes which do not show any microphonic tendencies. This can be determined by tapping the input tubes with the monitor speaker on a full gain to see whether an acoustic howl will build up between the speaker and the input tubes.

Use matched sets of 6C6 tubes on the second stage and a matched set of 6B5 tubes in the output stage. The mutual conductance of the sets should be matched within ten percent.

Defective 6B5 tubes may be recognized by a slight gurgling or a raspy whistling sound in the speaker when no signal is on the amplifier. Weak overall gain is also an indication of defective 6B5 tubes.

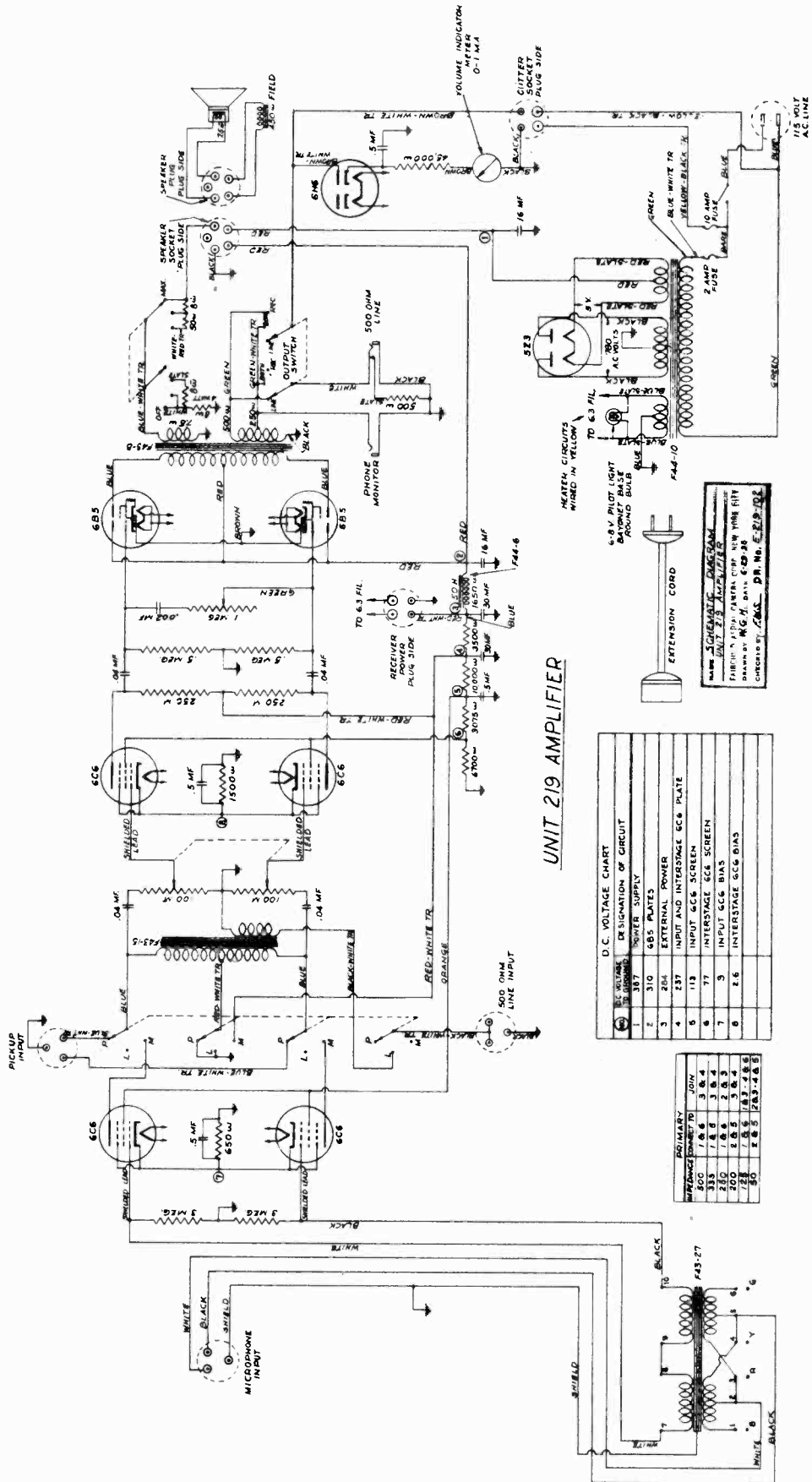
The 6H6 serves as the rectifier for the Output Level Indicator. Faulty operation of the Output Level Indicator is remedied generally by replacing this tube. Satisfactory performance will be obtained using an average good tube.

The 5Z3 provides the necessary operating D.C. voltages for the amplifier. The selection of this tube is not critical.

The tubes are accessible for replacement by removing the complete panel from the trunk held in place by six thumb screws. Tilt the panel forward and remove the tube shields and tubes. When replacing tubes make sure that the grid clamp on the grid cap of tube is not grounded on the top section of the tube shield.

MODEL 219-2

FAIRCHILD AVIATION CORP.



UNIT 219 AMPLIFIER

D.C. VOLTAGE CHART

WIRE NUMBER	DESIGNATION OF CIRCUIT
1	POWER SUPPLY
2	6B5 PLATES
3	EXTERNAL POWER
4	INPUT AND INTERSTAGE 6C6 PLATE
5	INPUT 6C6 SCREEN
6	INTERSTAGE 6C6 SCREEN
7	INPUT 6C6 DIAS
8	INTERSTAGE 6C6 DIAS

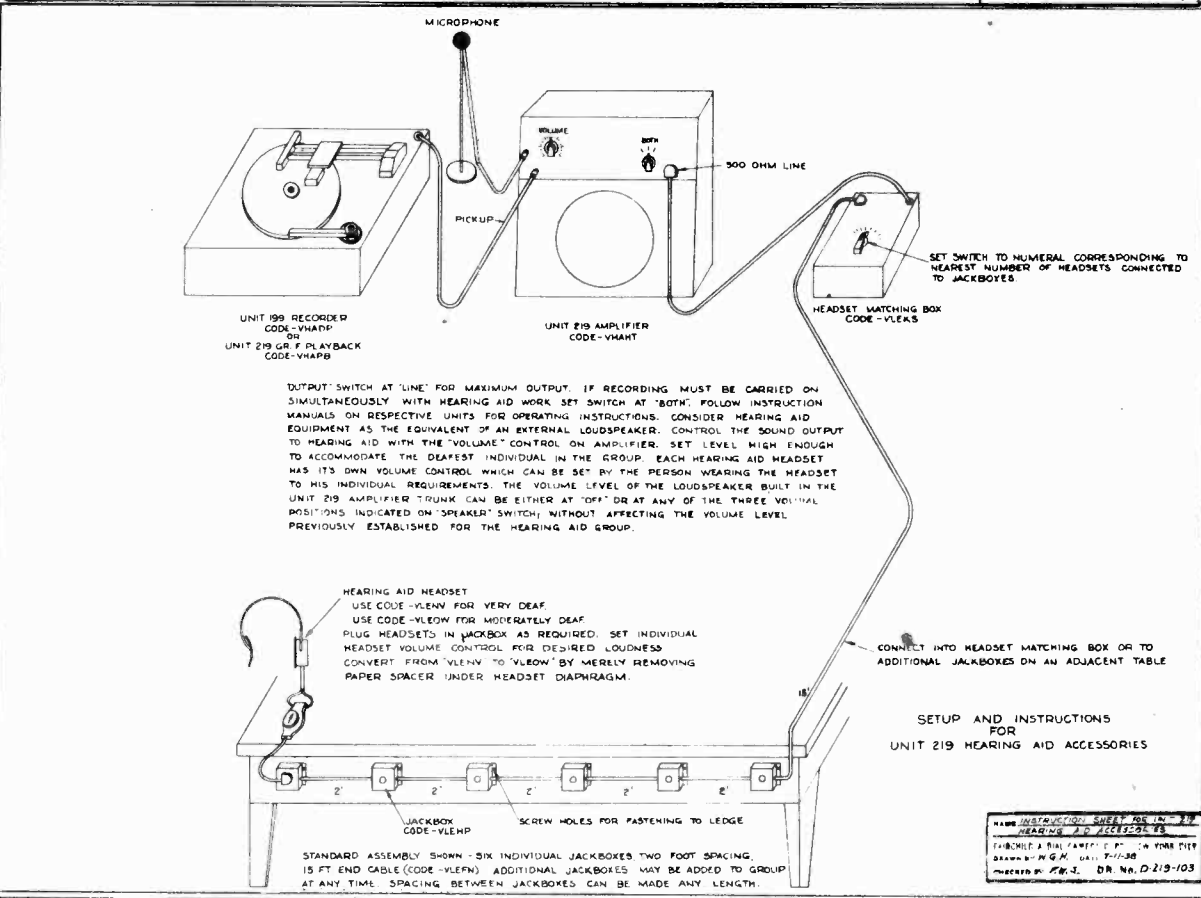
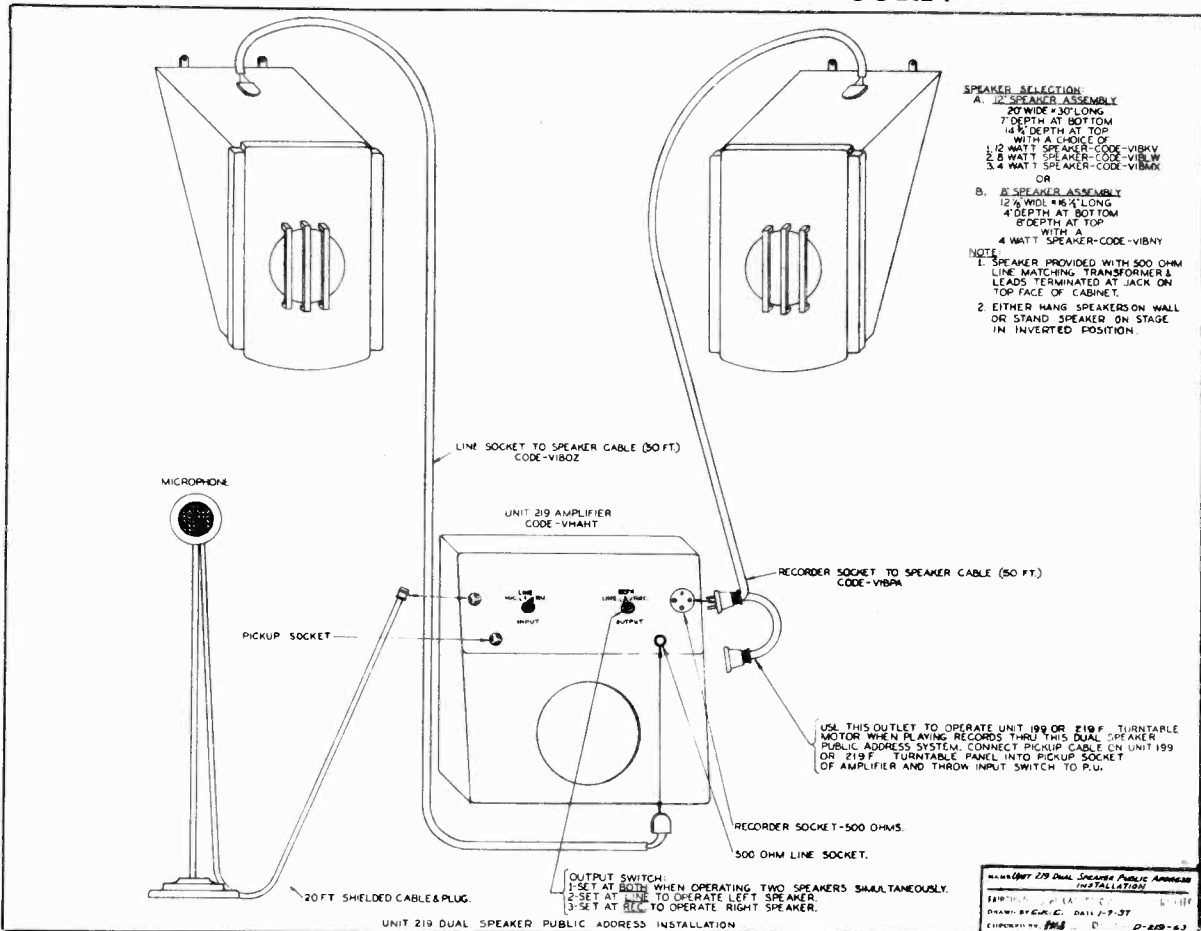
PRIMARY TO JOIN

500	1 6 6	3 6 4
385	1 6 6	3 6 4
500	6 6 6	5 2
728	6 6 6	8 3 2 4 6
80	2 6 5	2 4 3 4 6

NAME & CHEMICAL COMPANY
 DATE 11-15-45
 FAIRCHILD AVIATION CORP. NEW YORK 19 NY
 DRAWN BY M.C.H. DATE 6-29-48
 CHECKED BY G.W.S. DR. NO. E-219-2

FAIRCHILD AVIATION CORP.

MODEL 219-2



MODEL 227**FAIRCHILD AVIATION CORP.**

APPLICATION - The Fairchild Unit 227 Transcription Turntable has been designed to meet the demand for a high quality mechanism of rugged construction. Its performance specifications makes it worthy of the fine quality reproducers available today. All parts are assembled on the single panel so it can easily be mounted in a cabinet, control desk or table. When specified, the Unit 227 Transcription Turntable can be supplied in a trunk for portable use. Both lateral or vertical recordings up to 16 inches in diameter can be reproduced on this equipment and speeds of 78 RPM and 33.3 RPM are available by merely raising or depressing the center pin.

VOLTAGE AND FREQUENCY - The Transcription Mechanism is supplied as standard for operation on a 115 volt/60 cycle power line. Equipment can be supplied on order for operation on 115 volts/50 cycles; 220 volts/60 cycles; 220 volts/50 cycles. The power consumption is 70 watts.

GENERAL DESCRIPTION - The Transcription Mechanism (Model 1) is contained on an aluminum panel (21"-W, 17"-D, 1/4" thick) finished in black crackle lacquer, for flush mounting in a permanent studio cabinet installation (see Dr. #E227-29). A 1/50 HP synchronous motor drives the turntable through a two speed drive, D199-A22. The motor is spring suspended from the panel. The motor shaft is connected to the two speed drive through a carefully balanced flexible rubber coupling A199-A16. The turntable C199-A8 is a 16 pound heat treated iron casting carefully machined flat and dynamically balanced. Net weight 45 lbs. A power connection should be made to the nearest base receptacle with an extension cord attached to the #7701 Twistlock plug located on the underface of the panel. This plug is supplied to insure a quick reliable connection that cannot be accidentally disconnected. Pickups are mounted on the Transcription Panel only when specified. Pickups are wired to a short pendant cord located under the panel. An Amphenol MC3F Connector and ten foot of shielded cable is supplied in this instance, to connect the pickup to the lines or amplifier input.

Directly above the switch is a nameplate with general operating instructions on the Transcription Mechanism. The Unit Number, Serial Number, Voltage, Frequency, and Power Requirements are also included on this nameplate.

The Portable Transcription Mechanism Assembly (Model 1P) is identical to the above assembly except that two five foot cables are brought out of the top right of panel. Whatever type of plug-in connector is required for connection to the a. c. line and the pickup amplifier input may be added at installation. The panel is mounted in a trunk and provisions are made for storing the turntable in the top cover of the trunk when transporting the equipment.

OPERATION

1. Turntable Speed - The sixteen pound turntable is driven by a synchronous motor through a gear and worm reduction. It rotates at 33.3 RPM when the shift pin, extending through the turntable shaft, is pressed down. It rotates at 78 RPM when the pin is pulled upward. The "OFF-ON" switch on the right of the panel operates the turntable driving motor. Always shut off the motor when shifting speeds to avoid unnecessary strain on gear drive assembly.
2. Fuse - The motor circuit is protected by a fuse located at the left of the motor "OFF-ON" switch. Remove screw cap in fuse holder with a screwdriver to replace fuse. Use a standard 1-1/4" radio type 10 ampere fuse.
3. Turntable Stop Pin and Clamping Nut - There is a removable stop pin on the two inch diameter of the turntable to prevent discs provided with suitably located stop pin holes from slipping while reproducing them. The stop pin may be removed with a screwdriver for those discs which do not have these stop holes. The removable record stop pin may get mislaid when removed from turntable. To prevent this possibility, it may be secured in threaded hole one inch above "OFF-ON" switch.

A clamping nut with a right hand thread is supplied for holding discs, not provided with stop pin holes, securely to turntable.

MAINTENANCE ADJUSTMENTS - The Fairchild Recording Mechanism has adjustments provided at all important points. These are carefully set at the factory and locked at the position for best operation. Readjustments may be required from time to time either on account of loosening due to moving the equipment around or to general wear.

1. Vibration - Excessive vibration can be reduced by realigning the motor cradle suspension beneath the panel. The motor cradle is supported on four springs. The height of each spring is adjustable by means of a stud and locknut. The adjustment is very critical, only a fraction of a turn being required to make a considerable difference in the vibration level.

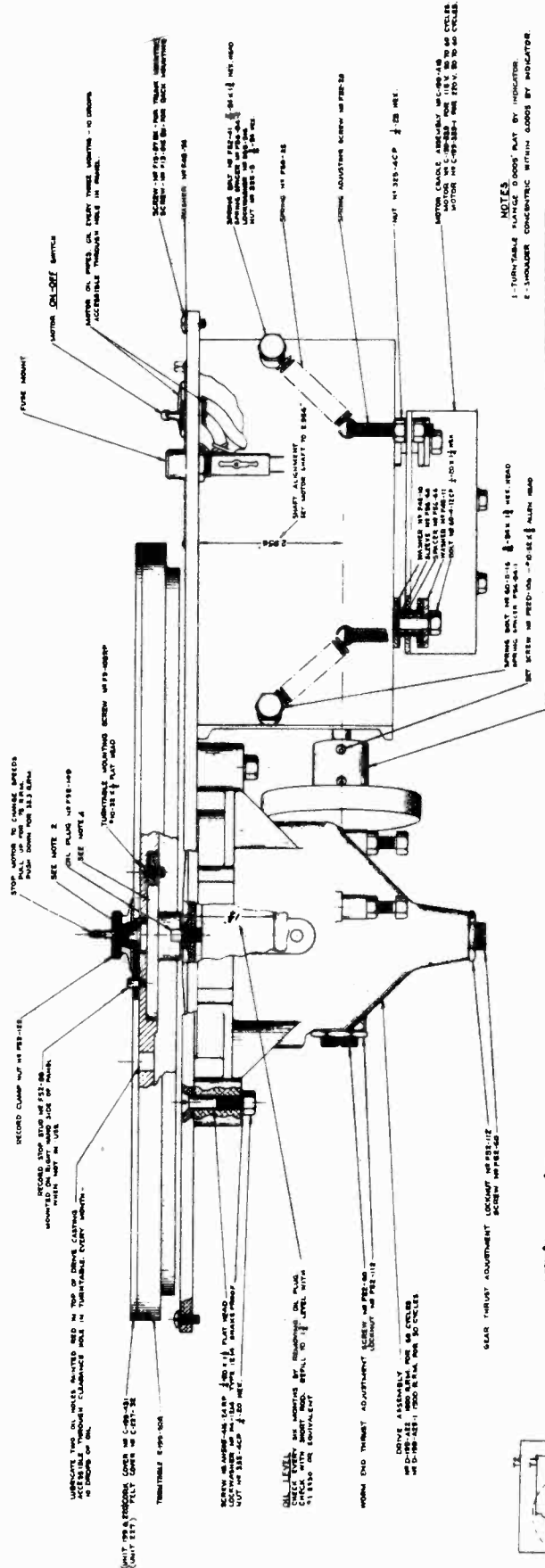
The rubber coupling connecting the motor to the drive may cause vibration if it is torn or if the cement loosens between the rubber and the collar. Excessive oil dripping on rubber will damage coupling.

FAIRCHILD AVIATION CORP.

MODEL 227

There are two end thrust adjustments on the two speed drive, the worm end thrust setscrew and the gear end thrust setscrew. These may be readjusted after a period of time to remove vibration arising from wear in the gear and the worm assembly. Under normal operating conditions the equipment should be oiled regularly every month. A more frequent lubrication may be necessary when the equipment is in continuous operation.

1. Motor - The front and rear bearings of the motor are lubricated through two oil pipes. Remove the plug button pressed in the nameplate; there are two red tipped oil pipes just below the opening in the panel. Lubricate pipes just below the opening in the panel. Lubricate each oil pipe every three months with about ten drops of oil



NOTES
 1-TURNABLE PLATE DOES NOT BY INDICATOR
 2-LOADER CONCENTRIC WITH GROSS BY INDICATOR

FAIRCHILD AVIATION CORP.
 MILWAUKEE, WIS.
 DIV. OF GENERAL ELECTRIC CO.
 MODEL 227-30

TURNABLE MECHANISM — 33.3 AND 78 R.P.M.
 UNIT 125, 126 AND 221 ASSEMBLES

SCHEMATIC DIAGRAM OF MOTOR CIRCUIT
 UNIT 227 ONLY

MODEL 295

FAIRCHILD AVIATION CORP.

GENERAL SPECIFICATIONS

Overall Gain - 50 ohms or 250 ohms output 107 db.

Pickup #1 100,000 ohms 61 db.

Pickup #2 100,000 ohms 61 db.

"T" 500 ohms 67 db.

"H" 500 ohms 67 db.

Frequency Response within 1 db. 15 to 15,000 c.p.s.

Distortion measurements below were made with no equalization and controls set at 20 c.p.s. and 10 Kc. A minus 10 db. Input to 500 ohm "H" line position.

Frequency in C.P.S.

LEVEL	50	80	100	400	1000	2000	3000	4000	5000	6000	7000	8000
plus 26 db.	1.4%	0.82%	0.75%	0.57%	0.6%	0.72%	0.85%	0.95%	1.35%	1.4%	1.7%	2.0%
plus 33 db.	3.0%	2.05%	1.75%	0.8%	0.82%	1.4%	1.95%	2.4%	2.9%	4.25%	4.4%	5.0%

Noise level below 0 level of .006 watts at full gain of amplifier with bass and high controls off -18 db.

Current drain and AC wattage consumption @ 117 volt AC total wattage 117 watts

Fuse Protection 3 amp.

Input Power 117 watts, 105/125 volts, 50 to 60 cycles.

Output Impedance 500 ohms "T" and "H" positions, also #1 and #2 cutterheads or "BOTH"

Tube Complement 7-7A4; 2-6L6G; 1-6H6; 1-5U4G

Weight 54 lbs.

Trunk Dimensions 17" width; 18 $\frac{1}{2}$ " height; 11" greatest depth.

Power Output 500 ohm winding 12.5 watts
15 ohm winding 1.5 watts

APPLICATIONS - The Fairchild Unit 295 Amplifier-Equalizer has been designed for portable use and all studio requirements in recording, playing back records, and public address work. The unit is considerably more flexible than any previous amplifier, and is extremely compact in its light gauge metal trunk.

When the volume or level of a typical amplifier is reduced, the frequency extremes, that is, the bass and the high frequencies attenuate or tend to disappear first. As the level is further reduced, the attenuation of bass and high frequencies apparently becomes still greater to the ear to that of the middle range. Thus the equalization element of the 295 is provided so that you may boost the extremes to compensate for this apparent falling off of bass and high frequencies. At any frequency from 20 to 100 cycles equalization of from 0 to 20 db. is available and at any frequency from 4000 to 10,000 cycles equalization from 0 to 20 db. may be added. There is a negligible interaction between the controls, and they can be preset at any time to provide known amounts of equalization for any particular purpose. The increase or emphasis of both high and low frequency controls up to 20 db. above the average program level may be made without materially changing the output level of amplifier supplying cutterheads or loudspeakers. Thus, the volume or gain of amplifier need not be altered in the midst of a recording merely because the equalization is changed. The accompanying prints have been designed to show the amount of equalization you can obtain at any arbitrary setting.

For RECORDING and PLAYBACK the amplifier is provided with receptacles for instantaneous hookup to the Fairchild Unit 199 and 220 Recorders, or the Unit 227 Turntable Mechanism. These combinations provide a complete, self-contained, portable outfit for the direct recording of voice, music, and sound, and for the direct playback of such records.

For PLAYBACK service only, the amplifier may be similarly hooked up through the same receptacle to the Fairchild Unit 227 which is a transcription turntable with both 78 and 33 $\frac{1}{3}$ rpm.

FAIRCHILD AVIATION CORP.

MODEL 295

For HEARING AID work the amplifier's 500 ohm "H" output position may be connected to the Unit 219C Hearing Aid Headset Matching Box, which provides the correct impedance match for multiple groups of hearing aid headsets. The value of the Unit 295 for this particular work is greatly increased by its ability to give considerable emphasis to recording or playback in a part of the audible range where special boost is desired.

For PUBLIC ADDRESS work the Unit 295's "H" 500 ohm line output may be connected to permanent magnet speakers mounted in suitable baffles or enclosures. The speakers should be supplied with a 500 ohm voice coil matching transformer. A single transformer will be found satisfactory for multiple operations provided the voice coils are properly phased and proper impedance provided.

INPUT CIRCUITS - The Unit 295 is provided with six screw type receptacles for a microphone of either 50 or 250 ohms impedance, two Fairchild 209-3 crystal pickups, a "T" 500 ohm line and an "H" 500 ohm line for use with a radio tuner. If the Fairchild Unit 209-4 dynamic pickup is used, it should be connected to the 50 ohm microphone position. These receptacles are located on the rear of the chassis on the right hand side. A switch is provided on the front of the panel for selecting any one of these inputs. Equalization may be inserted, or not, on any input signal. The signal input to 500 ohm "H" or "T" should be held to minus 10 db. for best performance.

OUTPUT CIRCUITS - The selector switch on the right hand side of the amplifier allows the signal to go to both heads at once, either head, the "T" line or the "H" line. A separate attenuator is supplied on the right hand side of panel for the speaker which is mounted on the back cover of the trunk. This second attenuator provides for adjustment of monitoring level independent of level going through volume indicator to cutterheads or lines. In cases where a master record is being made and must be checked without playing, the signal is fed simultaneously to both cutterheads, allowing one record to be auditioned though the other is processed. The "H" line position provides an output to loudspeakers separate from equipment. The phone monitor jack is wired to 8 ohms output winding. A high or low impedance headphone set may be plugged into this jack which provides a comfortable audio level at normal recording levels.

POWER SUPPLY DATA - The power supply is integral with the chassis for operation on a commercial 50 to 60 cycle, 105 to 125 volt AC line. The total wattage required is 117 watts, and the Unit 295 is protected by a 3 ampere fuse at the rear of the chassis. The "OFF-ON" switch controls the power supply to the amplifier, but not external circuits.

OUTPUT LEVEL INDICATOR - Located at the central point of the panel is a milliammeter and a 6H6 tube rectifier. The dial scale is calibrated in decibels, and the zero reading is equivalent to a plus 20 db. level (0.6 watts) across a 500 ohm resistive load. The indicator has a damping and speed approximating the standard general purpose instruments in commercial use. It is used in all output positions except the 500 ohm "H" line. This affords protection where levels greater than plus 26 db. are employed as in the case of public address work. When replacing control panel, be sure that meter leads are properly polarized. A red dot will be found on the terminal strip indicating the proper terminal for the red lead of the meter.

RACK MOUNTING - The Unit 295, when supplied for rack mounting, is shipped minus the rear cover of trunk and loudspeaker. Standard spacing is used for the rack mounting panel which is 21" x 19". The part number is B295-A18. The necessary mounting screws and washers are supplied with this model.

MAINTENANCE - Should the amplifier and power supply fail to function in the normal manner, all external connections should be inspected. If the difficulty is not located, the power should be shut off and the tubes removed from their sockets and tested in a reliable tube tester. In case of failure that cannot be traced to incorrect connections or defective tubes a systematic point to point voltage test should be made. For this test the tubes should be in their respective sockets and the power turned on. The voltage readings obtained should closely approximate the values tabulated on the schematic diagram. Reduction in hum noise can be obtained by careful adjustment with a screwdriver of a variable C. T. resistor located near the left hand side of the power supply deck on the rear of the unit. This adjustment cancels residual A.C. unbalance in the heater circuit. Stray magnetic fields may to some extent influence residual noise in the amplifier.

TUBE REPLACEMENT - The use of tubes matched for gain and plate current is recommended for future tube replacements. Under practically all conditions of normal operation this will be satisfactory. When it is necessary to make tube replacements, the following points should be considered. For the input 7A4G stage use tubes which do not show microphonic tendencies. This can be determined by tapping these input tubes with the monitor speaker on at full gain to see whether an acoustic howl will build up between the speaker and

MODEL 295

FAIRCHILD AVIATION CORP.

7A4G's. The 6H6 serves as a rectifier for the Output Level Indicator. Faulty operation of this Indicator is generally remedied by replacing this tube. Satisfactory performance will be obtained using an average good tube. The 5U4G provides the necessary operating D.C. voltages for the amplifier. The selection of this tube is not critical. The 6L6G's are the power output tubes and should match reasonably well in characteristics. The tubes are accessible for replacement from the rear deck of the trunk.

CONTROLS - When unit is allowed to remain idle for several days the variable controls may develop a slight scratching noise due to oxidation of the wire-wound variable resistors. If each control is rotated several times throughout its range, this oxidation will be removed by the wiper element in each variable resistor. These controls should be checked before proceeding with recording.

The use of the Unit 295 Fairchild Amplifier-Equalizer necessitates some statements of fact and procedure for those who are not familiar with equalization and its use in recording, playback and audio amplifying systems. What follows applies directly to recording and reproducing sound with the use of Fairchild Recorders having our latest cutterhead and network VHAOA; to playback systems that are essentially flat from 50 to 10,000 cycles such as the Fairchild Dynamic pickup #209-4, the Western Electric #9A, RCA diamond point pickup, etc. It is obvious, of course, that other units in the systems such as amplifiers and speakers must also conform to similar frequency response characteristics, since the "over-all" quality and response can only be as good as the weakest unit in the system.

So far, only the *frequency response* has been mentioned. *Distortion* is equally important but not always adequately taken into account. The Fairchild "over-all" distortion at 400 cycles, using the #3A or 3AC cutterhead, #295 Amplifier and #209-4 Dynamic pickup is less than 5%. (Our laboratory tests show as low as 3%). This means that a recording made on our equipment and played back with our dynamic pickup through an adequate speaker system will come pretty close to perfection in the quality of "naturalness". There are cutterheads and pickups on the market whose distortion content is several times that of the Fairchild units. Speakers present one of the greatest problems to effective sound reproduction but several are now available that are quite adequate. Amplifiers good to 10,000 cycles and with low distortion content are easily available but amplifiers especially adapted to recording such as the Fairchild #295 are comparatively rare.

Equalizing for Recording

The "highs" need to be boosted on the inside of a 16 inch disc (15 minute program, center about 8 inches using 118 lines per inch) so that in playing back the brilliancy will not suffer too much by comparison with that on the outside of the record. It is impossible to reproduce 10,000 cycles (8 inch diameter, 33-1/3 speed) at full intensity due to the diameter of the reproducing needle point being greater than the wave length of a 10,000 cycle note at that diameter. Bearing these facts in mind the set of the equalizer dials as given in the following diagram are for recordings for flat playback. (Orthacoustic is also given but should in no case be used unless *sure* that the record is to be played on a pickup with Orthacoustic Characteristics).

Equalizer dials (top row) are, for our purpose here, numbered from 1 to 4, left to right. No. 2 permits selection of any frequency from 20 to 100 cycles in the bass. Please refer to charts I, II, III and IV for the shape of the curve, 20, 40, 70 and 100 cycles arbitrarily selected - (any others could be used.) Dial #1 regulates the amount of bass boost desired. (Note the curves arbitrarily boosted at 5, 10, 15, 20 db. - they would equally apply at any other set of the dial from 0 to 20 db.) Dial #3 permits selection of any frequency on the high end of the frequency spectrum from 4000 to 10,000 cycles, also continuously variable, and Dial #4 regulates the amount of the boost from 0 to 20 db. See charts V, VI, VII, VIII. Chart number IX shows effect on the amplifier when dials ("gain"), #1 and 4 are at 0, etc. Please note that no matter where the dials #2 and #3 are set, there is no effect of the equalizer on the frequency response if the "gain" dials #1 and #4 are at zero.

From this it will be seen that the initial adjustment, and three other 'sets' of the dials, is sufficient to equalize to meet the changing diameter needs and keep an even brilliancy from inside to out. The Fairchild cutterhead is especially adapted to equalization. By referring to curve of the cutterhead you will note it is 22 db. below reference at 50 cycles and flat at 1000 to 8000 cycles. These frequency characteristics are almost identical with equalized modern pickups which have a bass boost of 18 to 20 db. at 50 cycles and flat from 1000 to 8000 and beyond. By adding a small amount of bass as shown, the result will be found to be ideal.

You will note that 5 db. at 8000 is left in from 7th to 15th minute. This theoretically would not give back a flat playback but in practice about this amount is necessary to com-

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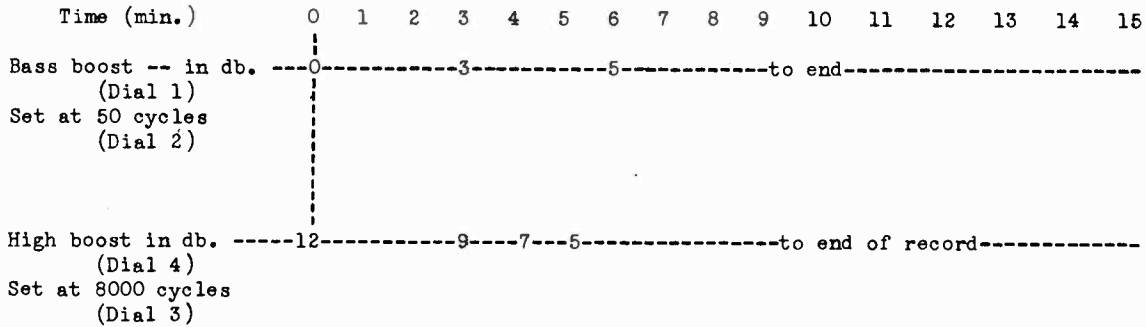
MODEL 295

compensate for the softness of record material which does not actuate the playback needle at full strength.

You may find less bass boost necessary or more. Or you may wish to put in more highs in the center. In general the above has been found to give the most satisfactory response and wide variations from this pattern should be avoided.

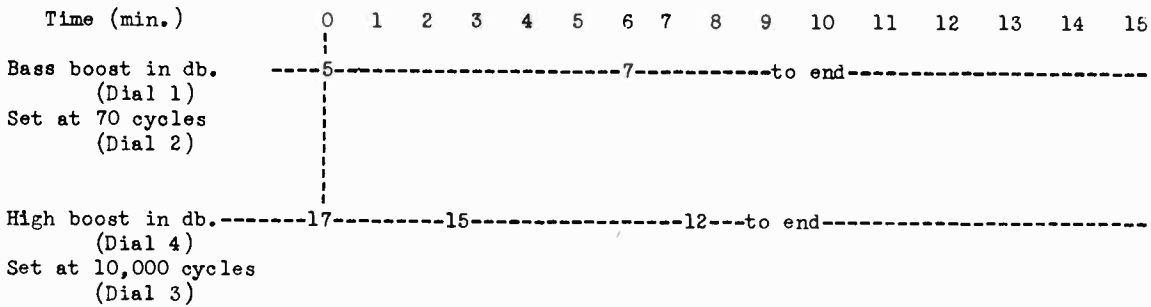
Recording for flat playback

33-1/3 speed
118 lines per inch



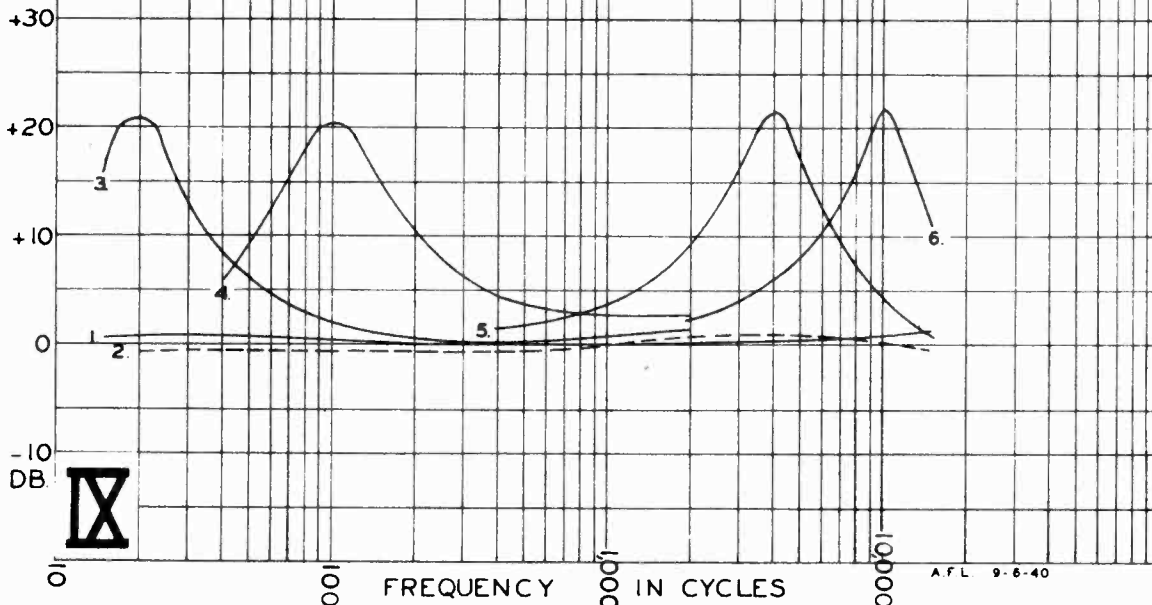
For Orthacoustic Recording

33-1/3 speed
118 lines per inch



AMPLIFIER RESPONSE UNIT 295

- 1. FLAT POSITION BASS 20~ HI 10KC.
- 2. FLAT POSITION BASS 100~ HI 4 KC.
- 3. 20~ BOOST BASS 20~ GAIN MAX.
- 4. 100~ BOOST BASS 100~ GAIN MAX.
- 5. 4 KC. BOOST HIGH 4KC. GAIN MAX.
- 6. 10KC. BOOST HIGH 10KC. GAIN MAX.

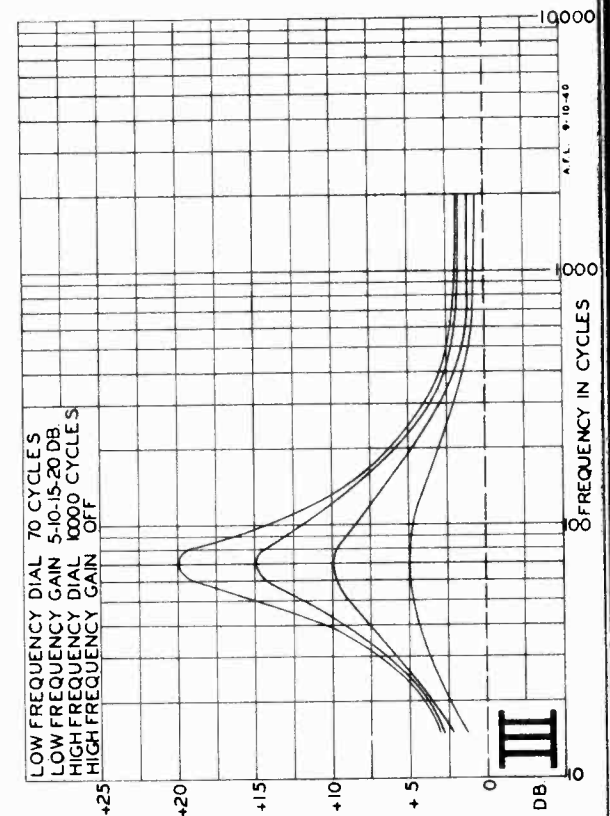
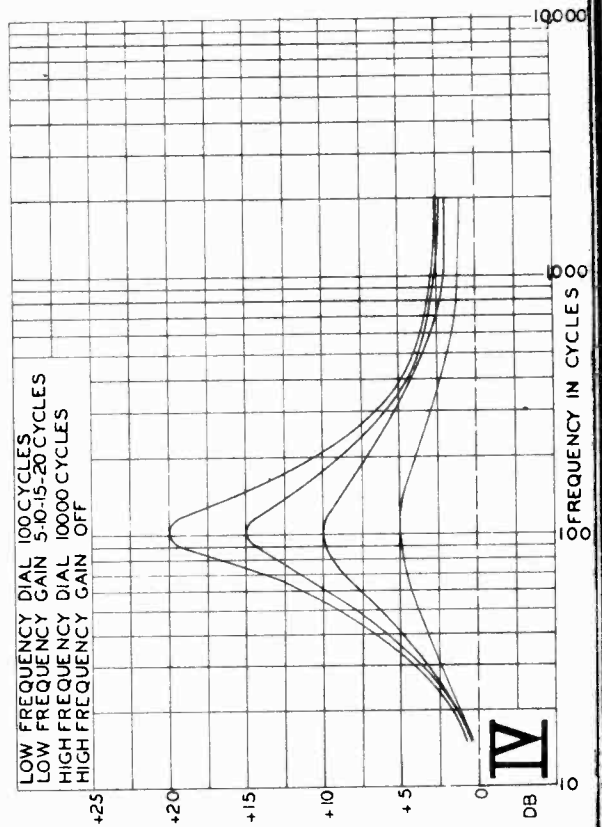
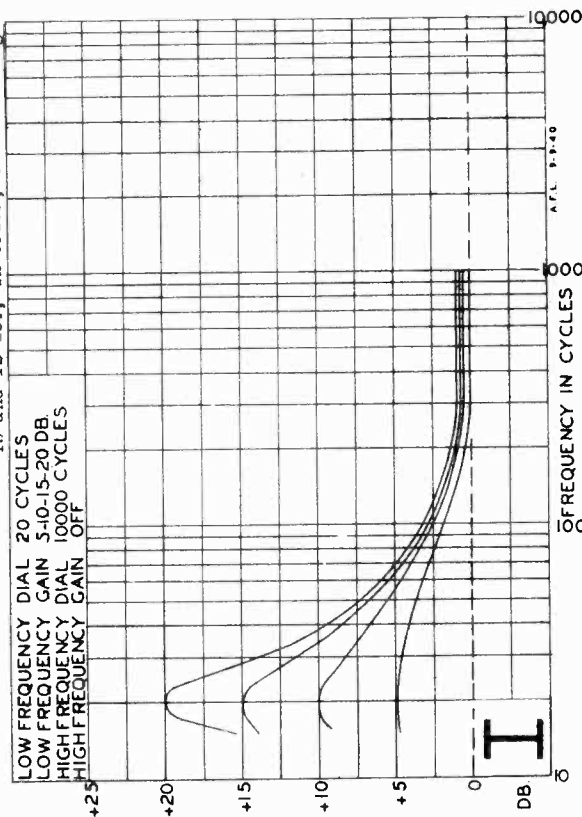
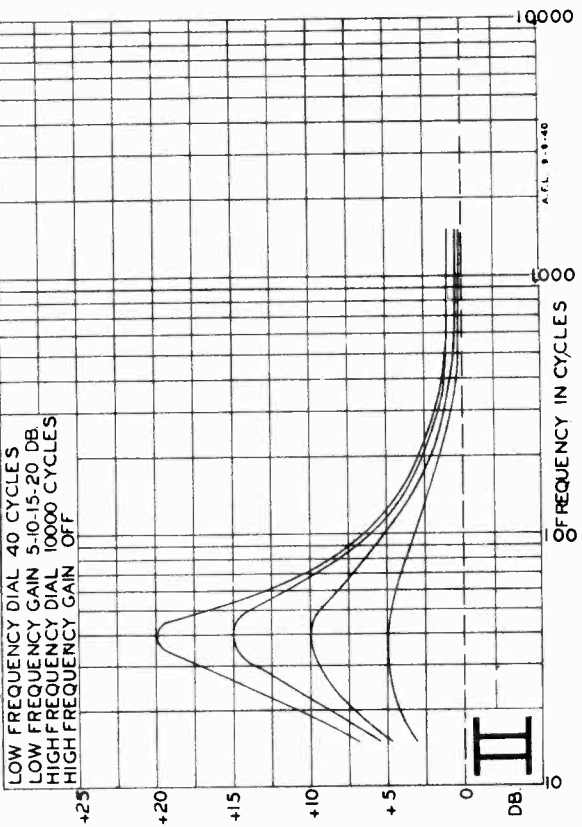


A.F.L. 9-6-40

MODEL 295

FAIRCHILD AVIATION CORP.

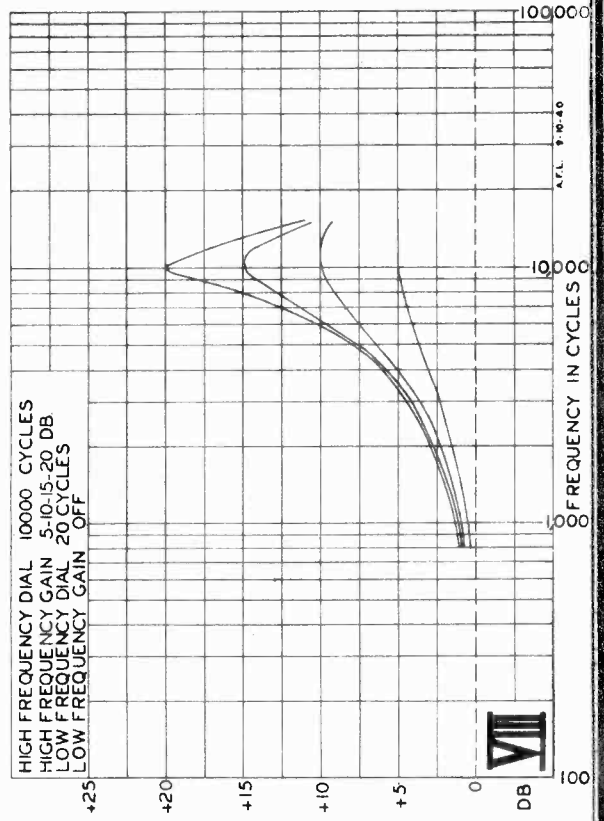
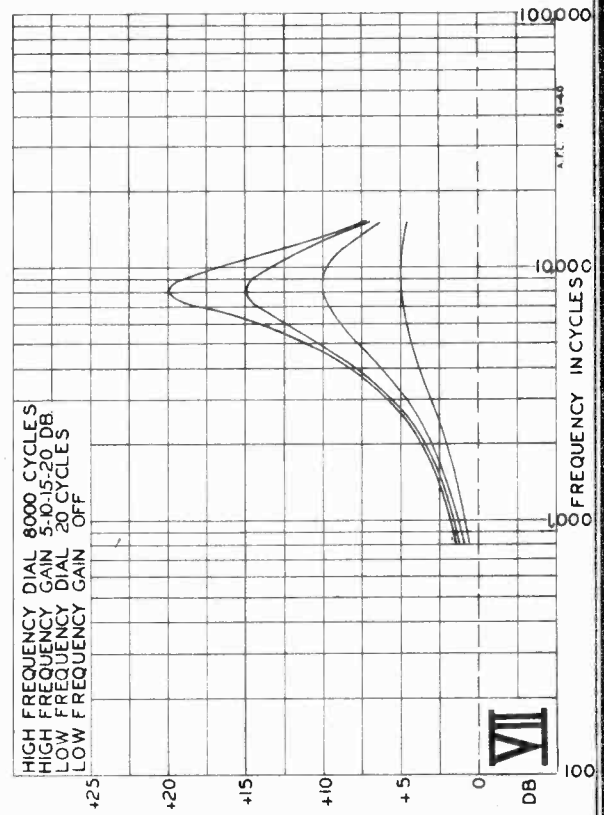
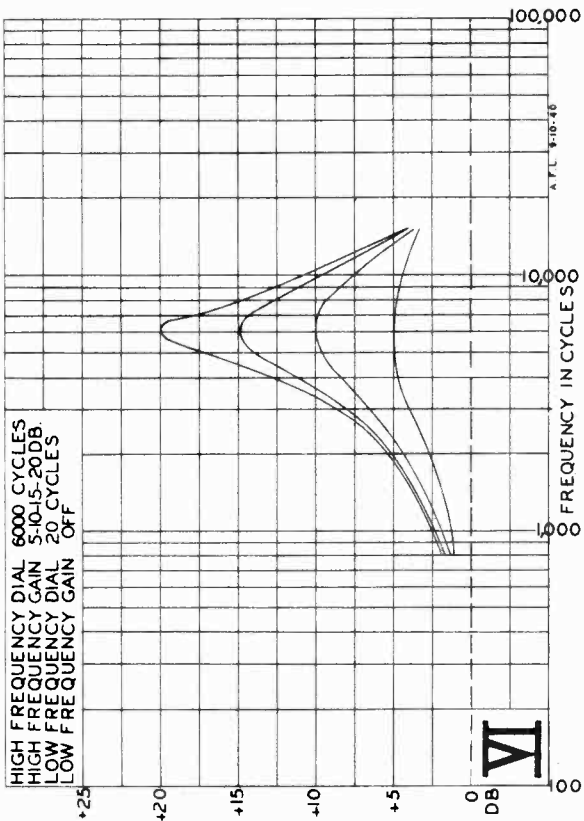
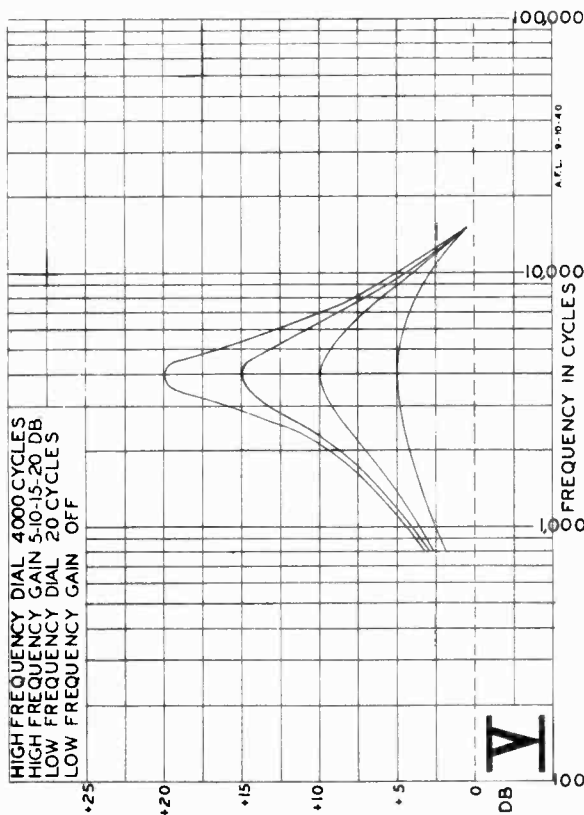
The latest orthacoustic curve calls for 10 db. at 10,000 cycles. The curve is almost identical to the curve shown on our Charts VII and VIII with peak set at 10,000 cycles. The extra 7 db. added in this chart gives extra boost on the inside of the record. Reduced to 15 and 12 db., in order, the recording should match orthacoustic playback.



FAIRCHILD AVIATION CORP.

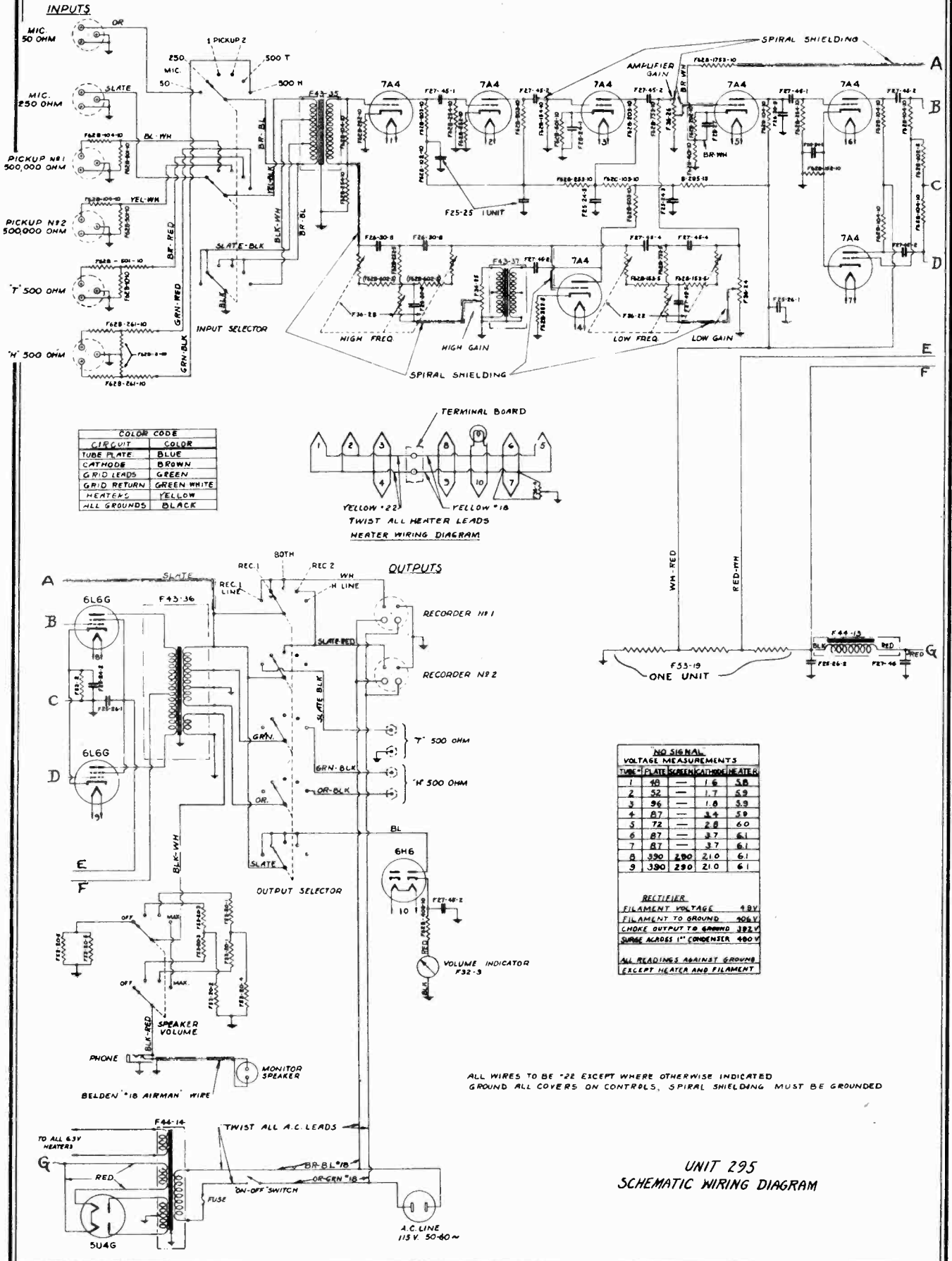
MODEL 295

Fairchild cutters need to be boosted from 5 to 7 db, in the bass (70 cycles is probably the most favorable peak, see Charts III and IV) to match the orthoacoustic curve. The amounts of equalization may be varied somewhat if found desirable, but wide differences should be avoided.

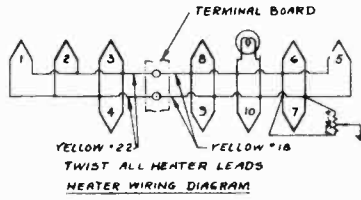


MODEL 295

FAIRCHILD AVIATION CORP.



COLOR CODE	
CIRCUIT	COLOR
TUBE PLATE	BLUE
CATHODE	BROWN
GRID LEADS	GREEN
GRID RETURN	GREEN WHITE
HEATERS	YELLOW
ALL GROUNDS	BLACK



NO SIGNAL VOLTAGE MEASUREMENTS			
TUBE	PLATE	SCREEN	CATHODE HEATER
1	50	1.6	5.8
2	52	1.7	5.9
3	96	1.8	5.9
4	87	3.4	5.9
5	72	2.8	6.0
6	87	3.7	6.1
7	87	3.7	6.1
8	390	2.0	6.1
9	390	2.0	6.1

RECTIFIER
 FILAMENT VOLTAGE 4.8V
 FILAMENT TO GROUND 106V
 CHOKO OUTPUT TO GROUND 382V
 SURGE ACRES 1" CONDENSER 480V

ALL READINGS AGAINST GROUND EXCEPT HEATER AND FILAMENT

ALL WIRES TO BE #22 EXCEPT WHERE OTHERWISE INDICATED
 GROUND ALL COVERS ON CONTROLS, SPIRAL SHIELDING MUST BE GROUNDED

UNIT 295
 SCHEMATIC WIRING DIAGRAM

FARNSWORTH TELEV. & RADIO CORP.

MODEL P-2
CAPEHART
(Part 1)

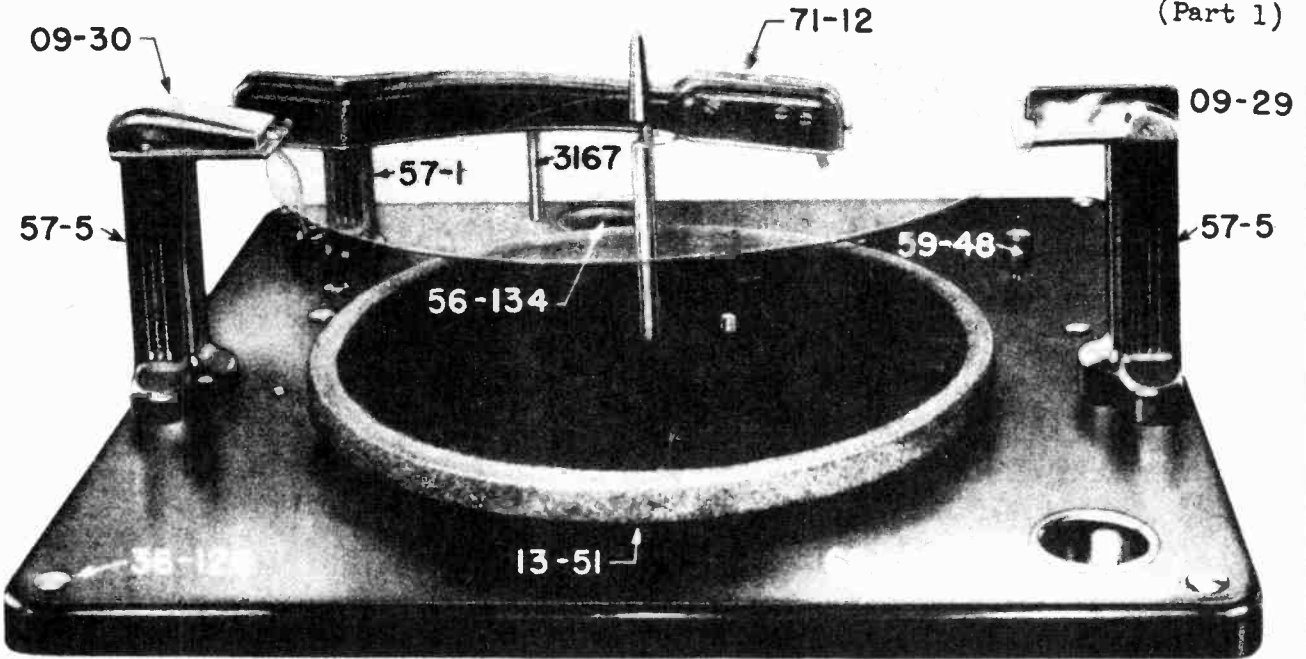


FIGURE 1

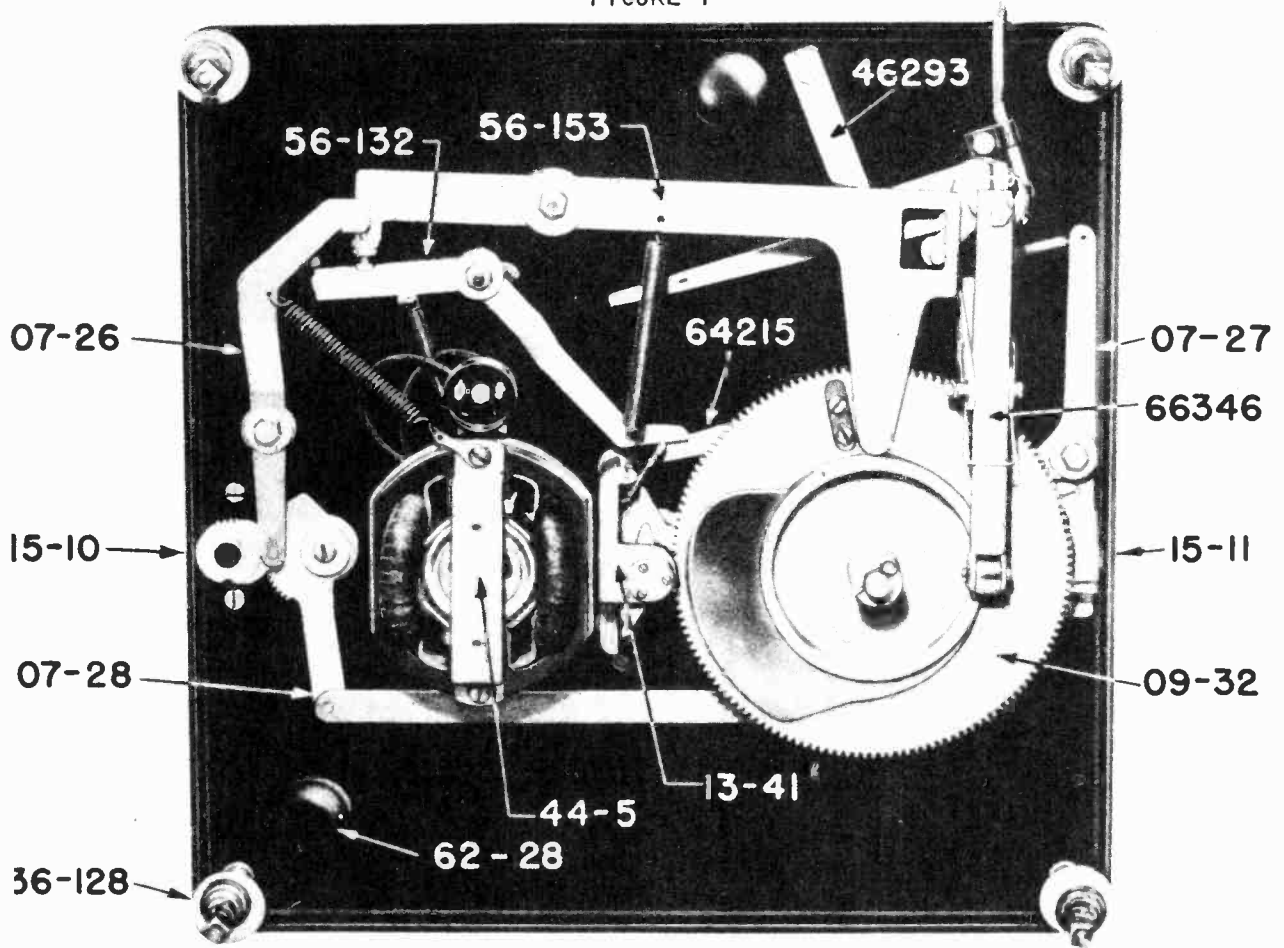


FIGURE 2

MODEL P-2 CAPEHART
(Part 1)

FARNSWORTH TELEV. & RADIO CORP.

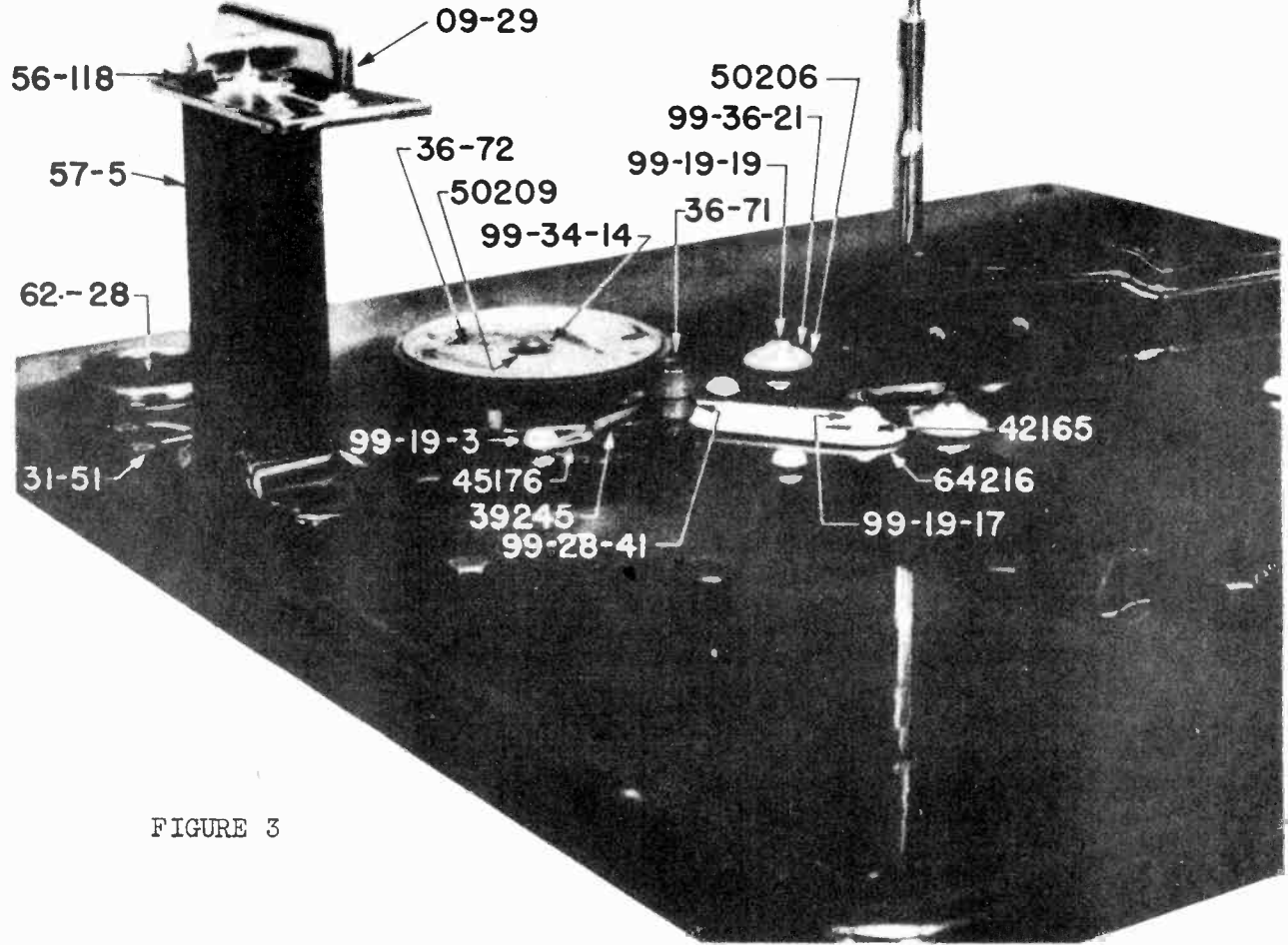


FIGURE 3

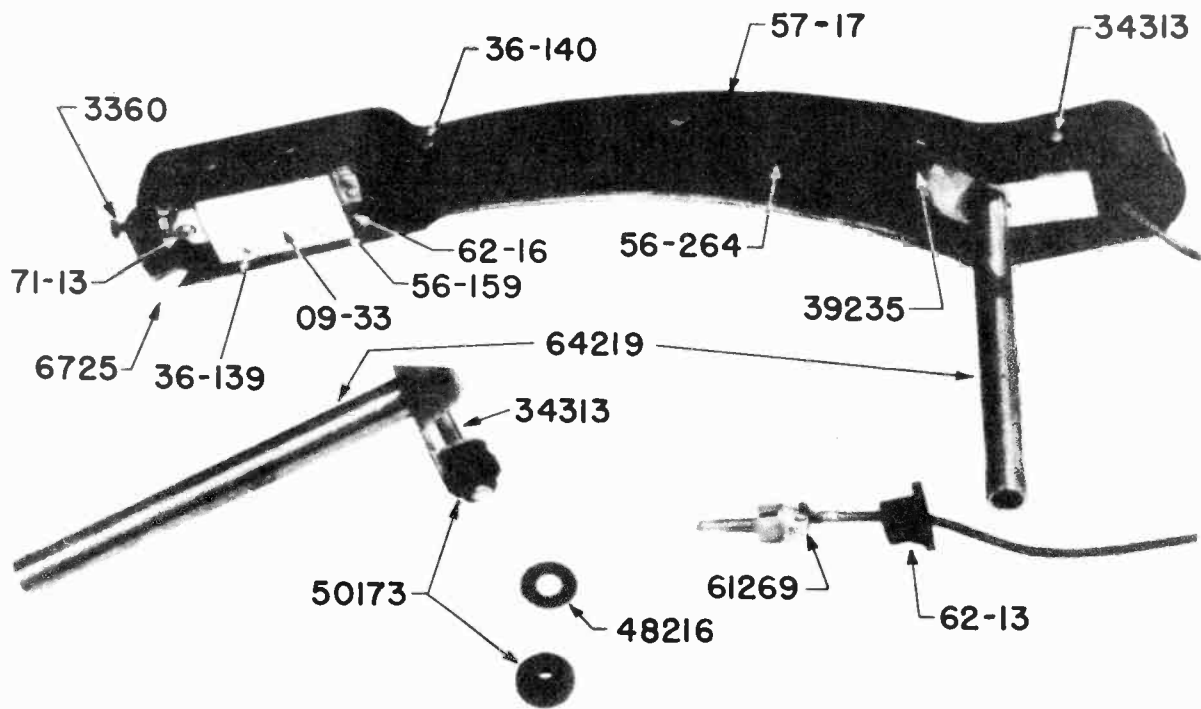


FIGURE 4

FARNSWORTH TELEV. & RADIO CORP.

MODEL P-2
CAPEHART
(Part 1)

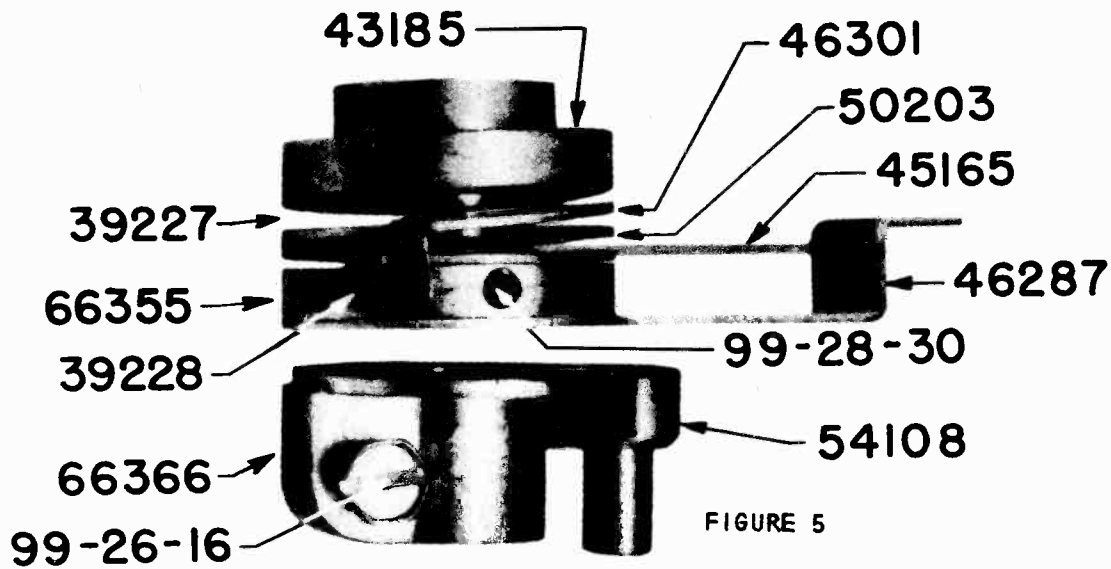


FIGURE 5

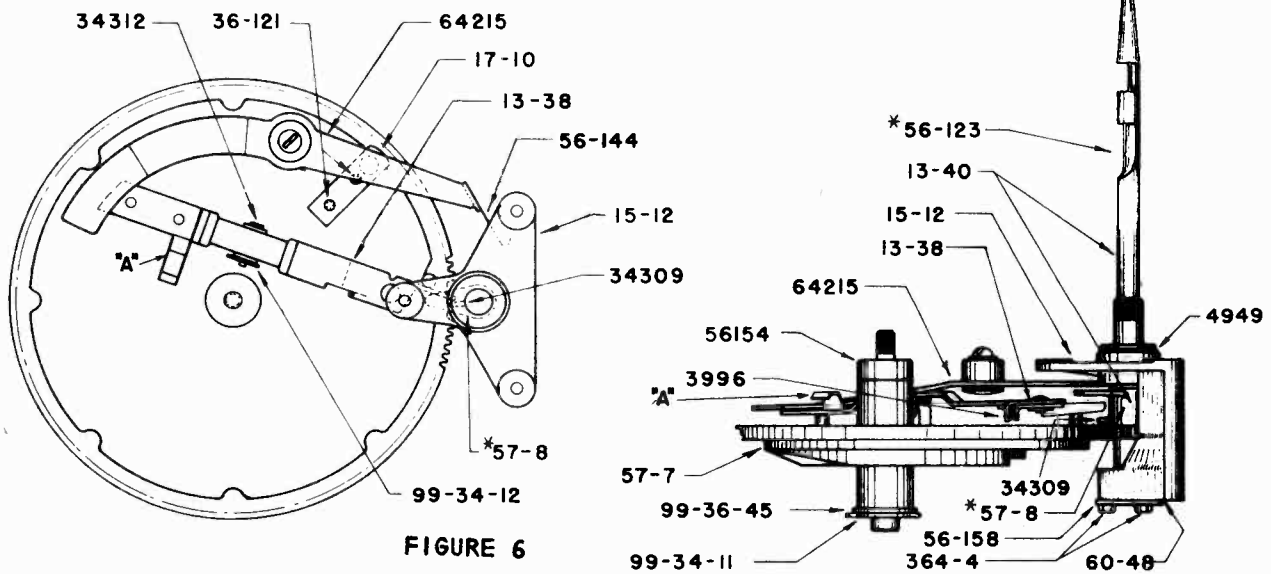


FIGURE 6

FARNSWORTH - MODEL P-2 MOTOR DATA

Although standard speed of phono motors is 78.26 rpm manufacturing requires broad tolerance of speed limits - commercial practice is 76.59 to 80.00 rpm.

New type stroboscope disc supplied by Farnsworth - is arranged for 79.23 and 77.42 as well as the 2 speeds on the older one - 78.26 and 33.33 - and the upper and lower limits above (76.59 and 80.00).

MECHANICAL ADJUSTMENTS

1. TO REMOVE THE TURNTABLE 13-51,
(Fig. 1)

The Turntable unscrews from the Record Spindle, 56-123 (Fig. 6) by rotating the Turntable counter clockwise. The Spindle Gear, 57-8 (Fig. 6) should be held by a screwdriver while unscrewing or while replacing the Turntable. Under no circumstances should you attempt to hold the Record Spindle in a pair of pliers when removing the Turntable. Care should be exercised while holding the Spindle Gear not to damage the teeth of the gear.

When replacing Turntable make sure that it is securely screwed down against the stop washer.

2. TO ADJUST OR REPLACE IDLER PULLEY
36-72, (Fig. 3)

The Idler Pulley is used to transfer power from the Motor Pulley 36-71 (Fig. 3) to the Turntable. Unless it is held under proper tension by the Idler Spring the turntable speed may be too high or too low, it should fall between 76.59 RPM and 80.00 RPM. This tension is adjusted by loosening screw 99-19-3 (Fig. 3) holding the Spring Holder 45176 (Fig. 3) and turning the Spring Holder to secure the required tension. Be sure to tighten screw holding the Spring Holder.

To replace the Idler Pulley remove the Hair Pin Cotter 99-34-14 (Fig. 3) and the Thrust Washer 50209 (Fig. 3). After removing the Idler Pulley remove the other Thrust Washer 50209 underneath the Pulley. When replacing the Pulley it is best to replace both the Thrust Washers with new ones. A single drop of oil should be used on the Pulley Stud when the Pulley is replaced.

CAUTION--Do not allow any oil to get on either the Motor Pulley 36-71 (Fig. 3) the Idler Pulley, or rim of the Turntable.

3. TO REPLACE TURNTABLE DRIVE BRACKET AND
STUD ASSEMBLY 64216 (Fig. 3)

After removing the Idler Pulley and Spring 39245 (Fig. 3), remove the Motor by removing the three RHMS 99-19-3 (Fig. 3) then remove the two nuts and the brass washer which are normally covered by the Idler Pulley. Next remove the Screw 99-19-7 (Fig. 3) and the Spacer 42165 (Fig. 3). When replaced, the Bracket and Spindle Assembly must move in all directions without binding or sticking. Be sure the double nuts are locked securely.

4. ADJUSTMENT OF RECORD SHELVES 09-29 AND
09-30

The center line of the record shelves should form a straight line passing through the center of the Record Spindle. They should be exactly $9\frac{21}{32}$ " apart when in the 10" position and equidistant from the spindle. The shelves may be lined up by loosening the set screws on the shelf locking Cam and Gear 15-10 or 15-11 (Fig. 2). After alignment tighten set screws.

5. ADJUSTMENT LOCKING LEVERS AND SHELF
LOCKING CAM, 07-26 AND 07-27 -- 15-10
AND 15-11 (Fig. 2)

The Front Record Shelf 09-29 (Fig. 1) should be lined up with the Record Spindle in the 10" position. The Shelf Locking Cam 15-10 (Fig. 2) is lined up with the center line of the Gear Sector assembly 07-28 (Fig. 2) and adjusted until the Locking Lever is properly seated in the Shelf Locking Cam 15-10. The set screws of the Cam and Gear assembly are then tightened.

The rear record shelf 09-30 (Fig. 1) should be lined up with the Spindle and in the 10" position. The Locking Lever Hex-Head mounting screw 36-114 may be loosened if the adjustment of the Locking Lever to the Cam and Gear Assembly need be changed.

FARNSWORTH TELEV. & RADIO CORP.

MODEL P-2
CAPEHART
(Part 1)

the two felt washers in the Spindle Gear Bracket. One washer is located at the bottom of the Spindle Gear, the other is at the top of the bracket and is accessible by removing the Turntable. Two or three drops of oil on the felts in the Motor. One drop of oil on the Pin for the roller of the Tone Arm Lift Lever. A very light application of White Vaseline on the teeth of the Main Cam, also some on the face of this Cam where the Tone Arm Swing Lever rides. A single drop of oil on the 10" and 12" plungers. Care should be exercised to prevent an excess of oil being used on any part.

No further lubrication of the tone arm bearing will be necessary unless a replacement is made. On this case a thin film of vaselline may be used.

Care should be taken to see that no oil gets on the motor pulley, idler pulley or rim of the turntable. No oil should be used on the Friction Trip Assembly.

Use only a good grade of machine oil with a viscosity of SAE 10.

12. STARTING PIN 34309 AND STARTING LEVER 13-38 (Fig. 6)

The Starting Pin 34309 (Fig. 6) is normally driven into the Spindle Gear 57-8 (Fig. 6) until the square end is flush and the pointed end projects about 1/8" and should engage the end of the Starting Lever 13-38 to allow the teeth of the Main Cam to mesh with the Spindle Gear without topping. Two adjustments are possible if the teeth do not engage properly, either drive the Starting Pin in further or bend the end of the Starting Lever.

13. MOTOR SPEED

Due to commercial tolerances it is impossible to secure motors which will run at exactly 78.26 RPM. Our limits are from 76.59 RPM to 80.00 RPM.

14. The following simple OILING INSTRUCTIONS will result in a minimum of service calls—

Every six months or once each year, two or three drops of oil should be put on

Loosen Lock Nut 99-11-6; these are part of 56-153 and adjust Screw 99-18-15 until the needle drops 5-7/8" from the center of the Record Spindle. Be sure nut 99-11-6 is tightened after adjustment is made.

10. ADJUSTMENT OF TONE ARM 71-12 (Fig. 1)

With records on the shelves, the top of the pickup arm at the highest point in its return should be 3/16" below the bottom of the bottom record on the shelves.

Adjustment -- Loosen Lock Nut 99-13-5. adjust Screw 99-26-17 parts of 66346 (Fig. 2) to secure proper clearance. Be sure Lock Nut is retightened.

With the tone arm 71-12 off the record and off the rest the needle should clear the top of the base plate from 3/16" to 5/16". Adjustment is made by bending the front lip of 64219 (Fig. 4).

The Pickup Brush 6725 (Fig. 4) should be adjusted so the needle pressure is from 2 oz. to 2-1/4 oz.

11. TRIP MECHANISM - (Fig. 5)

The proper adjustment of the Trip Mechanism is, when the needle is 1-7/8" from the center of the record spindle, the Trip Finger 46287 (Fig 5) trips the Starting Lever Release Trip 07-31 (Fig. 6).

To adjust tension loosen Bristol Set Screw 99-28-30 in Upper Collar 43185 (Fig. 5). Turn collar counter clockwise to increase friction (if changer does not trip at end of record) and clockwise to decrease friction (if changer trips before the end of the record). There should never be any more friction than is necessary to move Starting Lever Release Trip 64215 (Fig. 6) off the end of the Starting Lever 13-38 (Fig. 6).

Excessive friction will cause a loud click each revolution of the turntable after a part of the record has been played

ADJUSTMENT OF MON TRIP CAM OF STARTING LEVER 13-38 (Fig. 6)

This Cam shown at "A" in (Fig. 6) should be adjusted so that when the machine is in the "Manual" position, the Starting Lever Release Trip 64215 (Fig. 6) will pass over the end of the Starting Lever 13-38 (Fig. 6) without touching. The front end of the Starting Lever must also clear the bottom of the Resetting Dog and the top of the Starting Pin both part of the Spindle Gear 57-8 (Fig. 6)

7. ADJUSTMENT OF TRIP PIN ASSEMBLY 17-10 (Fig. 6)

Both the 10" plunger 56-116 and the 12" plunger 56-117 (see 09-30 Fig. 1) should extend over the edge of the Record Shelves from .010" to .025". This distance may be changed by adjusting the Trip Pin Assembly 17-10 on the Main Cam. Care should be exercised to see that the Trip Pin assembly is not set over too far as it can bind on the plunger cam and jam the changer.

8. THE TRIP FINGER STOP 46293 (Fig. 2)

The Trip Finger Stop 46293 should be 2-1/4" from the inside of the base plate to the inside face of the 90° bend at the end of the Stop.

9. NEEDLE LANDING

In 10" position, adjust the Tone Arm Crank 66366 (Fig. 5) so the needle lands 4-7/8" from center of the Record Spindle. To adjust have record changer in playing position, loosen Tone Arm Set Screw 99-26-16 (Fig. 5) set needle 4-7/8" from center of Record Spindle. Hold Tone Arm Crank firmly against Tone Arm Swing Lever 56-153 (Fig. 2) at the same time hold the Tone Arm Crank firmly up against the Trip Finger 46287 (Fig. 5). Tighten the Set Screw 99-26-16. There should be a small amount of play up and down in the tone arm. Next set the 12" drop. To adjust set the record shelves for 12" records and have record changer in playing position.

PARTS PRICE LIST

DESCRIPTION

PART NO.

LIST PRICE

07-26	Locking Lever Assembly, Front.	•••••	\$.15
07-27	Locking Lever Assembly, Rear	•••••	.15
07-28	Connecting Link Assembly	•••••	.65
09-28	Tone Arm Return Lever Assembly	•••••	.40
09-29	Front Record Support Shaft Head Assembly	•••••	1.35
09-30	Rear Record Support Shelf Head Assembly	•••••	2.00
09-32	Main Cam Assembly	•••••	2.40
09-33	Crystal & Bracket Assembly	•••••	3.40
11-25	Pick-up, Lead, Grommet and Plug.	•••••	2.00
13-38	Starting Lever Assembly	•••••	4.75
13-39	Plunger Shaft and Cam Assembly	•••••	.40
13-40	Spindle & Gear Assy. needs 1-34309 pin to complete	•••••	.35
13-41	Turntable, Gear and Bracket Assy	•••••	1.80
15-10	Gear & Cam Assy, Front Shelf	•••••	3.40
15-11	Gear & Cam Assy, Rear Shelf	•••••	2.00
15-12	Spindle Support Bracket Assy	•••••	.80
17-10	Trip Pin Assy.	•••••	1.35
36-110	Spacer Washer - Gear Sector.	•••••	.25
36-111	Spacer Washer Gear Sector.	•••••	.10
36-112	Washer Tone Arm Return Lever	•••••	.10
36-114	10-32 x 21/32" H.H.M.S. Reject Lever, Locking Lever & Gear	•••••	.10
36-116	10-32 x 1/4" Hex. Head M. Screw, Lift Lever Bracket.	•••••	.10
36-117	10-32 x 1/4" Hex. Head M. Screw, Locking Lever	•••••	.10
36-119	8-32 x 3/8" Bind H.H.S. - Shelf Posts.	•••••	.10
36-120	8-32 x 5/16" Bind H.H.S. Tone Arm Support.	•••••	.10
36-121	6-32 x 1/4" Bind H.H.S. Trip Pin Assy.	•••••	.10
36-122	4-36 x 5/16" F.H.M.S. (Phillips) Record Support Head Assy.	•••••	.10
36-127	Cup for Mounting Spring.	•••••	.10
36-128	Mounting Bolt.	•••••	.10
36-129	1/4-28 Nut, Main Cam Stud.	•••••	.10
36-136	Washer	•••••	.10
36-137	Bottom Spring Retainer	•••••	.10
36-139	#4 x 5/8" F.H. Self Tapping Screw, Crystal Bracket	•••••	.10
36-140	#4 x 1/4" Phillips S.S.	•••••	.10

MODEL P-2 CAPEHART
(Part 1)

FARNSWORTH TELEV. & RADIO CORP.

PART NO.	DESCRIPTION	LIST PRICE	PART NO.	DESCRIPTION	PRICE LIST
36-142	#8 x 1/2" Self Tapping Screw, Motor Plug.	.10	39227	Spring, Flat, Friction Trip Assy.	.10
36-231	Hex. Head Bolt, Rear Gear Sector & Reject Lever	.10	39228	Spring, Coil, Friction Trip Assy.	.10
364-4	6-32 x 1/4" H.H.M.S., Spindle Thrust Plate.	.10	39229	Spring, Tone Arm Lift Lever.	.10
44-5	Motor 60 cycle 110 Volts.	7.00	39234	Spring, Tone Arm Return Lever.	.10
44-8	Motor 25 cycle 110 Volts.	9.50	39235	Spring, Clip Long.	.10
44-14	Motor 50 cycle 110 Volts.	7.50	39236	Spring, Reject Lever.	.10
56-100	Starting Lever End.	.10	39245	Spring, Idler Pulley.	.10
56-102	Gear Sector & Spindle Bracket Spacer.	.10	4058	Roller, Tone Arm Lift Lever.	.10
56-103	Tone Arm Return Lever Spacer.	.15	42165	Spacer, Idler Bracket.	.15
56-104	Connecting Link.	.15	43182	Tone Arm Lift Rod.	.15
56-106	Rivet for Starting Lever End.	.10	43185	Collar, Upper, Friction Trip	.30
56-112	Shelf Locking Lever Spacer.	.10	45165	Friction Trip Lever.	.10
56-116	Plunger for 10" Record.	.20	45176	Tension Spring Holder (Turntable Pulley)	.10
56-117	Plunger for 12" Record.	.20	46287	Trip Finger.	.10
56-118	Plunger for 12" Record.	.10	46291	Tone Arm Lift Lever.	.20
56-119	Spring for 56-116	.10	46292	Bracket Tone Arm Lift Lever.	.15
56-120	Spring for 56-117	.10	46293	Trip Finger Stop.	.10
56-121	Set Screw for Plunger 56-118.	.10	46301	Friction Trip Stop Disc.	.10
56-122	Spacer for Rear Locking Lever.	.20	46301	Friction Trip Stop Disc.	.10
56-124	Gear Sector Shelf Drive, Front.	.20	4949	Washer, Fish Paper, Tone Arm	.10
56-132	Reject Lever.	.15	50173	Rubber Bushing, Tone Arm	.10
56-134	Needle Cup Cover.	.15	50203	Cork Washer, Trip Friction Drive Disc, Large	.10
56-139	Plunger Support Bracket	.15	50204	Cork Washer, Tone Arm to Base, Small.	.10
56-144	Starting Lever Spring	.10	50206	Rubber Grommet	.10
56-153	Tone Arm Return Lever	.30	50209	Thrust Washer, Drive Disc.	.30
56-154	Stud, Main Cam.	.30	54108	Tone Arm Crank	.10
56-155	Spacer Sleeve, Reject Lever	.10	6069	Reject Button.	.15
56-158	Spindle Thrust Plate.	.10	61269	Plug for Part 11-25	.15
56-159	Crystal Mounting Bracket.	.10	64214	Release Trip & Hub Assy.	.40
56-163	Flng. Bracket for Motor.	.10	64215	Starting Lever Release Trip Assy	.50
56-181	Shelf Drive Gear Sector, Rear	.20	64216	Idler Bracket & Stud Assy.	.15
56-284	Tone Arm Brace.	.35	64219	Tone Arm Bracket Assy.	.40
56-353	Pulley For 25 Cycle Motor	.10	66346	Tone Arm Lift Lever & Bracket Assy	.70
56-364	Turntable Drive Pin Spring.	.10	66347	Tone Arm Lift Lever & Roller Assy.	.40
56-365	Turntable Drive Pin Housing.	.45	66351	Friction Trip Assy.	.85
57-1	Tone Arm Support Shelf, Front	1.15	66355	Collar, Pin & Set Screw Assy.	.35
57-2	Record Support Shelf, Rear	.65	6725	Brush.	.20
57-3	Record Support Shelf, Rear	.85	99-11-6	6-32 Nut 5/16" Flat, Tone Arm Return Lever.	.10
57-4	Record Support Post.	.60	99-12-1	8-32 Nut 1/32 x 1/8" Idler Bracket & Tone Arm Rest	.10
57-5	Spindle Support Post.	1.05	99-12-3	8-32 Nut 1/4" x 3/32"	.10
57-6	Spindle Support Bracket	1.30	99-13-5	10-32 Nut 5/8" x 1/8", Tone Arm Lift Lever, Locking Lever and Gear Sectors.	.10
57-7	Main Cam.	.80	99-13-6	10-32 Nut 5/16", Reject Lever.	.10
57-8	Spindle Gear (Part of 13-40).	.10	99-14-5	1/4" Nut 28 Nut 7/32" Thick.	.10
57-17	Tone Arm Housing Only.	.10	99-18-15	6-32 x 7/16" RHMS, Tone Arm Return Lever	.10
59-48	Reject Button See 6069.	.10	99-19-17	8-32 x 5/16" RHMS, Rear Lock Lever and Starting Lever.	.10
60-48	Gasket, Paper, Spindle Thrust Plate	.10	99-19-19	8-32 x 7/16" RHMS, Spindle to Base	.10
62-13	Grommet for Pickup Cord	.10	99-26-16	10-24 x 1/2" RHMS, Tone Arm Crank.	.10
62-16	Crystal Mounting Cushion.	.15	99-28-31	Set Screw 6-32 x 1/4" Bristol, Friction Trip Assy.	.10
62-28	Rubber Needle Cup	.10	99-28-41	6-32 x 3/16" Bristol Set Screw, Gear & Cam Assy.	.10
64-11	Spring for 56-118	.10	99-34-11	6-32 x 1/8" Bristol Set Screw, Motor Pulley.	.10
64-13	Spring, Rear Locking Lever.	.10	99-34-11	Hair Pin Cotter, Main Cam Stud Assy.	.10
64-14	Spring Top, Mounting	.10	99-34-12	Hair Pin Cotter, Tone Arm Lever & Roller Assy.	.10
64-15	Spring Bottom, Mounting	.10	99-34-13	Hair Pin Cotter, Tone Arm Lever Roller & Bracket Assy.	.10
64-16	Spring, Front Shelf	.10	99-34-14	Hair Pin Cotter, Idler Pulley.	.10
71-12	Tone Arm & Pickup Assy.	7.80	99-36-1	Washer, Starting Lever End	.10
71-13	Pickup and Lead Assy.	4.25	99-36-9	Washer, Motor Spacer & Locking Levers	.10
80-28	2 Prong Male Motor Plug	.25	99-36-21	Washer Brass, Spindle Bracket.	.10
3167	Tone Arm Rest	.10	99-36-38	Washer, Connecting Link Assy.	.10
3364	Shoulder Bearing, Clutch Locking Lever.	.10	99-36-45	Washer, Idler Bracket.	.10
3360	Needle Screws.	.10	99-37-2	Washer, Main Cam Assy.	.10
34312	Pin, Tone Arm Assy. or Lift Lever Roller	.10	99-41-7	Spring Washer, Gear Sector.	.10
34313	Pin, Tone Arm Hinge	.10	99-42-10	Eyebolt for 56-144 Spring	.10
34316	Pin, for 66346	.20	99-42-11	Turntable Stop Washer.	.10
3671	Pulley, Motor, 60 Cycle	.75			
3672	Pulley, Idler	.35			
3681	Pulley, Motor, 50 cycle	.10			
3996	Spring, Starting Lever.	.10			

All prices subject to change without notice.

FARNSWORTH TELEV. & RADIO CORP.

MODELS P-2, P-3

CAPEHART

(Part 2)

THE MODEL P-3 IS THE SAME AS MODEL P-2 EXCEPT THAT
THE MODEL P-3 HAS A PLAY CONTROL ADDITION.

RECORDS FAIL TO DROP

- A. Failure of records to drop may be due to:
1. Shifting of the spindle assembly, causing it to be too close to rear record shelf.
 2. Shifting of record shelves.
 3. Excessive pressure or jamming of spring between head of plunger and its housing of 12" plunger spring.
 4. Record release plunger does not extend sufficiently beyond edge of record shelf.
 5. Over size diameter record or center hole of record eccentric with relation to rim of record.

The first step in checking this operation is to determine if all adjustments are correct.

The spindle assembly should be checked first to determine if it is correctly centered. Loosen the three mounting screws. The rubber grommets in this assembly will tend to automatically center it when the screws have been loosened. Now retighten carefully. Turn screws all down evenly, do not tighten one fully - and then the balance. It is best to tighten the left hand screw first - this will be less likely to shift the spindle assembly out of line. Careful checking with a 12" record as a gauge will indicate if the spindle assembly has shifted, and in which direction.

- B. The relative position of the record shelves should next be determined as described in the service notes. If either shelf (usually the rear) is too close to spindle or front shelf, the two screws holding the rear side of the record post to the base plate should be retightened as securely as possible. If this does not correct the condition, it will usually be found that there is a fiber shim between the rear edge of the post and the base plate, which can be removed by loosening the two screws and driving a thin wedge under the rear side of the post. The shim can then be worked out with a knife - and the screw retightened securely after the wedge is removed.

Make sure that the record release plunger on the rear record shelf - when in full release position - extends up to 1/32" beyond the extreme edge of the record shelf.

If record release plunger acts sluggish make sure there is no metal burr or dirt retarding its action.

More effective release action can be obtained by filing the release plunger so as to have a slight downward taper - this taper or undercut should not exceed 15 degrees. Filing the release plunger so as to have a taper or undercut will facilitate releasing records which are slightly oversize.

IF TWO OR MORE RECORDS DROP

This condition might be caused by:

1. Rear shelf release plunger sticking or sluggish due to a burr or dirt.
2. Plunger support, part #56-125 below base plate has shifted to either side. 12" retard plunger in front shelf has stuck in its housing. (early production).
3. Front or rear record shelf has shifted outward.

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screw in lower collar and turn the collar slightly clockwise facing from the underside of the changer.

2. Tripping before the end of a record may also be caused by the friction trip assembly being too tight. Cure is to loosen set screw in upper collar #43185 and turn collar slightly clockwise facing from the underside of the changer. This threaded collar regulates the pressure on the friction clutch assembly.

3. Another condition which can cause premature tripping during the playing of the latter part of the record is improper setting of the spring blade #56-144 on release trip assembly #64215. Under normal conditions this spring should be bent in toward the spindle approximately 1/16".

4. It is also possible that the bushing holding the release trip #64215 to the base plate may work loose due to handling in transportation. Such a condition can cause premature tripping and can be remedied by removing the turntable and tightening the screw holding the bushing.

In connection with the above it should be mentioned that holding the reject button rigidly in reject position during changer operation is detrimental to the life of spring #56-144 and may subsequently cause the mechanism to trip prematurely. A quick flip of the reject button is all that is necessary to trip the mechanism.

If the P-2 changer trips without playing a record or the reject button fails to trip the mechanism, it is possible that the friction trip lever part #45165 may be binding on the reject lever part #56-132.

To overcome this condition it may be necessary to spring the friction trip lever part #45165 up toward the base plate slightly or the same result will be accomplished by springing the reject lever part #56-132 down away from the base plate slightly.

Either of the above conditions may be noticed when the instrument is first unpacked and are usually caused by rough handling during shipment, due to the fact that the tone arm is held against the spindle during shipment and when in this position the friction trip lever is held in place over the reject lever.

RECORD WILL NOT TRIP

1. If the changer will not trip when it enters the change grooves and will not trip by the reject button, there may be an excessive amount of hard oil on the bearing of the starting lever #13-38. This trouble can be cleared up by cutting the hard oil off with some light machine oil.

2. If the changer will not trip by a fast carry-in of the tone arm within 3-1/2" of the spindle but will trip in normal change grooves, the friction trip assembly is too loose. Turn upper collar #43185 counter clockwise slightly.

3. It is possible during handling in shipment that the end of trip finger #46287 may become jammed either above or below the starting lever release trip lever #64215. The trip finger can be released by hand from the underside of the changer.

4. Motor spindle assembly has shifted forward.
5. Rear plunger springs for 10" or 12" records has shifted out of place - too short.

MARRIED CENTER HOLE OF RECORD

We are receiving some reports to the effect that the center hole in records is being excessively worn. This condition may be experienced on 10" records, but is more likely to occur on the 12" records.

A. Condition is not general on 10" records because of lightness of record. 10" record weight between six to seven ounces.

B. 12" records are more likely to be effected due to its larger diameter and extra weight, approximately 3/4 pound.

1. The marring of the center hole of the record may be due to the beveled edge corner on the lower taper of the spindle. The difficulty is more likely to happen if the record happens to have a center hole, which is slightly under size, or if the center hole has sharp or uneven edges. Marring of the center hole is more likely to happen on the first and second records dropped from a stack, due to the increased angle of fall. When more records are on the turntable the fall is less, reducing the angle.

An effective remedy is to dress the edge of the bevel on the lower taper on the spindle. This can be done with a very fine file or emery paper just breaking the shoulder or corner on each side of the bevel on the lower taper of the spindle (see figure 1).

As a result of the above conditions, it is possible on rare occasions that a record may be broken or badly cracked.

2. Damage to the center holes in records is frequently caused by the party operating the machine, lifting off a stack of records and marring the center hole by having them catch in the cut out portion of the spindle. A stack of records should always be removed by compressing them firmly with both hands and lifting them upward along the straight side of the spindle in as near a horizontal plane as possible.

ERRATIC OPERATION OF TRIP MECHANISM

Some reports state that the mechanism will not trip at the end of the record. Others that it trips too soon, that the record will be playing along and for no apparent reason it will reject in the middle of a record. The erratic operation of the trip may be due to too little or too much tension caused by the convex spring in the friction clutch. This convex spring is convexed to approximately 1/16". If for any reason it has been excessively tightened, its correct tension may have been destroyed, or if it is not sufficiently tight, it may not operate properly. Improper adjustment of the friction clutch is likewise responsible for excessive clicking noise and which occurs at each rotation of the turntable.

TRIPS BEFORE END OF RECORD

1. This is usually caused by collar #66355 being turned too far counter clockwise thereby causing the spring #39228 to trip the changer before the needle comes within 1-7/16 inches of the spindle. Cure is to loosen set

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PICKUP BRUSHES

are set for a standard 5/8" needle inserted fully in the pickup cartridge. If longer or shorter needles are used, it is obvious that a change will have to be made in the brush adjustment. The setting of the brush should be such that the brush bristles just engage in the record groove and affords the proper amount of inward motion, without holding the needle from making full contact with the record.

PICK-UP BOUNCES OR JUMPS A FEW GROOVES

We have received a few reports to the effect that the pick-up will occasionally bounce or jump a few record grooves. It has been observed when this occurs that the flexibly mounted motor board has been set in motion from the record which has just been dropped into place. The method of correction is obvious and this is to slightly tighten up the spring mounting just sufficient to eliminate excessive floating of the motor board.

Another factor which is important in this connection is the record brush adjustment, adjust as per section "F".

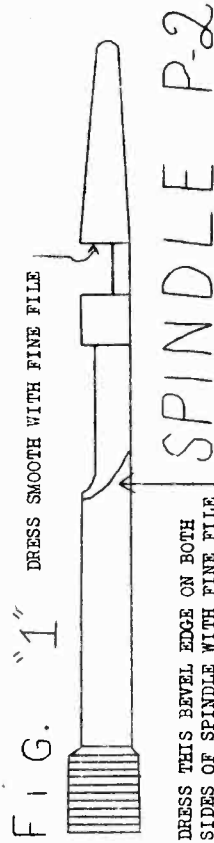
Since the record changer is mounted in its cabinet in such a way as to make quick removal possible it is sometimes very desirable to remove it before making certain adjustments. To remove, pull the AC plug on the phono motor and remove the polarized pickup plug from its socket in the radio chassis. Reasonable care should be exercised to prevent the shielding on the pickup cord from being torn when it is loosened from the cabinet mounting, since this may cause a heavy hum during phono operation. Remove the shipping and hold-down clamps on the lower end of the four mounting bolts on the changer and with the cabinet lid opened completely lift the instrument up gently, tilting the front side up first.

The following adjustments are easily made without removing the changer from the cabinet:

1. 12" needle landing.
2. Spindle placement with relation to record shelves.
3. 10" needle landing.
4. Tone arm lift.
5. Spring trip adjustment.

On the following items it is desirable to remove the changer.

1. Record shelf positioning with relation to spindle.
2. Friction trip adjustments.
3. Aligning record shelves.
4. Record plunger adjustment.

TRIP ADJUSTMENT

The friction trip arrangement consists of:

1. The upper collar #43185.
2. Spring wave washer #39227.
3. Cork washer #50203.
4. Friction trip lever #45165.

This trip is so arranged that it will trip release lever #64215, when the tone arm moves inward more than the width of three grooves in one revolution of the turntable after the needle has played to within 3/4" of the spindle. This friction trip arrangement will take care of standard records which are only partially transcribed, such as the last record of an album, which may not carry the change grooves to the center of the record.

To further insure that records will trip properly, a spring trip arrangement consisting of friction trip stop disc #46301, lower collar #66355, and spring #39228, is also used. Collar #66355 is adjusted so that when the needle is 1-7/8" from the center of the spindle, the spring #39228 will pull the lip of the stop disc #50203 against the lip of the friction trip stop lever #45165 and thereby trip the mechanism at any farther carry in of the tone arm.

If the changer will trip by a fast carry in, but occasionally does not trip in the change grooves, the spring trip assembly may be at fault. Turn the lower collar #66355 slightly counter clockwise and check operation.

CLICKING SOUND

A clicking sound each revolution of the turntable is caused by the resetting dog hitting the spring #56-144. The click may be eliminated or minimized by loosening the friction trip assembly to the lowest pressure that will give consistent trip action.

Excessive clicking noise with the friction trip set at proper tension may be caused by using records with enlarged center hole or records on which the grooves are not concentric with the center hole.

SQUEAKING NOISE

This condition may be due to the following:

1. Hole in record under size.
2. Hole in record off center or not concentric with relation to the rim of the record.
3. Oversize diameter of record which causes excessive record pressure against rear record support post and causes record to bind against spindle.
4. Top edge of upper cut out of spindle too sharp; dress with fine file (see figure 1).
5. Front record shelf too far from spindle allowing undersize record to rest in the rounded edge of the shelf and forcing the record back against the spindle and rear shelf.

When the squeaking noise is not caused by record pressure on the spindle, and is heard only at some time during the changer cycle, the trouble may be due to the following causes.

6. Lack of lubrication on tone arm lift roller #4058.
 7. Vibration of tone arm return lever on main cam.
- Remedy by pressing return lever hard against the cam by hand during three or four change cycles.

REFERENCE TABLE FOR AUTOMATIC MECHANISM ADJUSTMENTS

Symptom	Check and Correct
Does not play automatically.	Solenoid relay circuit and S2, S5, S6, L1, L8. Section 19, 20. S4 under recording arm open.
Keeps on repeating automatically.	Check S1, S2. Section 15, 26, 27.
Trips before record is finished.	Section 27.
Does not trip at end of record.	Section 27, 26.
Does not feed new record.*	Section 2, 3, 1
Record does not center on turntable.	Section 1, 7, 9, 10.
Does not reverse records properly.	Section 1, 8, 11, 12, 13, 28.
Does not reverse record.	Section 1, 8, 18, 28, 25.
Pickup does not land correctly on record.	Section 5, 6, 16, 17, 14.
Chatter while changing record.	Section 21, or short circuit in relay trip system.
Ringing noise while changing record.	Section 4.
Record Selector Lever does not work properly.	Section 25, 23, 18.

* Make sure record is not warped or chipped or has rough edges.

NOTE: When Automatic Mechanism jams, shut Master "Power" Switch "OFF" before clearing the jam, as the turntable "Motor Switch" does not shut power to the motor off while the mechanism is in cycle.

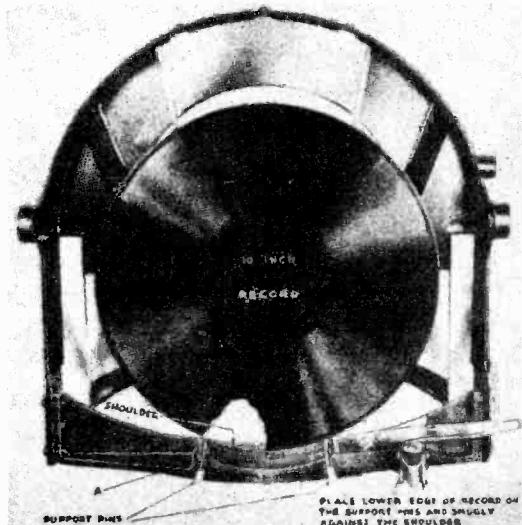
Note:—When mechanism jams upon first being played after being unpacked, check to see whether the record magazine is lined up as stated in Adjustment 7. Also check to see if the Record Reverse Arm Lock No. 46 Fig. 2 is on top of the Record Reverse Arm Lock Stop No. 48 Fig. 2.

1. MAGAZINE LINK ADJUSTING SCREWS ("D") (Fig. 1).

The record magazine should always come back snugly against the magazine stop screw, "C," Fig. 1. If it does not, it is necessary to loosen the two set screws ("D," Fig. 1) to a sliding tension and run the record changer through a cycle of change. When the magazine has reached the horizontal position, as shown in Fig. 1, press down on the lower end of the magazine; this will lengthen the link assembly. Then when the magazine returns to its normal position, the magazine link will adjust itself so that the magazine is snugly against the stop screw. Then tighten the magazine link screws "D."

2. RECORD SEPARATOR ADJUSTMENT.

The separator stop "J," Fig. 1, should be adjusted so that a small 10" record will positively clear the knife portion of the separator lever as shown in the following illustration. A



standard to use is to make certain that there is approximately $\frac{1}{32}$ " clearance between the edge of the small record and the point of the separator lever, as shown at "A" in illustration below. However, it may be necessary to vary one way or the other from this measurement, depending on whether or not the slotted end of the record separator lever goes over the hook (7) (Fig. 1) without binding.

3. RECORD SEPARATOR HOOK ADJUSTMENT.

After adjusting the record separator it will be necessary to check the record separator hook (7) (Fig. 1) to see that it enters the slot in the record separator without binding. This hook is threaded and by loosening the locknut the hook can be turned in either direction, to raise or lower it. After the correct adjustment is obtained, tighten the locknut.

It should never be necessary to change these adjustments on record changers unless they have been tampered with by an inexperienced person.

SEPARATOR HOOK AND ARM (7) (Fig. 7).

Be sure set screw "K" in Fig. 4 is screwed all the way in.

4. RECORD MAGAZINE BUSHING (13) (Fig. 1).

If a ringing noise is heard while the instrument is changing records, i. e., such a noise that might be made by a spring, it will be found that the Durex bushing (13) (Fig. 1) is too tight, in which case it will be necessary to loosen the lock nut of the holding bolt, and back the bolt out, from a quarter to a half turn, then tighten the lock nut.

5. TO ADJUST THE TONE ARM HEIGHT.

To adjust the tone arm height, first place a 12" record on the turntable and adjust the tone arm stop lever (18) (Fig. 1) so that the record hits the rubber roller (21) (Fig. 1) in the center. Start the record changer through a cycle and stop it when the tone arm lever hook (22) (Fig. 1) just touches the stop lever assembly. In this position adjust the tone arm height so that the top of the stop lever is the same height as the center of the hook. This adjustment is made by loosening the two Allen set screws at the rear of the tone arm.

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These Allen set screws are accessible by raising the tone arm by hand. After making the height adjustment it is necessary to make certain that there is a clearance of approximately $\frac{3}{8}$ " between the pickup head and the record tray. This distance may be checked between the bottom of the record tray and the bottom of the pickup when the record tray is approximately parallel with the pickup.

6. TO ADJUST THE STOP LEVER HOOK (22) (Fig. 1).

Always adjust the tone arm position on a 12" record before adjusting for a 10" record. Adjust the tone arm stop lever hook (22) (Fig. 1) by moving it in or out. This hook is locked in place by a set screw in the stud whose nut is shown in Fig. 1 as No. 2. This set screw is at the bottom of this stud. Adjust the hook so that it will pass through the notch in the pickup arm lever (18) (Fig. 1) without binding against the top or bottom of the notch, when in the playing position. With a 12" record on the turntable, the rubber roller (21) (Fig. 1) against the edge of the record and the stop lever hook (22) against the blade of the stop lever (18) the needle should stop on the record exactly $\frac{3}{32}$ " from the edge of the record.

With the record changer in exactly the same position as described above, and with a 10" record on the turntable and the hook (22) (Fig. 1) against the blade, the stop lever should allow the needle to stop on the record $\frac{3}{32}$ " from the edge of the 10" record. A 6-32 screw shown in Fig. 1 is provided for making this adjustment, simply by screwing it in or out. A check should be made for clearance between the roller and the tray, this roller should never bind on the record tray. This can be taken care of by slightly bending the tone arm stop lever (18) (Fig. 1) up or down. If it is necessary to bend the stop lever it will be necessary to re-adjust for 12" records.

7. THE ADJUSTMENTS OF THE RECORD MAGAZINE.

Before attempting to adjust the magazine, be sure that the center of the magazine pivot pins (6) (Fig. 1) is $8\frac{3}{8}$ " above the base plate. This height is very important and we recommend checking the height of the right hand pin, when looking at the magazine, before any adjustments are made.

The record magazine is positioned by moving it sideways on its bearing or pivot pins. The two set screws underneath the pivot pins lock the magazine in position. Loosen these set screws, then see that the left hand side of the record reverse assembly fork (part of 4, Fig. 2) is between $\frac{1}{32}$ " and $\frac{1}{16}$ " inside the left hand side of the Reverse crank, when looking at the magazine. That is, the left hand edge of the record reverse fork is about $\frac{1}{32}$ " or $\frac{1}{16}$ " to the right of the left hand edge of the crank. After moving the magazine, lightly set up the set screws. Then with the selector arm in the "Repeat" position swing the record reverse arm around in front of the magazine, to see whether the record guide strikes either of the record support pins (55) (Fig. 2). If the guide strikes either of the support pins it will be necessary to bend the pin away from the guide so they can not strike. If it is necessary to bend either pin, set the control lever in the "Repeat" position, then raise the record tray by hand, with a 10" record on it, observing the way the record strikes the support pins, the record should hit both pins about $\frac{1}{16}$ " from the end of the pin; if it does not it will again be necessary to adjust the pin until the record hits both pins an equal distance from the ends. If it is necessary to bend the pins, check the clearance between the record guide arms and the pins and between the arm carrying the record guide and the right hand pin. Also if the magazine has been shifted it is necessary to see that the two points, which extend down-

ward from the magazine, have ample clearance in the channels, in the record tray, which are provided for their passage. If there is possibility of the points striking it probably means the magazine has been shifted too much.

If the magazine has been adjusted, it is also necessary to see that the record separator hook (7) (Fig. 1) does not bind in the slot in the end of the record separator arm (45) (Fig. 2). If it does the section covering these parts give the adjustment.

8. MAGAZINE STOP SCREW.

The magazine stop screw "C," Fig. 1, should be adjusted so that the crank pin (part of 9, Fig. 1) is approximately $\frac{1}{16}$ " from the edge of the record reverse arm fork (part of 4, Fig. 2) which is furthest from the magazine, when the record reverse guide is in front of the magazine, that is, in the reversing position.

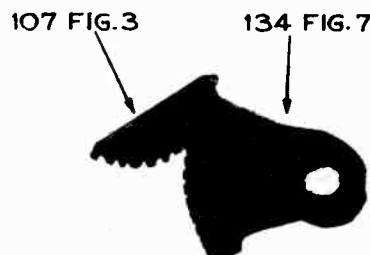
9. TO LOCATE AND ADJUST THE RECORD TRAY (29) (Fig. 2).

In assembling the record tray to the record changer, the first tooth of the driver quadrant (107) (Fig. 3) should mesh with the second tooth of the driven quadrant of the tray as shown.

With the two gears properly meshed, loosen the Allen set screws which hold pins No. 8, Fig. 1, in place. This will allow you to move the record tray sidewise, adjust tray sidewise until the turntable spindle is exactly in the center of the 10" record level of the record tray. (The 10" record level is that part of the tray where the felts No. 24 are indicated in Fig. 2.)

With the control lever in the "one side" position, run the record changer through its cycle until the large hole in the main cam is exactly half way past the upper edge of the record tray cam follower, as shown at "A," figure 1. At this position, the points of the ten-inch felts (24) (Fig. 2) should be level with the top of the turntable felt. If this tray is too low or too high, it may be adjusted to the proper level by loosening the eccentric screw (15) (Fig. 1) "B" and turning this screw until the proper level is obtained. Be sure to tighten the lock nut after adjustment.

If the tray is too high, at this position, the ten-inch records will not be centered over the turntable spindle. If the record tray is too low, the ten-inch records will slide out over the ten-inch tray shoulder and not properly center.



10. TO ADJUST THE VERTICAL BUMPER GUIDE (10) (Fig. 2).

This guide is located back of the magazine cross bar (33) (Fig. 2). After the records are separated from the magazine they are guided in dropping off the separator so they hit the center of the record bumpers (31) (Fig. 2). This vertical bumper guide also guides the records when the elevating hook, on the rear of the record tray lifts the record. The vertical bumper should be set back just far enough to allow a 12" record to drop onto the record bumpers freely. The

lower part of the vertical bumper, which extends into the record well, should extend toward the center of the well rubber bumpers far enough to make sure that the upper edges of the records fall behind the points of the upper record support (39) (Fig. 2). This adjustment is not critical. In most cases it will be found that the upper end of the vertical bumper will just clear the elevating hook on the rear of the tray. In cases where it is found that 10" records are chipping about the edges, due to bouncing against the points of the upper record support (39) (Fig. 2) it will be necessary to bend the vertical bumper (10) (Fig. 2) back at the top to a point where it just barely clears the elevating hook at the rear of the tray. It should never be bent back far enough to raise the front of the tray.

11. RECORD REVERSE GUIDE (41) (Fig. 2).

With a 12" record in the magazine the record reverse guide assembly (41) (Fig. 2) should be parallel with the record when in the reversing position, in front of the magazine.

If the record reversing assembly is parallel with a 12" record as above, it should come around and lay against the reverse guide pin tubing (42) (Fig. 2), if the eccentric cam (77) (Fig. 4) is properly adjusted. This cam can be adjusted, by loosening the screw through the cam and turning it so that the record reversing assembly returns to the reverse guide pin tubing. Care should be taken when making this adjustment so that the crank pin (part of 9, Fig. 1) does not hold the reverse guide away from the pin tubing. This cam should be turned so that the reverse guide assembly just touches the pin tubing; if the cam is turned too far it will allow the reverse guide assembly to hit the pin tubing, but in the reversing position the assembly will not be able to assume a position parallel with a 12" record.

12. REVERSE ASSEMBLY LINK ROD.

Loosen lock nut "H," Fig. 6, while the record changer is in the reversing position, that is, when the reversing assembly (41) (Fig. 2) is in front of the magazine. Remove the screw (79) (Fig. 4) holding the reverse segment link (80) (Fig. 4) to the reverse segment (61) (Fig. 4) and lengthen or shorten the link, by the link thread until the reversing crank (9) (Fig. 1) stands with the crank pin just barely touching, but not binding, against the front side of the fork (4) (Fig. 2). After the adjustment has been made, lock the link in place with the lock nut "H," Fig. 6.

13. TO ADJUST REVERSE CAM ARM AND ROLLER ASSEMBLY (57) (Fig. 3).

See Section 7 under Instructions For Replacing a Reverse Cam.

14. LATERAL LOCATION OF THE MAIN CAM SHAFT.

Both end bearings of the main cam shaft are movable, and are used to locate the cam shaft in its proper lateral position, as well as adjust the amount of end play. The main cam shaft is located laterally so that the ball in the end of the tone arm lift rod (87) (Fig. 5) travels in the exact center of the tone arm lift cam (86) (Fig. 5). As shown at "M" in Fig. 5.

15. TO ADJUST THE CLUTCH THROWOUT LEVER AND CAM.

The clutch throwout lever cam is shown as No. 125 in Fig. 7 and is adjusted by loosening the shoulder screw (69) (Fig. 7) to a sliding tension after the record changer has been stopped in the playing position. The clutch throwout lever

cam should just clear the point of the turntable throwout cam (93) (Fig. 5) with the clutch disengaged. Unless clearance between the turntable throwout cam and the clutch lever throwout cam is maintained the record changer will jam. If too much clearance is allowed the turntable throwout cam will not disengage the clutch and the record changer will continue to change records without playing them.

16. TO ADJUST THE PICKUP ELEVATION.

When the tone arm swings in towards the record, the pickup arm lever hook (22) (Fig. 1) comes to rest against the pickup arm stop lever (18) (Fig. 1) and when the tone arm lowers the pickup toward the record it pauses momentarily before the pickup arm lever hook goes through the stop lever. If the record changer is stopped during this pause, it will be found that the ball in the end of the pickup arm lift shaft (87) (Fig. 5) is at the point marked "L" in Fig. 5 on the lift cam (86) (Fig. 5). Now if the pickup, with a needle in the proper position, is moved beyond the edge of the record, the point of the needle will extend below the top surface of the record a distance equal to half the thickness of the record. The correct elevation of the pickup is made by the screw in the underside of the tone arm fork against which the pickup cover rests. Loosen the locknut, adjust the screw to bring the needle to the position mentioned above, then lock the locknut.

17. PICKUP FEED IN ADJUSTMENT.

The collar of the pickup arm swing lever and collar assembly (84) (Fig. 5) should ride on the leather facing of the friction cam (96) (Fig. 5) until the pickup arm lever hook (22) (Fig. 1) has engaged the stop lever (18) (Fig. 1). Then a slight amount of friction should be maintained after the ball at the end of the pickup lift arm (87) (Fig. 5) has engaged with the lift cam (86) (Fig. 5). This friction should be maintained until the needle has touched the record, otherwise the pickup arm may move away from the stop lever and the needle miss the record. If the friction be maintained too long the needle may be forced beyond the first playing groove. To adjust this, the pin locking the friction cam to the main cam shaft should be driven out and the Allen set screw loosened to a sliding tension. The cam is rotated forward, in the direction of rotation of the main cam shaft, to maintain the friction a longer time and backward to maintain it for a shorter time.

18. TO ADJUST THE REVERSE CAM SHIFT LEVER (105) (Fig. 7).

This lever is moved by the record control shaft (116) (Fig. 7) and is held in position by an Allen set screw. It should be positioned on its shaft so that the record reverse cam (85) (Fig. 5) is firmly engaged with its pin (74) (Fig. 4) in the "Both Sides" position. In the "One Side" and "Repeat" positions it should have good clearance with the pin. If any adjustment of this lever is made be sure to check the setting of the Reverse Cam Arm and Roller Assembly (57) (Fig. 4) as instructed in Section 7 of the instructions on replacing a reverse cam.

19. TO ADJUST THE SOLENOID MOTOR SWITCH (108) (Fig. 6).

After the switch cover has been removed the switch is exposed. The upper switch points should make good electrical contact, while the main clutch is disengaged, in this position the clearance between the bottom points should be approximately $\frac{3}{32}$ ". While the clutch moves from the dis-

engaged to the engaged position the upper switch points should remain closed until the lower set of points are closed. When the clutch is fully engaged the lower points should make good contact and the clearance between the upper points should be approximately $\frac{3}{32}$ ".

To adjust the switch loosen the screw through the bakelite switch base at the rear of the switch assembly. After the position is found where proper clearance is secured, with the clutch engaged and disengaged, the switch should be locked in position with the screw.

In some machines a headless set screw is used to lock the switch in position. This screw is near the point of the tapered bakelite insulating block. Loosen this screw and adjust switch to get proper clearance then lock the switch in position by the set screw.

The two upper contacts are in series with the auto trip switch and the two lower contacts are shunted across the motor switch. When the clutch is engaged the auto trip switch is out of circuit and the motor switch is shunted by the lower contacts thus insuring the completion of the change cycle even though the instrument is switched to radio or turned off.

20. CLUTCH CLEARANCE.

The clearance between the driven (70) (Fig. 5) and driving (99) (Fig. 5) members of the clutch should be approximately .020" (Twenty thousandths), and is adjusted by loosening screw "N" Fig. 7 to a sliding tension and adjusting the clutch fork (121) (Fig. 7) and the solenoid to clutch lever and pin assembly until the proper clearance is obtained. After adjustment is made lock the screw "N," Fig. 6.

21. TO ADJUST SOLENOID WEDGE SPRING.

This phosphor bronze spring is located on one of the three spacers used to mount the solenoid plate bracket to the solenoid bracket. It is used to prevent clutch chatter or bounce when the clutch engages. The only adjustment is to bend the spring to a snug fit with a long screw driver so as to increase or decrease its pressure on the solenoid to clutch lever (118) (Fig. 7).

22. TO ADJUST THE RECORD REPEAT LOCK LEVER (82) (Fig. 7).

The purpose of this lever is to prevent accidental shifting of the Selector Arm while the instrument is not in the playing position. In the "Repeat" position this lever is on the side of the Solenoid to Clutch Lever (118) (Fig. 7) away from the main cam. In the "One Side" and "Both Sides" positions it is on the main cam side of the solenoid to clutch lever. With the tone arm in the playing position (Main Clutch Disengaged) this lock lever should clear the solenoid to clutch lever by approximately $\frac{3}{16}$ " when moved under it.

23. TO ADJUST THE REVERSE CAM LOCK LEVER (115) (Fig. 7).

This lever should be on the main cam side of the solenoid to clutch lever when in the "Both Sides" position. And on the opposite side when in the "One Side" and "Repeat" positions. With the main clutch disengaged the lock lever should clear the solenoid to clutch lever by approximately $\frac{1}{16}$ " when moving under it.

24. TO ADJUST RECORD REPEAT THROW-OUT LEVER (119) (Fig. 7).

No adjustment of this part is necessary.

25. TO ADJUST RECORD REPEAT CLUTCH LEVER (83) (Fig. 7).

The adjustment of this lever is made by loosening the Allen set screw to a sliding tension then moving the part along the shaft. The sliding clutch should engage in the "One Side" and "Both Sides" positions, but should be disengaged in the "Repeat" position. The fork of this lever should not bind the sliding clutch in either the "Repeat" or "Both Sides" position.

26. TO ADJUST THE STOP TRIP SWITCH (137) (Fig. 8).

This switch is accessible by removing the turntable, which will expose the switch cover. To remove the switch cover it is necessary to remove the trip arm, which goes through the switch cover and the two flat head screws which hold the cover in place. The clearance between the contact points on the fixed and movable arms of the switch should be $\frac{1}{32}$ ". After replacing the trip arm (27) (Fig. 8) in the switch, after the switch cover has been removed, set the turntable on the spindle, push stop trip arm (142) (Fig. 8) slowly about $\frac{1}{4}$ " toward the magazine and then turn the turntable through one complete revolution. This will insure the fibre cam, on the turntable, resetting the trip switch, the clearance between the trip arm and the moveable arm of the switch should be $\frac{1}{32}$ ". The distance between the trip arm and the switch trip guard finger should also be $\frac{1}{32}$ ".

To adjust the clearance between the trip arm hook (27) (Fig. 8) and the moveable switch arm, loosen the screw in the bakelite switch base, at the end nearest the tone arm. Move the switch until $\frac{1}{32}$ " clearance is secured between the trip arm hook and the moveable arm of the switch, then tighten the screw holding the switch. In making this adjustment be sure that the stationary arm of the switch is not bent when tightening this screw.

On some models a headless set screw, near the end of the coil spring, is used to lock the switch in position; loosen this screw, adjust the switch, then tighten the set screw.

27. TO ADJUST THE FRICTION JOINT OF AUTOMATIC TRIP SWITCH.

The amount of friction necessary in the friction joint between the auto stop trip lever—long (27) (Fig. 8) and the auto stop trip lever—short (142) (Fig. 8) should be just sufficient to close the automatic stop trip switch (137) (Fig. 8). The friction is regulated by adjusting the screw which tightens the flat spring (141) (Fig. 8). If the tension is too great the instrument may trip before finishing a record, if not enough tension is had the instrument will not change records when the needle hits the automatic change groove.

28. INSTRUCTIONS FOR REPLACING THE RECORD REVERSE CAM AND ITS ADJUSTMENTS.

1. Set record changer in the playing position. Carefully mark the drive gear (92) (Fig. 3) on the main shaft and the driven gear as shown 81, Fig. 3, by prick punch marks or scriber, so that the same teeth can be engaged after re-assembly, thus insuring proper timing.

2. Remove the two bolts, one (60) (Fig. 3) securing the magazine slide and roller assembly to the magazine slide arm lever, and one (15) (Fig. 1) securing the record slide arm and stud assembly to the record tray drive crank.

3. Looking in from the rear of the instrument, remove the Durex bushing from the end of the main cam shaft, nearest the motor drive shaft. This is accomplished by loosening the bolt to the right of the main shaft. Care should be

taken when replacing this bushing so as not to tighten the bolt enough to crush the bushing; a snug fit only is required.

4. Remove lower half of bearing and Durex bushing from the other end of the main cam shaft and work the cam shaft out of the record changer. The same precaution against crushing this bushing should be taken with this one as with the one in the preceding section.

5. Remove taper pin from gear and loosen set screw in the collar, both shown as 81 in Fig. 4, of the reverse cam shaft assembly, as well as the pin (74) (Fig. 5) over which the reverse cam forks, when in the reversing position. After removing the collar and sliding the gear to one side, file all burrs from the edges of the holes in the reverse cam shaft. Slide the shaft through its Durex bushing toward the rear of the instrument far enough to allow the removal and replacement of the reverse cam (85) (Fig. 5).

6. Reassemble the reverse cam shaft assembly, making certain that the taper pin holes in the shaft and gear are correctly aligned to permit the taper pins being properly inserted. The set screw in the collar at the end of the shaft should be properly tightened.

7. Remove the reverse cam arm and roller assembly (57) (Fig. 4) and make sure that the roller pin and arm are not bent, if either of these items are found bent we suggest that you replace the reverse arm and roller assembly.

8. In reassembling the reverse cam arm and roller assembly (57) (Fig. 4) in its proper position for alignment with the reverse cam, be sure the roller is about $\frac{1}{32}$ " inside the ridge on the reverse cam, when the cam is in the reversing position.

9. Remove the taper pin from the gear (92) (Fig. 5) on the main shaft, which drives the gear on the reverse cam shaft assembly (81) Fig. 5) and remount the main shaft to the record changer chassis, pushing the above gear, from which the pin was removed, to one side so that it will not mesh with its driven gear.

10. Locate the main shaft so that the lower end of the pickup arm lift shaft travels in the center of the pickup arm lift cam, as shown at "M" in Fig. 5. With the main shaft in this position, adjust the main shaft Durex bushings so that there is no end play in the main cam shaft assembly.

11. Rotate the main cam shaft to the playing position so that the pickup arm is lowered over the turntable.

12. Set the reverse cam in its lowest position, with the control lever in the "Both Sides" position, so that the fork of the reverse cam is meshed with the driving pin.

13. Mesh the reverse cam assembly driver gear (92) (Fig. 5) with the reverse cam assembly driven gear so that the identifying punch marks correspond to the original position. The taper pin for the driver gear should be inserted next. If the assembly has been properly made there should be approximately $\frac{1}{32}$ " clearance between the roller or the reverse cam arm and the reverse cam. See "F," Fig. 5.

14. Throw the control lever to the "One Side" position and rotate the reverse cam with the fingers until it is in the reversing position. Again throw the control lever to the "Both Sides" position. Now there should be approximately $\frac{1}{32}$ " clearance between the reverse cam and the roller. See "G," Fig. 5. If the clearance is not approximately $\frac{1}{32}$ " for both positions of the reverse cam it indicates either the gears are not properly meshed or the reverse segment link rod may be bent. A careful check of the latter while the main shaft is out will save time and trouble later.

29. INSTRUCTIONS FOR REMOVING THE AUTOMATIC MECHANISM FROM THE CABINET:

In most cases, any repairs and adjustments on this mechanism can be made with the mechanism in the cabinet. If

it is necessary to remove the mechanism for any reason, it is recommended that the following procedure be observed, and that two persons take part in the removal. Make sure the mechanism is not in cycle.

1. There is a great possibility, when removing the chassis from the cabinet, to mar or scratch the cabinet. If you will place a piece of cardboard around the record changer it will eliminate, to a great extent, the possibility of marring the finish. A rubber auto mat, with a hole for the record changer, the same size as the one in the cabinet makes an excellent pad. This pad can be split and is easily put in position and removed. Pad the sides of the cabinet with pieces of cardboard.

2. Remove the backs from the record changer, and amplifier compartments.

3. Remove the five prong socket cable from the solenoid assembly, remove the pickup lead from the terminal board, and free the shielded lead going to the shorting switch.

4. Remove the four bolts that hold mechanism to the shelf.

5. Loosen the two Allen set screws in the flexible coupling and allow it to slide down the drive shaft, so as to clear the record changer shaft.

6. Remove the screw marked "P" in Fig. 2. This is the middle of the screws of the upper record support.

7. Remove the magazine link shoulder screw No. 40 Fig. 2. This will allow the magazine to be swung parallel to the turntable, and take up less room.

8. Remove the pickup arm assembly by removing the three screws in the pickup arm base, swinging the pickup arm to the back of the mechanism and working the bottom of the pickup assembly out of the hole.

9. Carefully mark the drive gear (92) (Fig. 3) on the main shaft and the driven gear shown as part of 81, Fig. 3, by prick punch marks or scriber, so that the same teeth can be engaged after reassembly, thus insuring proper timing.

10. Remove the two bolts, one (60) (Fig. 3) securing the magazine slide and roller assembly to the magazine slide arm lever, and one (15) (Fig. 1) securing the record slide arm and stud assembly to the record tray drive crank.

11. Looking in from the rear of the instrument, remove the Durex bushing from the end of the main cam shaft, nearest the motor drive shaft. This is accomplished by loosening the bolt to the right of the main shaft. Care should be taken when replacing this bushing so as not to tighten the bolt enough to crush the bushing; a snug fit only is required.

12. Remove lower half of bearing and Durex bushing from the other end of the main cam shaft and work the cam shaft out of the record changer. The same precaution against crushing the bushing should be taken as stated, in the preceding section.

13. From the rear of the cabinet, lift the mechanism straight up, and carry it straight back until the rear bearing bracket of the main shaft has cleared the shelf; then rotate the mechanism 90°, turning it so that the record magazine comes toward the back of the cabinet until the record magazine is clear of the cabinet. Then drop the record magazine end of the mechanism slightly so that the drive shaft will clear the bottom shelf, and remove the mechanism.

To Replace Mechanism:—1. Replace mechanism by reversing procedure of step 13 above.

2. Replace the main cam shaft and its bushings, but do not tighten the bushings in place. Make sure that the gears marked in (9) above are meshing properly as marked. Make sure the throw-out cam 71 Fig. 4 is resting on top of the main shaft.

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3. Replace the pickup arm assembly. Locate the main shaft so that the lower end of the pickup arm lift shaft travels in the center of the pickup arm lift cam, as shown at "M" in Fig. 5. With the main shaft in this position, adjust the main shaft Durex bushings so that there is no end play in the main cam shaft assembly.

4. Replace the two bolts removed in (4) (6) (7) and (10) above.

5. Adjust the position of the record tray as described under: "9. TO LOCATE AND ADJUST THE RECORD TRAY", by adjusting screw 15 (Fig. 1).

6. Turn the drive shaft or turntable with the fingers and put the mechanism thru a cycle to see that it is working correctly.

7. Replace the flexible coupling on drive shaft and replace connections to record changer.

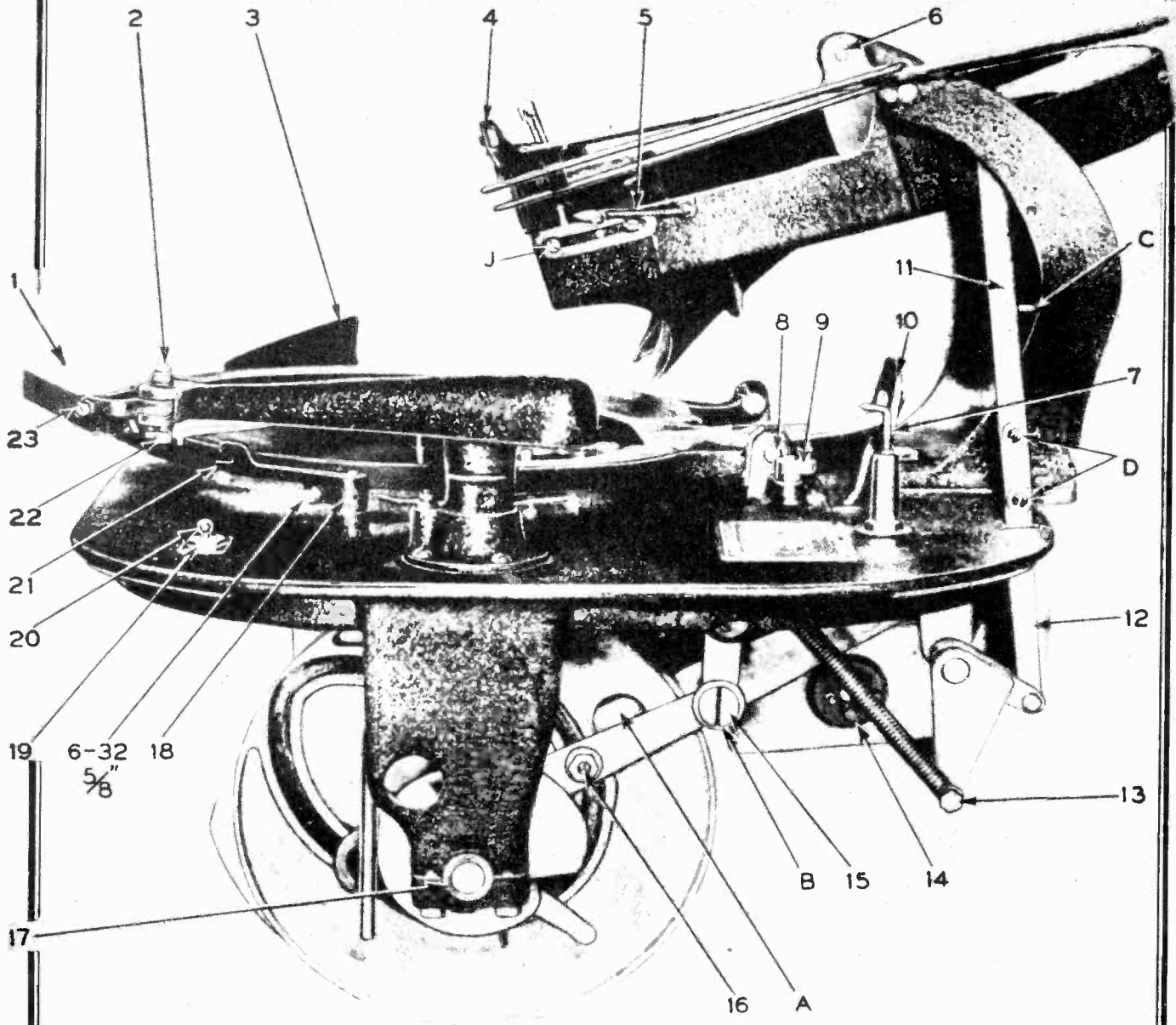


Fig. 1

Reference No.	Stock No.	Description	Reference No.	Stock No.	Description	Reference No.	Stock No.	Description
1	37293	Pickup Housing	7	88116	Separator Hook and Arm Assembly	16	88024	Pin—Record Tray Slide
2	38068	3/8"—28 Hex. Cap Nut	8	38018	Pin—Record Tray Pivot	17	38055	Main Shaft Bushing
3	38084	Record Tray Shield Felt—Outer	9	38119	Reverse Pinion and Crank Assembly	18	88131	Pickup Arm Stop Lever Assembly (Specify color)
4	38117	Record Reverse Arm and Fork Assembly	10	38188	Record Bumper Guide and Felt Assembly	19	38005	Escutcheon Plate Off-On Switch, Automatic
5	38044	Spring—Separator	11	38075	Magazine Link Upper	20	38001	Stop Lever Roller Tubing
6	38017	Pin—Magazine Pivot	12	38076	Magazine Link Lower	21	38094	Pickup Arm Lever Hook
			13	88057	Record Magazine Bushing	22	38069	Lock Nut for Pivot Screw
			14	38118	Chassis Plug			
			15	38006	Shoulder Screw — Record Tray Slide			

NOTE: In ordering any part that is painted, please specify color wanted.

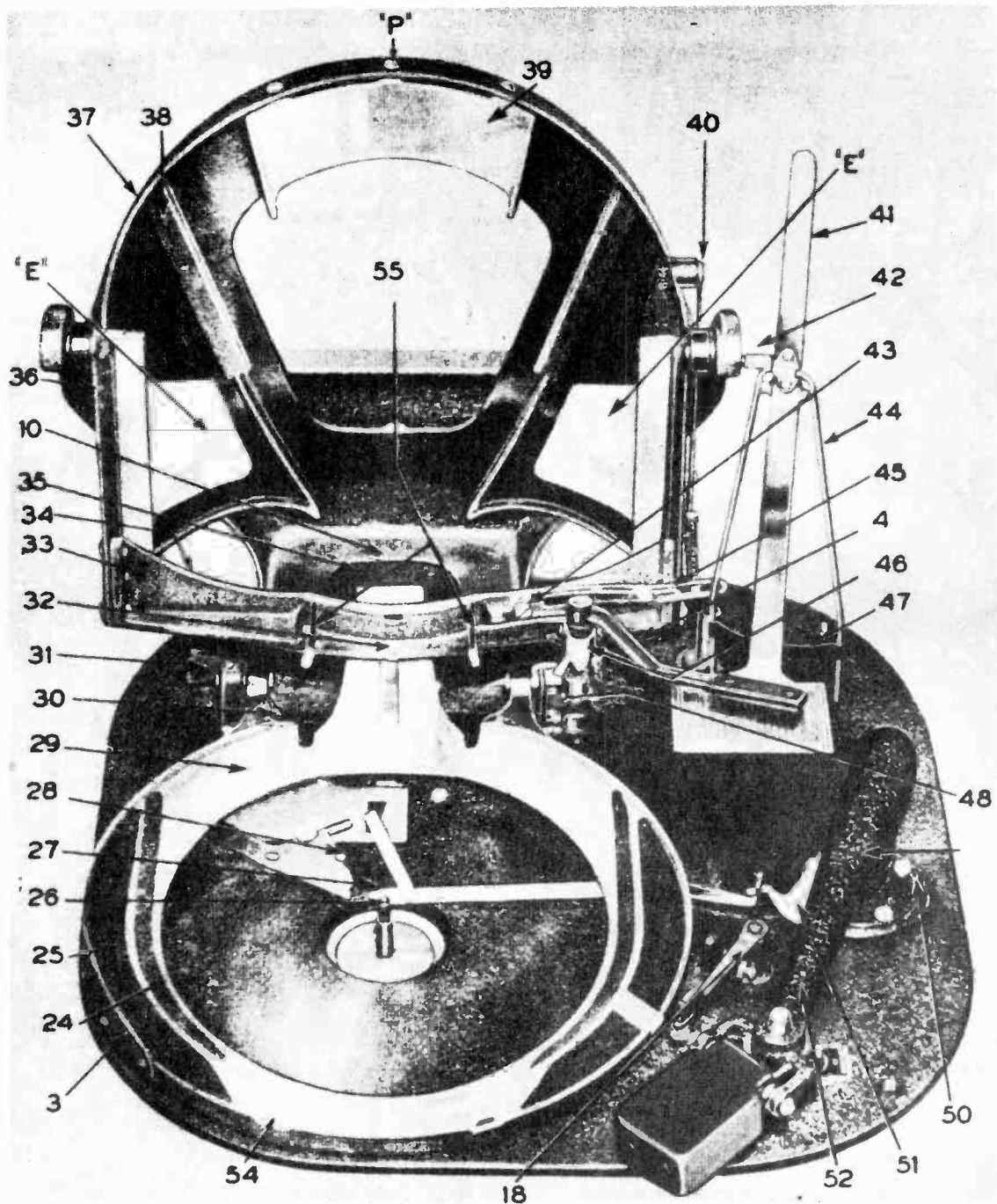


Fig. 2

Reference No.	Stock No.	Description
8	38084	Record Tray Shield Felt Outer
4	38117	Record Reverse Arm and Fork Assembly (specify color)
10	38138	Record Bumper Guide and Felt Assem.
18	38131	Pickup Arm Stop Lever Assembly (specify color)
24	38079	Record Tray Felt—Small
25	38078	Record Tray Felt—Large
26	38139	Turntable Drive Shaft Cap
27	38132	Automatic Stop Trip Lever Assembly
28	38023	Pin—Record Control Rod
29	38137	Record Tray Assembly
30	38089	Record Tray Bumper—Rear
31	38097	Record Bumper
32	38092	Reverse Arm Bumper
33	38135	Lower Record Support Assembly
34	38081	Lower Record Support Felt
35	38082	Record Bumper Guide Felt

Reference No.	Stock No.	Description
36	38083	Magazine Side Felt
37	38136	Record Magazine Assembly
38	38080	Record Magazine Felt
39	38106	Record Support—Upper
40	38008	Shoulder-Screw-Magazine Link
41	38126	Record Reverse Guide Assembly
42		Pin—Reverse Guide Stop
43	38011	Shoulder Screw—Separator
44	38108	Record Reverse Guide
45	38127	Record Separator and Hub Assembly
46	38072	Record Reversing Arm Lock
47	38052	Record Reverse Guide Spring
48	38074	Record Reverse Arm Lock Stop
50		Pickup Arm Base
51	38071	Automatic Stop Trip Lever, Short
52	38110	Pickup Arm Casting only
54	38088	Record Tray Bumper—Front
55	38140	Pin—Record Support

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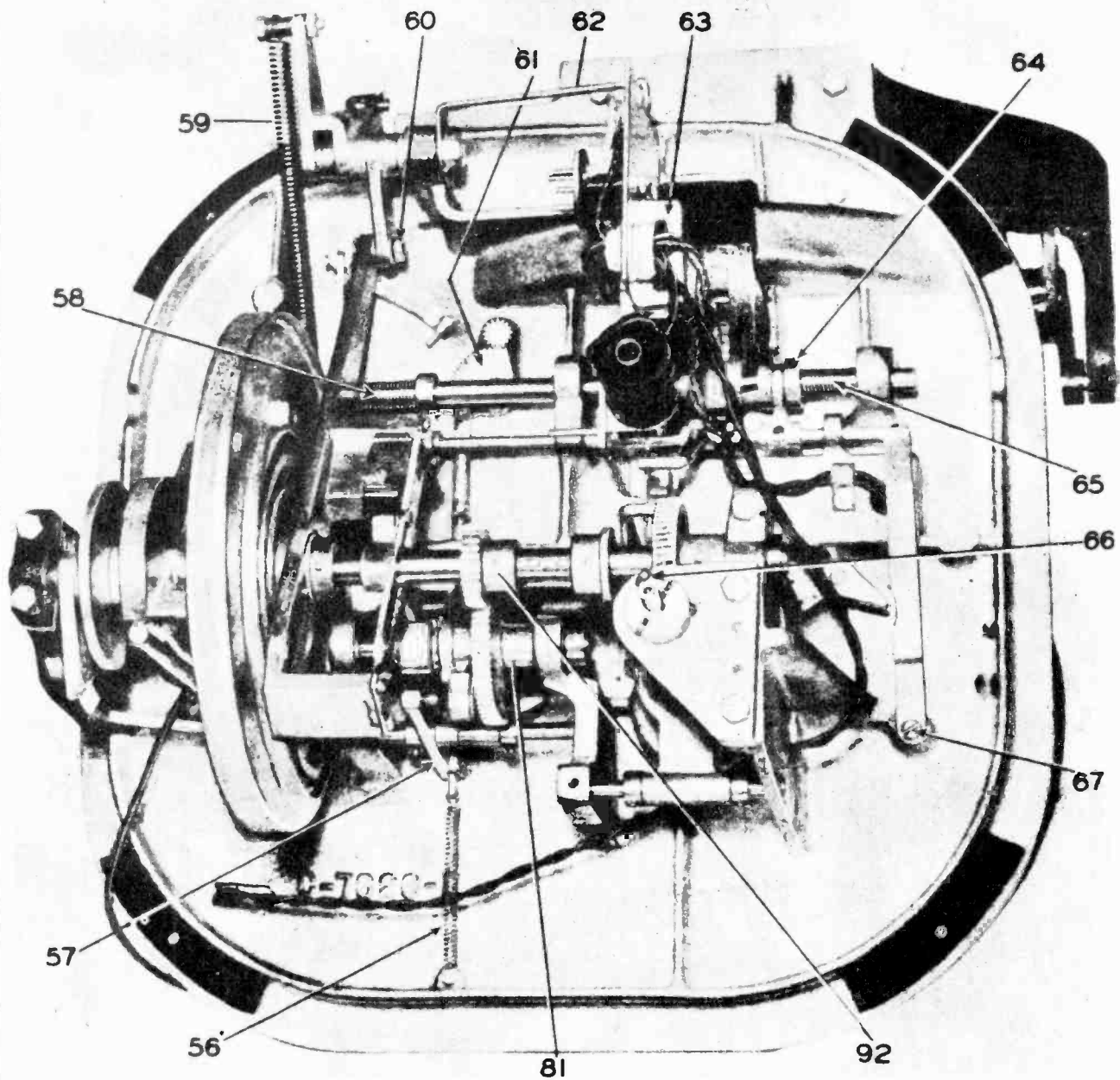
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Fig. 3

Reference No.	Stock No.	Description
56	38050	Spring—Reverse Arm
57	38128	Reverse Cam Arm and Roller Assembly
58	38038	Spring—Record Separator Hook Lever
59	38039	Spring—Magazine Slide Arm
60	38007	Shoulder Screw—Magazine Slide Arm
61	38031	Record Reverse Pinion Segment
62		Solenoid Plate Bracket
63	38000	Condenser—1.0 Mfd. 400-Volt (in can)
64	38037	Record Repeat Sliding Clutch Cam
65	38040	Spring—Record Repeat Clutch
66	38016	Screw—Turntable Shaft Collar
67	38012	Shoulder Screw—Repeat Lever
81	38121	Record Reverse Cam Shaft Assembly
92		Gear—Reverse Cam Shaft Driver

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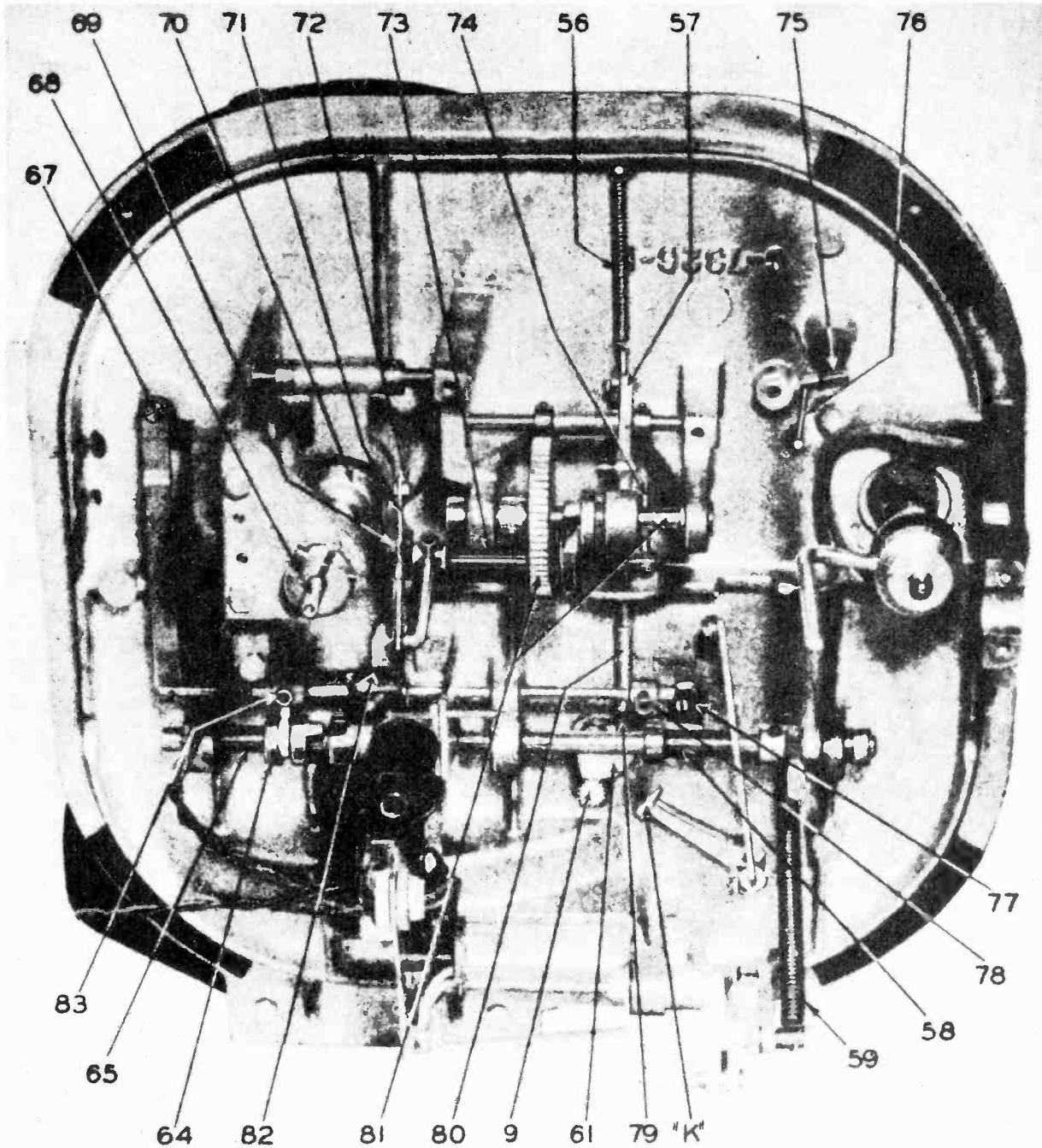


Fig. 4

Reference No.	Stock No.	Description	Reference No.	Stock No.	Description
9	38119	Reverse Pinion and Crank Assembly	71	38130	Clutch Throwout Lever and Spring Assembly
56	38050	Spring—Reverse Arm	72	38013	Shoulder Screw—Clutch Throwout Lever
57	38128	Reverse Cam Arm and Roller Assembly	73	38043	Spring—Record Reverse Cam Control
58	38038	Spring—Record Separator Hook Lever	74	38022	Pin—Reverse Cam Shaft
59	38039	Spring—Magazine Slide Arm	75	38095	Stop Lever Collar Pin Tubing
61	38031	Record Reverse Pinion Segment	76	38046	Spring—Tone Arm Lever
64	38037	Record Repeat Sliding Clutch Cam	77	38036	Reverse Segment Stop Cam
65	38040	Spring—Record Repeat Clutch	78	38101	Record Repeat Throwout Hook Lever
67	38012	Shoulder Screw—Repeat Lever	79	38010	Shoulder Screw—Reverse Segment Link
68		Turntable Drive Shaft Assembly	80	38021	Pin—Short—Reverse Segment
69	38015	Screw—Clutch Throwout Cam	81	38121	Record Reverse Cam Shaft Assembly
70	38124	Worm and Bushing Assembly	82	38104	Record Repeat Lock Lever
			83	38102	Record Repeat Clutch Fork Lever

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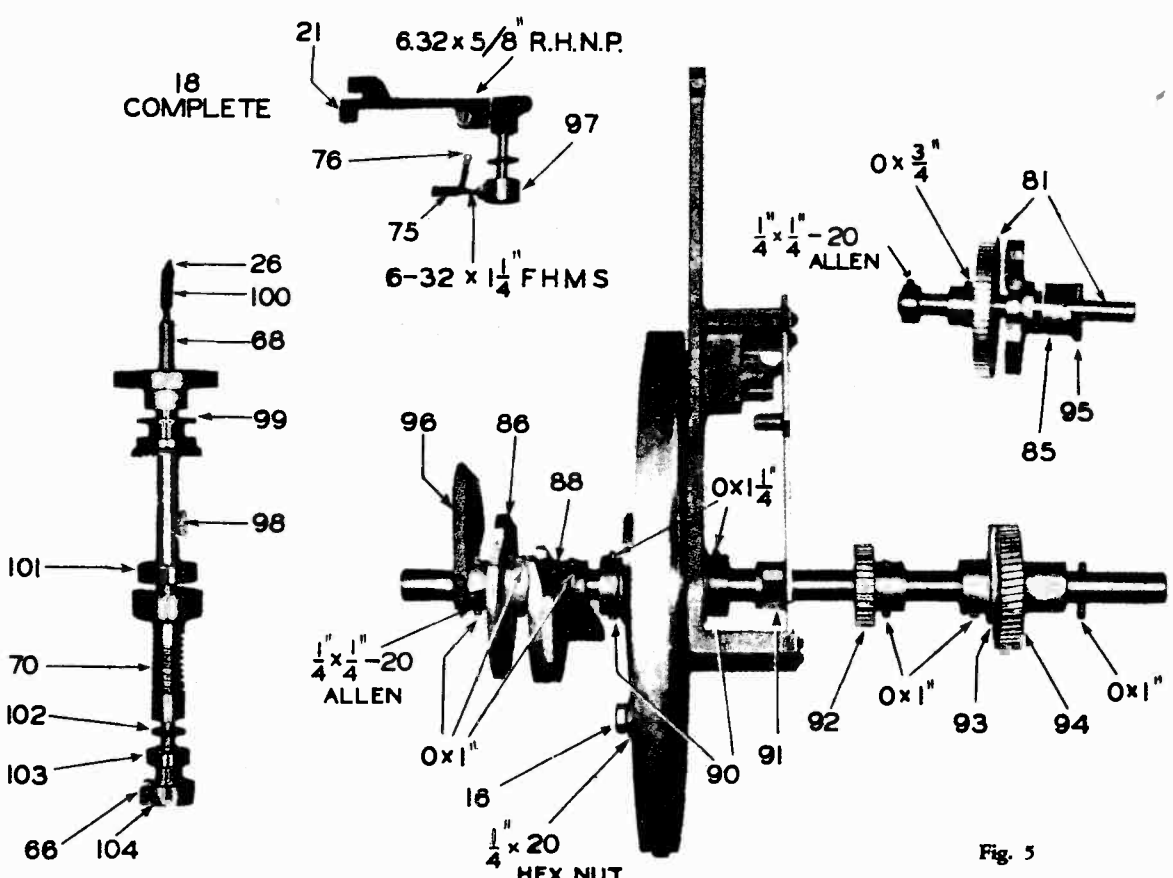
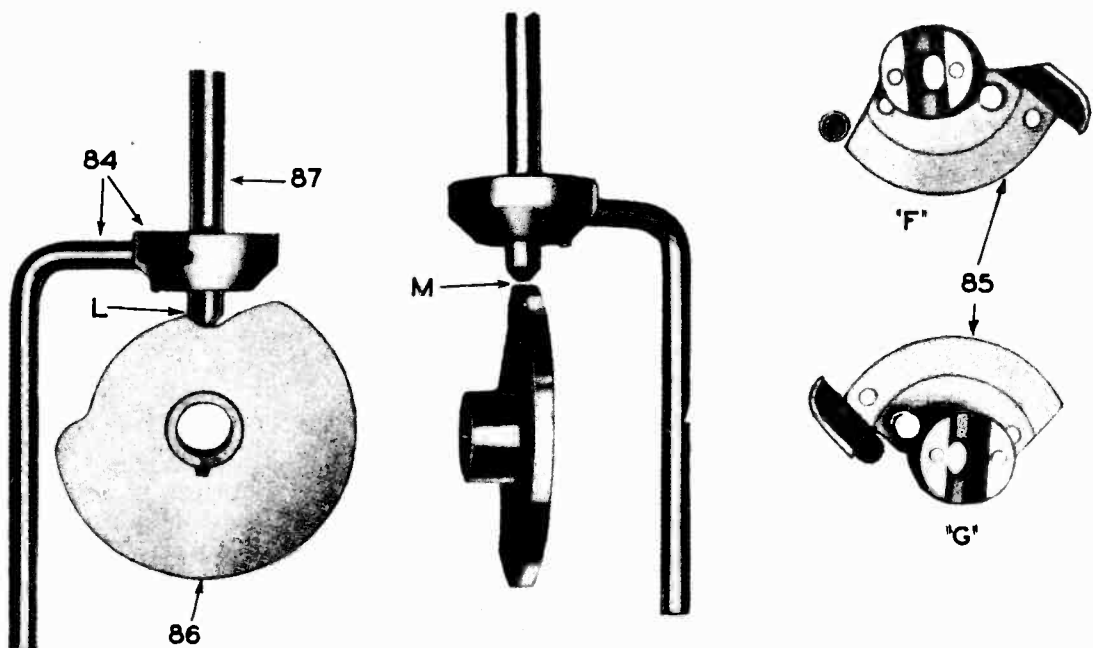


Fig. 5

Fig. 7

Reference No.	Stock No.	Description
16	88024	Pin—Record Tray Slide
18	88181	Pickup Arm Stop Lever
21	88094	Stop Lever Roller Tubing
26	88189	Turntable Driveshaft Cap
66	88016	Screw—Turntable Shaft Collar
68		Turntable Shaft Assembly
70	88124	Worm and Bushing Assembly
74	88022	Pin—Reverse Cam Shaft
75	88095	Stop Lever Collar Pin Tubing
76	88046	Spring—Tone Arm Stop Lever

Reference No.	Stock No.	Description
81	88121	Record Reverse Cam Shaft Assembly
84		Pickup Swing Lever and Collar Assembly
85	88123	Record Reverse Cam and Pin
86		Pickup Lift Cam and Hub Assembly
87		Pickup Arm Lift Shaft
88		Pickup Arm Swing Cam
89		Main Cam Collar
90		Magazine Slide Arm Cam
91		Gear—Reverse Cam Shaft Driver
92		Turntable Throwout Cam and Hub Assembly

Reference No.	Stock No.	Description
94	88030	Gear—Main Drive
96		Pickup Arm Friction Cam Assembly
97		Pickup Arm Stop Lever Collar
98	88152	No. 2 Woodruff Key
99	88084	Turntable Shaft Clutch
100		Turntable Driveshaft Cap Tubing
101	88088	Ball Bearing—Upper
102	38050	Thrust Washer—Worm Shaft
103	88082	Ball Bearing—Lower
104	88064	Turntable Shaft Collar

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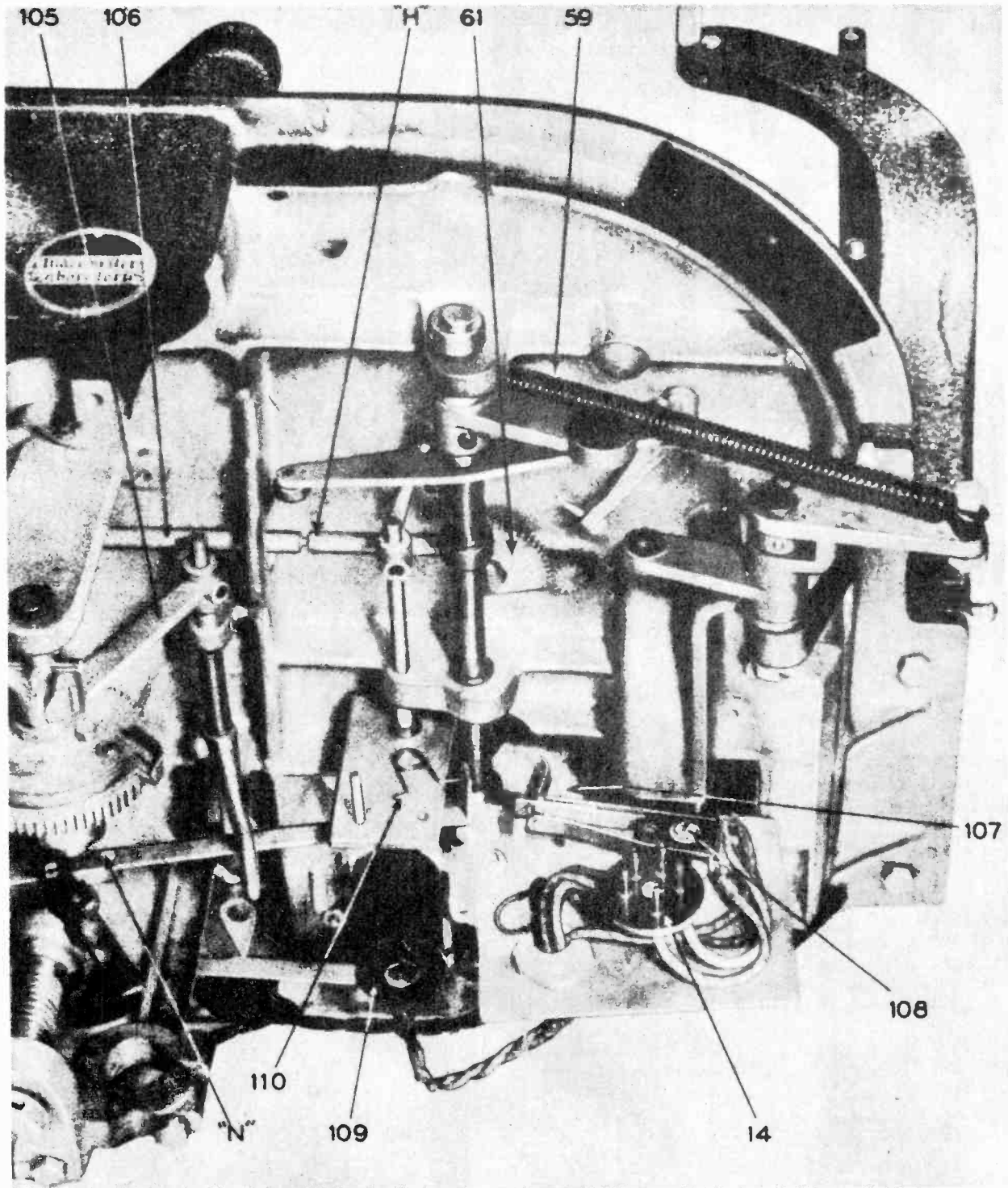


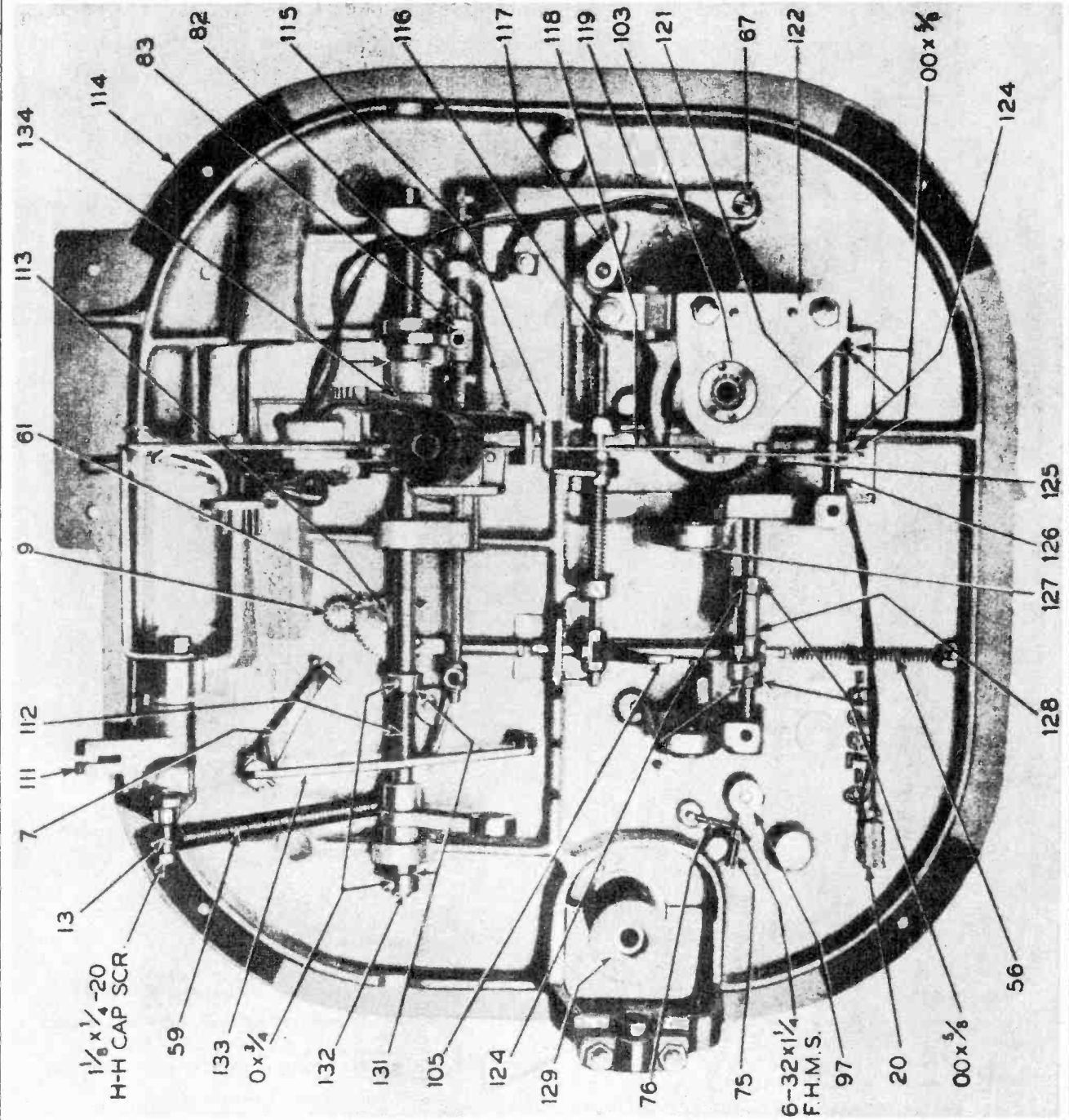
Fig. 6

Reference No.	Stock No.	Description
14	38118	Chassis Plug 5 Prong Male
59	38039	Spring—Magazine Slide Arm
61	38031	Record Reverse Pinion Segment
105	38100	Record Reverse Cam Shaft Lever
106	38020	Pin—Long, Reverse Segment
107	38111	Record Tray Gear—Driver
108	38008	Switch Assembly—Solenoid and Motor
109	38141	Solenoid Coil only
110	38047	Spring—Solenoid Lever Torsion

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Refer- ence No.	Stock No.	Description
7	38116	Separator Hook and Arm Assembly
9	38119	Reverse Finion and Crank Assembly
18	88057	Record Magazine Bushing
26	38001	AC Motor Switch
56	38050	Reverse Arm Spring
59	38039	Magazine Slide Arm Spring
61	38031	Record Reverse Finion Segment
67	38012	Repeat Lever Shoulder, Screw
70	88046	Stop Lever Stop Pin, Spring
76	88042	Record Repeat Lock Lever
82	38104	Record Repeat Clutch Fork
83	38102	Record Repeat Clutch Fork Lever
97		Pickup Arm Stop Lever Collar
108	38032	Record Repeat Cam Shaft
105	38100	Record Repeat Cam Shaft Lever
111	88045	Magazine Slide Arm Lever
112	38009	Separator Hook Spring
113		Reverse Segment Shoulder
114	90000	Magazine Frame Pad
115	38153	0.04 Taper Pin
116	38154	0.24 Taper Pin
117	38105	Reverse Cam Lock Lever
118	38120	Record Control Shaft
119	38129	Stud Assembly, Clutch Lever and Pin Assembly
121	38073	Record Repeat Throwout Lever
122	38086	Main Clutch Fork Lever
123	38086	Bearing Retainer Plug
124	38097	Clutch Shaft Collar
125	38115	Clutch Shaft Collar
126	38115	Solenoid Lever Shaft Assem.
127	38059	Record Tray Shaft Bushing
128	38114	Record Reverse Arm Shaft Assem.
129	38090	Pickup Arm Brake Facing
132	38062	7/16 Shaft Collar
133		Record Tray Drive Shaft Assembly
134	38144	Separator Hook Lever and Roller Assembly
135	38123	Record Tray Gear and Sliding Cam Clutch



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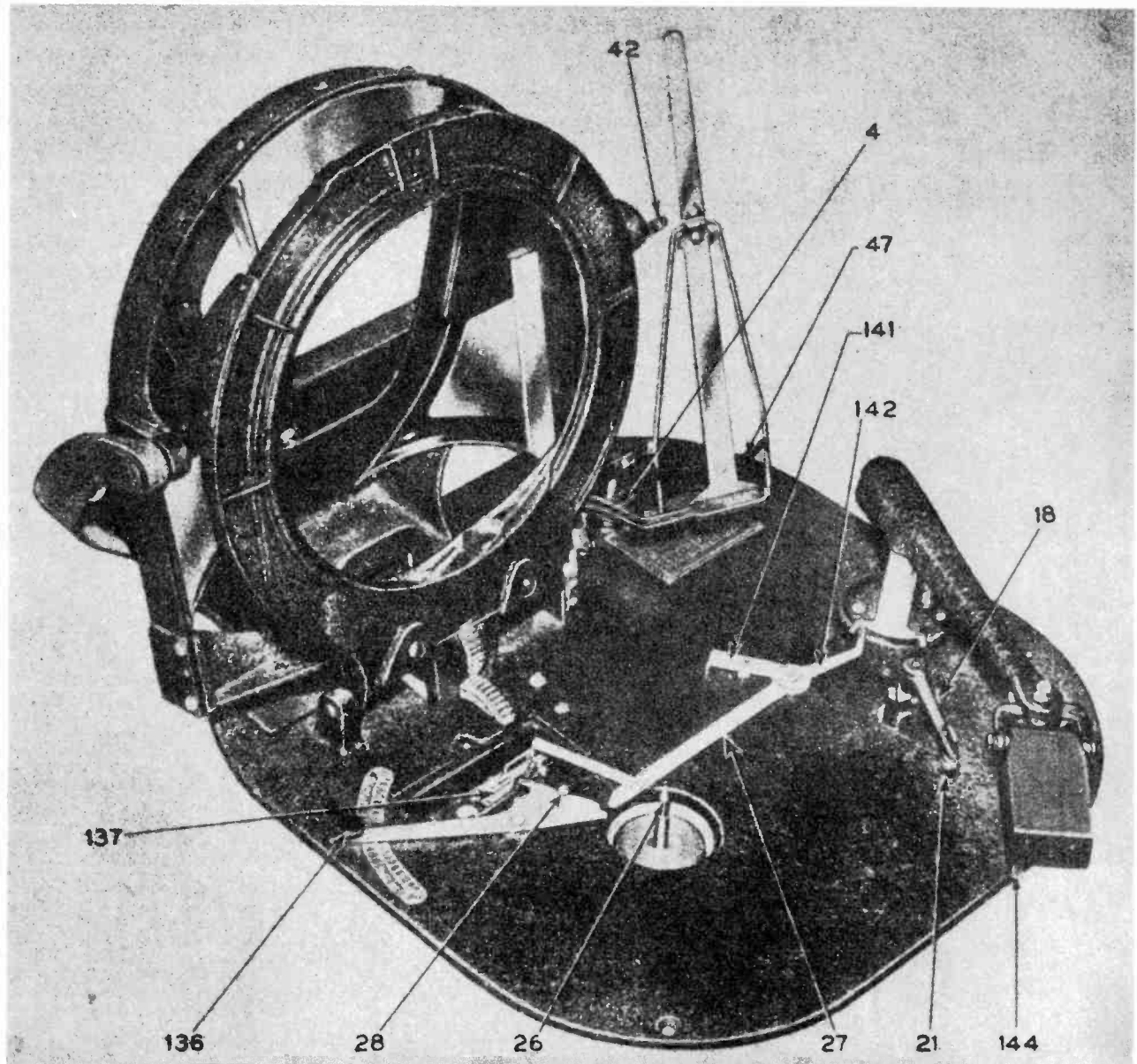


Fig. 8

Reference No.	Stock No.	Description	STOCK No.	DESCRIPTION
				MAGNETIC PICKUP ASSEMBLIES
4	38117	Record Reverse Arm and Fork Assembly (specify color)	14291	Armature—Pickup armature and spring
18	38131	Pickup Arm Stop Lever Assembly (specify color)	37292	Brush—Pickup brush and mounting bracket
21	38094	Stop Lever Roller Tubing	14672	Coil—Pickup coil and support assembly
26	38189	Turntable Drive Shaft Cap	14292	Damper—Pickup armature damper block
27	38132	Automatic Stop Trip Lever Assembly	37293	Housing—Finished pickup housing only—less mechanism and cover
28	38023	Pin—Record Control Rod	37291	Mechanism—Magnetic pickup unit only—less housing and brush
42	38052	Pin—Reverse Guide Stop	3811	Screw—Pickup needle screw
47	38052	Record Reverse Guide Spring	37294	Terminal—Pickup connector block with set screws and mtg. screw
136		Selector Knob	37286	Pivot—Pickup unit pivot screw and locknut
137	38004	Record Trip Switch Assembly—complete	37287	Bearing—Pickup unit pivot bearing
141	38048	Spring—Automatic Trip Lever Pin		
142	38071	Automatic Stop Trip Lever—Short		
144	37292	Pickup Brush Assembly		

FOR AUTOMATIC PHONOGRAPH PICK-UP
SEE RCA MODEL MI-12701

The cutting point of the stylus must be in perfect condition in order to make good recordings.

The condition of the stylus point can not be determined by ordinary visual inspection. If the recordings are noisy or poor in quality, first try a new stylus.

The stylus cutting point can be ruined by dropping the cutter on the record, by cutting into the base metal of the recording blank, or by cutting into the paper label on the blank.

Always stop the recorder before it reaches its inner limit as it will repeat in the last groove and may wear into the base metal, thereby ruining the stylus point. See that the instrument is perfectly level.

LUBRICATION.

Due to its careful design and precise workmanship, this record changer requires a minimum of oiling.

About once each year a light coat of vaseline or petroleum jelly should be applied to all moving surfaces which were coated with graphite at the factory.

A very light coat of vaseline should be applied to the surfaces of the magazine, indicated at "E" in Fig. 2. It is best to apply this coating every six months. The vaseline should be applied with, and removed by, the fingers, on the

Recorder Service

Cutter Head Drive:—The cutting head drive screw (lead screw) should rotate freely and be free from end play. If end play is present loosen the jamb screw which locks the cone point bearing located at end away from driving gear and adjust this bearing until end play is eliminated (being careful not to cause binding), then tighten jamb screw.

Cutter Head Mounting:—Two cone pointed set screws support the cutter head and its mounting bracket. These should be adjusted to prevent end play but to permit free movement of the cutter head up and down.

Record Threads:—Keep the drive gears and lead screw free from record threads.

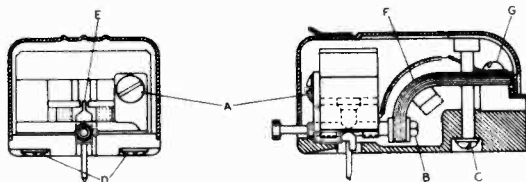
Equalizing Groove Width:—In order to keep the groove width cut at the inside and outside of record equal, it may be necessary to adjust the spindle bearing into which the swivel spindle of the recording arm is placed, and which is located at the right hand center of the phono board. To adjust this bearing loosen the set screw in the base and move bearing up or down as desired. If the grooves at the edge of record are shallower than those at center of record, lower the bearing. If grooves at edge of record are deeper than those at center of record, then raise the bearing.

Lubrication:—Keep the drive gears, lead screw, and other bearing surfaces well lubricated with Vaseline or Petroleum Jelly.

"Automatic" Cut-Off Switch Under Recorder Arm:—When the Recorder Arm is swung in position over a record to make a recording, the weight of the arm is brought down on a switch mounted under the recorder arm swivel bearing, opening the switch and making the Automatic Phonograph inoperative.

This switch should be adjusted so that when the Recording Arm is on its rest, the switch is closed; i. e. the switch plunger is all the way up; and there should be about $\frac{1}{2}$ -inch clearance between the top of switch, and the swivel shaft. When the Recording Arm is in the recording position, the switch is open; i. e. the switch plunger is pushed down.

Cutter Head:—



Cutter Head

magazine faces. DO NOT USE EXCESSIVE AMOUNTS OF LUBRICANT ANYWHERE ON THE RECORD CHANGER.

A good grade of machine oil, not too light, should be used on the sliding clutches, reverse cam shaft and all eccentric and shoulder screws.

NEVER OIL THE "DUREX" BUSHINGS (one of which is shown as No. 17 in Fig. 1), AS THIS WILL CAUSE THEM TO DISINTEGRATE.

Once each year the motor oil cups should be oiled with a good grade of motor oil. At the same time the gear box should be inspected, and the grease replaced if it has become hard. A good mixture to use here is 75% vaseline and 25% SAE 40 motor oil.

DRIVE CLUTCH.

The phono drive clutch is located on the drive shaft just above the reduction gear box. The clutch should be adjusted so that there is no slippage in the clutch during a cycle of the mechanism, yet the clutch should slip if the turntable is stopped by hand. To adjust clutch, loosen the two nuts above the clutch on the drive shaft, and move the lower nut down the shaft for more pressure in the clutch, or move the lower nut up for less clutch pressure.

The cutter head used is of an improved design. There is a centering spring attached to the armature to maintain proper adjustment and to provide a limiting effect on the movement of the armature. Service operations which may be necessary on the cutter are as follows:

Centering Armature:—Refer to the figure showing the cutter inner structure. The armature "E" is shown in its proper relation to the magnet pole pieces, i. e., exactly centered. To center armature remove screw C and remove cutter cover. Insert a small rod or nail into the armature needle hole and tighten the needle holding screw to hold the rod securely. If the armature clamping screws D have not been disturbed, screw A should be loosened which will permit the armature to be moved from side to side, the rod acting as a lever to perform this operation. The proper adjustment is obtained when the armature is brought to the mid position between the pole pieces. Screw A should then be tightened. The armature position should then be central between the pole pieces and at right angles to them. Check to make sure that the armature is not touching the coil. The air gap between the pole pieces and the armature should be kept free from dust, filings, and other foreign material which would obstruct the movement of the cutter armature.

Replacing Coil:—Remove the cutter cover by removing screw C. Remove screws D and A and lift magnet off coil assembly. Unsolder coil leads. Remove coil and bakelite board on which it is mounted. Replace with new coil and mounting board. Replace magnet. Replace screws A and D. Solder new leads. Tighten screws D so that the armature is perpendicular to the pickup base. Center armature as described above.

To Replace Viscoloid Damping Block (F) or Replace Armature E:—Remove cover. Remove screws G. Remove screws D and A. Remove magnet assembly. Unsolder coil leads. Remove coil assembly. Remove armature and viscoloid block. Remove nut B. Remove viscoloid from armature. Replace either new armature, new viscoloid or both as desired. When replacing nut B make sure that viscoloid is parallel to the armature and that it will not twist the armature when clamped under screws G. Tighten nut B so that viscoloid is firmly fastened on shaft. Replace parts in reverse order as removed above. Center armature as described above.

MODEL S30 CAPEHART
 (Part 1) FARNSWORTH TELEV. & RADIO CORP.

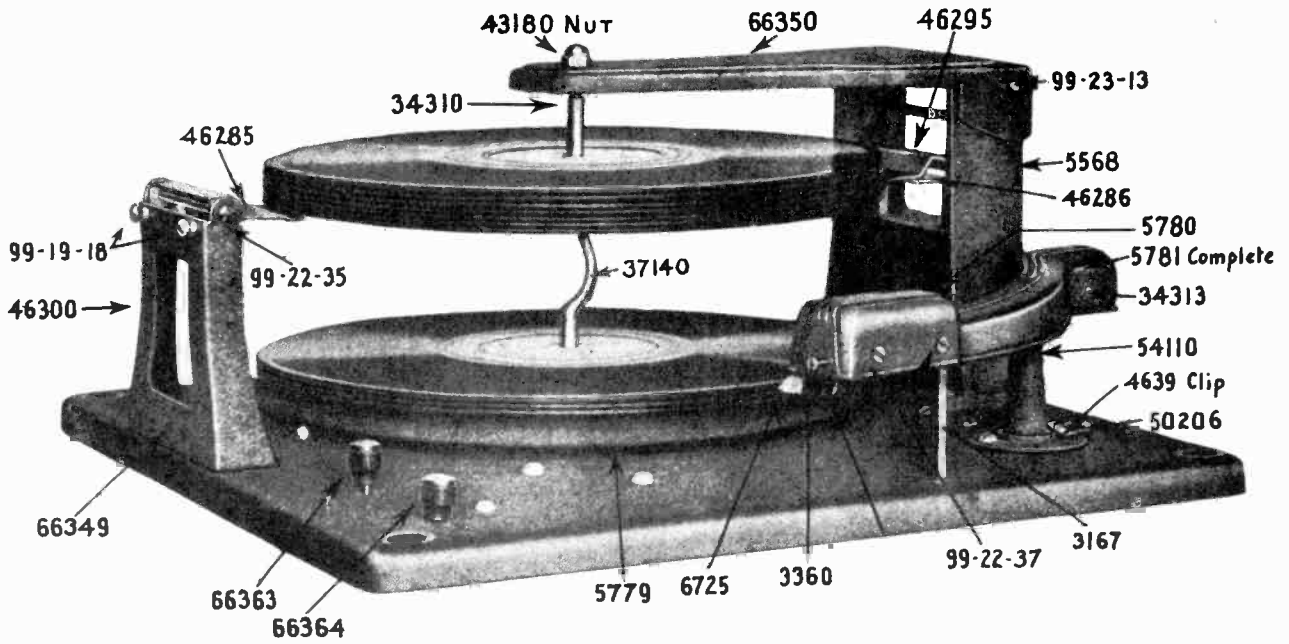


FIGURE 1

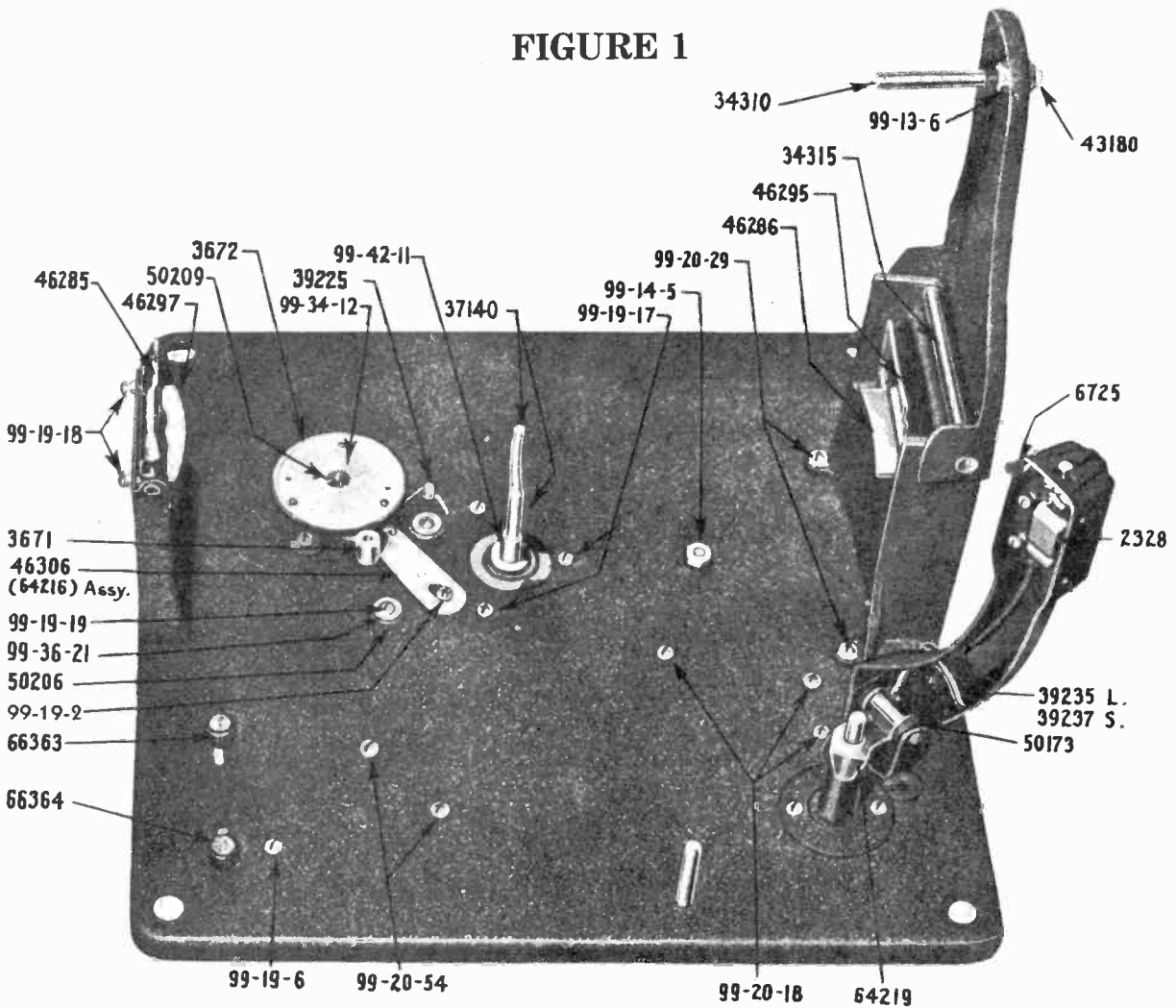


FIGURE 2

FARNSWORTH TELEV. & RADIO CORP. MODEL S30 CAPEHART (Part 1)

FIGURE 3

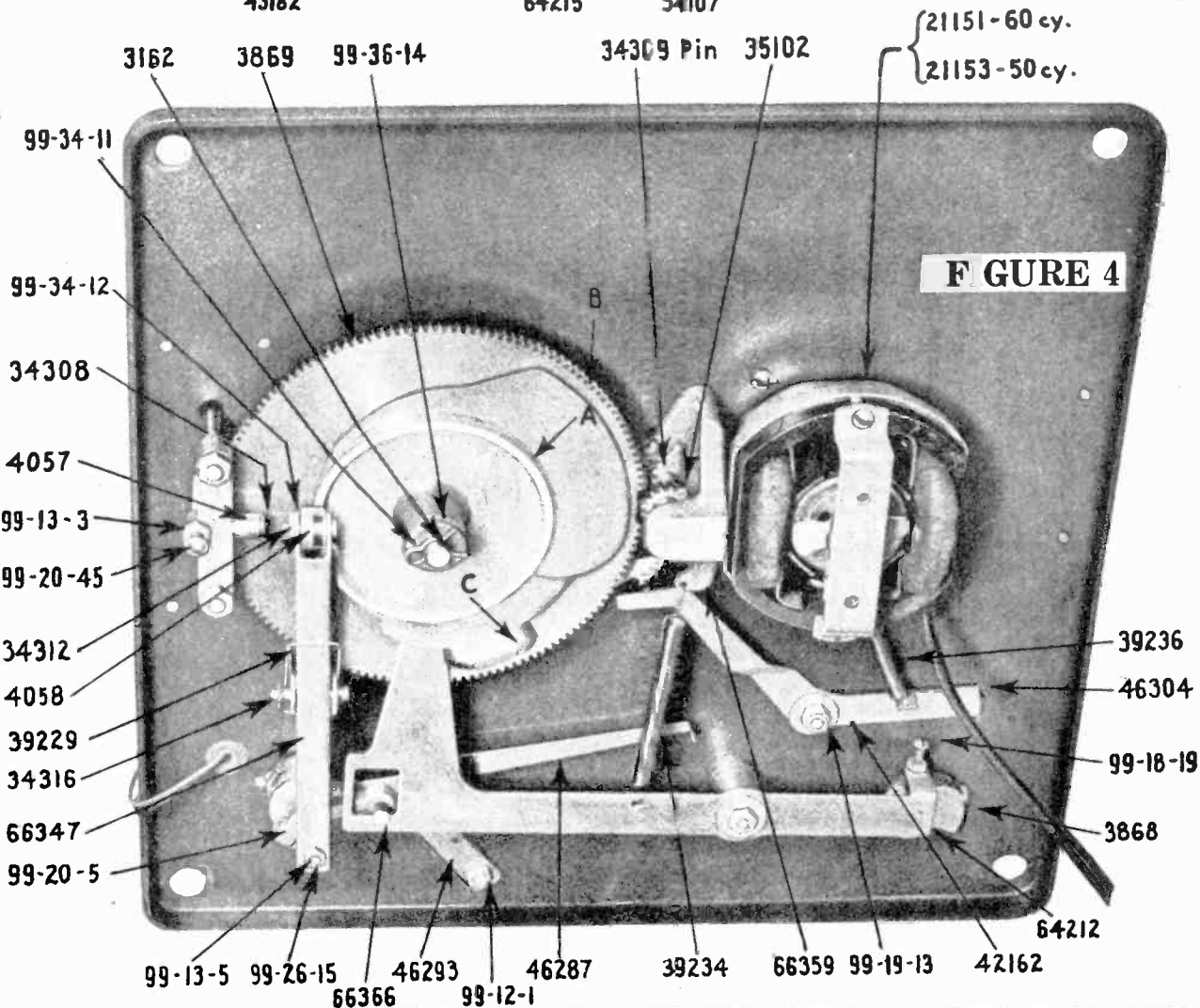
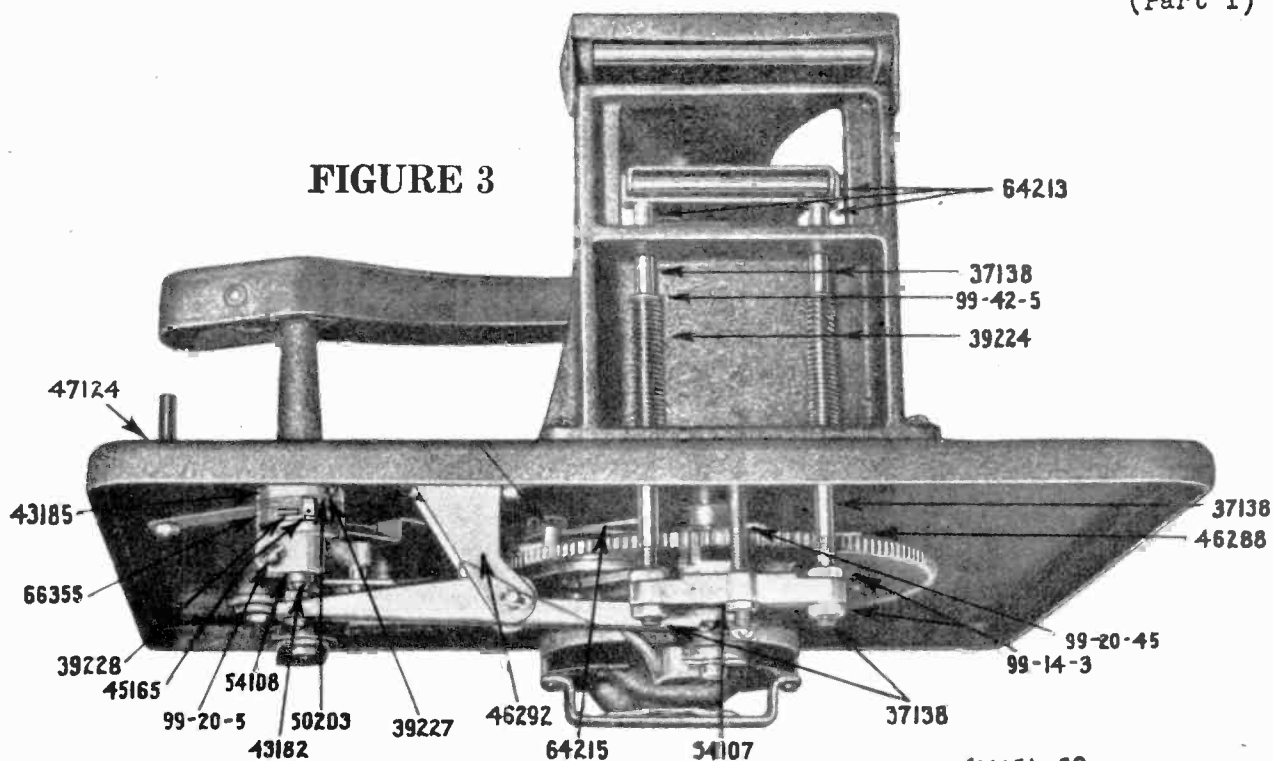


FIGURE 4

MODEL S30 CAPEHART
(Part 1)

FARNSWORTH TELEV. & RADIO CORP.

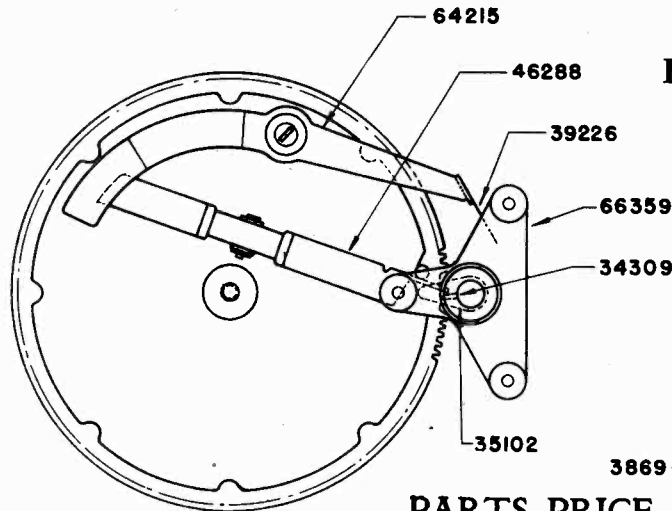
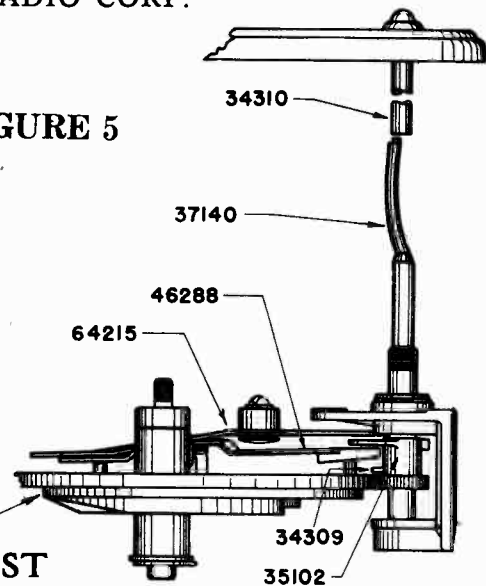


FIGURE 5



PARTS PRICE LIST

Part No.	DESCRIPTION	List Price
715-1	Crystal Pickup, head and Plug AK-59 only	\$ 4.50
716-1	Crystal Pickup, head and Plug AK-76, 95 and 96	4.70
*2331	Replacement Cartridge—Panamuse	6.10
3159	Drive Disc Stud	.10
3162	Main Cam Stud	.25
3167	Tone Arm Support	.10
3294	Screw, shoulder clutch lock lever	.10
*3360	Screw, Needle — Panamuse	.10
3361	Screw, Needle — Farnsworth	.10
3671	Pulley, Drive-motor	.20
3672	Pulley, Drive-turntable	.75
3868	Cam, stop, tone arm 10-12	.10
3869	Cam, Main	1.20
4057	Roller, Record Lowering	.10
4058	Roller, Tone Arm Lift Lever	.10
4059	Bushing, main cam	.10
4639	Wire Clip, cadmium plated	.10
4639	Wire Clip, painted	.10
4949	Felt for Spindle	.10
5568	Bracket, Record Support	.60
5779	Turntable	1.75
*5780	Tone Arm only — Panamuse	.70
*5786	Tone Arm and Pick-up assembly complete — Panamuse	9.00
5787	Tone Arm only	1.00
6069	Reject Knob	.15
6287	Motor Gear and Spindle assembly	1.75
6725	Brush assembly	.20
7344-1	Gauge	.75
21151	60 Cycle motor less pulley	8.00
21161	60 Cycle motor with drive pulley	8.35
*30153	Escutcheon — Panamuse	1.35
34308	Pin, record lowering	.10
34309	Pin, motor spindle gear	.10
34310	Pin, record centering (Farnsworth)	.25
34311	Pin record support shelf	.10
34312	Pin	.10
34313	Pin, tone arm hinge	.10
34315	Pin, Record Support Plate Hinge	.10
34316	Pin	.10
*34322	Pin, Record Centering (Panamuse)	.25
39224	Spring, record lowering	.10
39225	Spring Idler — early production	.10
39226	Spring, starting lever release trip	.10
39227	Spring, friction trip	.10
39228	Spring, friction trip	.10
39229	Spring, tone arm lift lever	.10
39230	Spring washer — change cam	.10
39234	Spring, tone arm return arm	.10
39235	Spring clip, pickup lead, long	.10
39236	Spring, reject lever	.10
39237	Spring clip, pickup lead, short	.10
39245	Spring idler (coil) late production	.10
42161	Spacer Motor	.10
42162	Spacer Shoulder	.10
42163	Bearing, Tone Arm Lever	.15
42165	Spacer, bolt	.10
43180	Nut, Record Centering Pin (Farnsworth)	.25
43182	Tone Arm Lift Rod	.10
43184	Collar, lower friction trip	.20
43185	Collar, upper friction trip	.15
45165	Lever, friction trip	.10
45171	Bracket, crystal cartridge	.15

FARNSWORTH TELEV. & RADIO CORP.

MODEL S30 CAPEHART
(Part 1)

Part No.	DESCRIPTION (Continued)	List Price
*45173	Bracket, escutcheon Panamuse	.10
*45174	Bracket Record Support Panamuse	.15
46284	Record Support Plate Farnsworth	.40
46285	Record Support Front 10"	.40
46286	Record Support Rear 12"	.35
46287	Trip Finger	.15
46288	Main gear starting lever	.15
46289	Bracket, crystal cartridge	.15
46292	Bracket, tone arm lift	.15
*46330	Bracket Record Support	.45
46293	Trip finger stop	.10
46295	Record Support Rear 10"	.45
46297	Record Support Front 12"	.30
46300	Record Support bracket	.35
46301	Friction Trip	.10
46304	Reject Lever	.15
46305	Wire Clip	.10
46330	Record Support Plate	.45
48216	Insulating Washer tone arm	.10
50173	Tone arm bushing	.10
50203	Disc, friction trip drive	.10
50204	Washer, friction trip lever	.10
50206	Rubber grommet	.10
50209	Washer, thrust drive disc	.10
50219	Insulating sleeve	.10
50223	Mounting spacer	.10
50226	Decalomania, 10"-12"	.10
50227	Decalomania "Reject"	.10
54107	Link, record lowering	.20
54108	Crank tone arm	.25
54110	Tone Arm Support Housing	.30
61265	Plug Shell	.15
61269	Plug male	.15
63119	Record lowering link assembly complete	.35
63120	Spindle support brack and bushing assembly	.85
64213	12" rear record support and shaft assembly	1.00
64215	Starting lever release trip and hub assembly complete	.35
64216	Turntable drive bracket and stud assembly	.15
64219	Tone Arm Bracket assembly	.30
66346	Tone Arm Lift Lever and Bracket assembly	.70
66347	Tone Arm Lift Lever and Roller assembly	.40
66348	10" and 12" Record Support Assembly complete	1.70
66349	Record Support Bracket assembly front	1.35
66350	Record Support Plate and Pin assembly Farnsworth	.95
66351	Friction Trip Assembly	.85
66353	Tone Arm Return Assembly complete	.50
66355	Collar, pin and set screw assembly	.20
66356	Main Cam and starting lever assembly	1.50
66359	Spindle, gear and bracket assembly	2.85
66366	Tone Arm Crank and Clamp Screw assembly	.35
66371	Record Support Plate and Standard assembly	4.20
66372	Record Lowering Bracket and Standard assembly	2.95
66391	Record Support Plate and Pin assembly Panamuse	1.00
68328	A.C. Motor 60 ohm with leads and plug	9.00
99-12-1	8-32 H.H. nut	.10
99-13-3	10-24 H.H. nut	.10
*99-13-5	10-32 H.H. nut Panamuse	.10
99-13-6	10-32 H.H. nut	.10
99-14-3	½-28 H. Half nut	.10
99-14-5	¼-28 H. Half nut	.10
99-18-19	6-32x½" Mach. Screw	.10
99-19-6	8-32x¾" R.H.M.S.	.10
99-19-13	8-32x¾" R.H.M.S.	.10
99-19-17	8-32x5/16" R.H.M.S.	.10
99-19-18	8-32x5/16" R.H.M.S. Nickel	.10
99-19-19	8-32x7/16" R.H.M.S.	.10
99-20-5	10-24x½" R.H.M.S.	.10
99-20-18	10-32x¼" R.H.M.S. Nickel	.10
99-20-29	10-32x5/16" R.H.M.S. Nickel	.10
99-20-45	10-24x2" R.H.M.S.	.10
99-20-54	10-32x1½" R.H.M.S.	.10
99-22-35	6-32x¼ oval H.M.S. Nickel	.10
99-22-37	4-36x½ oval H.M.S. oxidized	.10
99-23-13	8-32x¾ oval H.M.S. Nickel	.10
99-26-15	10-32x¾ H.H.M.S.	.10
99-34-11	Cotter Key Hairpin	.10
99-34-12	Cotter Key Hairpin	.10
99-36-14	Cotter Key Hairpin	.10
99-36-21	½"x.170"x.042" brass washer	.10
99-38-18	Washer	.10
99-42-5	Keeper for 3/16" shaft	.10
99-42-11	Turntable Stop Washer	.10

Numbers preceded by * are used on CAPEHART PANAMUSE exclusively.

PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

Where (Capehart) appears behind a part, this part is used on Capehart Panamuse Instruments exclusively.

Where (Farnsworth) appears behind a part, this part is used on Farnsworth combinations exclusively.

MODEL S30 CAPEHART (Part 1)

FARNSWORTH TELEV. & RADIO CORP.

MECHANICAL ADJUSTMENTS

1. TO REMOVE THE TURNTABLE, 5779 (Fig. 1)

The turntable unscrews from the Record Spindle, 37140 (Fig. 1), by turning the turntable counter clockwise. If the Main Cam, 3869 (Fig. 4), turns backwards, damage to the Starting Lever Release Assembly Spring may result. Hold the Main Cam while unscrewing the turntable.

2. TO ADJUST DRIVE PULLEY, 3672 (Fig. 2)

In case "wows" are heard in the reproduction, additional tension should be placed on the Turntable Drive Bracket Spring by turning the Spring Clip, which is held by one of the motor mounting screws, 99-19-19 (Fig. 2), so as to increase the tension on the spring. On earlier models, it may be necessary to bend the hairpin spring.

3. TO REPLACE DRIVE PULLEY, 3672 (Fig. 2)

Remove the Hair Pin Cotter Key, 99-34-12 (Fig. 2), and the Drive Disc Thrust Washer, 50209 (Fig. 2). This permits the removal of the Turntable Drive Pulley. In replacing this pulley, the long shoulder goes toward the base plate.

4. BRACKET AND STUD ASSEMBLY, 64216 (Fig. 2)

Remove Turntable Drive Pulley (see 3) and remove screw, 99-19-2 (Fig. 2), and nut, lock nut and washer under drive pulley. In replacing this part, 64216 (Fig. 2), be sure the nut and lock nut under the Drive Pulley are set up so there is very little play between the Base and the Bracket, 64216, but the Bracket should move sidewise freely. Replace the Drive Pulley. (See 3).

5. IF RECORDS FEED INCORRECTLY.

Record shelves may be out of line. Run changer through its change cycle until the back record shelves are in their lowest position. Roller 4057 (Fig. 4) is on point C of Main Cam, 3869 (Fig. 4). The front shelves do not move during the cycle. With the shelves in place for a 12" record, 10" shelves raised, a straight edge from shelf to shelf should just clear the shoulder near the top of the Record Spindle, 37140 (Fig. 2). The shelf may be adjusted while in the lower position by adjusting the four nuts holding the lower link, 54107 (Fig. 3). Care should be taken not to run one nut farther than another and so get the link out of line with the Support Rods 37138 (Fig. 3). The Screw, 99-20-45 (Fig. 3), is to prevent the upper nuts on the lowering link from hitting the Main Cam. Probably it will not require any adjustment.

up and down and should hit the center of the Trip Finger, 46287 (Fig. 4). The up and down motion of the Reject Lever may be corrected by tightening the nut that holds it against the base. Do not tighten it so as to cause the lever to bind; it must move freely.

If changer will not trip when needle enters change groove but will change when reject button is pushed, bend Starting Lever Trip Spring, 39226 (Fig. 5), towards Motor Spindle Gear. On records where the recording occupies only $\frac{1}{2}$ to $\frac{1}{3}$ the available space, if instrument fails to trip in change grooves, it may be necessary to loosen the Bristol set screw in the Trip Friction collar, 43185 (Fig. 3), and move the collar slightly. Use $\frac{5}{32}$ Bristol wrench, 6075, for this adjustment. Turn the collar a small amount clockwise, when viewed from the bottom of the changer. Check the operation of the changer on standard records as it is possible to move the collar too far.

CHANGER TRIPS TOO SOON. If instrument trips when only half the record has been played, check the position of the Starting Lever Release Trip Spring, 39226 (Fig. 5). The Dog, on the Motor Spindle Gear, 35102 (Fig. 5) should throw the Spring back so the Starting Lever Release Trip, 64215 (Fig. 5), over laps the Starting Lever, 46288 (Fig. 5), approximately $\frac{1}{16}$ ". In case the over lap is less, bend Spring slightly toward the Motor Spindle Gear until proper overlap is secured.

If instrument trips near end of record: Set needle $\frac{1}{4}$ " from record spindle, loosen set screw in Collar, Pin and Set Screw Assembly, 66355 (Fig. 3), turn Collar slightly counter clockwise (viewed from bottom of changer). This will decrease the tension on the Friction Trip Lever Spring, 39228 (Fig. 3); tighten set screw and check tripping action on records again.

ADJUSTMENT OF TRIP FINGER, 42687 (Fig. 4). The Trip Finger must not rub on the Base Plate when Tone Arm is raised. It may be bent slightly to clear Base Plate if necessary.

The Trip Finger must move freely. If it moves stiffly or binds, Tone Arm Cam, 66366 (Fig. 4), may be dropped slightly.

The Trip Finger Stop, 46293 (Fig. 4), should be set exactly $\frac{2}{16}$ " from outside of Base Plate.

9. ADJUSTMENT OF TONE ARM HEIGHT.

With a 10" record on the turntable, a standard needle in pickup and 10" records in the magazine, there should be approximately $\frac{1}{4}$ " clearance between the top of the pickup and the bottom of the bottom record in the magazine during the change cycle. This clearance is adjusted by the screw, 99-26-15 (Fig. 4).

Still with a 10" record on the turntable, pickup in playing position, lift pickup off record so that both brush and needle clear record. The point of the needle should drop $\frac{3}{4}$ " of the thickness of the record below the top surface of the record. This height is adjusted by bending the Tone Arm Support, 64219 (Fig. 2).

To adjust needle pressure: Move Tone Arm so all the brush is on the record but the needle clears the edge. Adjust the Brush, 6725 (Fig. 2), by the screw in the pickup head so the needle is halfway between the top and bottom faces of the record.

Care should be taken to see that there is some slack in the pickup lead between the pickup arm and base. If the lead is too tight, the needle will skip over the record instead of stopping in the first groove.

10. TO REMOVE TONE ARM.

Loosen Tone Arm Crank Screw, 99-20-5 (Fig. 4); loosen set screw in Collar, Pin and Set Screw Assembly, 66355 (Fig. 3); loosen screw holding cord clamp at rear of Tone Arm; lift Tone Arm straight up. Recover Lift Rod, 43182 (Fig. 3).

11. REPLACEMENT OF CRYSTAL CARTRIDGE

On Farnsworth S30 changer, the entire cartridge, cord and plug must be replaced.

On Capehart Panamuse, only the cartridge need be replaced.

12. REMOVAL OF MAIN CAM.

Remove Turntable according to directions in section 1. Remove nut, 99-14-5 (Fig. 2), which holds Main Cam Spindle. Pull Record shelves down and Main Cam will slip out. Reassemble in the reverse order.

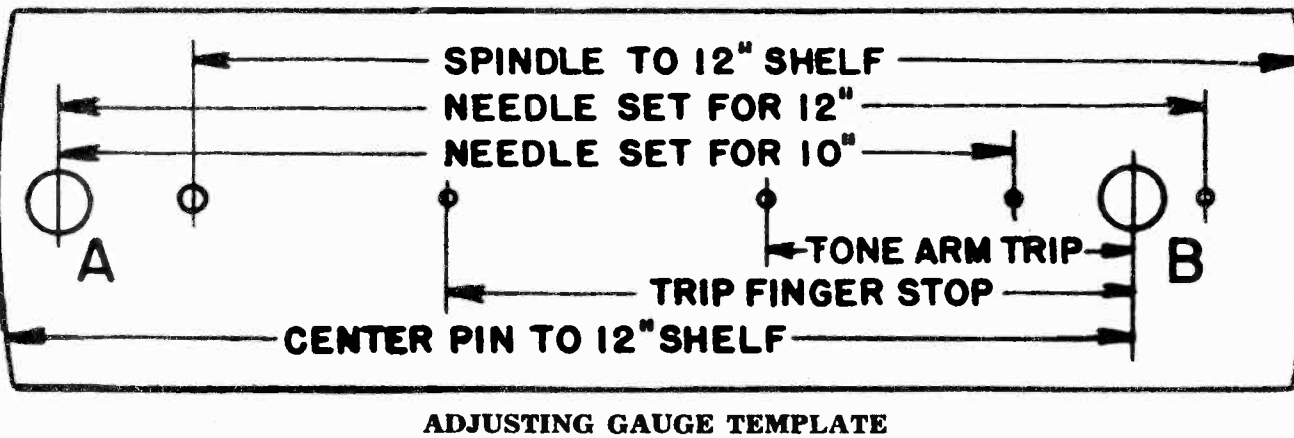
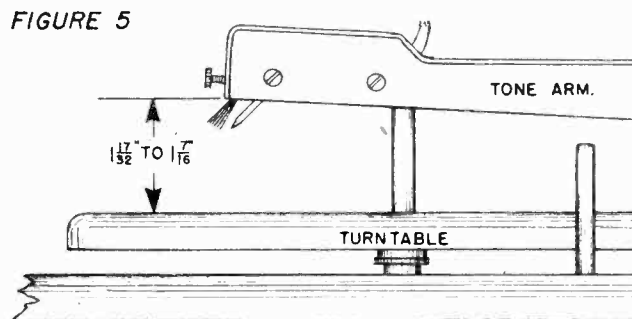
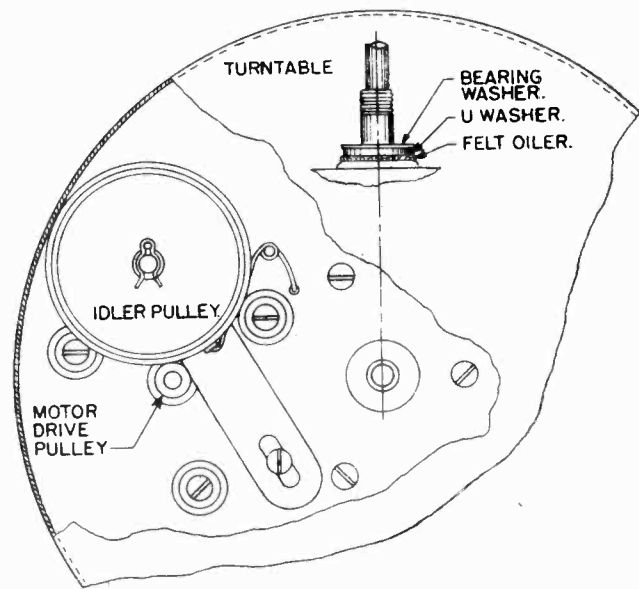
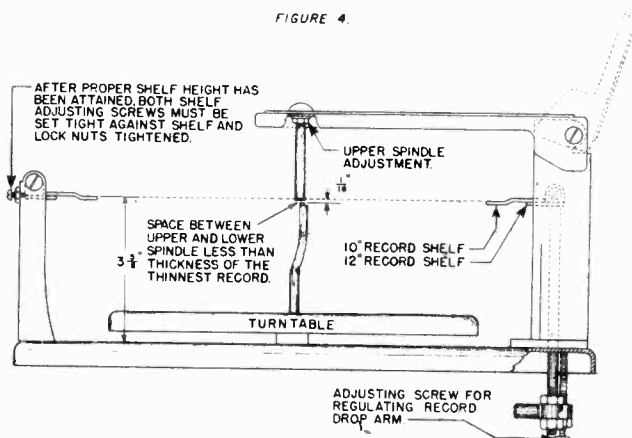
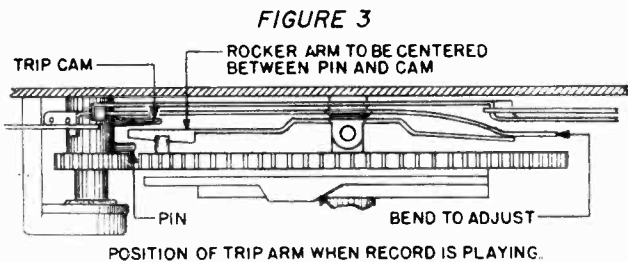
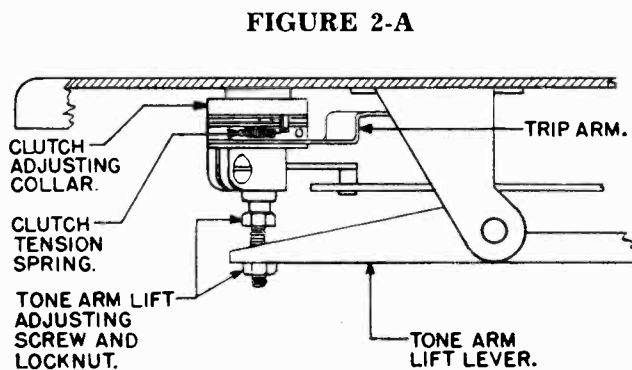
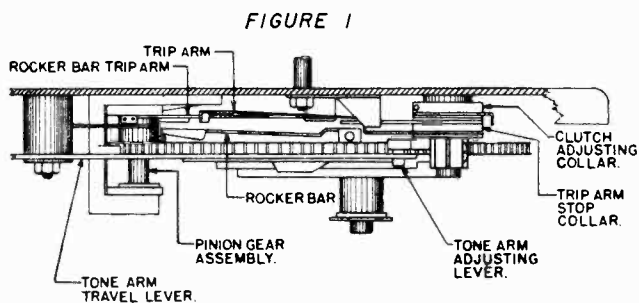
13. IF GEARS JAM

And changer won't cycle, see that Starting Lever, 46288 (Fig. 5), is so positioned that when it engages with Pin, 34309 (Fig. 5), the first teeth mesh properly. It may be necessary to bend the lever to secure proper mesh.

14. A SQUEAK during the change cycle is usually caused by a lack of oil on Roller, 4058 (Fig. 4). A drop of oil placed on it will usually cure it.

Any rumble, occurring during the change cycle between the Motor Spindle Gear and the Main Cam Gear, can be minimized by loosening the three screws, 99-19-17, (Fig. 2), and properly positioning the Motor Spindle. Retighten the screws.

FARNSWORTH TELEV. & RADIO CORP. MODEL S30 CAPEHART (Part 2)



MODEL S30 CAPEHART (Part 2) FARNSWORTH TELEV. & RADIO CORP.

AUTOMATIC RECORD CHANGER

This record changer is mounted on a heavy metal base which is rubber mounted to the cabinet. The turntable is rim driven and in turn drives the automatic changing mechanism. Each changer is thoroughly tested before it leaves the factory and should not need any further adjustments. It is possible that due to wide variations in types of records used, minor adjustments in settings may have to be made. Under the following headings are listed effects, possible cause and method of correcting.

A word of caution when checking for quality.

1. Make sure that all the packing has been removed, around motor, turntable, etc.
2. See that the changer unit does not touch the cabinet, it must float on the four rubber mountings. The four screws which mount base to cabinet should be removed (AFTER RECEIVER IS IN POSITION).
3. ALWAYS USE A GOOD NEEDLE AND SEE THAT IT IS SEATED AND THAT THE NEEDLE SCREW IS TIGHT.

1. Motor Will Not Start.

1. Plug not in receptacle, house fuse blown, defective outlet.
2. Defective switch (Phono-Radio), open motor winding or leads.
3. Motor stopped in an overload position, i. e., record drop cam and cam roller at point where roller is just about to LOWER shelf. Turn the turntable (clockwise) two or three revolutions by hand.

NOTE: The turntable screws down on the record spindle. To remove, turn in clockwise direction by hand until the curve on the spindle is toward the loading rack, then lock small drive pinion in that position. Spindle must NOT turn. Unscrew turntable (counter clockwise).

4. Friction drive pulley stuck, friction drive pulley not touching turntable rim or bushing on motor shaft not touching friction drive pulley. Oil on friction drive pulley.

5. Center pinion shaft stuck or tight. Free and oil. When replacing be very careful so as not to bend or spring the friction drive pulley which will have to be pushed under the edge while screwing the turntable in position.

2. Tone Arm Does Not Drop In Correct Position.

1. 10 inch or 12 inch lever not in correct position for record being played. Check setting of lever.
2. Tone arm drop not set correctly to meet record

variations. Records may vary as much as 1/2-inch in diameter. Adjust for average conditions.

To adjust tone arm drop, place gauge on turntable, large hole (A) over spindle, place needle in tone arm and then place tone arm so the needle sets in small hole marked "NEEDLE SET FOR 10". Throw 10" record lever in correct position. The tone arm adjusting lever, see Fig. 7, must have its stud in contact with the tone arm travel lever, this lever must be in contact with die cast cam and gear. Loosen screw in adjusting lever and adjust lever, then tighten. Check operation and repeat until tone arm drops in correct position.

To adjust for 12-inch records, throw lever to left for 12-inch records. With gauge in place on turntable place tone arm in position marked "NEEDLE SET FOR 12". Loosen lock nut on tone arm travel lever and adjust screw to stop. Tighten lock nut and check. Repeat until needle drops in correct position.

For the above adjustments use a small cotter pin instead of a needle. This prevents any scratching or marring of records or turntable surface.

3. Trips Before Record Is Finished.

This condition invariably is caused by the clutch being too tight. This clutch is the friction type and when the pickup moves at an increased speed toward

the center of the record, sufficient torque is developed to cause the tripping arm to act. To remedy it is necessary to have a No. 6 Bristol wrench to loosen the special set screw in the collar nearest the base of changer, see Fig. 1. Loosen set screw and turn collar a fraction of an inch to the left (counter clockwise) tighten set screw. Check and repeat until record plays to end.

4. Does Not Trip After Record Is Finished.

1. Center groove on record does not have sufficient pitch to develop enough torque to actuate clutch. This may result from improperly cut trip groove in record or loose clutch setting.

2. It may be possible that the trip arm may have jumped to the wrong side of the rocker bar trip arm, see Fig. 7. It should be on the same side as reject arm.

3. To check the trip action adjustment, place the gauge (hole marked B) on the lower spindle and set needle or cotter pin in hole marked TONE ARM TRIP (1 1/2" centers). When in this position the cam on the center pinion shaft should be pointing toward tone arm. With cam as stated, the starting lever should be touching cam when cam and starting lever are in this position. The tone arm tripping lever should be in contact with the starting lever. Likewise the rocker bar (Fig. 3) (bar which engages pin in pinion gear shaft causing large cam gear to engage pinion gear)

must be in contact (beneath) the end of the starting lever (Fig. 3) The end of starting lever may be bent sufficiently to make contact. The end of starting lever must not be bent any more than that which is necessary to center the other end of the rocker bar between the cam and the pin on the small pinion gear (Fig. 3) (running position).

After the above has been checked and adjusted the trip arm (while unit is running) should come in contact with the starting lever when the needle is about 3 1/2 inches from the center line of the spindle. This may be adjusted by loosening the Bristol set screw in tripping lever stop collar (Fig. 1) and turning collar a fraction of an inch to the left. Check operation after tightening set screw.

4. The clutch may be too loose, thereby not developing sufficient torque. To adjust loosen Bristol set screw in clutch collar, rotate collar (Fig. 1) to the right a fraction of an inch. Tighten set screw. Check operation.

5. Records Do Not Drop.

1. Record hole tight or record warped.
2. Shelf height not correct. To adjust see Fig. 4 for correct height; adjust for 10" records first.
3. Spindles may not be in correct relation. See Fig. 4, for correct alignment. Top spindle adjustable.
4. Record drop cam roller out of adjustment. Set correct shelf height (10" shelf) by loosening lock nut and turning screw; tighten locknut.

6. Drops More Than One Record.

1. Warped record.
2. Spindle alignment and etc. Same procedure as listed under 5.

7. Tone Arm Drags On Record.

1. Too many records on the turntable.
2. Records may be thicker than average or warped.
3. Needle too long or not properly seated.
4. Tone arm lift adjusting screw loose or out of adjustment.

To check the tone arm for correct lift, rotate turntable (clockwise) by hand and push reject button in order to actuate trip. Turn slowly until tone arm reaches maximum height and starts to travel toward tone arm rest, then stop when the arm is approximately one inch from edge of turntable. Check the height of the tone arm from the surface of the turntable as indicated in Figure 5. From the lower edge of the tone arm to the top of the turntable the distance should be between 1 7/16" and 1 17/32". To adjust the tone arm lift screw (Fig. 2-A) loosen locknut and adjust screw until arm is within above tolerance, then tighten locknut.

Although standard speed of phono motors is 78.26 manufacturing requires broad tolerance of speed limits - commercial practice is 76.59 to 80.00 rpm.

New type stroboscope disc supplied by Farnsworth - is arranged for 79.23 and 77.42 as well as the 2 speeds on the older one - 78.26 and 33.33 - and the upper and lower limits above (76.59 and 80.00)

The click heard after the record changer is half played may be due to excessive friction in the trip assembly at the bottom of the tone arm assembly. A temporary repair may be effected by use of small piece of adhesive tape on face of spring where re-setting dog strikes the spring.

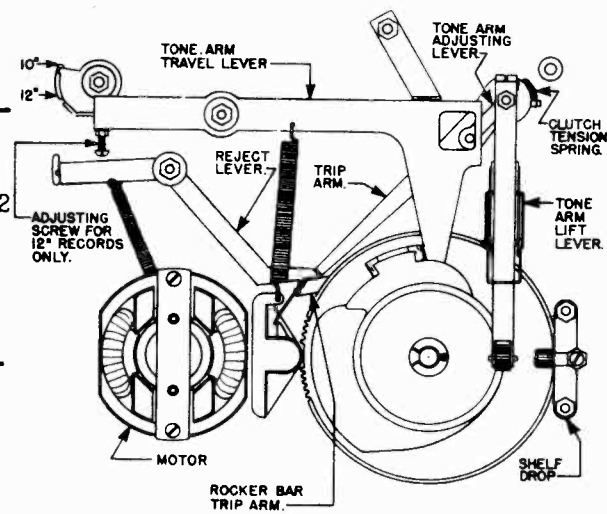


FIGURE 7

FARNSWORTH TELEV. & RADIO CORP.

FOREWORD

Due to the fact that a complete understanding of the proper operation of a record changer is necessary before any attempt be made to repair or affect Service adjustments; we are giving a description of the change cycle of the P-40 Series Capehart-Farnsworth Record Changers.

The record shelves are set for the size record to be played (either 10" or 12") by turning either shelf to the position indicated on the decal, then the correct number of records should be placed on the record shelves. (Twelve 10" or ten 12"). The tone arm should be on its rest.

Before loading the records on the shelves they should be examined for rough edges (burrs, flash or chips) and if any burrs are found they should be removed with fine sandpaper.

Turn on the control which starts the phonograph and next move the reject button sidewise. The changer will go into cycle lifting the tone arm off the rest and swinging it under the stack. The tone arm should swing clear of the record stack, a record should drop to the hooks, pause, then gently settle to the turntable. The tone arm should swing back and be lowered to the starting groove on the record. When the record is played the above cycle is repeated until the records have been played.

Now let's follow the above cycle through the mechanism.

When the reject button is moved, the Reject Lever (56-877) pushes the Start Lever and Release Trip Assembly (64215) far enough to disengage it from the Starting Lever Assembly (13-38). Due to its construction the Starting Lever (which is part of the Main Cam Assembly) (13-296) tilts down and engages with the Starting Pin (34309) to make the Main Cam Gear mesh with the Spindle Gear (part of 13-297).

The Turntable is screwed onto the Spindle Gear and both are driven through the Idler Pulley (3672) by the Motor. When the cycle is completed the Main Cam Gear disengages from the Spindle Gear because several teeth are left off the Main Cam Gear, this is called the playing position, see Fig. A.

When the Starting Lever engages with the Starting Pin (see above) the Main Cam Assembly is moved forward at the right speed and the correct distance to cause the gears to mesh properly. Then the Main Cam goes through a complete revolution.

First the Tone Arm is lifted off the record through the Tone Arm Lift Lever (13-303).

As this happens the Tone Arm Return Lever (09-119) moves the Tone Arm from under the record stack. The Rear Record Plunger moves forward at the same rate of speed as the eccentric portion of the Spindle and the Front Plunger does. This pushes the record off the Rear Shelf where the Rear Record Hook catches it. Both Front and Rear Plungers move backwards at the same rate as the Spindle does, pushing the record off the Front Shelf and dropping it to the Front Hooks, the record pauses here until the Hooks move to center the record in respect to the Spindle. Then both Hooks snap back out of the way, allowing the record to settle gently to the turntable. Next the Tone Arm swings into the proper position and is lowered to the record. A wire spring, against the Tone Arm Crank, keeps the Tone Arm from dropping off the record before the needle settles on the record playing groove.

*1

To accomplish the record feed there are three sections of the Main Cam, together with the Centering Lever and Rocker Arm Assembly involved. The first section² of the main is a "Boss" illustrated at the end of the Tone Arm Lift Lever in Fig. A. The second³ section is the Trip Roller Assembly on top of the Main Cam. The third⁴ section is the "slot" in the Tone Arm Lift portion of the cam adjacent to the Trip Roller Assembly.

The action is as follows; As the Main Cam rotates, the "Boss" strikes the Centering Lever and Rocker as shown in Fig. B, this moves the Record Plungers toward the Spindle. Because this pressure is applied through a spring, variations in record diameter are of little consequence. After the Boss passes the Centering Lever⁵, the Trip Roller strikes the Rear Rocker the first time moving the Rear Record Plunger forward and the Front Record Plunger is also moved forward, Fig. C. As the Main Cam moves on, the Record Plungers go to a central position then both move backward, Fig. D, then resume the central position, this is while the record rests on the Hooks. Then the Centering Lever drops into the "Slot" in the Main Cam, Fig. E, the Front and Rear Hooks are suddenly withdrawn from the record and it drops to the turntable.

As the Tone Arm moves over the record, its motion is transmitted through the Friction Trip to the Friction Trip Lever. When the needle enters the change groove the Starting Lever and Release Trip is released by the Friction Trip Lever, this allows the Starting Lever to drop and engage the Starting Pin.

* 1. Two- on P-44

2. No first section on P-44, only

"second" and "third" used.

3. First section on P-44

4. Second section on P-44

5. Up to this part of paragraph applies only to P-41

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In the following five illustrations we are showing the cycle of operation of a P-40 Series Capehart-Farnsworth Changer.

Figure A is known as the playing position.

* In Figure B the Main Cam has advanced so the "Boss" on the Main Cam has moved the Centering Lever Return Arm away from the cam, which because of the Return Spring causes the Centering Arm thru the Rocker Levers and Plunger Shafts to move the Record Plungers toward the Spindle. Due to the motion being transmitted thru the Return Spring different diameter records are handled equally well. The equalizer spring aids in exactly centering the record in regard to the Spindle. Note, in this illustration the Tone Arm Swing Lever is part way up the Cam Shoulder.

* ABOVE PARAGRAPH FOR P-41 ONLY

In Fig. C the Trip Roller (part of Main Cam) has advanced to move the rear plunger rocker away from the spindle, at

the same time moving the front plunger rocker toward the spindle. Due to the Plunger Shafts, which transmit the motion of the Rockers to the Record Plungers the Record Plungers move in the opposite direction from the Rockers, i.e. Front Record Plunger moves away from the Spindle. This causes the record to be pushed off the Rear Shelf and drop to the Rear Hooks.

Between C & D the Record Plungers go through the central position and assume the position shown in Fig. D where the Rear Record Plunger moves away from the Spindle causing the record to drop to the Front Hooks.

In Fig. E the Centering Lever Return Arm has dropped into the "Slot" in the Main Cam, moving both Plungers toward the Spindle, causing the Front and Rear Hooks to snap back, permitting the record to settle flat on the turntable. In this illustration the Tone Arm Swing Lever is returning to the normal position.

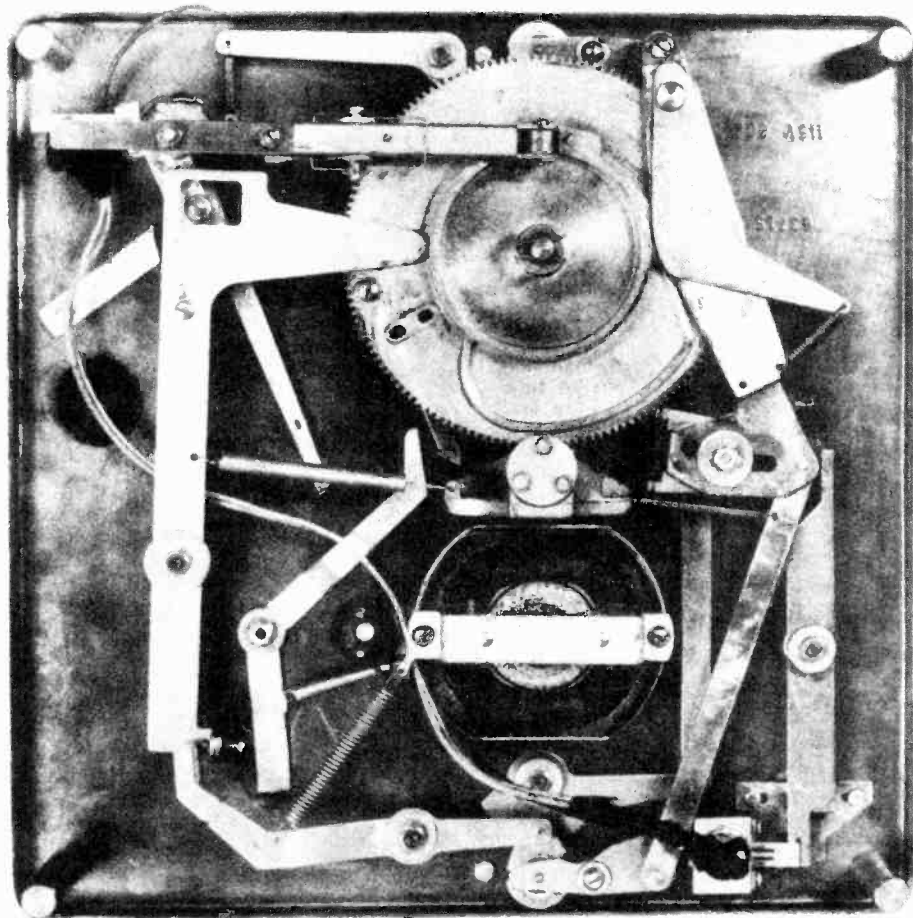


FIGURE A

FARNSWORTH TELEV. & RADIO CORP.

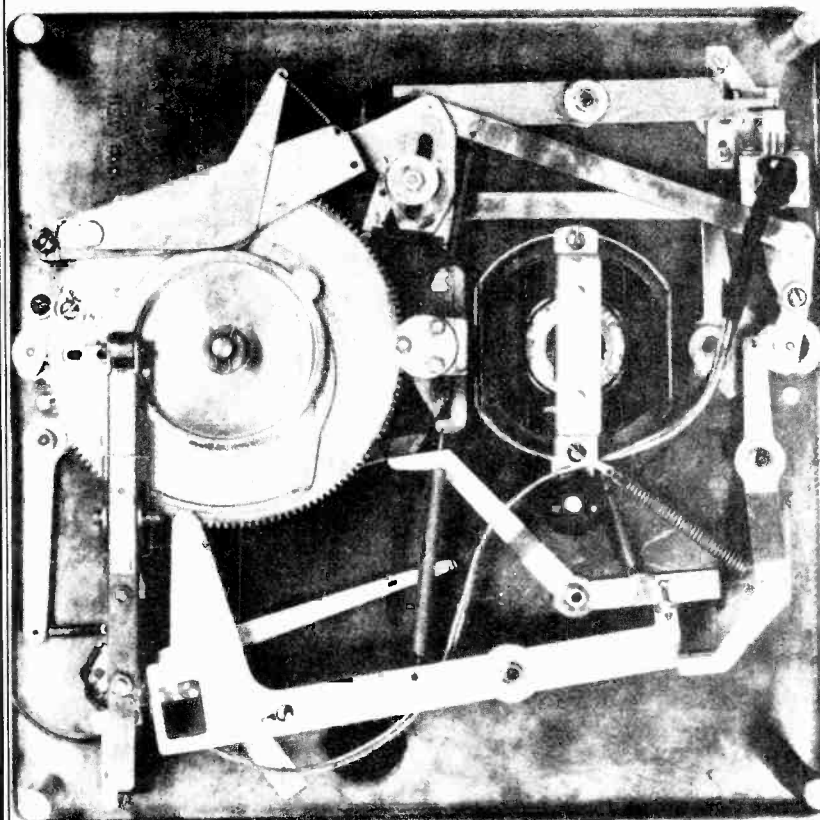
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FIGURE B

1. TO REMOVE TURNTABLE 13-299

The Spindle Gear may be wedged, by a screwdriver between it and the Main Cam, to prevent its turning, the Turntable should be unscrewed from the Spindle. When removing the Turntable make certain one of the Spacer Washers is not lost. These Washers often adhere to the Turntable because of an oil film from the Felt Washer 4949. When replacing Turntable make sure it is properly tightened. NEVER USE GAS PLIERS TO HOLD SPINDLE.

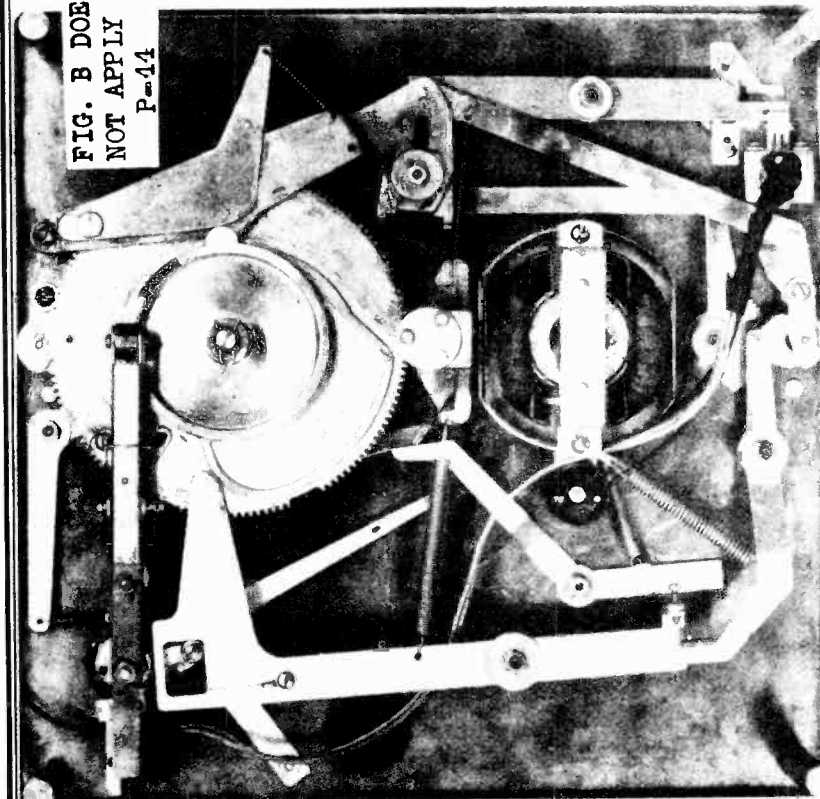


FIGURE C

2. TO REPLACE OR ADJUST IDLER PULLEY 3672.

First remove Turntable. The Idler Pulley is used to transfer power from the Motor Pulley 3671 to the Turntable. If the Idler Spring tension is incorrect the Turntable speed may be too high or too low, it should fall between 76.59 R.P.M. and 80.00 R.P.M. This tension is adjusted by loosening the Motor Mounting Screw holding the Spring Holder 45176 and turning the Spring Holder until the required tension is secured.

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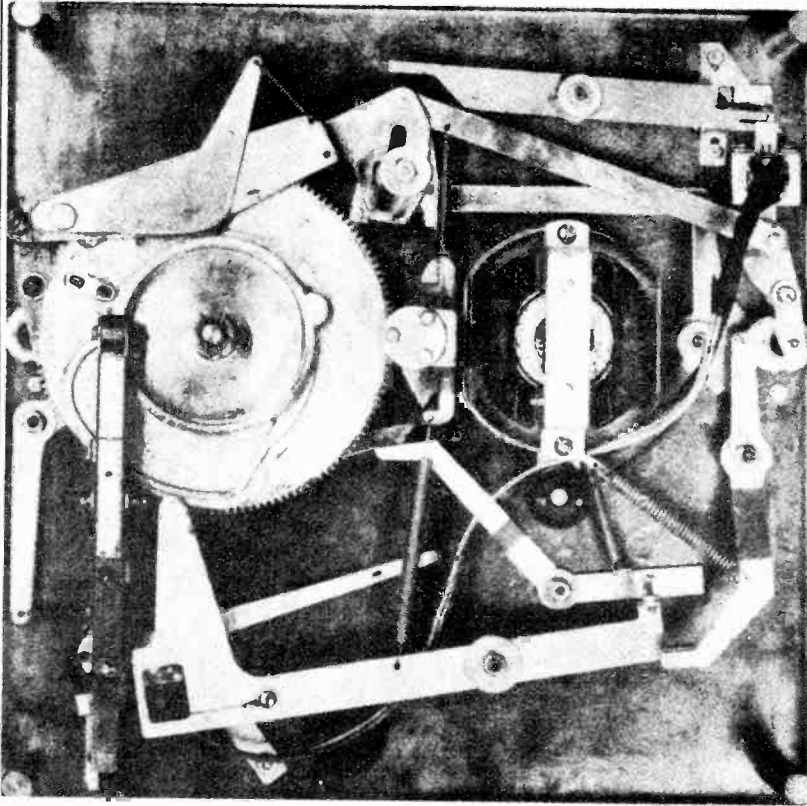


FIGURE D

3. ALIGNMENT OF RECORD SUPPORT SHELVES

The center line of the record shelves should form a straight line, in 10" position which passes through the center of the spindle. The shelves should be exactly $9-21/32$ " apart and the spindle should be equidistant from both. In the event it becomes necessary to change the spacing of the record shelves it is recommended that shims be used to adjust them. In some cases if oversized or

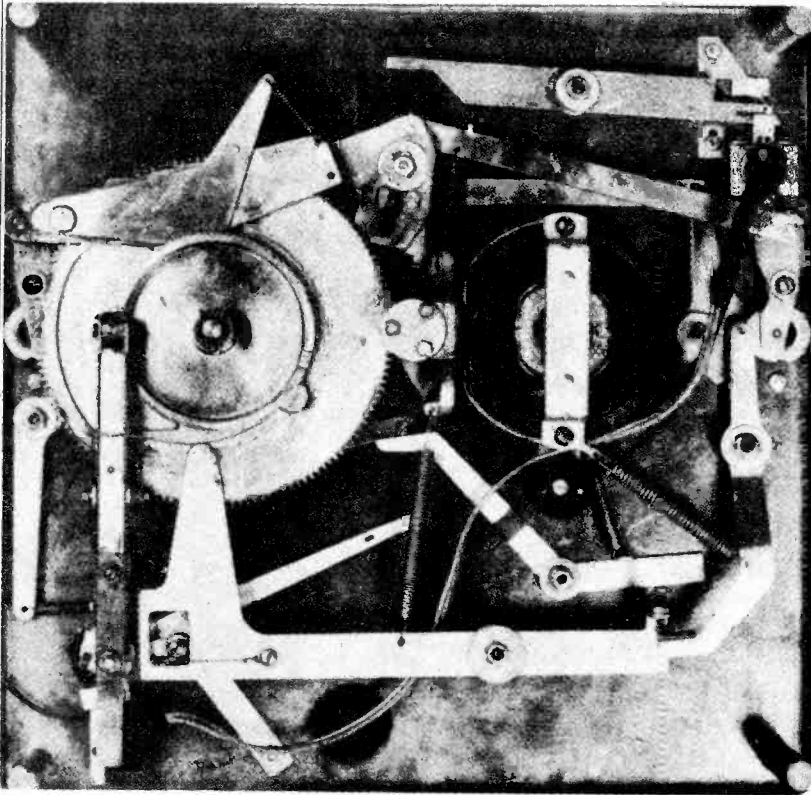


FIGURE E

If it is necessary to replace the Idler Pulley remove the Hair Pin Cotter 99-34-14 and the Thrust Washer 50209. After removing the Idler Pulley also remove the Thrust Washer used underneath the pulley. If the Idler Pulley is replaced both Thrust Washers should be also.

When replacing the Pulley a single drop of oil should be used on the Pulley Stud.

CAUTION--Do not allow oil to get on either the Idler Pulley or the Turntable Rim.

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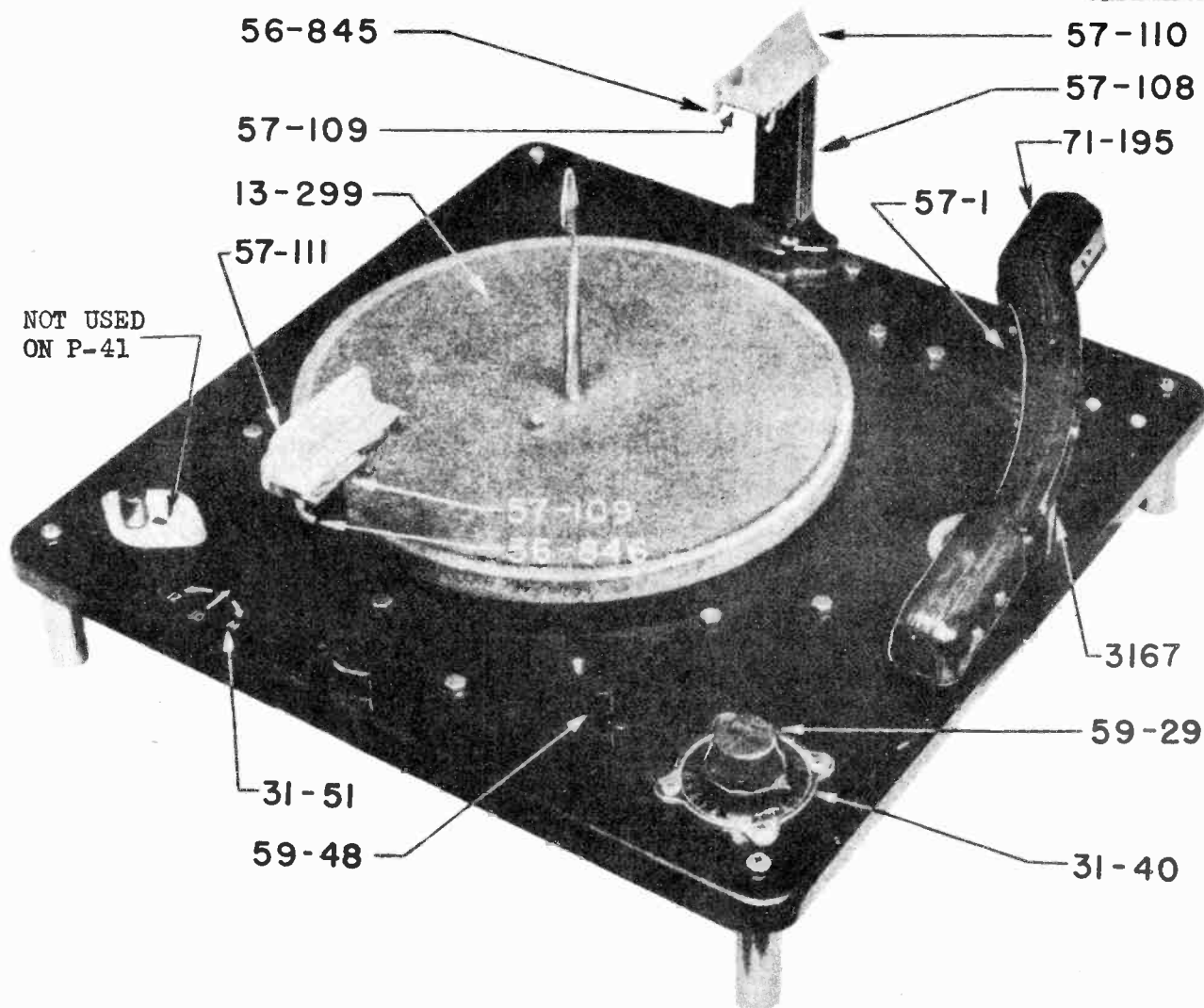


FIGURE 1

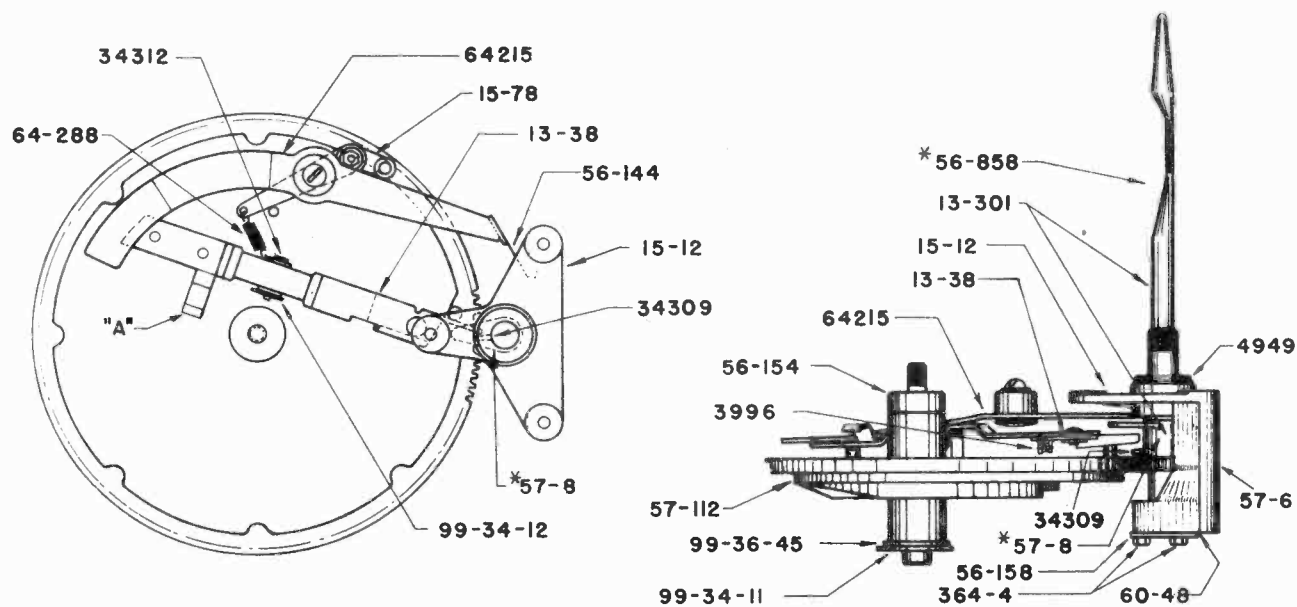


FIGURE 2

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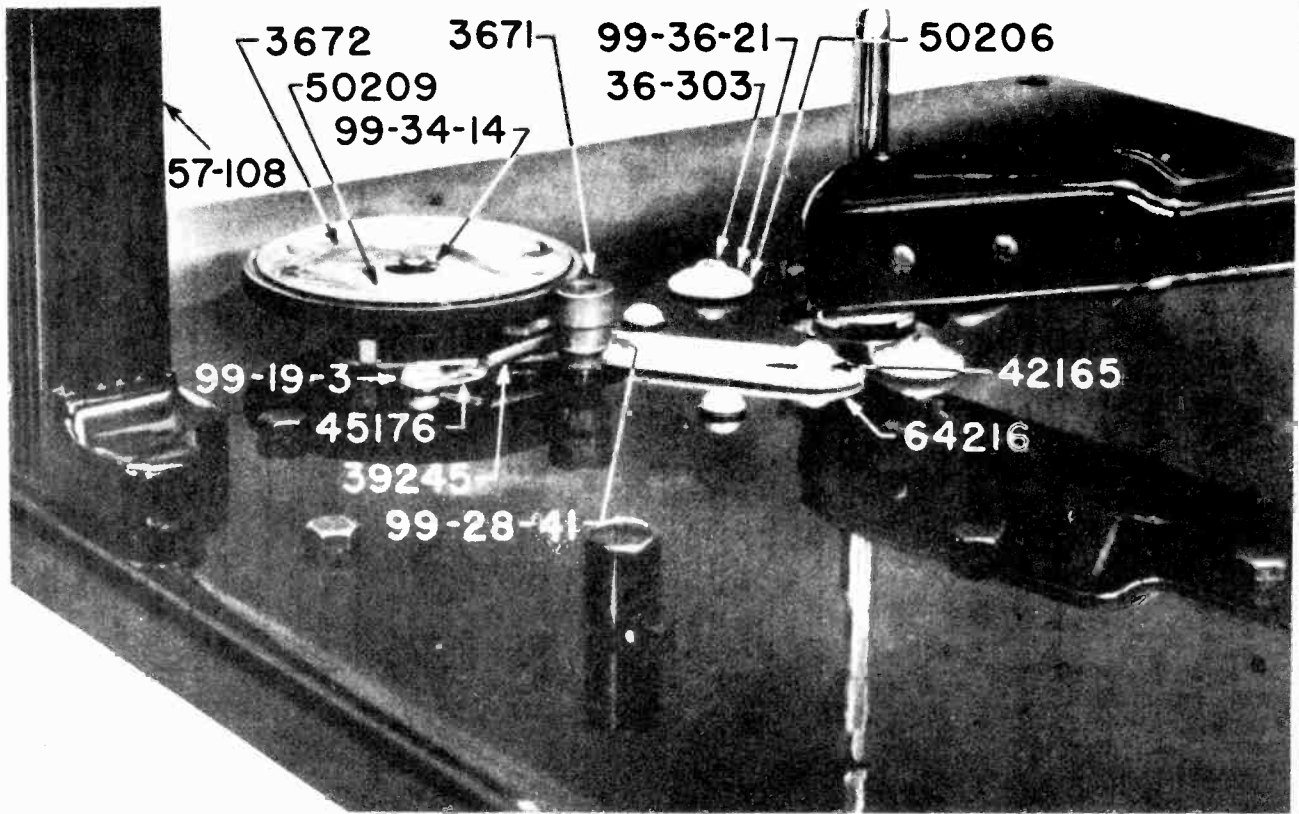


FIGURE 3

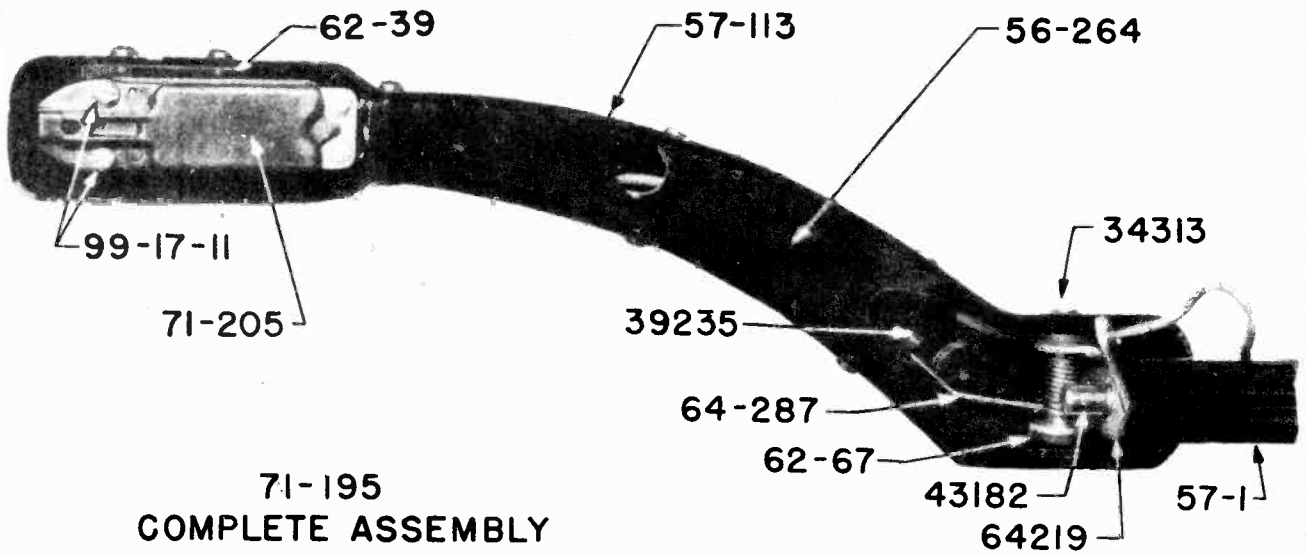


FIGURE 4

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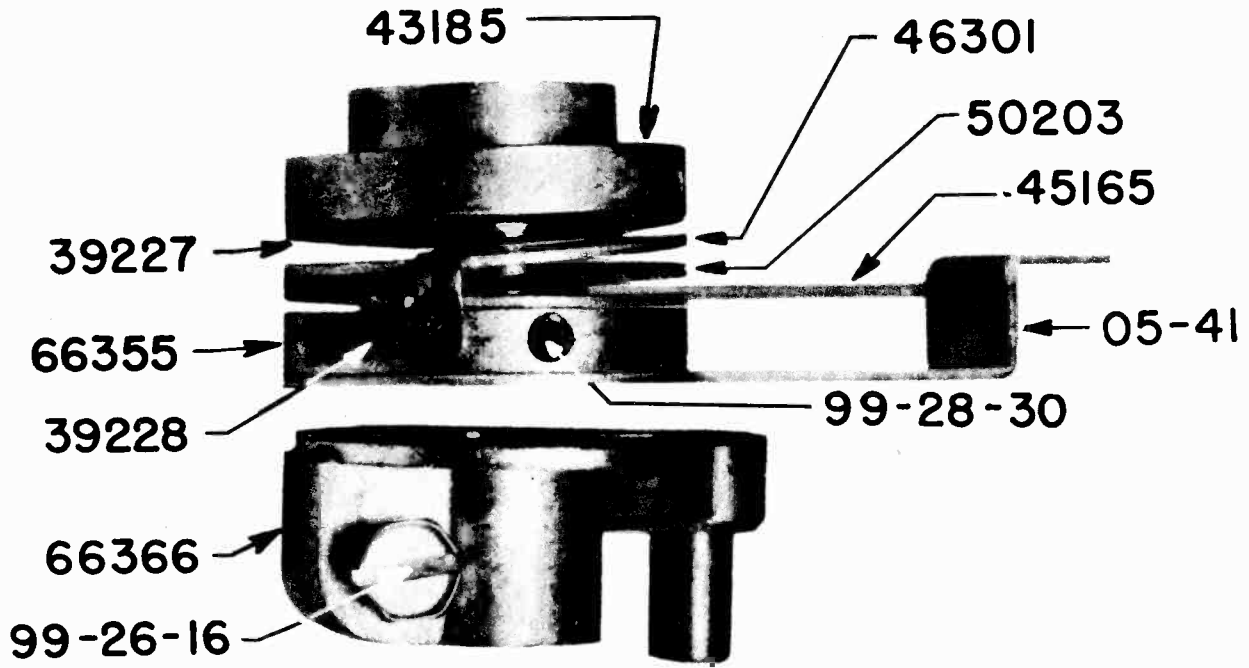


FIGURE 5

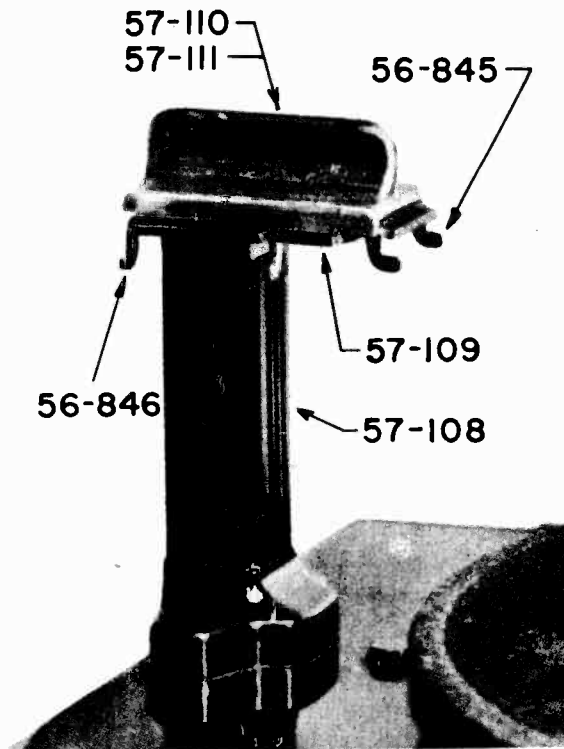


FIGURE 5A

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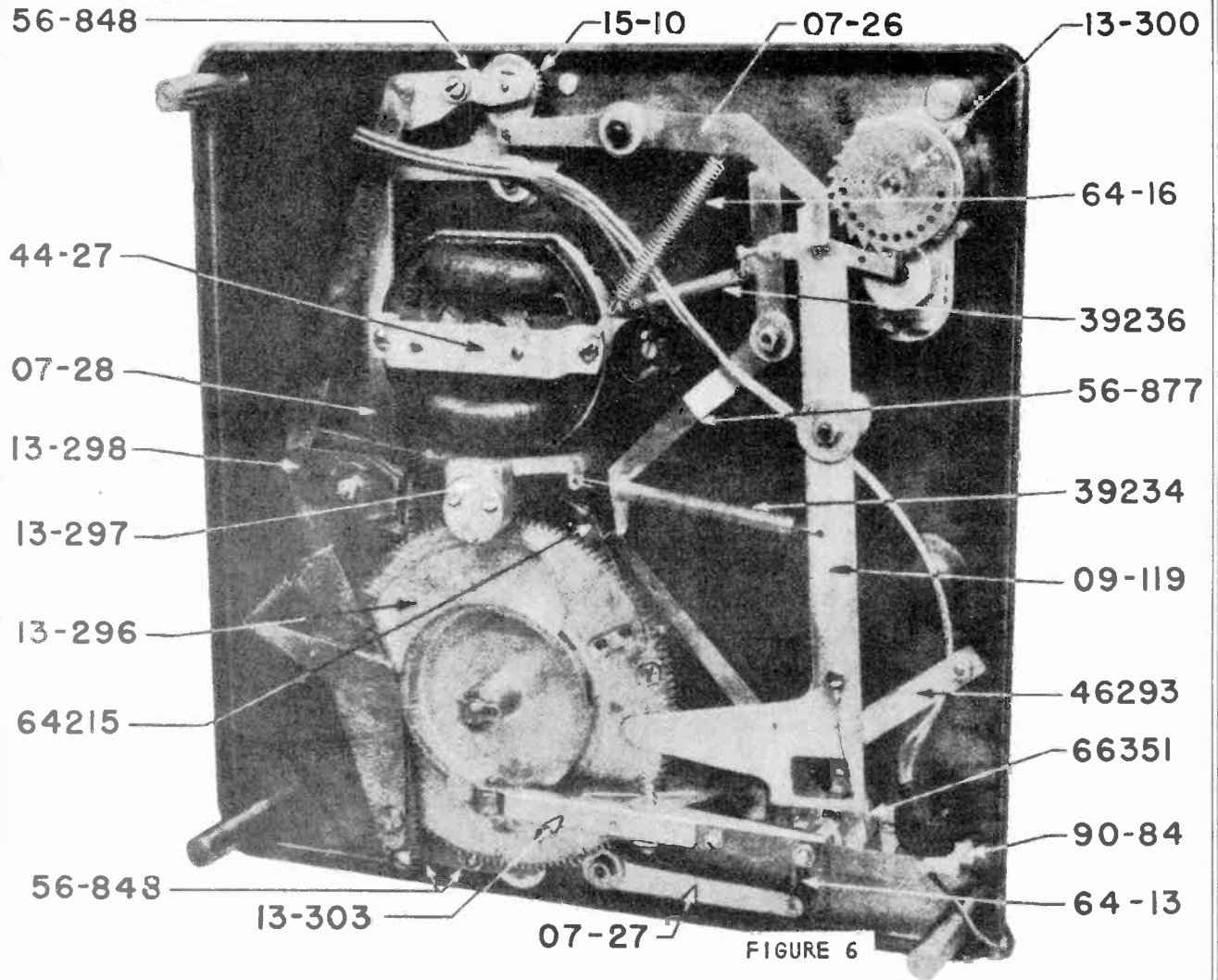
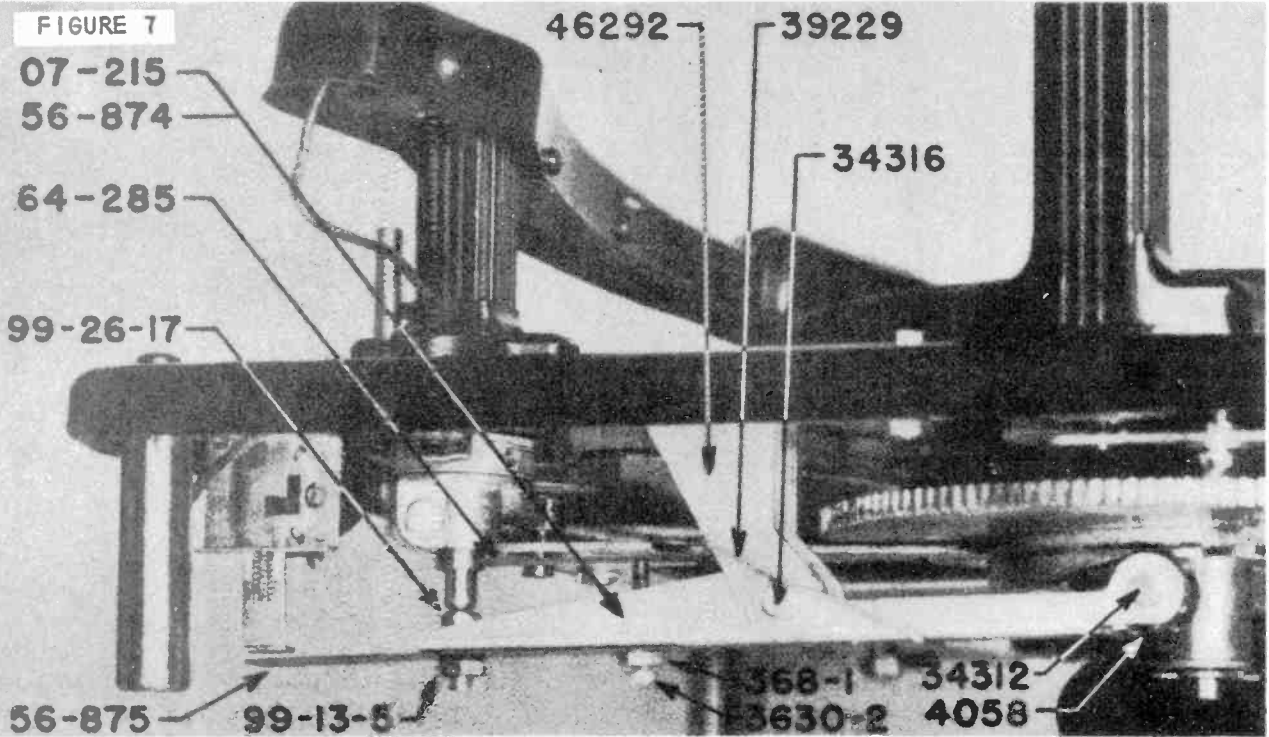


FIGURE 6

FIGURE 7



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undersized records are used it may be necessary to change the spacing of the shelves.

4. ALIGNMENT OF RECORD SPINDLE

To prevent feedback the Spindle, Gear and Bracket Assembly is rubber mounted and can shift in transit. To reposition the spindle loosen all three mounting screws, position the spindle and tighten all three mounting screws equally; so as not to force the spindle out of place which may happen if one screw is tightened first.

4-7/8" from center of the Record Spindle. To adjust have record changer in playing position, loosen Tone Arm Set Screw 99-26-16 (Fig. 5) set needle 4-7/8" from center of Record Spindle. Hold Tone Arm Crank firmly against Tone Arm Swing Lever 09-119 (Fig. 2) at the same time hold the Tone Arm Crank firmly up against the Trip finger 46287 (Fig. 5). Tighten the Set Screw 99-26-16. There should be a small amount of play up and down in the tone arm. Next set the 12" drop. To adjust set the record shelves for 12" records and have record changer in playing position. Loosen Lock Nut 99-11-6; which is part of 09-119 and adjust Screw 36-465 until the needle drops 5-7/8" from the center of the Record Spindle. Be sure nut 99-11-6 is tightened after adjustment is made.

9. ADJUSTMENT OF TONE ARM 71-195 (Fig. 4)

With records on the shelves, the top of the pickup arm at the highest point in its return should be 3/16" below the bottom of the bottom record on the shelves.

10. TRIP MECHANISM (Fig. 5)

The proper adjustment of the Trip Mechanism is, when the needle is 1-7/8" from the center of the record spindle, the Trip Finger 05-41 (Fig. 5) trips the Starting Lever Release Trip 64215 (Fig. 6).

To adjust tension loosen Bristol Set Screw 99-28-30 in Upper Collar 43185 (Fig. 5). Turn collar counter clockwise to increase friction (if changer does not trip at end of record) and clockwise to decrease friction (if changer trips before the end of the record). There should never be any more friction than is necessary to move Starting Lever Release Trip 64215 (Fig. 6) off the end of the Starting Lever 13-38 (Fig. 6).

Excessive friction will cause a loud click each revolution of the turntable after a part of the record has been played.

flush and the pointed end projects about 1/8" and should engage the end of the Starting Lever 13-38 to allow the teeth of the Main Cam to mesh with the Spindle Gear without topping. Two adjustments are possible if the teeth do not engage properly, either drive the Starting Pin in further or bend the end of the Starting Lever.

12. MOTOR SPEED

Due to commercial tolerances it is impossible to secure motors which will run at exactly 78.26 R.P.M. Our limits are from 76,59 R.P.M. to 80,00 R.P.M.

In the event it becomes necessary to get exact speed on one of these changers choose a motor pulley that gives a slightly higher speed than required. Using a fine file reduce the diameter of the motor pulley a little at a time until the required speed is secured.

11. STARTING PIN 34309 AND STARTING LEVER 13-38 (Fig. 6)

The Starting Pin 34309 (Fig. 6) is normally driven into the Spindle Gear 57-8 (Fig. 6) until the square end is

8. NEEDLE LANDING

In 10" position, adjust the Tone Arm. Crank-66366 (Fig. 5) so the needle lands

two or three drops of oil should be put on the two felt washers in the Spindle Gear Bracket. One washer is located at the bottom of the Spindle Gear, the other is at the top of the bracket and is accessible by removing the Turntable. Two or three drops of oil on the felts in the Motor. One drop of oil on the Pin for the roller of the Tone Arm Lift Lever. A very light application of White Vaseline on the teeth of the Main Cam, also some on the face of this Cam where the Tone Arm Swing Lever rides. A single drop of oil on the 10" and 12" plungers. Care should be exercised to prevent an excess of oil being used on any part.

No further lubrication on the tone arm bearing will be necessary unless a replacement is made. In this case a thin film of vaseline may be used.

Care should be taken to see that no oil gets on the motor pulley, idler pulley or rim of the turntable. No oil should be used on the Friction Trip Assembly.

13. THE FOLLOWING SIMPLE OILING INSTRUCTIONS WILL RESULT IN A MINIMUM OF SERVICE CALLS----

Use only a good grade of machine oil Every six months or once each year, with a viscosity of SAE 10.

6. ADJUSTMENT OF NON TRIP CAM OF STARTING LEVER 13-38 (Fig. 6)

This Cam shown at "A" in (Fig. 6) should be adjusted so that when the machine is in the "Manual" position, the Starting Lever Release Trip 64215 (Fig. 6) will pass over the end of the Starting Lever 13-38 (Fig. 6) without touching. The front end of the Starting Lever must also clear the bottom of the Resetting Dog and the top of the Starting Pin both part of the Spindle Gear 57-8 (Fig. 6).

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FIGURE LIST PRICE

PART NUMBER DESCRIPTION

PART NUMBER	DESCRIPTION	FIGURE LIST PRICE
07-26	Front Locking Lever Assembly	2
07-27	Rear Locking Lever Assembly	2
07-28	Connecting Link Assembly	2
07-215	Lever and Brake Spring Assembly	7
09-119	Tone Arm Return Lever and Spring Assembly	2
11-86	Lead and Plug Assembly, Tone Arm . . . . .	.40
11-180	Feed-in Spring Assembly . . . . .	.20
13-38	Starting Lever Assembly . . . . .	.40
13-153	Switch Cover, Play Control . . . . .	.10
13-296	Main Cam Assembly	2.30
13-297	Spindle Gear and Bracket Assembly	3.50
13-298	Centering Lever and Rocker Assembly	3.05
13-299	Turntable	1
13-300	Play Control Assembly	2
13-301	Spindle and Gear Assembly	1.80
13-303	Tone Arm Lift Lever and Bracket Assembly	2.00
15-10	Front Gear and Cam Assembly . . . . .	.80
15-11	Rear Gear and Cam Assembly . . . . .	.80
15-12	Spindle Support Bracket Assembly	1.35
15-76	Front Plunger Shaft Assembly30

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15-77	Rear Plunger Shaft Assembly.	Starting Lever Spring.	10
15-78	Trip Roller Assembly	...	3	...	Main Cam Stud.	...	6	30
15-80	Ratchet, Hub and Pin Assembly.	...	2	...	Spacer (Tone Arm Swing Lever).	...	2	10
31-40	Play Control Dial.	...	1	15	Spindle Thrust Plate	...	6	10
31-51	Decalomania	...	1	10	Ratchet Pawl	...	2	15
31-60	"Reject" tab	...	1	05	Shoulder Rivet	...	2	10
36-112	#10 Flat Washer 1" O.D.	...	...	10	Shaft, Play Control.	...	...	10
36-114	10-32x1/32" H.H. Screw.	...	...	05	Ratchet Locking Plunger.	...	...	10
36-115	10-32x1/2" H.H. Mach Screw	...	...	10	Spacer, Switch Cam	...	...	10
36-116	10-32x1/4" H.H. Mach Screw	...	...	05	Switch Bracket, Play Control	...	2	20
36-117	10-32x1/4" H.H. Screw Front Locking Lever.	...	...	10	Gear Sector, Rear	...	...	10
36-118	Turntable Washer	...	6	10	Wire Clamp	...	...	10
36-119	8-32x3/8" B.H.M.S.	...	...	05	Bracket Crystal Mounting.	...	...	05
36-120	8-32x5/16" B.H.M.S	...	...	05	Spacer, Crystal Mounting	...	2	10
36-129	1/4"-28 Hex Nut.	...	...	10	Gear Sector Spacer	...	4	30
36-136	#10 Flat Washer.	...	...	05	Tone Arm Brace	...	...	15
36-140	4x1/4" Phillips B.H.S.T.S.	...	...	10	Centering Lever	...	...	15
36-141	6-32x1/4" R.H.M.S.	...	2	06	Plunger Rocker	...	5A	20
36-143	Taper Pin, Play Control.	...	...	10	10" Record Plunger	...	5A	20
36-231	10-32x1/2" H.H. Screw.	...	...	05	12" Record Plunger	...	...	10
36-236	6-32x1/4" Phillips O.H.M.S.	...	1	10	Rocker Lever Spacer.	...	...	05
36-268	4-36x1/8" Phillips B.H.M.S.	...	3	10	Centering Lever Washer	...	...	10
36-303	8-32x7/16" R.H.M.S.	...	3	05	Centering Lever Guide Stud	...	...	10
36-440	8-32x5/16" Bristol Set Screw	...	1	15	Rocker Connecting Link Rivet	...	...	15
36-454	8-32x1/4" R.H.M.S.	...	3	05	Centering Lever Return Arm	...	...	05
36-465	8-32x5/8" R.H.M.S.	...	2	05	Centering Lever Rivet and Guide Pin.	...	...	15
36-504	4-56x3/16" Phillips B.H.M.S	...	4	10	Rocker Connecting Link	...	7	20
36-593	Pin, Play Control.	...	...	10	Tone Arm Lift Lever, Only	...	6	15
36-624	6-32x1/2" Phillips B.H.M.S.	...	...	10	Switch Trip Finger	...	...	15
36-687	4-36x9/16" F.H.M.S	...	...	10	Reject Lever	...	...	05
36-688	6-32x9/16" B.H.M.S	...	...	10	Centering Lever Guide Pin.	...	...	05
36-758	Needle Set Screw, Slotted.	...	...	05	Tone Arm Support Housing	...	...	45
362-1	Rivet, Brake Spring.	...	...	05	Record Support Housing	...	5A	60
364-4	6-32x1/4" H.H.M.S.	...	...	05	Record Support Shelf, Tube Assembly	...	5A	1.10
368-1	6-32 Hex Nut	...	7	05	Record Shelf Cover, Rear	...	5A	20
368-4	8-32 Hex Nut	...	...	05	Record Shelf Cover, Front.	...	5A	20
368-7	10-32 Hex Nut.	...	...	05	Main Cam Only.	...	2	1.20
3612-4	#6 S.P. Washer	...	...	05	Tone Arm Only.	...	4	.90
3624-2	#6 Flat Washer	...	...	05	PRICES SUBJECT TO CHANGE WITHOUT NOTICE	...	...	...
3630-2	6-32x7/8" R.H.M.S.	...	...	05	Play Control Knob	...	1	.10
44-27	Motor, 60 Cycle.	...	2	7.00	Reject Knob.	...	...	.10
44-28	Motor, 50 Cycle.	...	...	9.50	Paper Gasket	...	6	.10
56-100	Starting Lever End	...	6	10	Cycle Switch Cover	...	...	...
56-102	Spacer, Spindle, Gear and Bracket.	...	2	10	Bushing For Crystal Lead	...	...	10
56-104	Connecting Link.	...	2	15	Crystal Damping Shim	...	4	.15
56-106	Rivet, Starting Lever.	...	...	05	Bushing, Tone Arm.	...	...	.10
56-106	Connecting Link Rivet.	...	...	05	Spring	...	...	10
56-108	Record Support Post.	...	5A	.60	Spring, Shelf Lock Lever, Front.	...	2	10
56-109	Record Support Shelf and Tube	...	5A	.96	Spring, Ratchet Plunger.	...	...	10
56-110	Record Shelf Cover, Front.	...	6A	.20	Spring, Switch Cam	...	2	10
56-111	Record Shelf Cover, Rear	...	5A	.20	Brake Spring	...	7	10
56-112	Spacer, Front Rocking Lever.	...	2	10	Spring, Tone Arm Counter Balance	...	4	10
56-124	Gear Sector, Front	...	2	20	Spring, Trip Roller.	...	...	10
					Spring, Centering Lever Equalizing	...	...	10
					Tone Arm Assembly, Complete.	...	4	8.00
					Crystal Cartridge.	...	4	4.25
					Switch, Play Control30
					Switch, Cycle.	...	7	.50

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99-10-8	4-36 Hex Nut05
99-11-6	6-32 Hex Nut	2	.05
99-12-1	8-32 Hex Nut	2	.05
99-13-5	10-32x3/8" Hex Nut05
99-17-11	4-36x5/8" R.H.M.S. . . . .	...	.05
99-18-1	6-32x3/16" R.H.M.S. Play Control . . . . .	...	.05
99-19-3	8-32x3/8" R.H.M.S.	3	.05
99-19-8	8-32x1" R.H.M.S. . . . .	...	.05
99-20-31	No disc. . . . .	...	.05
99-26-16	Tone Arm Crank Set Screw	5	.05
99-26-17	10-32x1/2" H.H.M.S. . . . .	...	.10
99-28-30	6-32x1/4" Bristol Set Screw.	5	.10
99-28-31	6-32x3/16" Bristol Set Screw . . . . .	...	.10
99-33-1	#4 S.P. Washer . . . . .	...	.05
99-33-3	#8 S.P. Washer	3	.06
99-33-4	#10 S.P. Washer. . . . .	...	.05
99-33-5	1/4" S.P. Washer. . . . .	...	\$0.05
99-34-11	H.P. Cotter, Main Cam Stud.	6	.10
99-34-12	H.P. Cotter, Starting Lever	6	.10
99-34-13	H.P. Cotter, Tone Arm Lift Lever.	7	.10
99-36-1	Washer Starting Lever . . . . .	...	.05
99-36-7	Plain Washer, Play Control. . . . .	...	.05
99-36-12	Flat Washer 17/64"x3/4" . . . . .	...	.05
99-36-20	#8 Flat Washer. . . . .	...	.05
99-36-21	#8 Flat Washer.	3	.05
99-36-28	Brass Washer. . . . .	...	.05
99-36-36	#8 Flat Washer.	3	.05
99-36-38	Brass Washer, Idler Bracket	3	.10
99-36-45	Washer, Main Cam Stud	6	.10
99-37-2	Wave Washer . . . . .	...	.10
99-40-6	#0x3/16" Drive Screw. . . . .	...	.10
99-42-10	3/16" Ball Bearing. . . . .	...	.10
99-42-11	Washer, Turntable Stop.	6	.10
3167	Tone Arm Rest	1	.10
3294	Shoulder Bearing, Clutch Locking Lever. . . . .	...	.10
3671	Pulley, 60 Cycle Motor.	3	.20
3672	Idler Pulley.	3	.75
3681	Pulley, 50 Cycle Motor.	3	.35
3996	Spring.	6	.10
4058	Tone Arm Roller	7	.10
4949	Felt Washer	6	.10
34309	Starting Pin.	6	.10
34312	Pivot Pin	6	.10
34313	Hinge Pin, Tone Arm	4	.10
34316	Hinge Pin, Tone Arm Lift Lever.	7	.10
39227	Spring Washer	5	.10
39228	Coil Spring	5	.10
39229	Spring, Tone Arm Lift Lever . . . . .	...	.10
39234	Spring, Tone Arm Swing Lever.	2	.10
39235	Spring Clip	4	.10
39236	Spring, Reject Lever.	2	.10
39245	Spring Idler Pulley	3	.10
42165	Spacer Idler Bracket. . . . .	...	.10
43182	Tone Arm Lift Rod	4	.15
43185	Upper Collar.	5	.30
45165	Friction Trip Lever	5	.10
45176	Tension Spring Holder	3	.10
46287	Trip Finger	5	.20
46292	Bracket, Tone Arm Lift.	7	.15
46293	Trip Finger Stop.	2	.10
50203	Cork Washer	5	.10
50204	Cork Washer . . . . .	...	.10
50206	Rubber Grommet.	2	.10
50209	Thrust Washer, Drive Disc	3	.10
61269	Phono Plug. . . . .	...	.15
64215	Trip Lever Release.	6	.50
64216	Idler Bracket and Stud Assembly	3	.15
64219	Bracket, Tone Arm	4	.40
66351	Friction Trip Assembly.	5	.85
66355	Lower Collar, Pin and Screw	5	.50
66366	Tone Arm Crank Assembly	5	.35

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MODEL "LITTLE PRO" 12LP FEDERAL RECORDER CO.

OPERATING INSTRUCTIONS for FEDERAL "LITTLE PRO" RECORDER NO. 12LP

EXPLANATION OF CONTROL PANEL

Amplifier switch is at right; pilot light at upper left shows when amplifier is turned on. Cutter-speaker switch at lower left is down to "Cutter" position when recording; up to "Speaker" position when playing records, radio, or when recorder is used as a public address system. Dial at right is radio station selector, controlled by knob at right. Meter at left shows volume when recording. Jacks are provided for two microphones, each having a separate volume control. "Equalizer" adjusts high and low note emphasis. Bass quality is obtained when knob is turned toward left; treble quality when turned toward right. "Phono" control regulates volume when playing records. "Radio" control turns on radio and regulates volume when playing radio or recording off the air. Jack at left of volume indicator meter is for headphones.

MICROPHONE RECORDING

With recorder plugged into 110 volt AC power outlet, throw amplifier switch to "On." Throw cutter-speaker switch at left to "Cutter." Plug microphone into either jack and use respective control to keep monitoring needle in volume indicator below red mark, except for occasional momentary peaks. High quality headphones aid in monitoring because they permit the operator to hear the program exactly as it is recorded, and make possible his instructing various individuals to speak louder or alter their distances from the microphone to achieve better balance. Speaker may be unplugged when monitoring with headphones.

Put cutting arm mechanism in position by placing on pin in center of turntable. It will automatically mesh and lower itself when turntable begins to move. With cutting head swung back, insert stylus so flat cutting face is toward back of the cutting head and parallel to guide rod. Start motor by moving lever in upper left hand corner of machine to mark "78." Give the turntable a slight push at the same time so that it will be revolving when the rubber roller comes in contact with it. This prevents damage to rubber roller. Lock roller arm by turning knurled screw head.

Place cutting head in position so that the stylus is about one-quarter of an inch in from the outside edge of the disk. (For models built to cut inside-out, start cut at recommended minimum inside diameter.) First place the bar lightly on the lead screw, then lower the cutting head gently onto the disc. Depth of cut is regulated by knurled nut on top of bar. Proper depth is shown by a straight shaving about the thickness of a human hair, and the width of the groove should equal the width of the space between grooves.

Cut should be shiny and there should be no hiss or whine in cutting. Any such noise indicates that the stylus is worn out and a new one should be used. BE SURE TO KEEP SHAVINGS BRUSHED TO CENTER AWAY FROM CUTTING STYLUS AT ALL TIMES.

When recording is completed, lift cutting head from disk and turn motor off by moving lever to "OFF." Lift cutting arm mechanism from center pin and

place in rest before removing shavings. Brush all shavings off record before playing.

Recommended cutting diameter limits:

12-inch disk: From $3\frac{1}{4}$ in. to $11\frac{1}{2}$ in. diameters
11-inch disk: From $3\frac{1}{4}$ in. to $10\frac{1}{2}$ in. diameters
10-inch disk: From 3 in. to $9\frac{1}{2}$ in. diameters
8-inch disk: From 3 in. to $7\frac{1}{2}$ in. diameters
 $6\frac{1}{2}$ -inch disk: From 3 in. to 6 in. diameters
6-inch disk: From 3 in. to $5\frac{1}{2}$ in. diameters

PLAY BACK OF RECORDINGS OR PHONOGRAPH RECORDS

Turn amplifier on. Plug single speaker into left hand socket. If two speakers are used, plug them into the two sockets which are close together near the center, and do not use left hand socket. This automatically matches output impedances properly. Start motor and turntable as described above. Throw cutter-speaker switch to "Speaker." Use "Phono" control to regulate volume. Use "Equalizer" to regulate tone quality. Keep microphone controls at zero. Any type of phonograph needle may be used. We recommend PURR needles especially. Made for use with the Federal Recorder.

RECORDING RADIO PROGRAMS

Connect radio antenna (preferably an outside antenna) to binding post in right rear corner of machine. Turn on amplifier. Turn on "Radio" control, which also controls volume. Select stations by turning knob at right of radio dial. Throw cutter-speaker switch to "Cutter" and proceed with recording just as for microphone recording, observing the volume indicator meter and adjusting the setting of the radio volume control. Both radio and microphone can be mixed together by plugging in a microphone and adjusting the volume of each with its respective control. Proper balance is most easily obtained by listening with high quality headphones.

DUBBING

To record from a record, set up a separate record player and plug output of its pick-up into FM-Dubbing jack at front right top panel. Turn on amplifier and then throw cutter-speaker switch to "Cutter" and proceed with recording just as for microphone recording, using the volume indicator meter to adjust the setting of the "Phono" control.

Either or both microphones, as well as radio, may be mixed in when dubbing from another record, by adjusting the volume of each source with its respective control. This is most easily done by listening with high quality headphones.

PUBLIC ADDRESS SYSTEM AND RADIO

Turn amplifier on. Plug in speaker or speakers as directed under PLAY BACK, and throw cutter-speaker switch to "Speaker." For radio, turn on radio and adjust volume with radio control. For public address, plug microphone into either jack and use respective volume control. To avoid feed-back (howls or squeals) keep speaker as far as possible from microphone. Best position of

FEDERAL RECORDER CO. MODEL "LITTLE PRO" 12LP

NAME RECORDER -
AMPLIFIER

FEDERAL RECORDER COMPANY, Inc.
CHICAGO U.S.A.

DATE 11-1-33
SCALE 1/2" = 1"

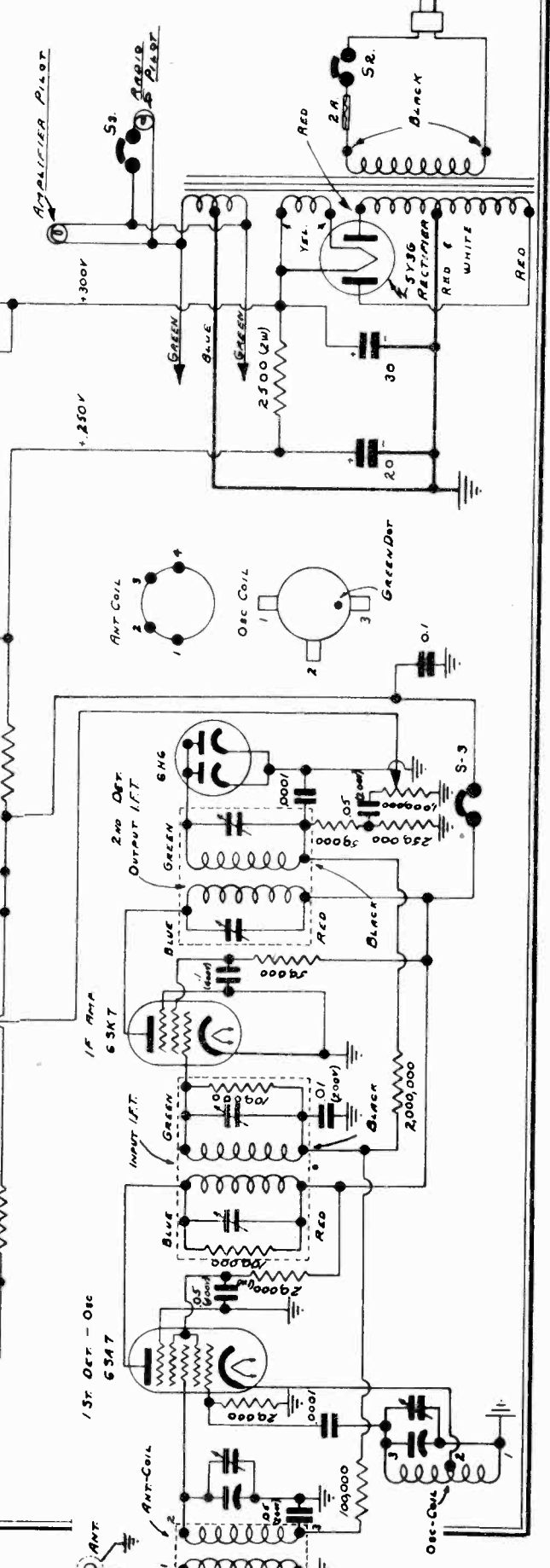
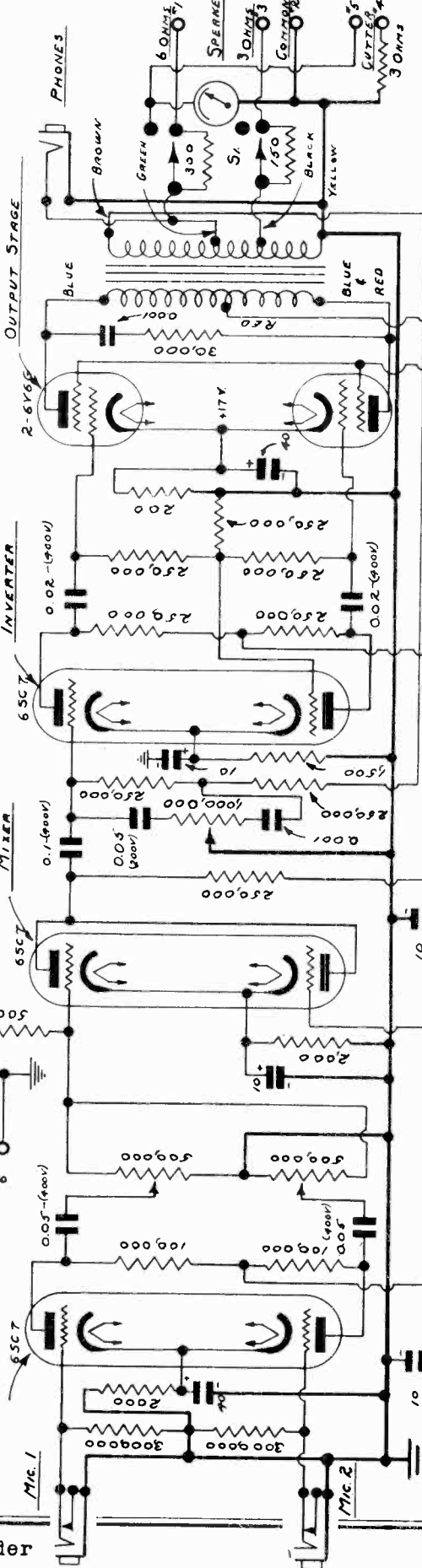
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NOTE - ALL VALUES GIVEN IN
MICROGRAMS OR OHMS.

AL. VOLTAGE MEASURED WITH 1000 OHM/MAT
VOLTMETER RATIO VOL MAX. ANT. OFF

DUAL MICROPHONE
PREAMPLIFIER

"7" 1,000,000
PHONO
"6"



MODEL "LITTLE PRO" 12LP FEDERAL RECORDER CO.

speaker is to left or right of microphone so that its side is toward the microphone. Use equalizer to regulate tone quality if desired. Radio and microphone may be mixed by adjusting volume of each with its respective control.

FM INPUT

For listening to frequency modulation transmissions plug audio output from frequency modulation tuner into FM-Dubbing jack. This makes the audio system, which is essentially flat to 15,000 cycles, available for this purpose. Plug in speaker or speakers as directed under **PLAY BACK**, throw speaker-cutter switch to "Speaker" and control volume with "Phono" control. Use equalizer to regulate tone quality if desired. If full advantage is to be taken of the high quality possibilities of this system, a special speaker, designed for frequency modulation and having an impedance of 6 ohms, is recommended.

For recording frequency modulation transmissions, plug audio output of frequency modulation tuner into FM-Dubbing jack and throw cutter-speaker switch to "Cutter." Proceed with recording just as for microphone recording, observing volume indicator meter and adjusting setting of "Phono" control. Either or both microphones may be mixed in when recording frequency modulation transmissions by adjusting the volume of each source with its respective control. Proper balance is most easily obtained by listening with high quality headphones.

USE OF EQUALIZER

The Equalizer is a special feature of the Federal Recorder and is operable in all uses of the recorder -- radio, playback, public address, and recording from any source. It may be used to give emphasis either to the low frequencies or to the high frequencies. When it is turned to the left of its normal center position it acts similarly to the usual type of tone control to emphasize the bass. However, when it is turned toward the right it emphasizes the high frequencies. The circuit used introduces a smoothly increasing rise above 1500 cycles, which reaches a maximum of 12db. at 7000 cycles when the knob is turned fully toward the right.

By means of this high frequency emphasis it is possible, when playing radio or records, to obtain greater clarity and better articulation. When recording, the high frequency emphasis may be used to produce a substantial reduction in noise level and also to compensate for the difference in tone quality between the inside and outside of the disk. By this means the careful operator can produce really fine recordings of professional quality. The following suggestions are given as starting points from which the individual operator can develop his own technique.

For Recording at 78 RPM

For Speech: Set Equalizer at about 1/2 of full distance to right.

For Music: Set Equalizer at about 3/4 of full distance to right.

For Recording at 33-1/3 RPM

Settings of Equalizer when recording midway between inside and outside of the record should be about as when recording at 78 RPM. When recording near the inside, the Equalizer should be 1/4 more toward the right. When recording near the outside, the position should be 1/4 less. In between, the Equalizer should be gradually moved in accordance with the position of the cutting stylus on the record. By doing this carefully, the natural decrease in high frequencies at the inner part of the record can be equalized and a recording with consistent quality throughout can be made.

IMPORTANT INSTRUCTIONS

Regular phonograph speed of 78 RPM is obtained when rubber motor pulley is in standard position with larger diameter at top. For 33-1/3 RPM, remove the little spring at top, lift up pulley, and replace with small diameter at top. Pointer lever can then be moved to "33" as marked on plate. Be sure to replace spring before starting motor. Always lock roller arm so that it will not move when machine is in operation.

In playing commercial records, it is not necessary to remove the extra pin on the turntable. Simply place the record in position and the pin will be depressed into the turntable. Be sure when placing a blank disk on the turntable for recording that one of the three holes fits over the extra pin. This prevents the disk from slipping.

Be sure to start the turntable revolving when you engage the rubber motor pulley. This special alloy steel 17-lb. turntable is made extra heavy so that its flywheel action improves the quality of recordings. Starting it by hand prevents excessive wear on the rubber pulley.

When inserting a new cutting stylus be sure that the **FLAT** cutting face is toward the back of the cutting head and parallel to the guide rod. **WHEN RECORDING BE SURE TO BRUSH SHAVINGS TOWARD THE CENTER, AWAY FROM THE CUTTING STYLUS.**

Moving parts, such as lead screw, motor, etc., should always be kept clean and oiled occasionally. No oil should ever be used on the rubber roller except an occasional drop of oil on its shaft. It is also desirable to clean the outside edge of the rubber roller from time to time since dust and shavings may collect and cause a slight noise when recording. Also clean shavings from the turntable shaft and grease the turntable shaft occasionally. To remove turntable, simply pull it up. Turntable may be removed from recorder, if desired, to reduce weight when carrying machine, but great care should be exercised to avoid getting dirt into the bearing.

To stop motor, indicator lever must be returned all the way to "Off" position. If this is not done, the motor will continue running even though the turntable and motor pulley may be disengaged.

FEDERAL RECORDER CO.

MODEL 306

SETTING UP RECORD CHANGER. Before plugging in line plug be sure the automatic record changer is properly set up for operation. The bracket to which the pickup arm (13-Fig. 2) is fastened should be removed as it is used for shipping purposes only. The bracket (28-Fig. 2) to which the recording arm (24-Fig. 2) is fastened should be removed and screwed in the position shown (28-Fig. 2). The turntable is next placed on the spindle and revolved until it drops into position.

PHONOGRAPH AND HOME BROADCASTER BUTTON. Press this button to connect the set for phonograph operation.

MICROPHONE VOLUME. Turn this control to the extreme left or "off" position.

RADIO-PHONO VOLUME. Turn this control to the right. The dial will become illuminated, showing that the power is connected. Wait about 30 seconds for the amplifier to become properly heated before attempting to play the phonograph. Use this control to adjust the volume of the phonograph in the same manner as it is used to adjust the volume of the radio.

tone control. Adjust this control to suit your own individual requirements. Turn to the extreme left for emphasis on the high notes or treble and turn to the extreme right to accentuate the bass notes. When this control is turned toward the right, the needle scratch will be reduced.

PICKUP. The pickup (13-Fig. 2) is the small arm located at the left of the turntable. To insert a needle, lift up the pickup, loosen the thumb screw (14-Fig. 2) and insert the needle in the small hole underneath the arm. Next, tighten the screw securely to clamp the needle in place.

MOTOR SWITCH. Push this switch once to start the motor; push again at the end of the record to stop the motor.

PLAYING RECORDS MANUALLY.

- (1) Move the lever (1-Fig. 2) to the manual position.
- (2) Place the record to be played on the spindle of the turntable.
- (3) Push the motor switch to start the motor.
- (4) Lift up the pickup and place on the smooth outer rim of the record.
- (5) Adjust the volume and tone control to suit your requirements.

After the record has been finished, remove the pickup and return it to the left, press the motor switch button to stop the turntable and remove the record. Never leave a record on the turntable, as it is apt to warp. Always return the pickup to its rest after the record has been played. This phonograph will permit playing of records of any size up to and including 12" records.

PLAYING RECORDS AUTOMATICALLY.

- (1) Set the lever (1-Fig. 2) to 10 or 12 depending on which size records are to be played. Ten 12 inch or twelve 10 inch records can be stacked on the changer at one time. Do not mix ten and twelve inch records. After the records to be played have been selected, line them up with the center holes and slip them on to the center post of the turntable.
- (2) Push the motor switch to start the motor.
- (3) Push the reject button to place the first record in place. The records will be played in order and the last one will be repeated until the motor is turned off.
- (4) Adjust the volume and tone control to suit your requirements.
- (5) To reject a record, push the reject button and the next record will fall into the playing position. After the last record has been played turn the motor off and return the pickup to its

rest. To remove records, move the support post lever to the "remove records" position and lift the records off the turntable. Never leave records on the support posts or the turntable except while playing the phonograph.

NEEDLES. Always use a good grade of needle for playing records, as you will obtain better tone quality and longer life from your records. Do not use fibre, bamboo, or cactus needles. If ordinary steel needles are employed, never use them for more than one playing of a record. A needle which has once been used should never be reinserted into the pickup again, as the point becomes worn and will never fit in the groove properly again. It is also very important never to play a needle on one of your own recordings after it has been used on a standard record. A needle which has become worn on standard records will spoil your own recordings. If long-life needles are used, never reinsert them after they have been taken out of the pickup. Your dealer will be glad to supply the proper needles for this machine as recommended by the manufacturer.

RADIO RECORDING

CUTTING HEAD. The cutting head is located in the large arm located at the right of the turntable (24-Fig. 2). To insert a stylus, lift the cutting head arm vertically, loosen the set screw and insert the stylus with the V-shaped point of the stylus up (See Fig. 1). Insert the stylus to the full depth of the hole and tighten the set screw securely.

CUTTING RECORDS. Move the lever (1-Fig. 2) to the manual position and place a blank disk on the turntable, making sure that the stud on the turntable projects through one of the three small holes near the center of the disk. Tune in a radio station as instructed in the section on radio operation. Push the button marked **radio recording** and adjust the volume control marked **radio-phonograph** until the eye just closes on the peaks or loud passages. Never allow the eye to overlap. The microphone volume control should be in the "off" position. After the proper level of recording has been determined, raise the cutting head to about 45 degrees and move it to the left until it is over the edge of the record. Lower the cutting head gently to the record. The radio program is now being recorded. As the record is being cut, a small shaving will be thrown off from the stylus and gradually will move towards the center of the record. The shaving can be pushed with the fingers towards the center and wadded up before removing. After the record is complete, raise the cutting head to about a 45-degree position, move it to the left and return it to its rest. The record is now cut and is ready for immediate playing. To play this record merely press the **phonograph**

and **home broadcasting** button and proceed to play the phonograph as you ordinarily would for any type of commercial record. Shavings should not be allowed to accumulate around the stylus. A soft brush will be of assistance in pushing the shavings towards the center of the record during the cutting process. The cutting head must not be allowed to cut too close to the center of the record. The cutter should be lifted off the turntable before the stylus reaches the label or the uncoated portion of the record, as the fine point on the stylus will be damaged. Also do not allow the stylus to touch the stud on the turntable. When placing the cutting head on a record, lift the head to a 45-degree position and move the head over the starting position on the record. Lower the head slowly to the record. If the stylus is not over the correct starting position, raise the head to 45-degrees before moving to a new position. Never move the cutting head until it is raised to a 45-degree position.

TONE CONTROL. In the recording position the tone control is not connected in the circuit. This feature was incorporated in the circuit to prevent you from spoiling records by cutting out the high notes, thus insuring that your recordings will be similar to those

made by commercial methods. When you play back your recordings, the tone quality can be adjusted by the tone control which is connected in the phonograph position.

HOME BROADCASTING

PHONOGRAPH AND HOME BROADCASTER BUTTON. When this button is pressed, the microphone is connected and can be used for home broadcasting purposes.

RADIO-PHONO VOLUME. Turn this control until the switch clicks and the pilot lights are illuminated. Do not turn this control any farther to the right.

MICROPHONE VOLUME. This control is used to determine the output of the microphone. In order to do home broadcasting it is necessary to have the microphone as far away as possible from the loud speaker of the receiver. This is necessary, as the output from the speaker will be fed back into the microphone and cause a loud squeal or howl. In order to do home broadcasting successfully it is preferable to have the microphone in another room if possible. An extension cord can be obtained for use with the microphone in order to place the microphone a long distance from the loud speaker. The tone control can be turned toward the bass position, giving more emphasis on the bass and also minimizing feedback trouble which may be experienced.

HOME BROADCASTING WITH PHONOGRAPH OR RADIO. To home-broadcast with a phonograph, press the **phonograph** and

home broadcaster button, play the phonograph as you normally would, and adjust the volume of the phonograph with the **radio-phonograph volume** control. The microphone can be controlled by the **microphone volume** control. To home-broadcast with radio, press the **radio** button and tune in the station as usual, adjusting the volume with the **radio-phonograph volume** control. Then adjust the **microphone volume** control for your microphone output.

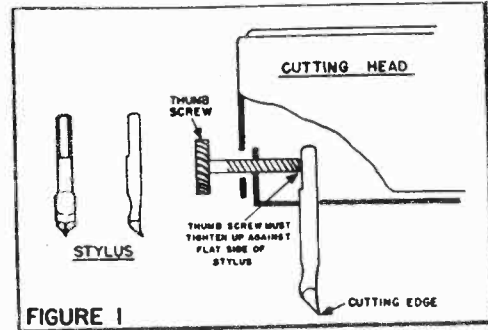


FIGURE 1

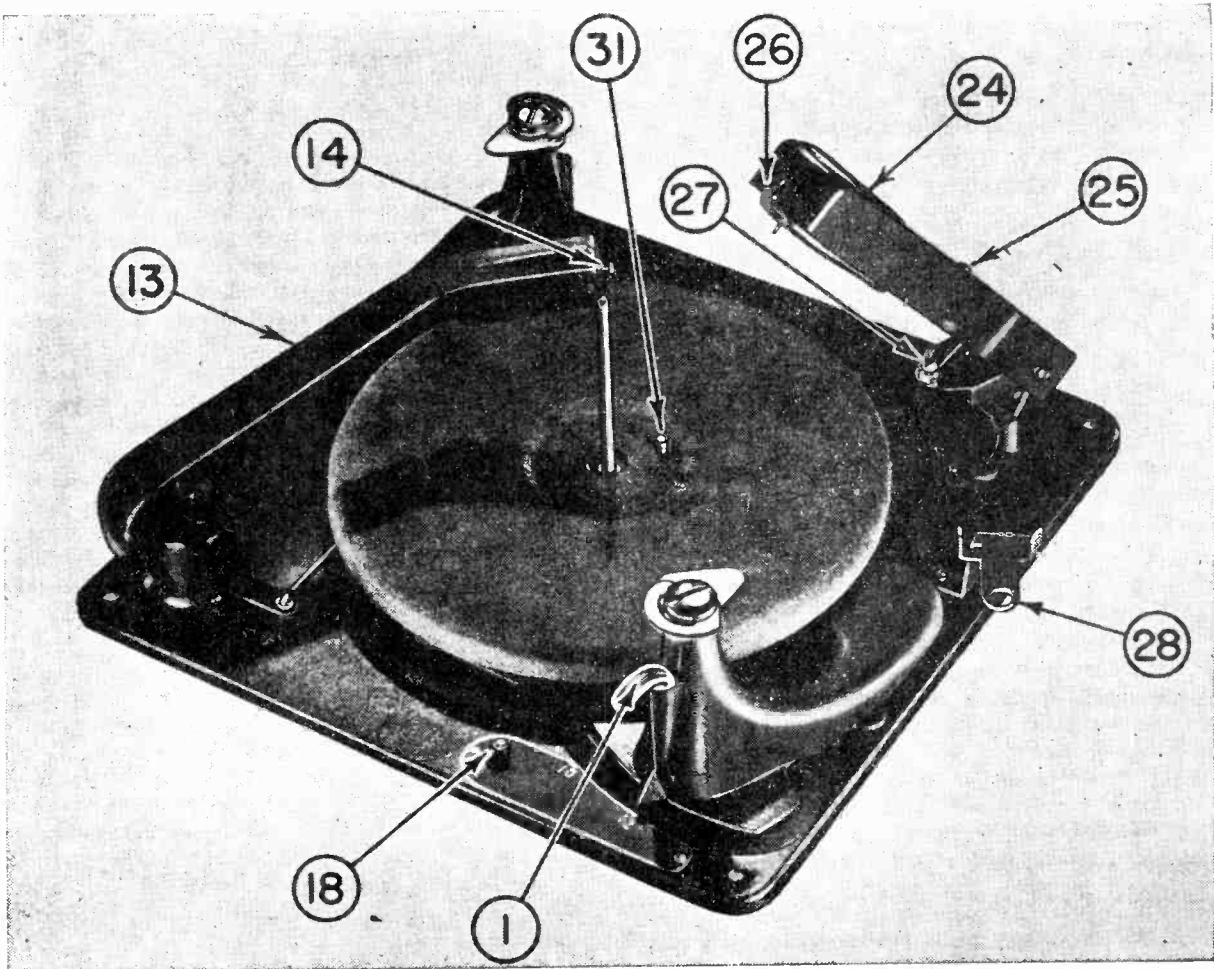


FIGURE 2

MICROPHONE RECORDING

RADIO AND MICROPHONE RECORDING. Press this button and the set is automatically connected for microphone recording.

RADIO-PHONO VOLUME. Turn this control until the power is turned on but do not turn this control any farther to the right.

RECORDING VOICE OR MUSICAL INSTRUMENTS. Place the microphone as far away from the radio set as possible in order to prevent any feedback which may occur. When speech is to be recorded first make a trial test. Talk into the microphone and adjust the volume control of the microphone until the eye just closes on the peaks, but does not overlap. The blank record

should now be placed on the turntable and the turntable started. The cutting head should be moved into position and the record can now be made. The speaker must talk into the microphone during recording in the same manner as he did during the preliminary test. If musical instruments are to be recorded, the same procedure should be used as for recording voice — that is, make a trial playing, adjust the volume correctly so that the eye just closes but does not overlap, when loud passages are played. It will take a little experience and practice in order to make successful recordings, but with a little patience and care really excellent results should be obtained.

RADIO AND MICROPHONE RECORDING

To cut a record with both radio and microphone takes some practice to do successfully. First, tune in the radio station as you normally would for radio recording with the **radio and microphone recording** button pressed. Adjust the volume until the eye just closes and note the position on the radio-phono volume indicator. You will note the scale around the knob of the control which is to be used for resetting this knob to the proper level for recording radio. Reduce this volume by turning the control to the left. Second, while speaking into the microphone, adjust the microphone volume until the proper level is obtained by observing the closing of the eye. Note the position of the microphone volume control. You have now obtained the correct control settings for recording either radio or microphone separately. If radio is to be

recorded first, turn up the **radio-phono volume** and start recording. Then the volume control can be turned down gradually and the microphone volume control brought up to the proper level. In this manner the radio can be faded out slowly and the microphone can be brought up to the proper level. The microphone can be gradually turned down and the radio brought up to the proper volume again. With a little experience you can accomplish this quite successfully. Your voice can also be recorded along with the radio by turning the volume of the radio down slightly and by turning up the volume of the microphone. When recording, it is essential that the microphone be kept as far away from the loud speaker as possible in order to prevent feedback into the microphone.

GENERAL INFORMATION FOR MAKING RECORDINGS

STYLUS. Before cutting a record the stylus should be tightened, as it has a tendency to work loose due to the vibration of the cutting head. The fine point of the stylus should not be touched against any metal or otherwise abused, as it is liable to lose its cutting qualities. Only the best grade of stylus should be used for this purpose, as the success of recording depends to a large extent on the condition of the stylus point. Your Federal dealer will be glad to supply the proper stylus for this recorder as recommended by the manufacturer. Be sure the stylus you buy is the same length as the one now used, otherwise it may be necessary to change the cutting arm or head adjustment as described in the following paragraph. If the stylus is cutting properly, it will throw out a fine shaving towards the center of the record, and will cut quietly, without any scratching noise. The resulting grooves will be shiny, not dull, and the background noise when playing the record back will be very low.

CUTTING ARM AND HEAD ADJUSTMENT. The recorder unit was properly adjusted and records were cut on it at the factory, but there is a possibility that this equipment may be thrown out of

adjustment due to shipping, and the following information is given so that you may determine if the head is properly adjusted for satisfactory recording. Place a blank record on the turntable without the motor running. Lower the cutting head to this record and note if the set screw which holds the stylus in place is in the center of the slot on the end of the cutting head. If this condition exists, the cutting head is in the correct position. If not, adjust screw (27-Fig. 2), which is located in the rear of the cutting arm and becomes exposed when the arm is lifted to a vertical position. To make the correct adjustment, this screw should be raised or lowered as required, and its lock nut tightened. Next, make a short blank recording to determine if the correct spring tension is applied to the cutting head. After this blank cutting is made, examine the record to see if the grooves are of the same width as the space between the grooves. If the groove is found to be too shallow (not as wide as the space), turn screw (25-Fig. 2), which is located on the top of the cutting arm, towards the rear, in a clockwise direction. This will increase the depth of cut. If, on the other hand, you find the groove is too deep (wider than the space), turn this screw to the left and make another test cutting to determine if the correct spring adjustment has been made. The proper adjustment is one in which the groove is exactly as wide as the uncut portion between grooves. Successful recordings cannot be made unless the cutting head is correctly adjusted.

MODEL 306

FEDERAL RECORDER CO.

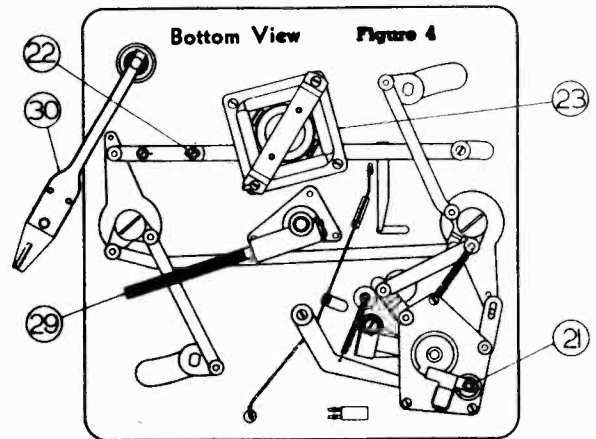
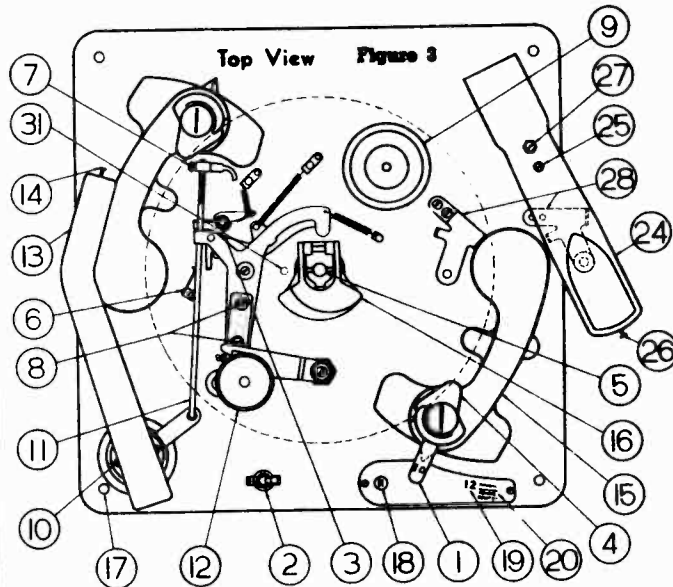
CUTTING ONE RECORD FROM ANOTHER

With this radio-recorder unit it is possible to make a duplicate recording from another record. A turntable with a crystal pickup is necessary for this type of recording. Remove the plug from the rear of the set which is marked **phonograph pickup** and insert a similar plug with the pickup from the external turntable connected to it. The record which is to be duplicated is placed on the external turntable and the blank which is to be cut is placed on the turntable which comes with your unit. It is necessary to push two buttons in order to make a copy of a record. Press the button marked **phonograph** and **home broadcaster** at the same time that you press the button marked **radio recording**. Play the record on the external turntable and adjust to the proper recording level by means of the **radio-phonograph volume** control. The **microphone volume** control must be turned to the extreme left or off position. The **tone control** should be turned to the extreme left,

otherwise the high notes will be eliminated in your recording. After the controls have been properly adjusted, start the motor on the cutting turntable and place the cutting head on the blank record. Then place the pickup of the external turntable on the record which is to be duplicated. At the end of the record remove the cutting head and return to its rest.

If several copies are to be made from one original always make them from the same original—do not make one duplicate from another duplicate, as the defects in recording are amplified with each duplication.

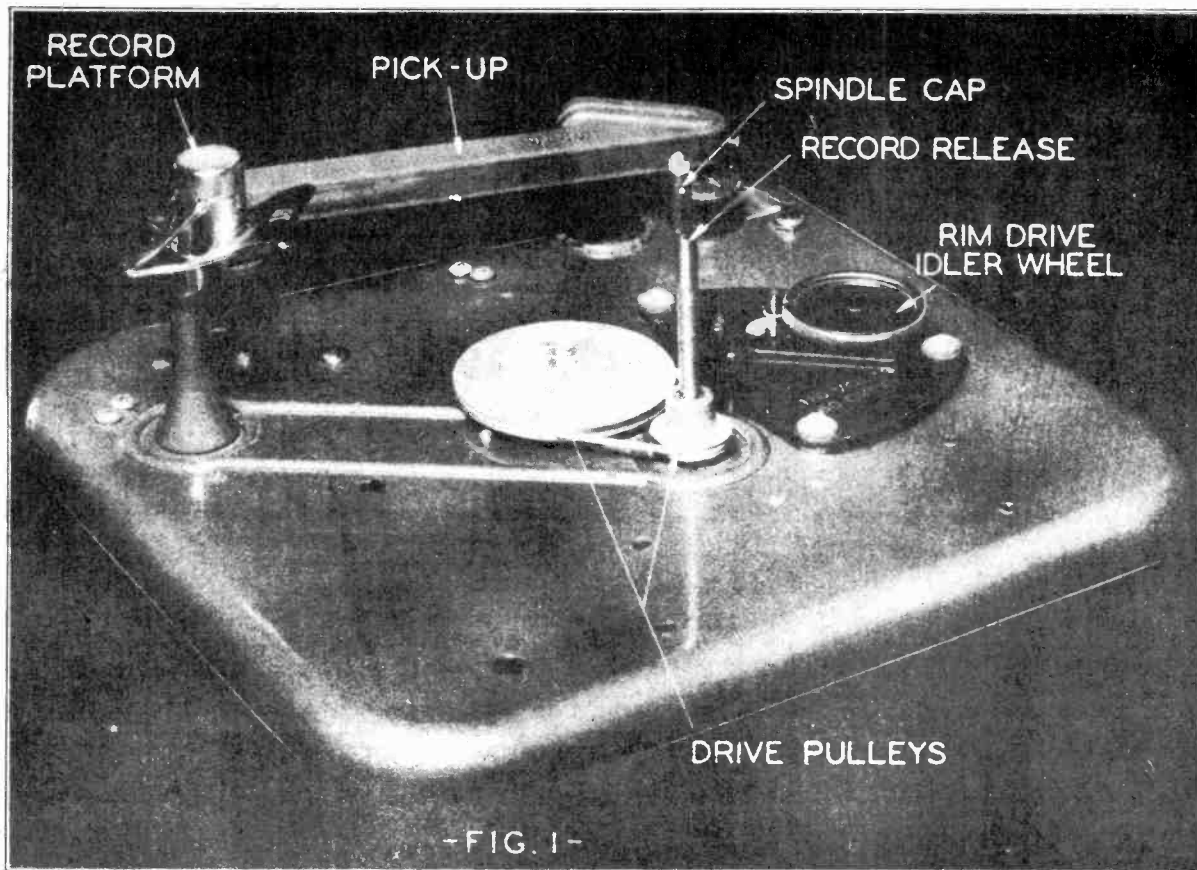
It is also possible, while making one record from another, to insert comments, announcements, etc. in the same manner as described in the section on radio and microphone recording.



- (1) Lever for setting to play 10-inch or 12-inch records, Manual playing or Remove records. Mechanism as shown is set for playing 10-inch records.
- (2) "On" and "Off" switch for operating the record playing mechanism. Not used on some models.
- (3) Trip mechanism designed to handle automatically records with either spiral run-in or oscillating grooves.
- (4) Record Support Fingers.
- (5) Turntable Shaft.
- (6) Trip Rod Tension Spring.
- (7) Adjustment for run-in or spiral-grooved records.
- (8) Adjusting lock screws for controlling position of power take off wheel (12).
- (9) Rubber-tired Drive Wheel. By means of a spring, this wheel contacts the steel pulley on the motor and the inside flange of the turntable; driving the table in clockwise rotation.
- (10) Adjusting screws for locking tone arm in position so that needle will rest properly on edge of record.
- (11) Trip rod.
- (12) Rubber-tired power take-off wheel. Through the trip mechanism, this wheel contacts the inside flange of the turntable during the change cycle from one record to the next, but does not operate during the playing of a record.
- (13) Pickup Arm.
- (14) Needle Set Screw.
- (15) Record Support Arm.
- (16) Master Trip Cam.
- (17) Mounting Holes. Rubber washers or springs should be used when bolting changer in cabinet to absorb possible vibration.
- (18) Reject Button. By pressing this button, changing mechanism operates immediately regardless of needle position on the record. Also by pressing this button, the first record will drop on turntable.
- (19) Position for Lever (1) when playing 12-inch records.
- (20) Position for Lever (1) for Manual playing, Removing records or Cutting records.
- (21) Adjusting screw for setting vertical movement of tone arm. If properly set, no further adjustment will be necessary.
- (22) Adjustable Tie Bar used for positioning record support arms. The adjustment of this bar properly made should require no further attention.
- (23) Rim Drive Electric Motor. Be sure Voltage and Cycles are correct for your Power Line.
- (24) Cutter Arm. At all times except when actually recording, cutter arm is placed on cutter arm support rest (28).
- (25) Adjusting Screw by which the tension on the cutter head equalizing spring may be varied for different types of records.
- (26) Cutting Stylus clamp screw.
- (27) Adjusting screw and lock nut for proper spacing between cutter arm and record.
- (28) Cutter arm support rest. Prevents interference with reproduction and also removes all strain on cutter-head equalizing spring. Full lines show shipping position—dotted, Installation Position.
- (29) Lead Screw.
- (30) Follower Arm and Spring Cam. This arm and cam mesh with lead screw (29) to provide lateral motion of cutter arm during recording.
- (31) Depressible Pin in turntable for driving home recording disc.

GALVIN MFG. CO.

MODELS B2RC, B3RC, B4RC



- FIG. 1 -

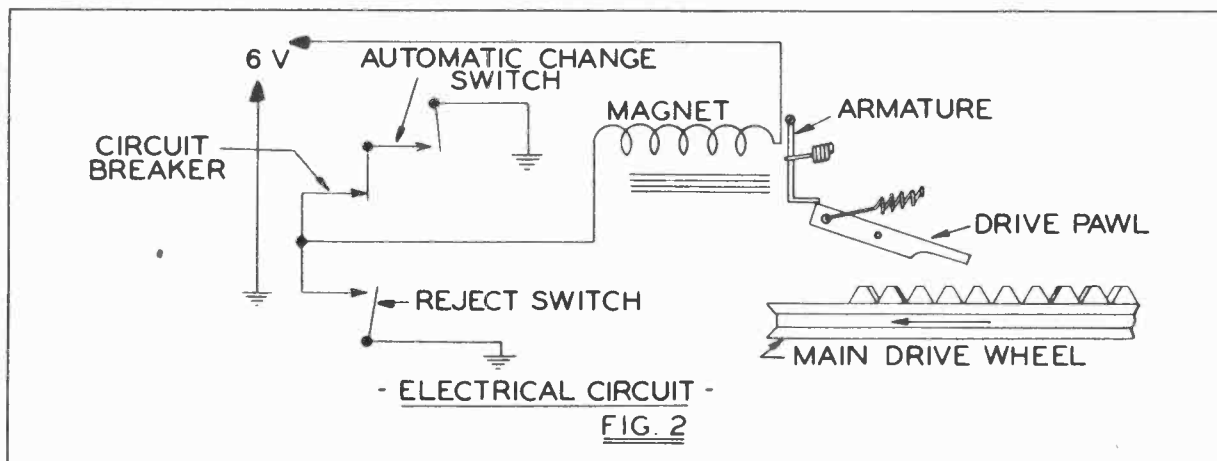
THEORY OF OPERATION

As in most modern phonograph turntables, power is derived from an electric motor. This power is transmitted to the turn-table through a geared down rim drive of the friction type.

The turntable is keyed to a small drive pulley, which in turn drives a large (3 inch) pulley, through a spring belt, both of these units being located on top of the base plate. (See Fig. 1). The 3 inch pulley transmits power by direct drive to another small pulley

located under the mounting plate. This second small pulley in turn drives the large (4 inch) main drive wheel, also located under the mounting plate.

When the turntable revolves, all of these pulleys and wheels mentioned above, also revolve—regardless of whether or not the Changer is going through a cycle of changing a record. By means of this series of pulleys, a high ratio is obtained between the motor and the changing mechanism, which assures ample power.



MODELS B2RC, B3RC, B4RC

GALVIN MFG. CO.

IMPORTANT

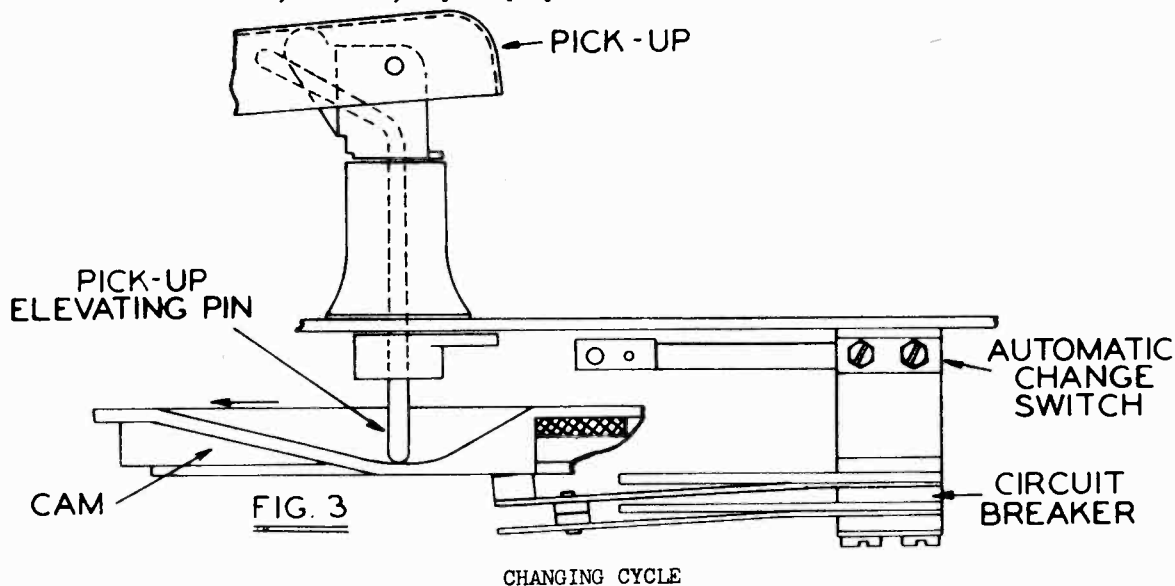
All service adjustments on Motorola Record Changers should be made with the instrument in a normal operating position.

Therefore, the instrument should be supported in such fashion that parts underneath are accessible. A jig consisting of four corner support posts would be helpful. A mirror would also permit the service man to make observations and adjustments without getting into awkward positions.

CHECK THE RECORDS FIRST

Before attempting to service or adjust this Record Changer, check the records first to make sure they are not causing the trouble. The instrument will handle most of the 10 or 12 inch records now available on the market, but it is not guaranteed to handle all of them. Records must be in good mechanical condition, and should not be chipped, particularly around the center hole. Do not try to play automatically, records that are too thick, too thin, or that are oversized or undersized, as regards diameter of record or center hole. Do not mix 10 and 12 inch records on the Changer.

Old records made before the days of automatic record changers may not change automatically, due to the differences in thickness, or to lack of a proper eccentric groove at the finish. Most of the old records, however, may be played one at a time.



By referring to the various photographs and figures which will be found in this Service Manual, you can readily follow through the changing cycle from the continuity given hereafter.

1. The needle in the pick-up finishes a record and enters the eccentric groove.

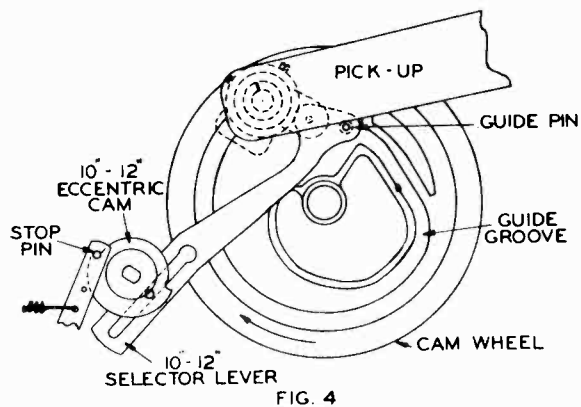
2. As the pick-up has slowly approached the eccentric groove, a phosphor bronze spring clip has gripped a fin of the automatic change switch.

3. When the needle enters the eccentric groove on the record, the pick-up oscillates slightly, which in turn causes the automatic change switch to make contact.

4. The first momentary contact of the automatic change switch is all that is necessary to start the changing cycle. When the switch closes, a small electro magnet is energized. The electro magnet pulls an armature back out of the way, permitting a drive pawl which is mounted on the cam wheel to fall down and engage in one of the notches which are provided on the upper surface of the main drive wheel. (See Fig. 2.)

5. Since the main drive wheel is already revolving, the engagement of the pawl now causes the cam wheel to revolve with it.

6. When the cam wheel starts to revolve, it causes several things to occur. In the first few degrees of revolution, it opens a circuit breaker switch (Fig. 3) which automatically opens the magnet circuit, thereby de-energizing it, to prevent "chattering".



GALVIN MFG. CO.

MODELS B2RC, B3RC, B4RC

7. The next few degrees of rotation causes the pick-up elevating pin to ride up on an inclined section of the cam, thereby elevating the pick-up and lifting the needle from the record which has just been played. (See Fig. 3).

8. A few more degrees of revolution cause the pick-up guide groove on top of the cam wheel. This part of the mechanism is not visible, since the cam wheel is mounted too close to the mounting plate, but Fig. 4 shows a drawing of the upper surface of the cam wheel. As the wheel revolves with the pin in the groove, it causes the pick-up to swing out beyond the edge of the record so it will be out of the way when the next record falls on the turntable.

9. The cam wheel continues its revolution, and at another point on its circumference a roller on the end of the trip-lever rides up an inclined section on the cam. This trip-lever is the copper-plated rod which is hinged approximately in the center by running through a die cast fulcrum block. As the roller on one end of the trip-lever rolls up the incline on the cam, the other end of the trip-lever bears against the push rod which operates the record release, causing it to push the next record off its support, thereby dropping it on the turntable.

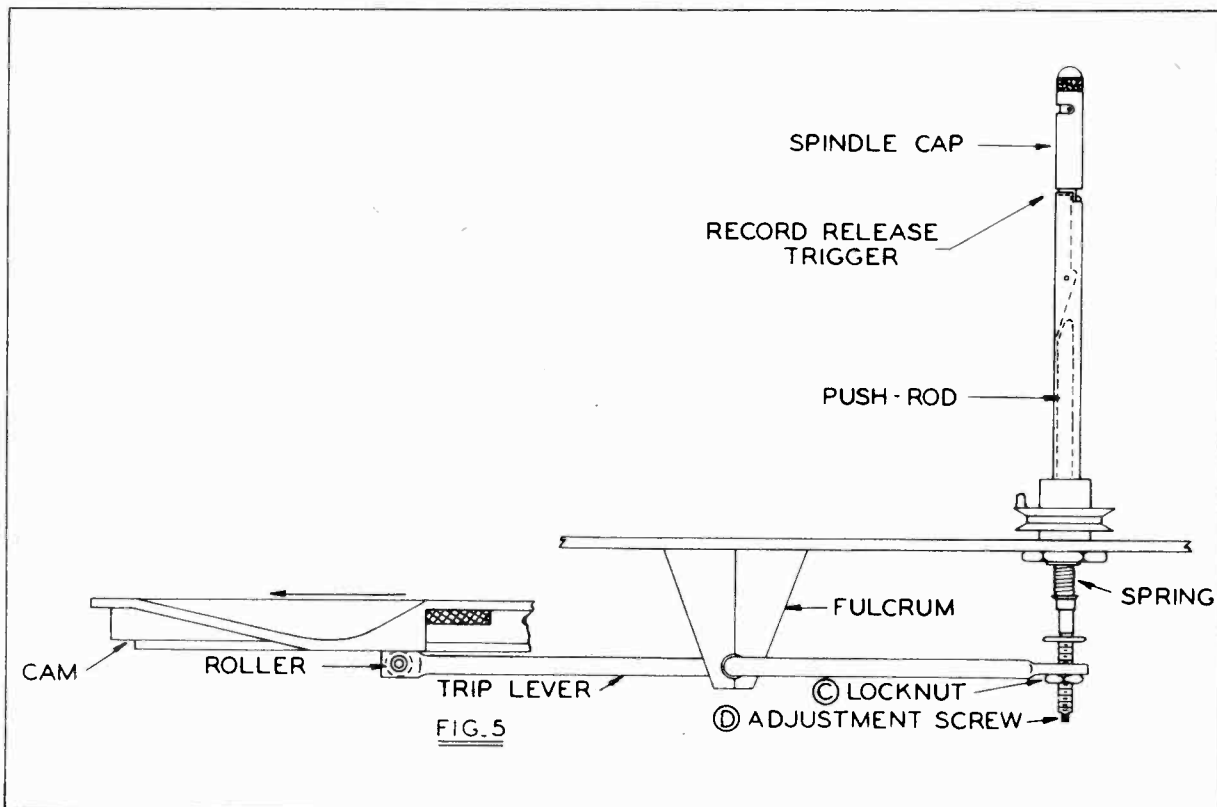
(See Fig. 5).

10. The cam continues to revolve, the groove in the top bringing the pick-up back over the edge of the record to the proper position where the needle will fall near the first groove when it comes down.

11. A few more degrees of revolution, and the pick-up elevating pin rides down another incline, permitting the needle to settle gently on the first groove of the record. (Fig. 3).

12. At this point, the cam has completed one full revolution of 360 degrees. At the same time the needle touches the record, the drive pawl hits the magnet armature, which forces it up, thereby disengaging it from the notch in the drive wheel. The cam wheel therefore stops, the turntable continues to revolve, and the record is played.

13. During the last few degrees of revolution, the circuit breaker switch has again been closed, as its fibre stud rides up an incline on the lower surface of the cam. (Fig. 3). This switch must be closed at all times except when the instrument is going through a changing cycle, otherwise, it would be impossible to start a new changing cycle automatically.



MODELS B2RC, B3RC, B4RC

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SETTING FOR 10 OR 12 INCH RECORDS

The record support platform is adjustable for either 10 or 12 inch records, depending upon which "lip" is turned toward the center of the turntable. The platform may be swung in an arc of 180 degrees, so that either the 10 or 12 inch lip may point toward the spindle.

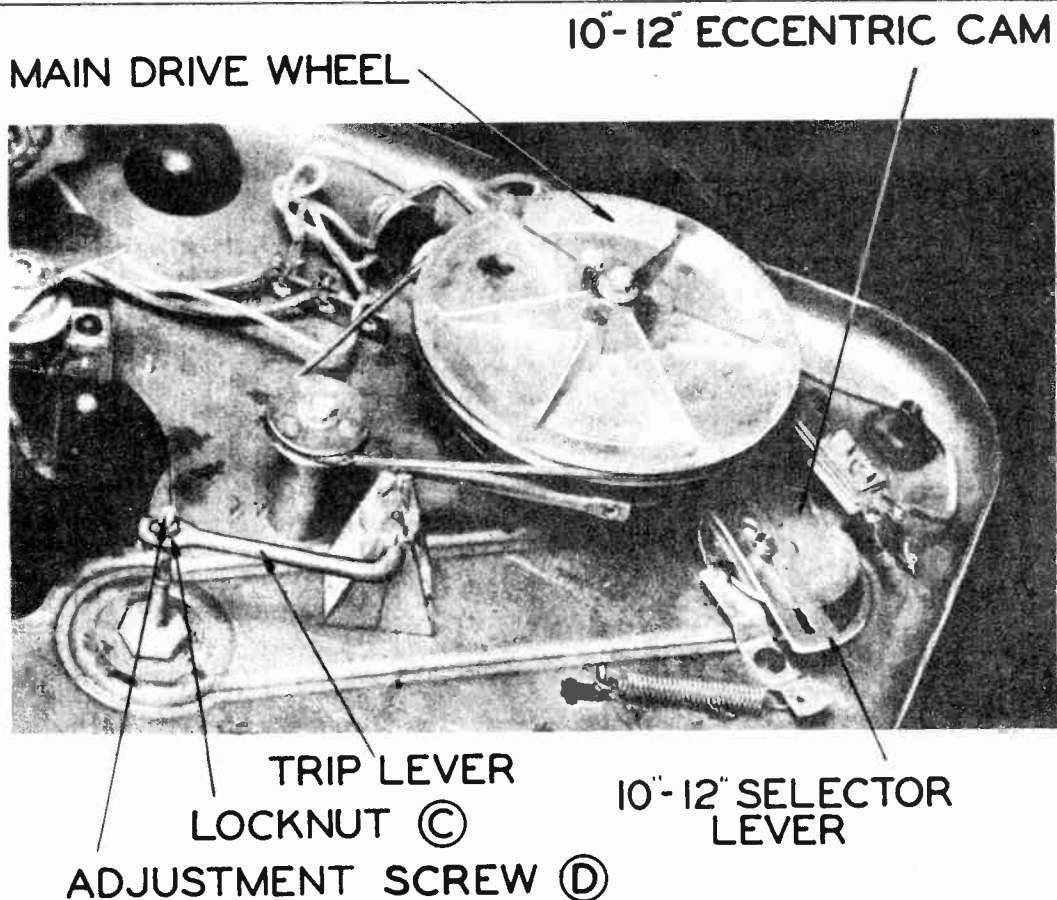
Underneath the mounting plate, and mounted rigidly to the record platform support shaft is an eccentric mechanism which moves

the 10" - 12" selector lever when the platform is moved. The position of this selector lever determines the point where the needle will come down on the record at the end of a changing cycle. In other words, it adjusts the pick-up for playing automatically either 10 or 12 inch records, depending upon the position to which the record support platform is turned. The eccentric cam and the selector lever are shown in Figs. 4 and 6.

START-REJECT SWITCH

The push switch mounted near one corner of the mounting plate is connected in parallel with the automatic change switch previously discussed. When this switch is closed, it energizes the electro magnet exactly in the same fashion as does the automatic change

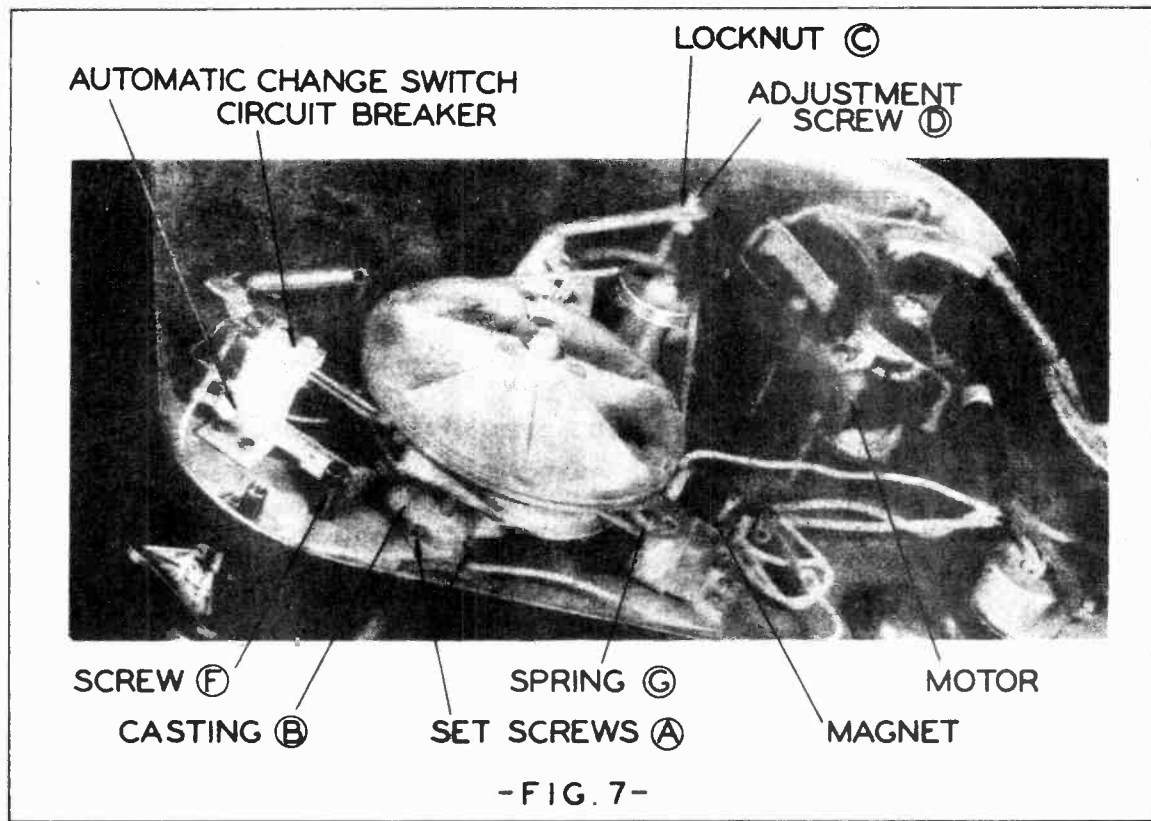
switch, thereby making it possible to start the changing cycle at any time, regardless of whether or not the record has been completely played. By this means a record can be "rejected". The wiring diagram showing switches and magnet can be seen in Fig. 2.



- FIG. 6 -

GALVIN MFG. CO.

MODELS B2RC, B3RC, B4RC



-FIG. 7-

TO ADJUST RECORD RELEASE

1. Place a stack of 10 inch records on the changer, after turning the record support platform to the "10 inch" position.
2. Start the turntable revolving.
3. Press the "Start-Reject" button.
4. If the first record does not drop to the turntable, double check the record to make sure that it is not too thick, or that the diameter of the center hole is not undersized, causing it to bind.
5. If the record proves to be normal, and is not causing the failure, loosen lock nut (C) which locks adjustment screw (D), as shown in Figs. 5, 6, or 7.
6. With a slab-head wrench, turn screw

(D) a fraction of a turn clockwise, and press the "Start-Reject" button again, checking to see if record is released.

7. If the record fails to drop, tighten screw (D) a trifle at a time, testing after each adjustment, until setting is reached, which releases record.

8. Tighten lock nut (C), after which a few more records should be changed, to make sure that this did not alter adjustment of screw (D).

NOTE: If the Changer stalls during the adjustment procedure, it may be an indication that screw (D) is too tight, in which case it should be turned back (counter-clockwise).

TO ADJUST PICK-UP POSITION

This adjustment is made to cause the needle to drop in the first groove of the record, as the Changer completes a changing cycle.

1. Turn the record support to the 10 inch position. (See Fig. 1).
2. Place a standard 10 inch record on the turntable and start it revolving.
3. Press the "Start-Reject" button. The Changer will now start a changing cycle.
4. Do not let the Changer complete the cycle, but stop it at the point where the pick-up starts to drop downward towards the

outer rim of the record. If the cycle is stopped at the right point, the pick-up will still be "in cycle" and will not be free to swing back and forth. Check this gently. Do not exert too much sidewise pressure on the pick-up.

5. Now loosen the two hex-head set screws (A) in the bell crank casting (B), which you can see in Fig. 7.

6. With the set screws loose, the pick-up arm can now be moved back and forth. Move it to the point where the needle rests directly over the first groove in the record.

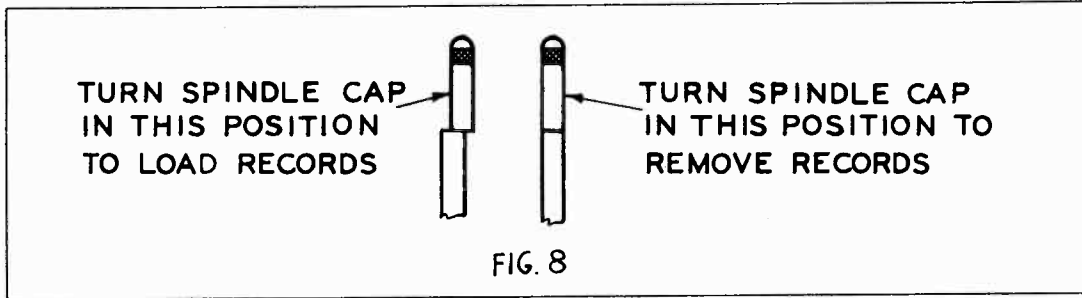


FIG. 8

(The correct dimension for proper adjustment is $4\frac{25}{32}$ " from the needle point to the center of the spindle.)

7. Tighten one set screw securely so that the shaft does not move while checking proper position of the pick up arm. After proper position has been located tighten both set screws securely.

8. Now place a 12 inch record on the turntable; turn the record support to the 12 inch position.

9. Press the "Start-Reject" button and let the Changer go through another cycle, watching carefully to make sure the needle comes down on the record at the proper point. If necessary, make minor readjustment.

TO LINE UP RECORD PLATFORM

It is important that all points on the "lip" of the record support platform be equidistant from the center point of the spindle. This will assure that all points of the record will leave the platform at the same time. If the record support is too far out of alignment, the record would actually hang on the point nearest the spindle and fail to drop properly.

1. To check this alignment, turn the spindle-cap so it is in alignment with the rest of the spindle, which is the correct position for removing records. (See Fig. 8.)

2. Turn the record support platform to the "10 inch record" position, making sure it is turned all the way to the stop.

3. Slip a standard 10 inch record over the spindle and check to make sure it clears

the lip of the platform at all points. (See Fig. 9.)

4. If one point on the lip extends farther than the other, the position of the record support may be adjusted after loosening the two Bristo set screws (E), located directly under the numeral "12" on the record support. (See Fig. 9).

CAUTION: Make sure the eccentric selector cam, which is located under the base, is turned all the way to its stop. (See Fig. 4.)

TEST: After tightening the set screws, test the adjustment by running a 10 inch record through a complete cycle and check the point where the needle falls. If the needle misses the record by one inch, the record platform is 180 degrees out of line with the eccentric cam, and should be turned one-half turn without turning the cam.

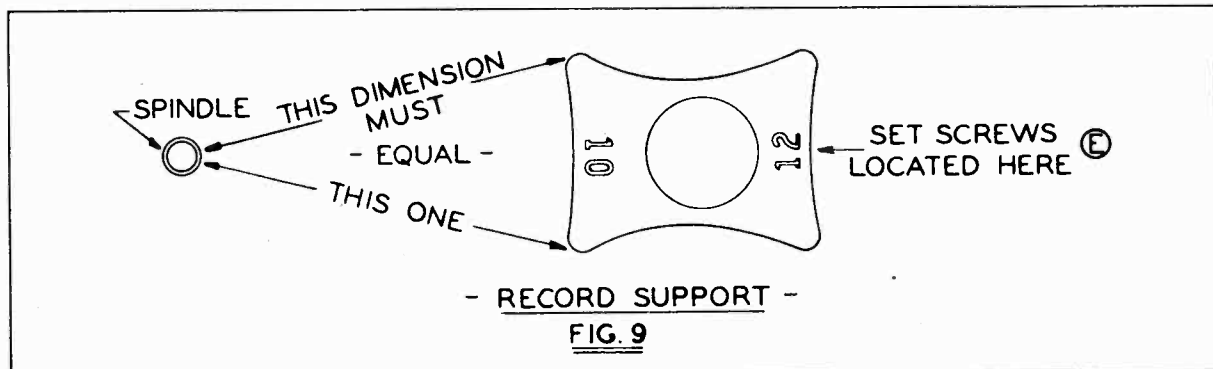


FIG. 9

GALVIN MFG. CO.

MODELS B2RC, B3RC, B4RC

TO ADJUST AUTOMATIC CHANGE SWITCH

The Automatic Switch (See Fig. 7) starts the changing cycle after a record has been completely played. The switch is actuated by the oscillating of the tone arm in the eccentric groove of the record, through the spring clip which grips the movable switch blade.

If the switch fails to operate positively, it may be readily adjusted by means of the adjustment screw (F). (See Fig. 7).

To make the adjustment, place a record on the turntable, start it revolving, and move the

pick-up over to the end of the record. Adjust screw (F) until switch closes the magnet circuit and starts the change cycle. Check points visually to make sure they do not remain closed after cycle is completed.

If the Changer immediately starts another cycle, it is an indication that the points are remaining closed or that the clutch release spring (G) (Fig. 7) does not have enough tension. This tension may be increased by taking it up another notch.

PARTS PRICE LIST
MODEL B2RC (Used in Models 23RC and 23RCW)

PART NO.	DESCRIPTION	LIST	PART NO.	DESCRIPTION	LIST
4A1957	"C" Washer .093 CP	DOZ. \$0.15	1X21479	Lever & Stud Assembly.	\$0.10
2S7045	Nut 1/4-28x5/8 Hex-1/8th CP. PER C. . . . .	.60	1X21480	Arm & Finger Assembly-Pickup bottom. . . . .	.30
3S7102	Set Screw 8-32x1/8" Bristo . . . . .	.85	40A21482	Power Switch . . . . .	.65
3S7114	Set Screw 8-32x1/4 SLABHD BQ. PER C.	1.50	59B21484	Phono Motor & Mounting Plate	5.25
3S7643	Washer 11/16-.021 CO . . . . .	.20	1X21487	Pickup Shaft & Bracket Assembly. . . . .	.25
4S7644	Washer 1/2-.140-.031 CO. . . . .	.80	1X21488	Cam Wheel & Bearing Assembly . . . . .	.55
66X10633	Bristo Head "L" Wrench . . . . .	.15	4A21491	Thrust Washer 9/16-.315-.020 .DOZ. . . . .	.20
66X10634	Slab Head Screw Driver	1.50	1X21496	Record Post Assembly	1.40
64A11245	Switch Holding Plate .022. . . . .	.25	47A21497	Grooved Pin (Drive Pawl) CP. .DOZ. . . . .	.25
31A11343	Terminal Strip 2 ins. #2 gnd . . . . .	.15	47A21499	Grooved Pin (Top Cap) NP . . .DOZ. . . . .	.30
66X12146	Phillips Head Screw Driver	1.35	41A21502	Compression Coil Spring 3/8 - Record Post . . . . .	.60
41A18863	Tension Coil Spring-Pawl . . .DOZ. . . . .	.30	1X21503	Push Rod & Eyelet Assembly . . . . .	.10
55A21170	Needle Cup . . . . .	.10	1X21504	Trip Rod & Block Assembly. . . . .	.50
49A21268	Wheel - 3" O.D . . . . .	.25	43A21505	Trip Rod Roller. . . . .	.05
62C21269	Main Drive Wheel only. . . . .	.40	1X21508	Wheel & Shaft Assembly 3" . . . . .	.35
64A21271	Record Hold-Down Plate . . . . .	.10	1X21509	Drive Wheel & Bearing Assembly - Record Post . . . . .	.55
45A21273	Fulcrum Block. . . . .	.20	1X21510	Release Magnet & Brkt. Assembly. . . . .	.35
64A21285	Detent Stop Plate. . . . .	.05	1X21511	Bracket Assembly W/Armature. . . . .	.10
46A21286	Shoulder Stud 3/8" Brass . . .DOZ. . . . .	.30	41A21516	Tension Coil Spring 7/32 - Armature. . . . .	.60
46A21287	Shoulder Stud 13/32 Cop. Pl. .DOZ. . . . .	.40	1K21517	Circuit Breaker Switch Assembly - Upper. . . . .	.25
3A21291	Record Push Rod Screw. . . . .	.95	1K21518	Automatic Change Switch Assembly - Lower. . . . .	.25
7A21293	Latch Bracket. . . . .	.05	37A21523	Rubber Grommet - Mtr. Mtg. . .DOZ. . . . .	.40
45A21294	Trip Rod - Cop. Pl . . . . .	.10	1X21524	TurnTable Pulley & Bearing Assembly. . . . .	.35
46A21295	Eccentric Shoulder Stud. . . . .	.10	40K21526	Push Switch - Momentary Contact. . . . .	.40
47A21296	Idler Shaft. . . . .	.15	43K21559	Bronze Bearing .750 Long - Record Post . . . . .	.20
3A21297	Screw 12-24x1/4 Spec.Hd CO .PER C. . . . .	.90	1B21560	Release Magnet Assembly. . . . .	.20
47A21298	Cam Shaft - Cop. Pl. . . . .	.35	13A21598	Switch Escutcheon. . . . .	.10
47A21299	Record Selector Shaft 10" - 12" . . . . .	.10	36A21662	Control Knob (Push-On) . . . . .	.10
49A21302	Pulley 1 & 1/16 OD . . . . .	.15	59B21840	Phono Pickup Arm - Less Mtg.	4.75
7A21303	Release Bracket. . . . .	.05	4X21941	"C" Washer .437-.281-.020CP. PER C. . . . .	.90
45A21306	Latch Armature . . . . .	.05	38X22151	Plug Button. . . . .	.05
45A21307	Drive Pawl	1.00	2K22211	Nut 1/2-27x5/8 Hex. Cop. Pl. . . . .	.05
46A21308	Pick-Up Drive Stud . . . . .	.05	49X22573	Rim Drive Wheel & Shaft.	1.50
46A21314	Pickup Push Rod - Bent . . . . .	.05	59X22574	Pickup Crystal Cartridge only.	2.65
43A21317	Detent Lever . . . . .	.30	4X22576	Flat Washer - for Rim drive wheel . . . . .	.30
45A21325	Eccentric Top Cap (Spindle). . . . .	.30	35X22577	Oil Wick Washer - for Rim Drive Wheel . . . . .	.30
41A21332	Tension Coil Spring - Record Hold-Down Plate . . . . .	.25			
37A21333	Pickup Mounting Cushion. . .PER C.	1.00		MODEL B3RC (Used in Model 58FRC) (Same as B2RC except that power switch is omitted)	
41A21334	Compression Coil Spring 11/16 - Push Rod. . . . .	.75	38X22148	Plug Button (Light Brown Hammerloid) . . . . .	.30
46B21335	Record Post - Cop. Oxd	1.05		MODEL B4RC (Used in Models 62F1 and 83F1) (Same as B3RC except for parts listed below)	
45A21336	Record Trip Lever - Cop. Oxd .DOZ. . . . .	.30		Same as B3RC except:	
1A21443	R.C. Switch Assembly . . . . .	.60	59B21483	Phono Pickup Arm-less mtg.	5.50
4A21444	Spring Washer 1/- .320-.008 .PER C. . . . .	.60	59X22575	Pickup Crystal Cartridge only.	3.10
7A21445	Switch Mounting Bracket. . . . .	.10			
35A21448	Trip Rod Cushion-Felt. . . . .	.30			
41A21454	Compression Coil Spring 1/4-Record Post . . . . .	.55			
41A21455	Cam Pulley Spring Belt . . . . .	.10			
41A21456	Turntable Spring Belt. . . . .	.10			
42A21457	Ring Clip .100-.014 CP . . . . .	.45			
46A21463	Pickup Mounting Pin. . . . .	.25			
59B21466	Phono Turntable 9"	1.00			
4A21469	Spring Washer 5/16-156-010 .PER C. . . . .	.50			
43K21471	Pickup Support Bushing . . . . .	.05			
43K21472	Record Support Bushing . . . . .	.10			
1X21474	Detent Plate & Shaft Assembly. . . . .	.15			
1X21475	Record Platform Assembly	1.40			
4K21476	Blank Cup - Chr.Pl. - Record Hold. . . . .	.10			
62K21477	Record Platform - Chr. . . . .	.50			

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODEL W2R.C.

GALVIN MFG. CO.

FOR OTHER DATA
SEE WEBSTER MODEL 22

MODEL W2RC RECORD CHANGER PARTS PRICE LIST

Dwg. Part No.	Description	List	Dwg. Part No.	Description	List
AA 64X29207	Changer Plate Assembly	\$4.00	BI 7X29227	Pickup Bracket Assembly	\$0.25
AB 4X29208	Fish Paper Washer	.10	BK 15X29228	Changer Cap	.30
AC 3X29209	Spindle Housing Screw	.10	BL 40X29229	A.C. Switch	.40
AD 41X29210	Spring Clip	.25	BM 64X29230	Shelf Plate	1.60
AE 35X29211	Idler Wheel Oil Wick	.DOZ.	BN 64X29231	Selector Plate	1.95
AF 45X29212	Bent Idler Wheel Link Assembly	.25	BO 4X29233	Changer Plate Spring	.25
AG 49X29213	Drive Sleeve - Idler Wheel	.30	BP 38X29234	Changer Plate Washer	.35
AH 41X29214	Bent Idler Wheel Link Spring	.10	BQ 38X29235	Push Button 10"	.15
AI 49X29215	Idler Wheel Assembly	.65	BR 38X29236	Push Button 12"	.15
AK 45X29216	Idler Wheel Link Assembly	.20	BS 38X29237	Push Button "M"	.15
AL 41X29217	Idler Wheel Link Spring	.05	CA 47X29238	Swivel Shaft & Head Assembly	.75
AM 47X29218	T.T. Spindle & Cone Assembly	1.70	CB 47X29239	Pickup Plunger	.25
AN 47X29219	T.T. Spindle & Housing Assembly	4.50	CC 47X29240	Lifter Guide	.30
AO 46X29220	Changer Post	.70	CD 41X29241	Hinge Spring	.10
AQ 4X29221	Changer Shaft Washer	.35	CE 41X29242	Pickup Plunger Spring	.05
AR 47X29222	Front Changer Shaft Assembly	.50	CF 43X29243	Pickup Plunger Sleeve	.20
BA 30X29223	Pickup Cord	.75	CG 55X29244	Key Control Assembly	1.10
BB 46X29224	Swivel Post	.80	CH 47X29245	Rejection Rod	.10
BC 3X29225	Sub-Plate Mounting Screw	.15	CI 47X29246	Manual Key Rod	.10
BF 45X29226	Pickup Arm Only	4.40			

MODEL W2RC RECORD CHANGER PARTS PRICE LIST—Continued

Dwg. Part No.	Description	List	Dwg. Part No.	Description	List
CJ 2X29247	Lifter Rod Nut	\$0.05	EE 41X29268	Changer Spreader Spring	\$0.15
CL 45X29268	Swivel Trunnion Assembly	1.80	EF 45X29269	Cam Conn. Rod Assembly	.85
CM 3X29248	Trunnion Shoulder Screw	.05	EG 41X29270	Return Spring	.05
CN 41X29249	Guide Arm Spring	.05	EH 45X29271	Return Spring Catch	.05
CO 41X29250	Swivel Spreader Spring	.55	EK 41X29272	Adj. Rod Lever Spring	.10
CP 45X29251	Clutch & Lever Assembly	1.40	EL 41X29273	Cam Connecting Rod Lift Spring	.10
CQ 49X29252	Cork Clutch Disc	.25	EM 64X29274	Lower Swivel Spreader	.10
CR 45X29253	Clutch Lever Assembly	1.00	EN 41X29275	Pickup Leader Spring	.10
CS 41X29254	Clutch Lever Sleeve Spring	.35	EO 2X29276	Post Nut	.15
CT 7X29255	Clutch Spring Retainer	.10	EP 458403	Lockwasher 5/8 Ext CP	.50
CU 2X29256	Lock Nut	.DOZ.	EQ 59K27841	Cartridge & Leads Only	4.00
CV 3X29257	Clutch Retainer Adj. Screw	.25	ER 64X29277	Lift Plate	.10
DF 41X29258	Pawl Spring	.10	FB 3X29278	Clutch Adjusting Screw	.35
DI 64X29259	Sub-Plate, Gear & Lever Assembly	7.50	FC 4X29279	Washer	.25
DJ 3X29260	Shoulder Screw	.10	FD 30X29280	Ground Lead Assembly	.15
DK 7X29261	Clutch Release Bracket	.05	FE 37X29281	Rubber Grommet	.05
DM 3X29262	Clutch Screw	.05	FG 45X29282	Changer Conn. Rod Assembly	2.35
DN 41X29263	Clutch Lever Spring	.DOZ.	FH 41X29283	Manual & Rej. Rod Spring	.10
EA 49X29264	Motor	17.00	FI 44X29284	Idler Gear	.45
EB 64X29265	Main Mounting Plate	5.10	FO 40X29285	Clutch Release Jack	.05
EC 43X29266	Changer Shaft Collar & Screw Assy.	.45	FP 45X29286	Adjusting Rod Assembly	1.10
ED 45X29267	Spring Roller	.35	FQ 64X29287	Upper Swivel Spreader	.10

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

GENERAL RECORD CHANGER
and MOTOR DATA

GARRARD ENG. & MFG. CO. LTD.

GENERAL RECORD CHANGER AND MOTOR DATA

Record Changer Model No.	Remarks	Type	Speed	Drive - Motor Data				
				AC, DC, or AC/DC	Freq. if AC	Line Voltage	Watts	Current*
RC1A		Induction	78	AC	50/60	100/130 and 200/250	19 @ 100 V, 50 cps 19.5 @ 200 V, 50 cps 29.5 @ 250 V, 50 cps	.27 @ 110 .28 @ 200 .32 @ 250
RC2A	Same Mech. as 1A	Universal	78	AC/DC	25 to 60 on AC	100/130 and 200/250	16 @ 100 V, 50 cps 36 @ 200 V, 50 cps 46 @ 250 V, 50 cps 20 @ 100 V DC 41 @ 200 V DC 52 @ 250 V DC	
RC4		Induction	78	AC	50/60	200/230	Same as RC50	
RC4A	Same Mech. as RC4	Induction	78	AC	50/60	100/130		
RC5	Same Mech. as RC4	Universal	78	AC/DC	25 to 60 on AC	100/130 and 200/250	Same as RC51	
RC5A	Same Mech. as RC4A	Universal Series	78	AC/DC	25 to 60 on AC	100/130 and 200/250		
RC6	Same mech. as RC4 except for coils & term. blocks in motor	Induction	78	AC	50/60	100/130 and 200/230	Same as RC50	Same as RC50
RC6A	Same Mech. as RC4A	Induction	78	AC	50/60	100/130 and 200/250		
RC8	Same as RC6	Induction	78	AC	50/60	100/130 Only	Same as RC50	Same as RC50
RC8A	Same mech. as RC4A	Induction	78	AC	50/60			
RC10		Induction	78	AC	50/60	100/130 and 200/250	12 @ 110 V, 60 cps 14 @ 230 V, 50 cps	.22 @ 130 V. .11 @ 250 V.
RC10A	Same mech. as RC10	Induction	78	AC	50/60	110/130 Only	Same as RC30A	
RC11	Same mech. as RC10	Universal Series	78	AC/DC	25 to 60 on AC	100/130 and 200/250	9 @ 100 V DC 24 @ 220 V DC 21 @ 230 V AC	.22 on DC .13 on AC
RC30		Induction	78	AC	50/60	100/130 and 200/250	14 @ 230 V, 60 cps	.22 @ 130 V. .11 @ 250 V.
RC30A	Same mech. as RC30	Induction	78	AC	50/60	110/120	12 @ 110 V, 60 cps	.24
RC31	Same mech. as RC30	Universal Series	78	AC/DC	25 to 60 on AC	110/130 and 200/250	9 @ 100 V DC 24 @ 220 V DC 21 @ 230 V AC	.22 on DC .13 on AC
RC40		Induction	78	AC				
RC41	Same mech. as RC40	Universal	78	AC/DC				
RC50 RC50C RC50X		Induction	78	AC	50/60	100/130 and 200/250	12.5 @ 230 V, 50 cps	.22 @ 130 V. .11 @ 250 V.
RC51 RC51C RC51X	Same mech. as RC50	Universal Series	78	AC/DC	25 to 60 on AC	100/130 and 200/250	38 @ 230 V DC 32 @ 230 V, 50 cps	.25 @ 130 V. .20 @ 250 V.

On some models designated with "A", this means 110 volt single range only.

(* NOTE: Some Universal motors use Series Rheostat or fixed resistance for 200/250 volt range.

The Automatic Trip.

The automatic trip plays an important part in the operation of the record changer; upon the certainty of the auto trip coming into action depends the whole operation of the record changer.

The auto trip mechanism will operate on all makes of records having a "run off" groove, either eccentric as H.M.V. or spiral as Columbia, Decca, Parlophone, etc.

The auto trip will not operate on records without a "run off" groove, and if trouble is experienced with the pick-up remaining at the end of a record and so preventing the changer from operating, it is advisable to see that the record has a "run off" groove before attempting to make any adjustment to the mechanism.

Operation of Auto Trip.

The method of operation is as follows: The Trip Lever being connected to the Pick-up Arm through a series of levers, is moved forward towards the Main Spindle a distance proportional to the advance made by the Pick-up. The Striker is fitted upon the Main Spindle in order to push back the Trip Lever and prevent the Auto Trip from operating whilst the record is being played. When the Pick-up reaches the end of the playing grooves and is moved into the "eccentric" or "run off" groove, the movement transmitted to the Trip Lever is too much to allow of its being pushed back by the Striker, which strikes the metal Trip Lever itself, and by tripping it, operates the changing mechanism.

Striker Adjustment.

The correct (and silent) functioning of the Trip mechanism depends on the rubber bush on the Trip Lever. When this bush becomes badly worn, a tapping sound will become apparent, and the Trip may operate before the end of the record. This fault may be rectified by turning the rubber bush round, in order to present a new surface to the Striker.

Automatic Trip Adjustment.

If the changer fails to operate at the end of a record the friction screw "F" on diagram 1 should be adjusted.

This screw is readily accessible by lifting off the turntable and it should be turned in an anti-clockwise direction to increase the friction or if the changer operates before the end of a record the screw should be turned in a clockwise direction.

It is only necessary to adjust this screw about one half turn at a time.

Before adjusting this screw, it is advisable to make sure that the operating and trip levers "A" on diagram 1 are clear of the base plate and not setting up additional friction by rubbing the plate.

Records and Record Dropping.

If trouble is experienced with records failing to drop, the cause is probably due to rough record edges preventing the blades from separating the records.

The edges of these records should be scraped with a penknife to remove the sharp edges; this fault is often found on records of foreign manufacture.

If the records appear to have smooth edges then the fault may be that one of the record separating blades have been bent slightly out of position.

These blades should be checked, and if necessary, bent to the correct position. The distance between the underside of the blade and the top of the platform should be $\frac{1}{8}$ inch.

If an occasional slowing up is noticed in the reproduction, the trouble is most likely due to the record slipping, through being concave or warped.

In these cases, the slipping can sometimes be stopped by sticking a piece of stamp edging on the outer edge of the record label.

Very often the motor is blamed for this slowing up, due to record slip and if any doubt exists about the motor, the record being played when the slowing up occurs should be placed directly on the turntable and played again.

If slowing up now occurs it is due to the motor, as the record cannot slip when in contact with the turntable.

Record slip may also be caused by burrs left round the centre hole in the manufacture of the record and these burrs should carefully be removed with a penknife.

Pick-up Arm Adjustment.

The Pick-up arm has been finely adjusted so that the needle comes on to the 10in. record on $\frac{1}{8}$ in. diameter circle, and comes on to the 12in. record on $\frac{1}{16}$ in. diameter circle. These dimensions have been arrived at after checking over a very wide selection of records of various makes.

There may be a few records where the playing groove starts further away from the centre, and in these exceptional instances the needle would come on to the record a few grooves in instead of on the plain part. If the Changer was set for these exceptional records it would mean that the Pick-up would not be lowered on to the edge of records of normal size.

Should the dropping position of the needle require adjustment, turn the knurled screw A on diagram 2 towards you to drop the needle further out and the opposite direction to drop further in.

On no account must the pick-up arm be forced into position, if for any reason the pick-up arm is out of position, switch on the changer and reject; the pick-up arm will then assume its correct position.

If the needle in the pick-up lands on the plain edge of the record and does not run into the first playing groove, see that the changer is reasonably level by testing with a spirit level placed on a record on the turntable.

Also make sure that the pick-up lead is not twisted or held in such a way as to prevent the free movement of the arm.

The trouble may also be due to the adjusting nut on the pick-up arm pivot being either too tight or too loose.

The mains lead should be connected to the mains change-over block situated on the top of the motor. To connect mains leads to motor, first remove round cover on Change-over Terminal Block by unscrewing knurled nut. Attach leads to the two screws marked "Mains," then replace cover with arrow pointing to the correct voltage to suit your supply.

It is important that the knurled nut is screwed up tightly with the fingers to ensure making good contact between the connections on inside of cover. See diagrams 6 and 7.

The R.C.2A Record Changer is fitted with a universal motor and is for use on alternating and direct current.

It will operate on 100/130 and 200/250 volts D.C. and A.C. 25/60 cycles.

The mains leads should be connected to the mains terminals on the slider resistance, (diagram 8) and the lead from the resistance is connected to the motor terminals on the Changer.

This resistance has an engraved scale and the slider must be set to correspond with the voltage, and frequency if A.C. of the supply.

To adjust this nut, "A" on diagram 3, first loosen its locking screw "B" on diagram 3, and lightly tighten up the nut with the fingers as far as it will go, then unscrew the nut one quarter of a turn and tighten up the locking screw.

This position will be approximately correct, but if the arm is still not quite free, a further slight adjustment in one direction or the other should rectify the trouble.

If the pick-up arm dips on 10" when a 12" record has fallen, or vice-versa, bend the small flat spring "B" on diagram 1 towards the front of the changer; this can be done by pushing the spring with a screwdriver between the top plate and the casting; on later models this spring has been superseded by a pivoted lever which does not require any adjustment.

Brake Adjustment.

If the changer does not stop in the correct position, but over-runs and does not drop the first record when loaded, the brake pad requires adjustment.

This is provided for on the lever carrying the brake pad, (diagram 4). When this adjustment is made, care must be taken to see that the switch-breaks contact before the pad touches the turntable.

Record Changer Motors.

The motor fitted to the "GARRARD" R.C.1A Record Changing Unit is for use on alternating current only, and is an induction type of motor.

It will operate on 100/130 and 200/250 volts 50/60 cycles.

Speed Adjustment.

Due to the wide voltage range of the motor it may be necessary on some voltages to make a slight re-alignment to the speed indicator lever (Dia. 5) to bring the speeds correct. To make this adjustment, first set the speed of the turntable at 78 R.P.M. while playing by means of the "Garrard" stroboscopic speed indicator enclosed with all A.C. Record Changers. With D.C. using Universal Model, the speed should be checked with a watch.

Next remove turntable, loosen quadrant screw on the speed indicator lever and move lever so that it points to 78 on the indicator plate, at the same time holding the quadrant stationary, then tighten quadrant screw. The speed should now be correct.

GARRARD ENG. & MFG. CO. LTD.

MODELS RC1A, RC2A

Maintenance of Motors.

Always ensure that the motor is well lubricated, if the bearings are allowed to run dry, the motor will become noisy.

The lubrication points are readily accessible by lifting off the turntable; suitable oil and grease should be used.

We recommend "GARRARD" Oil and Grease for this purpose, as it is specially prepared for use with these motors.

The lubrication points are shown on diagram 1.

On the the Universal motor an occasional inspection of the brushes is advisable, they are accessible by unscrewing the bakelite caps on the motor body and pulling out the brushes by means of the springs.

If dirty, the brushes can be cleaned by lightly scraping the contact surface with a penknife.

The brushes when new are $\frac{1}{8}$ " long under the springs; when they have worn down to $\frac{3}{8}$ " they should be replaced by new ones.

It is essential that the brushes be replaced in the same holder and the same way as originally found.

If for any reason the motor has to be removed from the record changer main casting, the following instructions should be observed :

First disconnect the motor leads from the switch and terminals, then holding the motor in one hand unscrew the motor fixing screws, the motor can then be withdrawn.

When reassembling the motor the mark on the two large gears should coincide for correct timing.

Current Consumption of Motors.

R.C.1A INDUCTION MOTOR.

On Alternating Current, 50 Cycles.

100 volts	19 watts
200 "	19.5 "
250 "	29.5 "

R.C.2A UNIVERSAL MOTOR.

On Direct Current.

100 volts	20 watts
200 "	41 "
250 "	52 "

On Alternating Current, 50 Cycles.

100 volts	16 watts
200 "	36 "
250 "	46 "

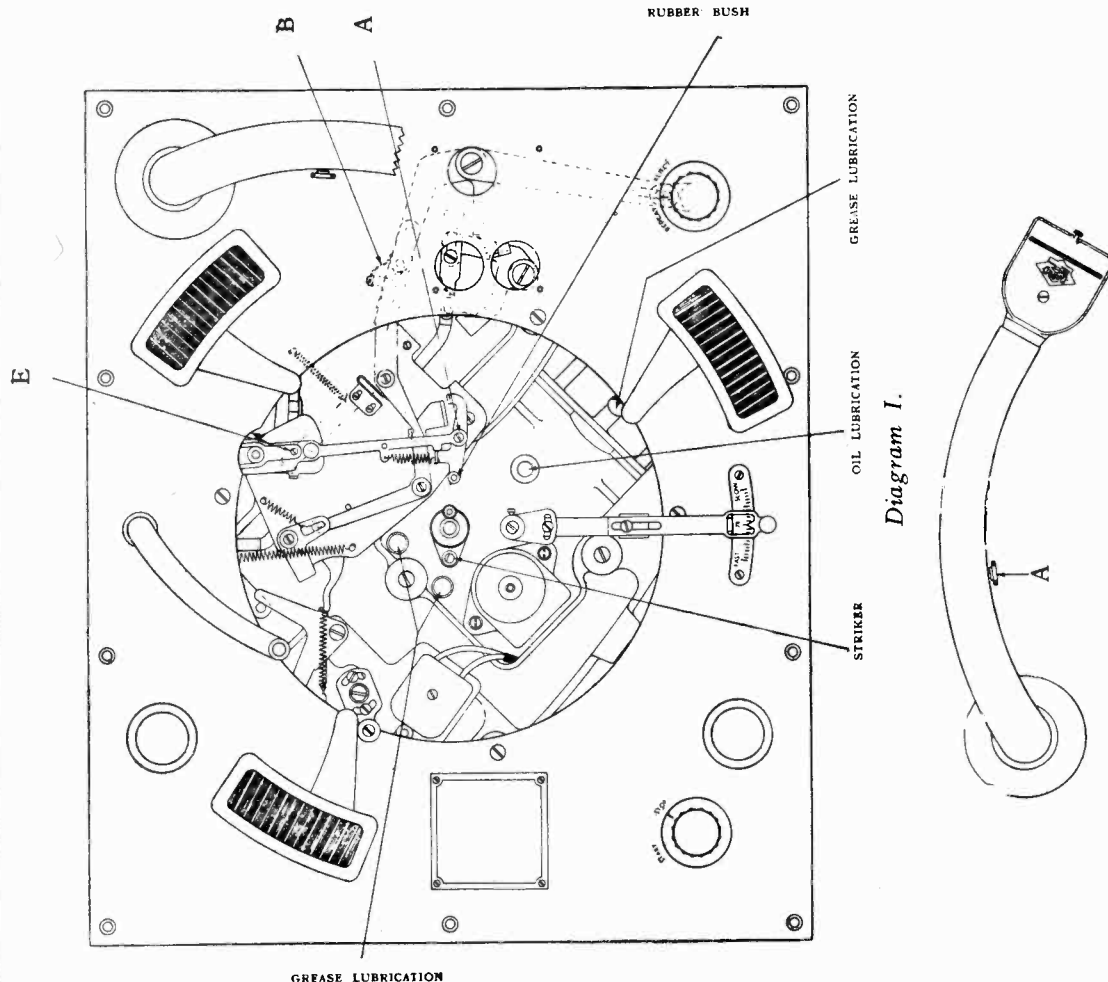


Diagram 1.

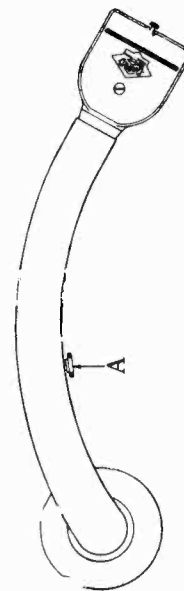
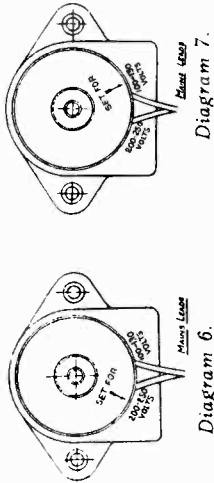


Diagram 2.



Pick-up.

The "GARRARD" Pick-up should be connected as shown in diagram 9. The volume control recommended has a resistance of 100,000 ohms.

If a volume control is not used in conjunction with the pick-up, the pick-up should be shunted with a fixed resistance of about 100,000 ohms to correct the response.

The resistance of the pick-up coil is 6,000 ohms, the impedance 29,000 ohms at 1,000 cycles and the output is 1.0 volt R.M.S. at 1,000 cycles.

Any type of needle playing 10 or more records is quite suitable for use in the pick-up on the Changer. The pick-up resistance of 6,000 ohms is standard on this changer, but pick-ups can be wound and adjusted to suit special requirements where necessary; also crystal pick-ups can be fitted to order.

Should it become necessary to remove the pick-up from the arm, proceed as follows:

First remove the stop screw; this is the small screw found underneath the arm just behind the pick-up head. Next remove the pick-up cover and unsolder the leads from the connecting tags, "A," on diagram 10. The pick-up can now be removed.

NOTE.

When adapting a D.C. mains set or a set using a D.C. eliminator to take a pick-up, a pick-up transformer or condensers in series with the pick-up should be fitted, otherwise the pick-up circuit becomes alive.

The leads from the set to the pick-up should be as short as possible. If it is essential for the leads to be more than about 10 feet long, a pick-up transformer should be used.

It is essential that the Changer be connected to earth, a screw and tag being provided for this purpose on the main casting. The same earth connection as used for the set or amplifier is quite suitable.

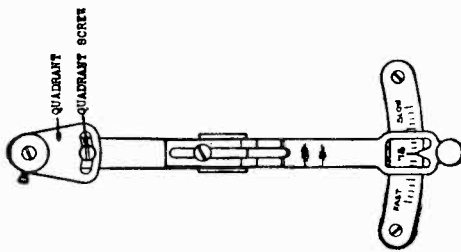


Diagram 5.

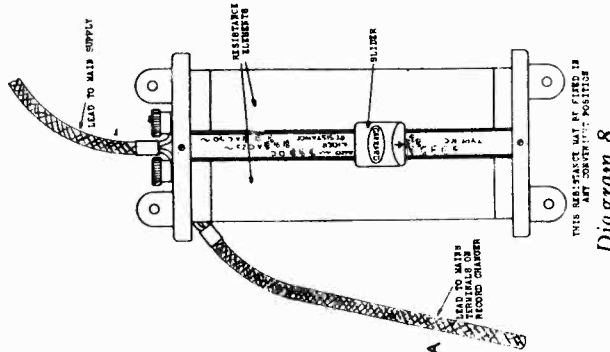


Diagram 8.

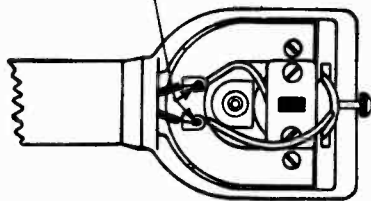


Diagram 10.

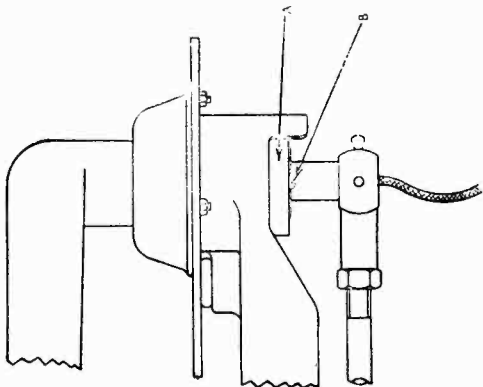


Diagram 3.

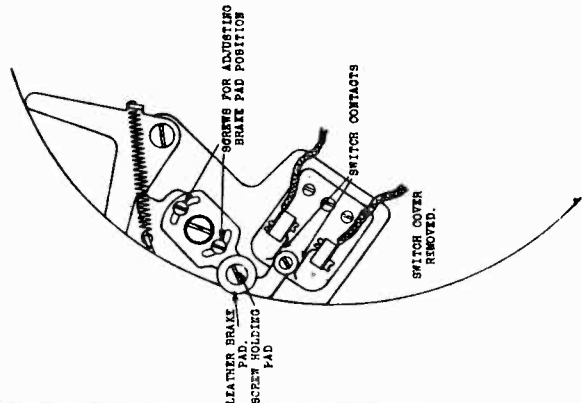


Diagram 4.

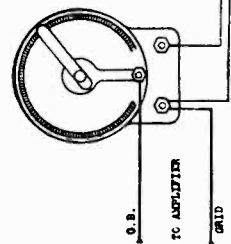


Diagram 9.

GARRARD ENG. & MFG. CO. LTD.

MODELS RC4, RC5,
RC6, RC8
Series

THE "GARRARD" MAGNETIC PICK-UP.

The "Garrard" Pick-up should be connected to the volume control as shown in diagram 5.

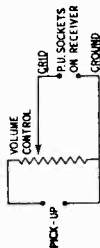


Diagram 5

The table below gives the values of the resistor and characteristics of the "Garrard" Pick-ups:

D.C. Resistance of Coil	Colour Coding on Coil	Fixed or Variable Resistor shunt.	Impedance at Output at 1000 C.P.S.	Impedance at Output at 1000 C.P.S.
2,000 ohms	Black Band.	50,000 ohms.	7,000 ohms.	0.5 V R.M.S.
6,000 ohms	Red Band.	100,000 ohms.	29,000 ohms.	1.25V R.M.S.

Use any type of needle made for playing 10 records or more.

PIEZO ELECTRIC CRYSTAL PICK-UPS.

Diagram 5 shows how to connect the crystal pick-up to a volume control, if one is required. Alternatively, connect a fixed resistor of equal value across the pick-up to adjust the frequency response. The usual value of the variable or fixed resistor is 500,000 ohms. A reduction in bass response can be achieved by substituting, for the value given above, a resistor of 250,000 ohms.

NOTE.

When adapting an AC/DC (Universal) Radio Receiver, Amplifier or one using a D.C. Eliminator for the reproduction of gramophone records, a pick-up transformer or condensers in series with the pick-up leads should be fitted, otherwise the pick-up circuit becomes alive. Also, the leads from the radio set or amplifier to the pick-up should be as short as possible in every case.

VOLUME CONTROL

To fit on Changer unit plate, remove the small name plate on the right hand side near the pick-up arm rest and fit in hole provided.

On some models this hole is not provided, and it will be necessary to drill a 5/8 in. diameter hole in a suitable position. Screened leads are necessary from the pick-up to the volume control and to the radio receiver, connect the metallic screening to earth (ground).

If a volume control is not needed, a fixed resistor of equal resistance value should be connected across the pick-up leads to correct the frequency response

"GARRARD" RECORD CHANGERS.

RC 4, RC 5, RC 6, and RC 8 Series

FOR ADJUSTMENTS ONLY

SEE MAGNAVOX MODEL RC-4

OPERATING INSTRUCTIONS.

The Record Changer will play any number of records up to eight 10" or eight 12". Either of these types can be played, but not mixed 10" and 12".

1. Turn the left hand knob so that the line on it is pointing to the number indicating the size of records to be played, e.g., 10" or 12". Now see that record spindle is in position, the sloping part leaning towards the record platform. When there are no records on the spindle it rises slightly.
2. Place any number of records up to eight on the record spindle. Insert a needle, of the type that will play 10 records or more in the pick-up head, by turning it anti-clockwise to bring the needle hole into view, then turn it back.
3. Next turn the right hand knob to "START". The motor will start and instrument operate without any further attention, and when the last record has been played it will automatically stop. After playing, withdraw the centre spindle and lift the records off the turntable.
4. To reject a record, turn the right hand knob to the "REJECT" position
5. The Record Changer can be stopped by turning the right hand knob to the "STOP" position. When the knob is turned again to the "START" position, the pick-up arm will lift and commence to play the next record.
6. Connected to the switch knob is the "REJECT" mechanism. If a Record Changer is switched off whilst playing a record, the reflector comes into operation and causes the pick-up arm to return to the rest position. Or conversely, when switching on again and causes the pick-up arm to return to the rest position.

NOTE. If the Record Changer has been stopped for any reason with the Pick-up Arm not on the rest, the Arm should NOT be interfered with, but the motor re-started and Arm allowed to return to its normal position on rest.

MAINTENANCE

Maintenance has been reduced to minimum; with normal use the motor should be lubricated about once a month.

The Motor is lubricated by means of the oil holes shown in diagram 1. They are readily accessible by lifting off the turntable, and a few drops of thin lubricating oil, preferably "Garrard" oil, will suffice.

**MODELS RC4, RC5,
RC6, RC8
Series**

GARRARD ENG. & MFG. CO. LTD.

TO REMOVE PICK-UP FROM THE ARM.

On Types R.C. 4, R.C. 5, R.C. 6 and R.C. 8 Series

"First remove the stop screw underneath the pick-up arm, just behind the pick-up head. Now remove the pick-up cover and unsolder the leads from the tags; the pick-up can now be withdrawn."

On these types of Record Changers it is necessary, in order to minimise tracking error, to fit a different pick-up arm when converting from magnetic to crystal type of pick-up or vice versa.

On Types with Plug-in Head.

"Remove the pick-up stop screw and the small screw on the left hand side of the pick-up arm. This will release the terminal block, the pick-up plugs can be pulled out and the pick-up withdrawn."

Crystal and various types of our magnetic pick-ups can be interchanged on these types of Record Changers without alteration to the pick-up arm.

SPEED SETTING.

Due to the wide voltage range of the motors it may be necessary on some power supplies to make a slight re-adjustment of the speed indicator lever (diagram 6) so that the speed of the turntable corresponds with that shown on the indicator scale.

To do this, first set the speed of the turntable at 78 revolutions per minute, whilst playing, by means of the "Garrard" Stroboscopic Speed Indicator enclosed with the "Garrard" A.C. Record Changers. With Universal Models, used on D. C. Power Supply, speed adjustment should be checked with a watch.

Now remove the turntable and carefully loosen the quadrant lever and move the lever so that it points to 78 on the indicator plate, at the same time holding the quadrant screw stationary, then tighten quadrant screw.

The speed should now be correct.

SERVICE INSTRUCTIONS.

Every "Garrard" Record Changer has been designed and manufactured to an extremely high standard of engineering precision. Each Record Changer is subjected to prolonged final tests to be certain that it operates satisfactorily before leaving our factory. Normally, therefore, no difficulty should be encountered.

These Service Instructions apply to either types RC4, RC5, RC6 or RC8 Series, as the record changing mechanism is the same in each case.

MOTORS.

R.C.6A Record Changer -- is operated by a "Garrard" R.C.6 Induction Motor.

designed for any voltage between 100/130 and 200/250 volts A.C. 50/60 cycles.

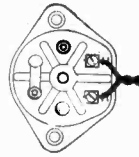
The terminals for connecting to the power supply are accessible by unscrewing the centre screw and removing bakelite cover.

All motors are set on 200/250 volt range before leaving our factory. If the motor is required for use on the 100/130 volt range, the two brass links should be removed and replaced as shown in diagram 8 below.

R.C.5A Record Changer--incorporates the Universal Motor R.C.5. It is a series wound motor and operates on any voltage between 100/130 and 200/250 volts D.C. or A.C. 25/60 cycles. The power supply is connected through a resistance mounted on the Changer. Three terminals are provided, one being common and the other two being for the high and low voltage ranges respectively.

The lubrication and speed settings is the same as the Induction Motor. If the brushes are allowed to become dirty or worn, brush noise will occur. The brushes may be removed by unscrewing the bakelite caps on motor body and pulling out the brushes by means of the springs. The brushes can be cleaned by lightly scraping the contact surface with a pen-knife. It is essential that the brushes be replaced in the same holder and the same way as originally found. The brushes when new are 9/16 inch, long under the springs; when they have worn down to 3/8 in they should be replaced.

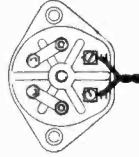
Connect Both Bars Thus for 200/250 Volts



Power Supply Leads

Diagram 7

Connect Bars Thus For 100/130 Volts



Power Supply Leads

Diagram 8

The R.C.4A and R.C.8A Motors are similar to the R.C.6A type, but are for single voltage ranges only.

1. TO REMOVE MOTOR

If for any reason the motor unit has to be removed, the following instructions should be observed:-

First disconnect the motor leads from the switch and terminals. On the Universal models the leads must also be disconnected from the fixed resistance. Next, unscrew the platform operating lever from the bottom of the motor casting. Now hold the motor with one hand and unscrew the three motor fixing screws; the motor can then be withdrawn.

GARRARD ENG. & MFG. CO. LTD.

MODELS RC4, RC5,
RC6, RC8
Series

WHEN REASSEMBLING THE MOTOR, THE MARK ON THE TWO LARGE GEARS MUST COINCIDE FOR CORRECT TIMING.

NOTE: If the motor refuses to start when switched on, check over all the wiring connections and make sure that the switch contacts are clean.

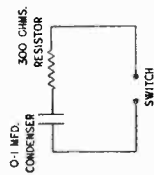
2. MECHANICAL FEED BACK AND SPRING MOUNTING.

In cases where mechanical feed back occurs, it is suggested that the record changing unit be spring mounted in the cabinet. This will give sufficient mechanical insulation between the loud speaker and the pick-up to prevent feed-back occurring.

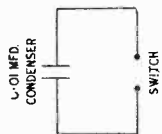
3. INTERFERENCE FROM SWITCH CLICKS.

It is essential that the record changer chassis be connected to earth (ground). If the switch clicks are unduly audible in the loud speaker, the following remedies are suggested:

Connect a condenser or condenser and resistor, as shown in the diagrams below, across the switch contacts.



The condensers should have a working voltage of at least 300 volts A.C.



4. PICK-UP REMAINING AT THE END OF A RECORD and therefore preventing the Changer from operating.

See that the record has a "run-off groove" before attempting to make any adjustment to the mechanism. Only records with a "run-off groove" can be played automatically on a Record Changer.

The probable cause is that the trip lever "A" in diagram 1 has not operated, due to insufficient friction at its pivot. To remedy, remove the record spindle, lift off the turntable, and adjust the friction screw. It is readily accessible and marked "E" on diagram 1.

Before adjusting the screw make sure that the operating and trip lever "A" (diagram 1) is clear of the base plate and not setting up additional friction by rubbing it.

To increase the friction give the adjusting screw "E" (Diagram 1) a slight turn in an anti-clockwise direction.

5. SWITCH (AUTOMATIC) NOT OPERATING AT THE END OF THE LAST RECORD.

See that all the levers are free and that all the springs are still fixed in position. Verify that the centre spindle is free in the main spindle. It should move about 1/8" when pressed down and should rise the same amount when released. Make this test when the Changer is in the playing position.

When the weight of the last record is removed from the centre spindle it should automatically lift slightly.

6. CHANGER OPERATES BEFORE PICK-UP REACHES THE END OF A RECORD.

Also bumping or tapping noises.

The friction adjusting screw mentioned in paragraph 4 should be turned slightly in a clockwise direction to decrease friction. As this adjustment is very sensitive, do not move more than a quarter of a turn at a time.

A worn rubber bush on the trip lever may also cause a noise and can be cured by giving the bush a turn to present a new surface to the striker.

7. RECORDS AND RECORD DROPPING

The record platform is set to the correct position for all average records, but if an undersize or oversize record is encountered, it may be necessary to make a slight adjustment to the platform position.

This is done by removing the nut, washer and screw "A" on Diagram 2 and turning the bush "B", clockwise to accommodate large records, and anti-clockwise for small records. Replace the screw, washer and nut. Check the record platform position by placing a record on the spindle, and if correct the record edge should rest on the platform just clear of the studs when the changer is in the playing position.

8. FIRST RECORD NOT DROPPING WHEN CHANGER SWITCHED ON.

This is due to the leather brake pad becoming worn and not braking the turntable sufficiently.

To adjust, loosen the two screws ("W" in Diagram 1) and turn the brake lever slightly to bring the leather pad nearer the turntable rim; now tighten up the screws. After making this adjustment see that the switch breaks contact before the leather pad touches the turntable rim.

MODELS RC4, RC5,
RC6, RC8
Series

GARRARD ENG. & MFG. CO. LTD.

FOR ADJUSTMENTS ONLY

9. PICK-UP ARM ADJUSTMENT.

SEE MAGNAVOX MODEL RC-4

The pick-up arm has been finely adjusted so that the needle comes on to the 10" record in a 9 5/8" diameter circle and on 12" record in a 11 5/8" diameter circle. These positions were arrived at after checking a very wide selection of records of various makes.

There may be a few records where the record track starts further away from the centre (i.e., nearer the edge) and in these exceptional cases the needle would come on to the record a few grooves from the start of the record instead of on the plain part. If the Record Changer was set for these exceptional records it would mean that the pick-up would not be lowered on to the edge of the record track with records of normal size.

If the dropping position of the needle requires adjustment, the turntable should first be turned by hand to bring the pick-up from the loading position to the point where needle has dropped to within 1/16" of the record.

The screw marked "N" in Diagram 3, which is accessible through a hole in the unit plate, should then be turned either to the right or left according to requirements. A quarter of a turn in either direction will give you the maximum adjustment, which should afterwards be checked by starting the changer and noting the dropping position.

If desired the pick-up height can be adjusted by loosening the set screw in the pick-up counterbalance weight ("M" in Diagram 2) and turning the weight whilst holding the spindle.

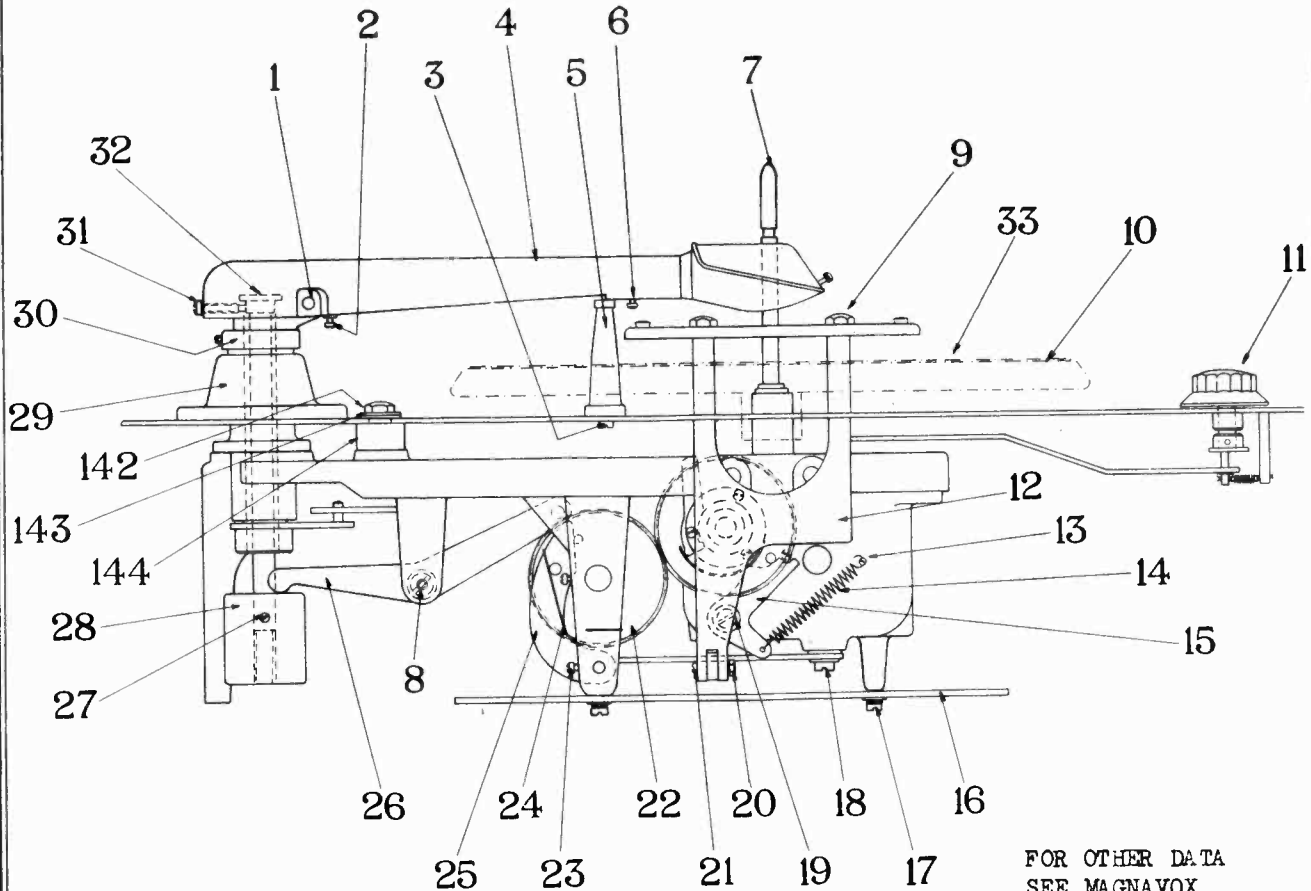
CAUTION: When making any adjustments to the Pick-Up Arm it should NEVER on any account be forced into position. If the turntable is turned by hand, it should NEVER be turned backwards.

10. PICK-UP NEEDLE DOES NOT RUN INTO RECORD GROOVES but stops on the plain edge of the record.

First see that the record changer is level by placing a spirit level on a record on the turntable. Next make sure that the flexible wire leading to the pick-up is not twisted or held in such a manner as to prevent the free movement of the pick-up arm.

See that the levers ("L" and "O", Diagram 2) are free and that the pin at the end of lever "C" is not rubbing on the bottom of the cam grooves.

GARRARD ENG. & MFG. CO. LTD.

MODELS RC4, RC5,
RC6, RC8
Series

SPARE PARTS LIST

FOR OTHER DATA
SEE MAGNAVOX
MODELS RC-4 SERIES

TYPES R.C.4, 5, 6 & 8 RECORD CHANGING UNIT.

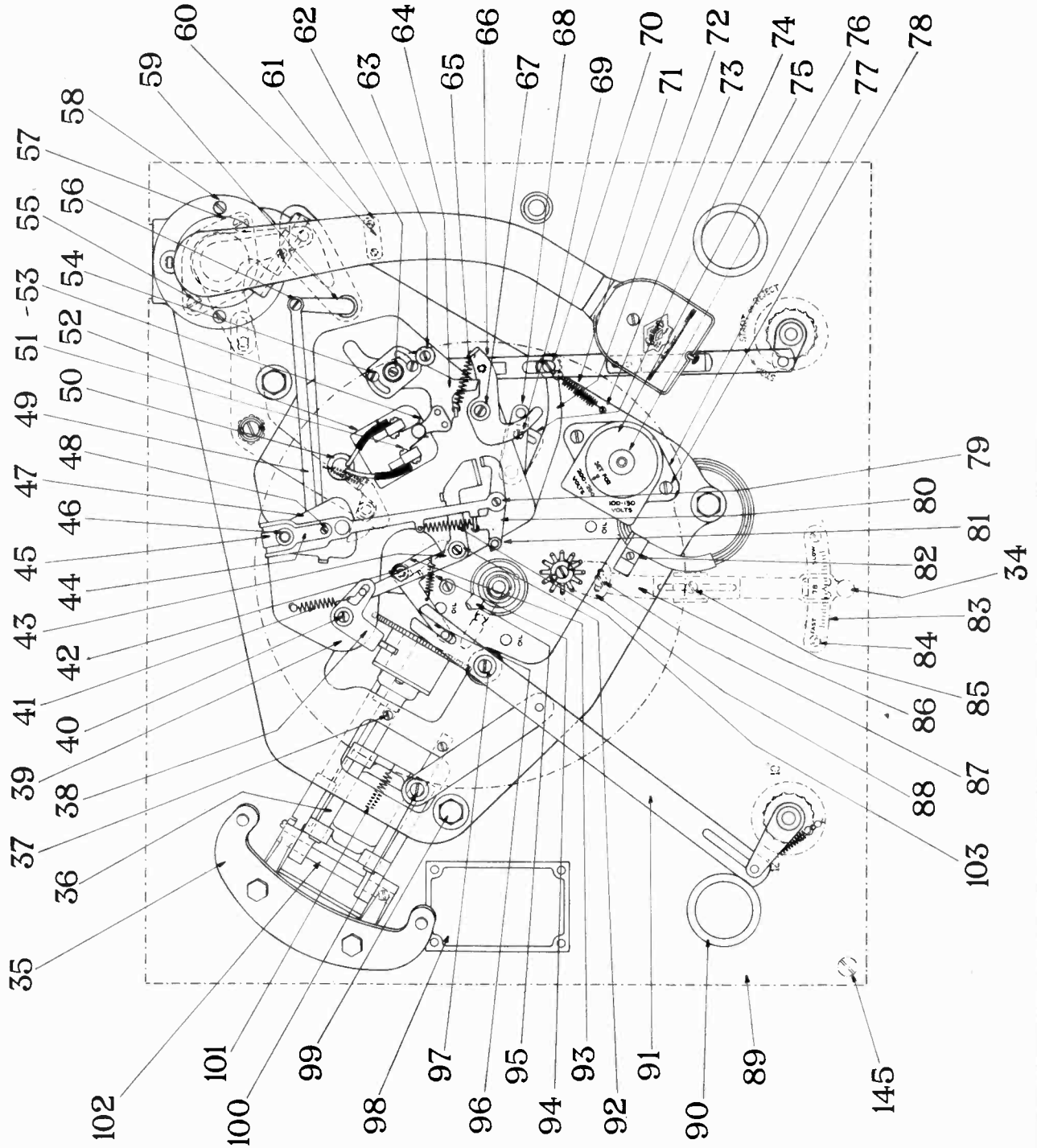
DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART
A 1	1872	Pivot pin.	A18	1807	Pivot screw collar and washer.
A 2	G2/14	Pivot pin screw.	A19	1807	Pivot screw collar and washer.
A 3	M1/14	Pick-up rest fixing screw.	A20	G7/9	Nut for Tie Rod extension.
A 4	1869*	Pick-up arm.	A21	B7/5	Screw for Tie rod extension.
A 5	1909	Pick-up stand.	A22	1889	Cam gear.
A 6	547	Pick-up stop screw.	A23	M1/14	Pressure lever screw.
A 7	1917	Record spindle.	A24	1912	Pressure lever spring.
A 8	1984	Screw collar and washer.	A25	1913	Pressure lever.
A 9	1863	Platform screw.	A26	1941	Lifting lever.
A10	1844	Turntable.	A27	UV1/9	Pick-up weight fixing screw.
A11	1809	Bakelite knobs.	A28	1939	P.U. Balance Weight.
A12	1848	Platform support.	A29	1930	Cover for P.U. Arm base.
A13	678	Stud for spring (not RC5)	A30	1982	Pick-up arm bracket.
	772	Stud for spring (RC5).	A31	1870	Lifting screw.
A14	1901	Clutch overthrow lever spring.	A32	1938	Lifting tube.
A15	1979	Clutch overthrow lever.	A33	B8/2	Turntable Covering and eyelet.
A16	2118	Packing Plate (not RC5).	A142	UV1/17	Steel washer.
A16	2196	Packing Plate (RC5).	A143	1933	Rubber step washer.
A17	2182	Screws & washers, pkg plate (not RC5).	A144	1932	Rubber washer.
A17	JJ1/10	Screws & washers, pkg plate (not RC5).			

*Special Pick-up Arm for use with "Piezo" Crystal Pick-up—Ref. No. 2439.

MODELS RC4, RC5,
RC6, RC8
Series

GARRARD ENG. & MFG. CO. LTD.

Diagram B



GARRARD ENG. & MFG. CO. LTD.

MODELS RC4, RC5,
RC6, RC8
Series

SPARE PARTS LIST

Sheet B.

TYPES R.C.4, 5, 6 & 8 RECORD CHANGING UNIT.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
B34	15/9	Indicator lever.		B68	1952	Stop lever.	
B35	1862	Platform.		B69	15/12	Screw for Stop Lever.	
B36	1849	Slide rods.		B70	1978	Screw for reject lever.	
B37	561	Screw for slide rod.		B71	1836	Spring for reject lever.	
B38	1947	Clutch trip lever.		B72	1950	Reject lever.	
B39	1945	Auto trip base plate.		B73	678	Stud for spring.	
B40	780	Screw collar and washer.		B74	1985	Knock off spindle quadrant.	
B41	1836	Spring.		B75	JJ1/32*	Top plate for change-over block (O.T.).	
B42	G13/12	Nut for Selector spindle.		B76	JJ1/36*	Nut for top plate (Old Type).	
B43	1946	Knock off lever.		B77	JJ1/31*	Change-over block (Old Type).	
B44	1151	Friction spring.		B78	M1/9	Fixing Screw for terminal block.	
B45	1910	Operating lever.		B79	724	Screw for trip lever (rivet on latest types).	
B46	G13/24	Retaining coil.		B80	1911	Trip lever.	
B47	1158	Friction plate.		B81	730	Trip lever rubber.	
B48	1152	Adjusting screw.		B82	EE13/3	Clip for leads.	
B49	1944	Connecting link.		B83	15/14	Regulating plate.	
B50	DC2/13	Rubber grommet.		B84	743	Regulating plate screw.	
B51	635	Screw for contact spring.		B85	15/12	Quadrant lever screw.	
B52	586	Switch block.		B86	1895	Quadrant lever.	
B52	2332	Switch cover.		B87	15/12	Quadrant screw.	
B52	594	Screw for cover.		B88	15/10	Quadrant.	
B53	591	Switch contact spring.		B89	1976	Unit plate.	
B54	15/12	Screw for brake pad lever.		B90	1200	Needle cup.	
B55	1807	Screw for pick-up base.		B91	1966	Change-over lever.	
B56	CC13/6	Step Screw (Connecting link screw).		B92	780	Pivot screw collar and washer.	
B57	1929	Pick-up base.		B93	1956	Selector link.	
B58	650	Screw for P.U. base cover.		B94	IT1/26	Spring.	
B59	1943	Control lever.		B95	1968	Striker complete.	
B60	1893	Flex plate.		B96	1957	Delay lever.	
B61	5/24	Screw for flex plate.		B97	1807	Pivot screw collar and washer.	
B62	780	Pivot screw collar and washer.		B98	1936	Instruction plate.	
B63	AS1/21	Leather brake pad and screw.		B99	1934	Fixing screws.	
B64	1949	Switch lever.		B100	1807	Pivot screw collar and washer.	
B65	1951	Switch link.		B101	IT1/26	Spring.	
B66	1948	Catch lever.		B102	1861	Platform spindle.	
B67	780	Pivot screw collar and washer.		B103	672	Spring for trip lever.	
				B145	1165	Fixing screw for unit plate.	

*For New Type Change Over Block (RC6) and Terminal Block (RC4 & 8) see Sheet M.

SPARE PARTS LIST

Sheet C.

TYPES R.C.4, 5, 6 & 8 RECORD CHANGING UNIT.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
C104	1940	Pick-up arm lever.		C123	1051	Split pin for spring.	
C105	1880/1	Cam shaft.		C124	1953	Change-over operating lever.	
C106	2043	Pick-up operating lever.		C125	1987	Motor fixing screws.	
C107	1971	Adjusting spindle.		C126	1850	Platform lever.	
C108	M1/14	Terminal strip fixing screws.		C127	1821	Release lever, not RC5.	
C109	1975	Terminal nut.		C127	2119	Release lever, RC5.	
C110	1973/1	Pick-up terminal strip.		C128	678	Stud for spring.	
C111	930	Spring for Latch.		C129	529	Pivot pin for release lever.	
C112	1890	Pressure Lever Shaft.		C130	584	Spring for release lever.	
C113	1958	Selector lever complete with spindle.		C131	1051	Split pin for spring.	
C114	607	Fixing screw for cam gear.		C132	1977	Switch operating lever.	
C115	2223	Pick-up lead, not RC5.		C133	1951	Switch operating link.	
C115	2224	Screened pick-up lead, RC5.		C134	2044	Latch.	
C116	1850/1	Tie rod.		C135	1879	Cam complete.	
C117	1916	Tie rod extension.		C136	1953	Switch knock off lever, not RC5.	
C118	1/9	Fixing screw for slide rod.		C136	2109	Switch knock off lever, RC5.	
C119	1906	Rivets for instruction plate.		C137	EE1/14	Screw for cam end plate.	
C120	1847	Platform slide.		C138	1959	Cam end plate.	
C121	2543	Base casting.		C139	1843	Spring for switch knock-off lever.	
C122	IT1/26	Spring for change-over link.		C140	M1/14	Screw for stop operating lever.	
				C141	1942	Stop operating lever.	

MODELS RC4, RC5,
RC6, RC8
Series

GARRARD ENG. & MFG. CO. LTD.

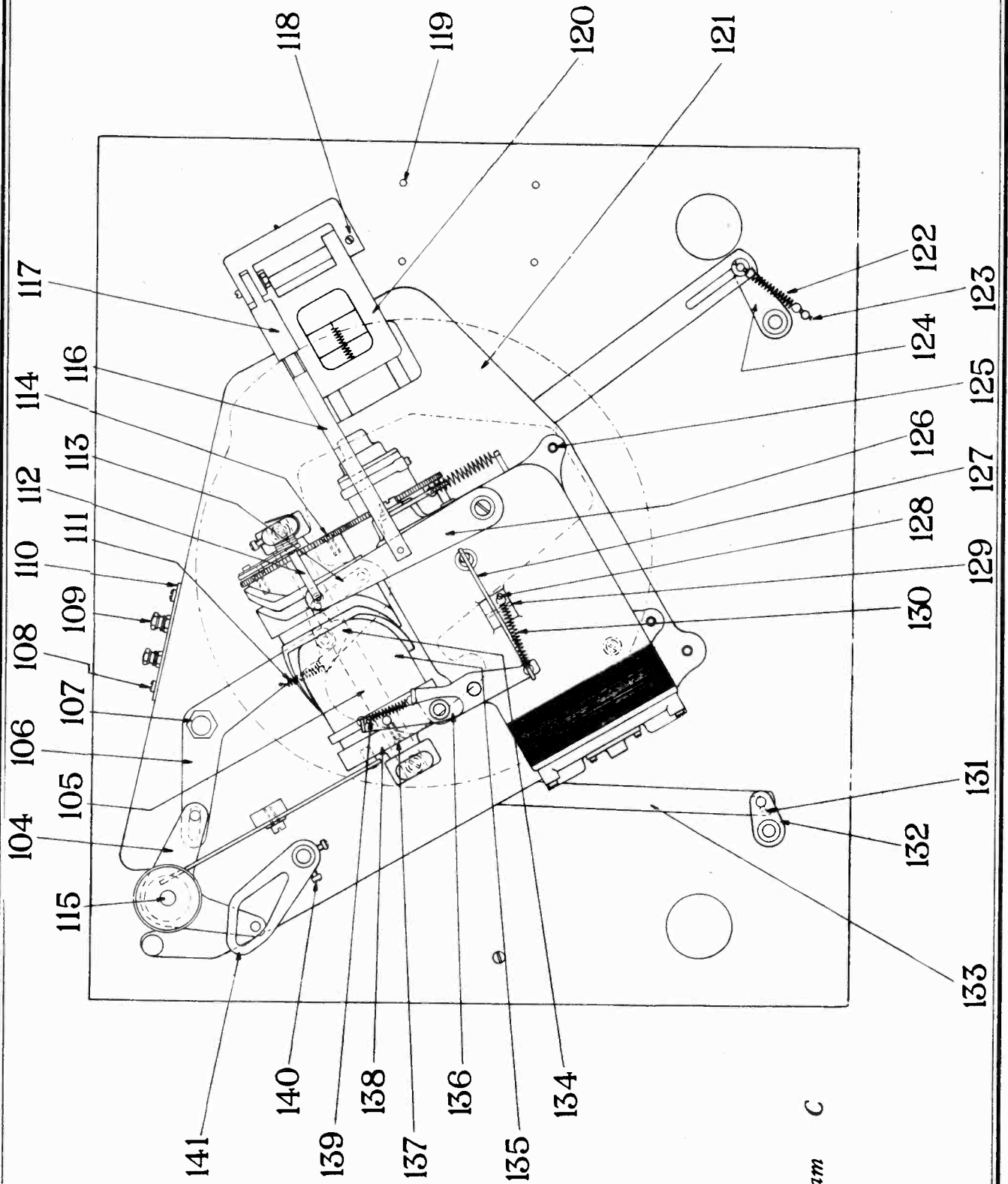


Diagram C

GARRARD ENG. & MFG. CO. LTD. MODELS RC4, RC5, RC6, RC8

SPARE PARTS LIST

Series

Sheet D.

TYPES R.C.4, 6 & 8 MOTORS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
D 1	V2/12	Screw for clutch spring.		D41	1965	Cover for clutch case.	
D 2	610	Clutch.		D42	1964/2	Clutch case.	
D 3	1964	Clutch gear.		D43	1960	Motor cover.	
D 4	561	Screw for cross shaft bush.		D44	1839	Main spindle with fibre gear.	
D 5	1963	Cross shaft gear.		D45	1838/2	Fixed spindle insert.	
D 6	1914	Pin for cross shaft gear.		D46	1838/3	Retaining coil.	
D 7	1961	Cross shaft.		D47	1838	Fixed spindle.	
D 8	1841	Fibre gear.		D48	1969	Regulating shaft with cam.	
D 9	LL7/3	Brake Swivel.		D49	6A/10	Split pin.	
D10	JJ7/7	Brake pad.		D50	15/19	Washer.	
D11	1998	Grommet. Not RC6.		D51	KK7/3	Spring washer.	
D12	2098*	Stator coils per pair connected.		D52	JJ7/2	Collar.	
D13	DD1/3	Thrust ball.		D53	5/24	Screw for governor ball.	
D14	G2/14	Screw for end cover plate.		D54	M1/14	Screw for motor cover.	
D15	1993	End cover plate.		D55	JJ7/11	Split pin for operating lever.	
D16	JJ1/17	Grommet. RC6.		D56	KK1/10	Screw for end cover.	
D17	1996	End cover.		D57	JJ2/10	Bobbin shield.	
D18	2097	Rotor and shaft complete.		D58	2096	Stator pack assembly less coils.	
D19	E6/3	Pin for bearing.		D59	DD5/1	Governor sleeve and disc.	
D20	JJ1/45	Rotor shaft bearing (large).		D60	5/21	Governor ball washer.	
D21	JJ7/11	Split pin.		D61	5/20	Governor ball.	
D22	JJ7/4	Brake operating lever.		D62	5/24	Governor fixing screw.	
D23	JJ7/10	Brake spring.		D63	JJ5/2	Governor collar.	
D24	5/27	Governor spring.		D64	1823	Release spindle.	
D25	2117	Rotor shaft.		D65	DC2/8	Fixing screws for fixed spindle.	
D26	1980	Motor frame.		D66	1928	Thrust plate.	
D27	1/9	Bearing screw.		D67	555	Thrust balls for main spindle.	
D28	DD1/3	Thrust ball.		D68	1927	Ball race case.	
D29	1905	Front bearing complete.		D69	V2/12	Name plate screws.	
D30	1892	Stop pin.		D70	1970*	Name plate (state type of motor, R.C. 8, 6 or 4).	
D31	1962	Cross shaft bush.		D71	JJ1/10	Stator fixing screws.	
D32	1964/3	Clutch Lever.					
D33	613	Spring for clutch case.					

*Motors RC4, RC6 and RC8 are different only in respect of their Coils, Name Plates and Terminal Blocks. The Type of Motor, as specified on Name Plate, should therefore be quoted, in addition to Reference Number, when ordering replacements for these parts.

SPARE PARTS LIST

Sheet E.

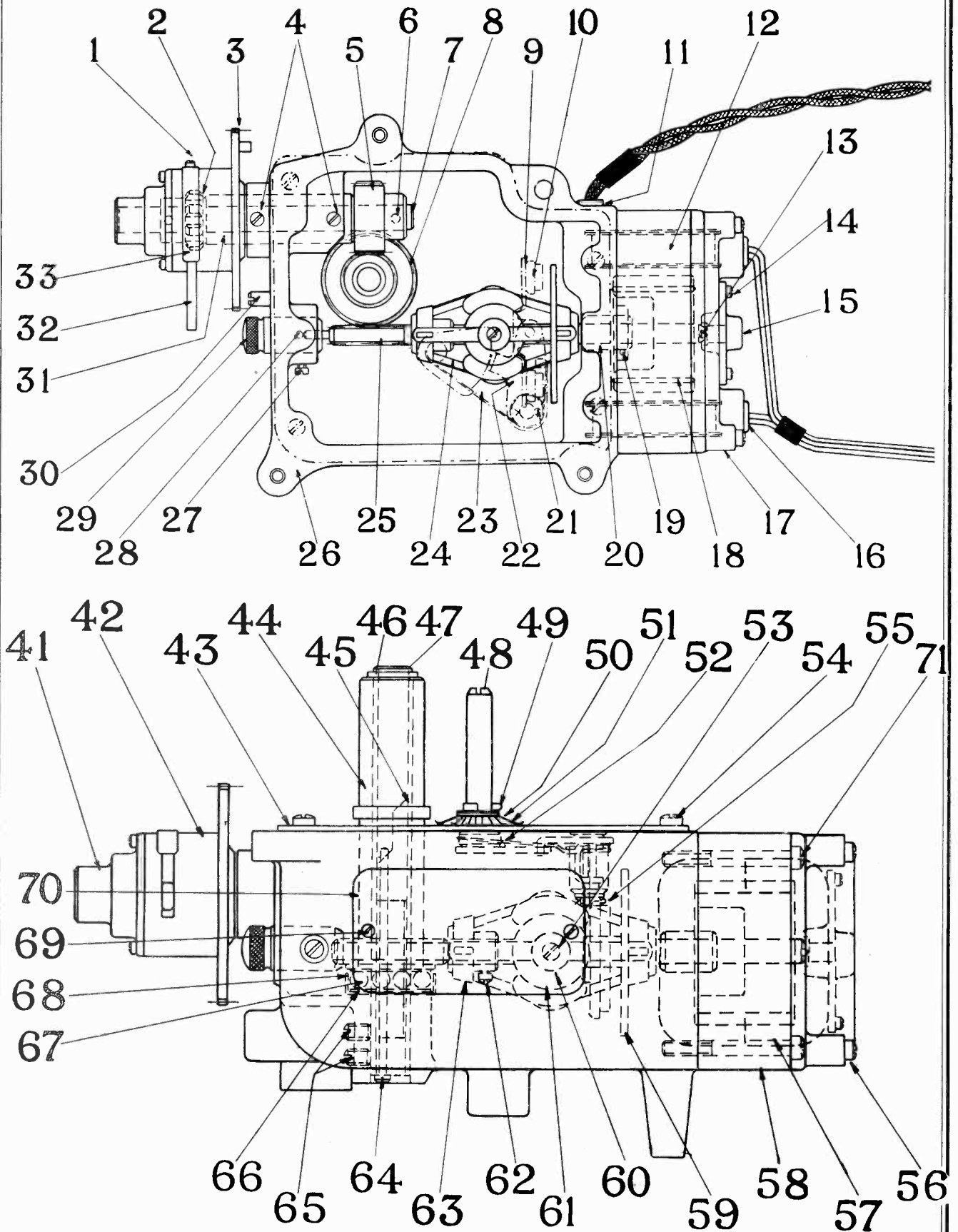
TYPE R.C.5 MOTOR.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
E 1	V2/12	Screw for clutch spring.		E33	1964/3	Clutch lever.	
E 2	610	Clutch.		E34	613	Spring for clutch lever.	
E 3	1964/1	Clutch gear.		E35	1965	Cover for clutch case.	
E 4	561	Screw for cross shaft bush.		E36	1964	Clutch case and gear complete.	
E 5	1963	Cross shaft gear.		E37	M.1/14	Motor cover fixing screws.	
E 6	1914	Pin for cross shaft gear.		E38	2103	Main spindle complete.	
E 7	1961	Cross shaft.		E39	2106	Fixed main spindle.	
E 8	1841	Fibre gear.		E40	2106/3	Retaining coil.	
E 9	LL7/3	Swivel for regulating brake.		E41	2106/2	Fixed spindle insert.	
E10	JJ7/7	Felt brake pad.		E42	5/28	Governor spring.	
E11	DD5/1	Governor sleeve and disc.		E43	5/24	Governor ball screw.	
E12	DD1/3	Thrust ball.		E44	JJ.1/15	Field pack fixing screws.	
E13	2100	RC5 Armature complete.		E45	LL.2/1	Field pack complete less coils.	
E14	AD1/16	Brush carrier bush.		E46	2099	Field coils (2 connected)	
E15	HH2/10	Felt pad.		E47	HH.3/8	Commutator washer.	
E16	HH2/9	Thrust disc.		E48	WB.1/5	Bearing Cover.	
E17	B5/9	Armature thrust ball.		E49	B.1/7	Bearing cover screw	
E18	LL2/5	Bearing cover fixing screws.		E50	HH.2/7	Felt Washer.	
E19	LL2/4	Brush carrier.		E51	LL.2/7	Leatheroid Shield.	
E20	2101	Motor frame.		E52	LL.2/6	Pin for coil.	
E21	JJ7/11	Split pin.		E53	5/20	Governor ball.	
E22	JJ7/4	Brake operating lever.		E54	5/21	Governor ball washer.	
E23	JJ7/10	Brake Spring.		E55	5/24	Governor fixing screws.	
E25	2337	Condenser.		E56	DD.5/3	Governor Collar.	
E26	B1/7	Fixing screws for condenser clip.		E57	2107	Release spindle.	
E27	830	Washer for condenser clip.		E58	DC.2/8	Main spindle fixing screws.	
E29	1/9	Screw for bearing.		E59	1928	Ball race thrust plate.	
E30	1905	Armature shaft bearing.		E60	555	Main spindle thrust balls.	
E31	1892	Clutch stop pin.		E61	1927	Ball race case.	
E32	1962	Cross shaft bush.		E62	V2/12	Name plate screw.	
				E63	1994	Name plate.	

MODELS RC4, RC5,
RC6, RC8
Series

GARRARD ENG. & MFG. CO. LTD.

Diagram D.



GARRARD ENG. & MFG. CO. LTD.

MODELS RC4, RC5,
RC6, RC8
Series

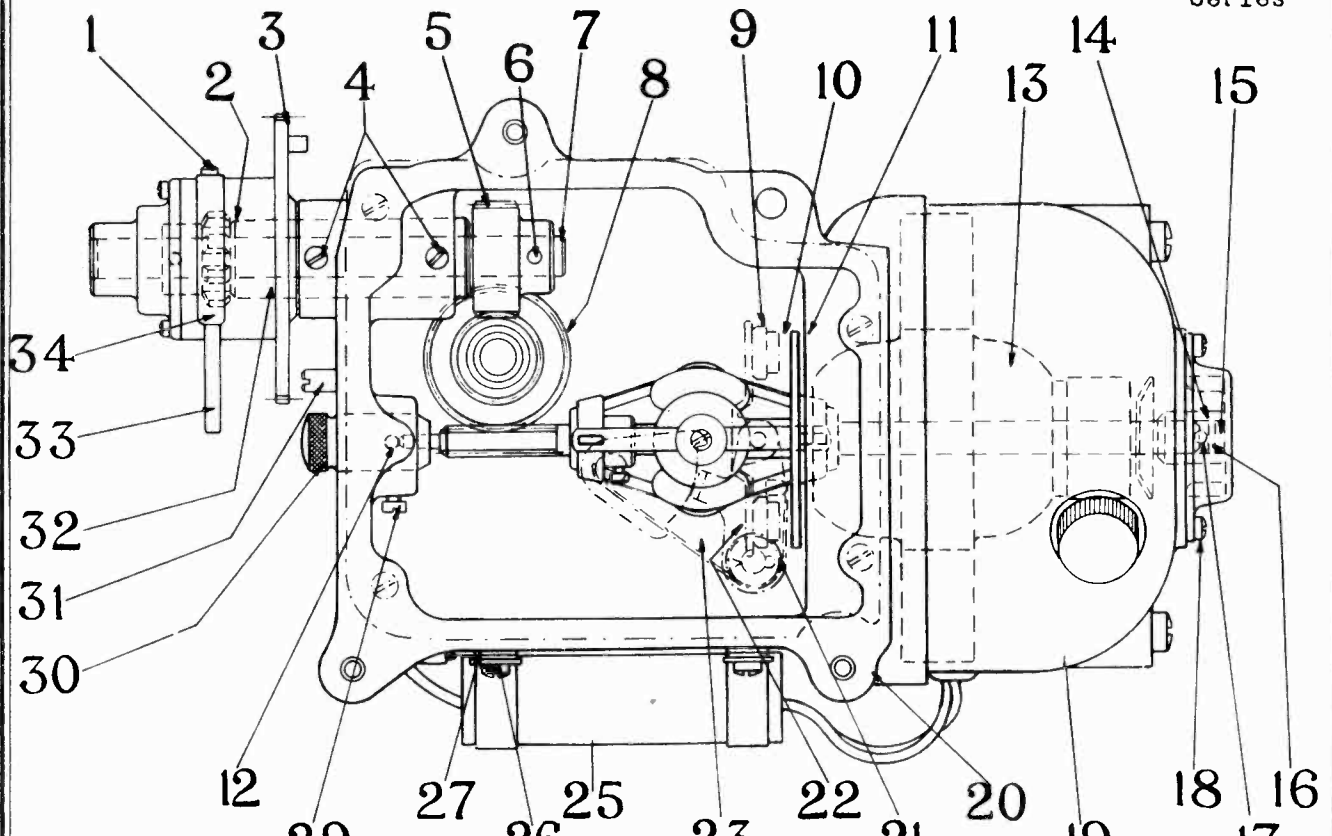
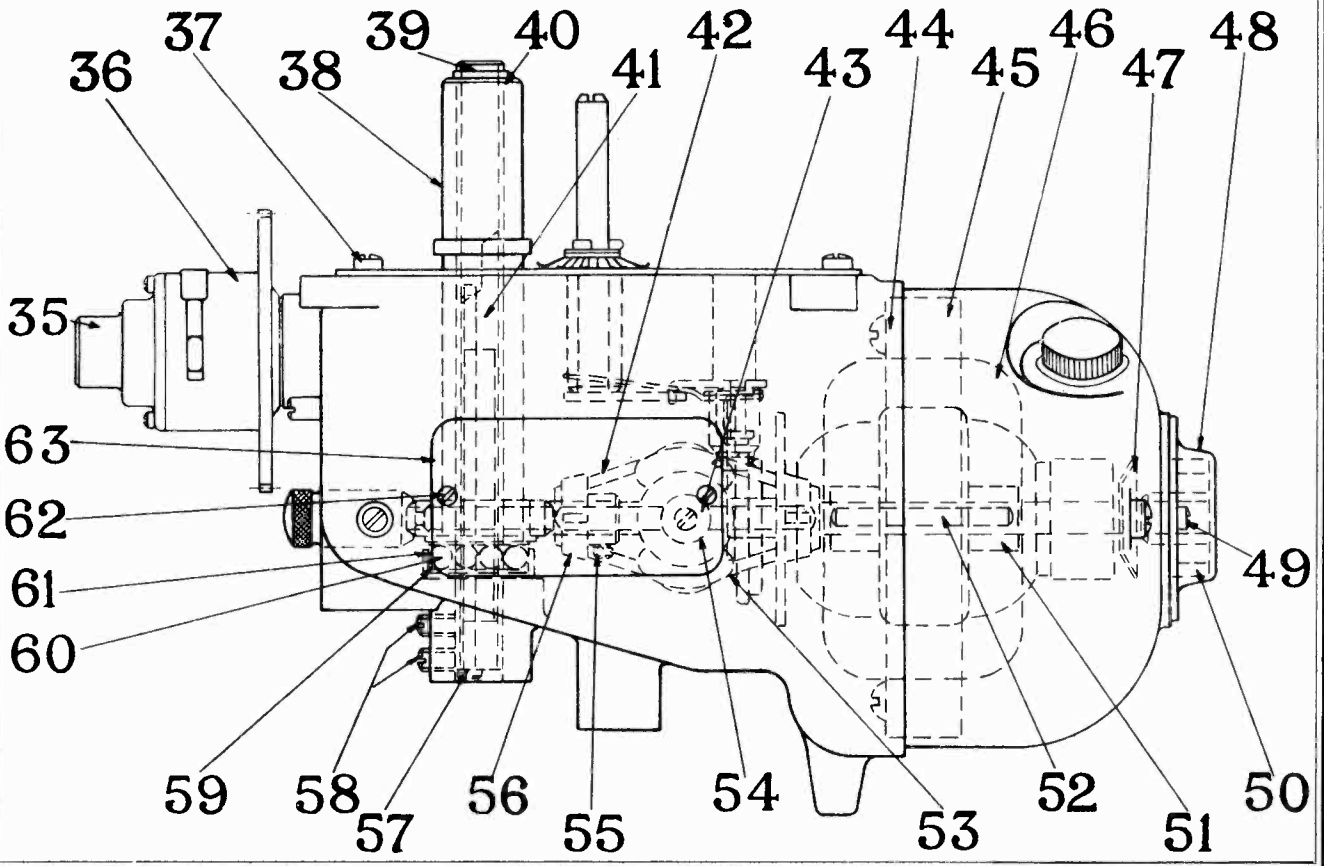


Diagram E



MODELS RC4, RC5,
RC6, RC8
SERIES

GARRARD ENG. & MFG. CO. LTD.

SPARE PARTS LIST 1.

Sheet F.

Comprising Sheets A, B, C, D, E, F, G.

TYPE R.C.5 MOTOR & RESISTANCE.

MOTOR—

RESISTANCE—

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
F64	15/19	Washer.		F 1	2377	Bracket.	
F65	6A/10	Split pin.		F 2	KK1/19	Connecting tag.	
F66	2105	Brake shaft and cam.		F 3	2111	Resistance front plate.	
F67	KK7/3	Spring washer for brake shaft.		F 4	M1/14	Fixing screw for resistance.	
F68	2104	Motor cover.		F 5	B2/12	Screw for bracket.	
F70	2181	Rubber grommet.		F 6	2115	Screw for resistance.	
F71	CC2/27	Earthing tag.		F 7	1266	Connecting screws.	
F72	HH2/22	Washer for brush cap.		F 8	UV19/7	Terminal washers.	
F73	WB2/16	Brush cap.		F 9	UV19/33	Terminal knobs.	
F74	HH2/11	Brush spring.		F10	2111/2	Terminal studs.	
F75	DC2/8	Brush tube fixing screw.		F11	2116	Distance piece.	
F76	HH2/23	Brush tube.		F12	WB11/22	Locking washers.	
F77	HH2/13	Carbon brush.		F13	G7/9	Nut.	
F78	2181	Rubber Grommet		F14	DD1/15	Terminal nut.	
F79	JJ1/43	Washer.		F15	2113	Resistance element complete.	
F81	HH2/15	Condenser clips.		F16	2112	Resistance back plate	
				F17	2113/2	Centre bar.	

SPARE PARTS LIST FOR
"GARRARD" PICK-UPS.

Sheet G.

Standard Pick-up Unit. Used on: Types R.C. 4, 5, 6 & 8
Record Changers. Types A & B Radio Gram. Units.

Type "E" Pick-up Unit.
Used on: Type "E" Radio Gram. Units.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G 1	652	Pick-up magnet.		G23	2506/3	Rivet.	
G 2	549	Pick-up body.		G24	2506/2	Connecting Plate.	
G 3	552	Pole pieces.		G25	2536	Earthing Tag.	
G 4	554	Screw for pole piece.		G26	2508	Magnet.	
G 5	553	Needle screw.		G27	795	Adjusting Plate Screw.	
G 6	550	Pick-up cover.		G28	653	Adjusting Plate.	
G 7	1194	Rubber washer for hum bucking coil.		G29	—	Empire silk tube.	
G 8	551	Cover fixing screw.		G30	2534	Insulating strip.	
G 9	653	Adjusting plate.		G31	2506/1	Base plate.	
G10	CC2/26	Connecting tags.		G32	2531	Pole Piece fixing screw.	
G11	555	Bush for sleeve with ball and spring		G33	656	Armature.	
G12	1967	Rubber magnet packing.		G34	655	Damping Rubber (Bottom).	
G13	1125	Small rubber washer for hum buck'g coil		G35	553	Needle screw.	
G14	2191	Top connecting U piece.		G36	see below	Bobbin.	
G15	554	Screw for connecting piece.		G37	654	Damping Rubber (Top).	
G16	654	Top damping rubber.		G38	2505	Pole piece.	
G17	795	Screw for adjusting plate.		G39	2507	Side plate.	
G18	See below	Humbucking coil.					
G19	See below	Pick-up coil.					
G20	656	Armature.					
G21	655	Bottom damping rubber.					
G22	2191	Bottom connecting U piece.					

"Piezo" Crystal Pick-up. Used (with special Pick-up Arms) on:
Types R.C. 4, 5, 6 & 8 Record Changers.
Types A & B Radio Gram. Units.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G43	1141	Body.	
G44	1145	Crystal Cartridge.	
G45	1142	Fixing Plate "A".	
G46	—	Needle screw.	
G47	1144	Fixing screws.	
G48	1143	Fixing Plate "B".	
G49	—	Empire Sleeveing.	
G50	CC2/26	Connecting Tags.	
G51	556	Connecting piece.	
G52	555	Bush for sleeve with spring and ball.	

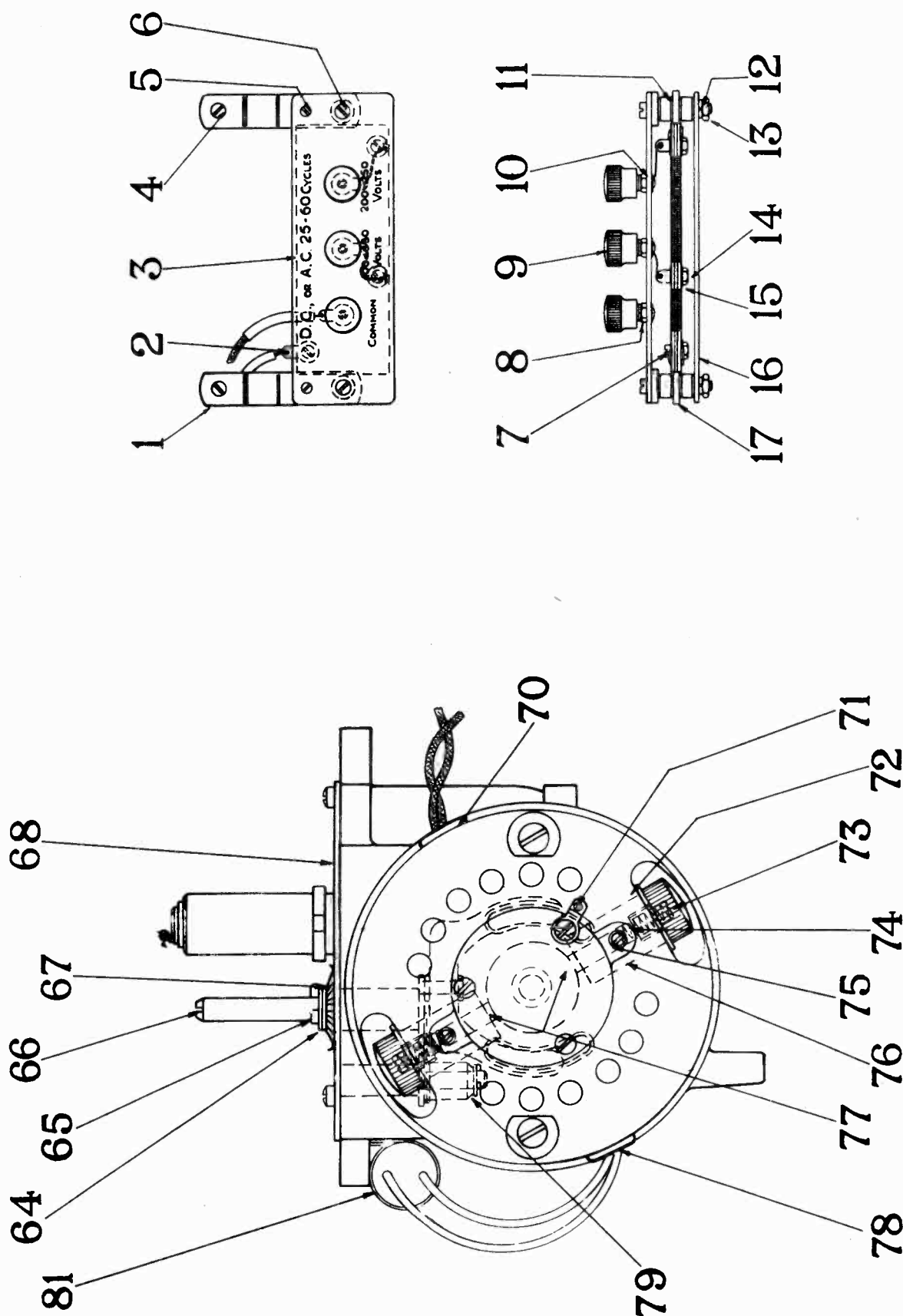
Pick-Up Coils (Std. & Type "E").

- Red Band - 6000 ohms Pick-up coil.
- Black Band - 2000 ohms Pick-up coil.
- Green Band - 700 ohms Pick-up coil.
- Orange Band - Humbucking coil (Standard Unit only).

GARRARD ENG. & MFG. CO. LTD.

MODELS RC4, RC5,
RC6, RC8
Series

Diagram F



MODELS RC4, RC5,
RC6, RC8
Series

GARRARD ENG. & MFG. CO. LTD.

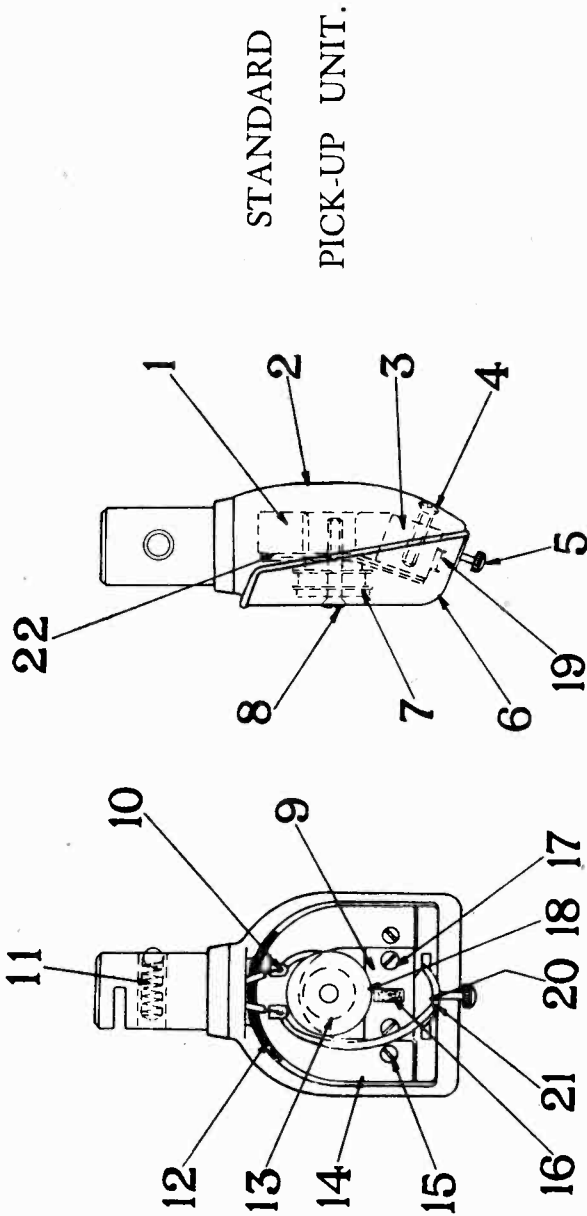
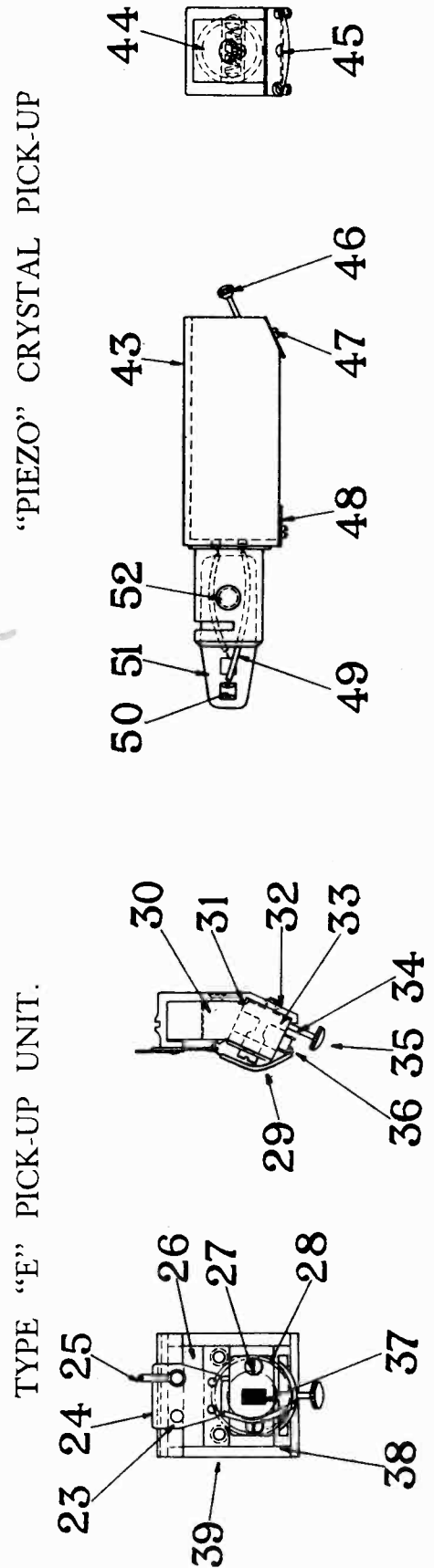


Diagram G



TYPE “E” PICK-UP UNIT.

MODELS RC-10, RC-11

GARRARD ENG. & MFG. CO. LTD.

TYPES No. R.C.10 & R.C.11 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
U 1	2510	Fixing Screw for Pick-up	...
U 2	2511/1	Cover Plate for Pick-up Arm	...
U 3	2511/2	Fixing Screw for Cover Plate	...
U 4	3526	Pick-up Cam Lever	...
U 5	1T1/26	Spring for Pick-up Lever	...
U 6	2182	Fixing Screw for Pick-up Base	...
U 7	3528	Pick-up Lifting Cam	...
U 8	CC1/6	Nut for Pivot Screw	...
U 9	1984	Collar for Pivot Screw	...
U10	JJ1/41	Washer for Pivot Lever	...
U11	1835	Pivot Screw	...
U12	3598	Roller for Pick-up Lifting Lever	...
U13	512	Pin for Cam	...
U14	1835	Pivot Screw	...
U15	JJ1/41	Washer for Pivot Screw	...
U16	CC1/6	Nut for Pivot Screw	...
U17	3529	Pick-up Swing Cam	...
U18	3600	Cam Shaft complete with Clutch and Cams	...
U19	3535	Collar for Cam Shaft	...
U20	AS1/28	Fixing Screw for Collar	...
U21	1843	Spring for Knock-off Cam Lever	...
U22	3558	Knock-off Cam Lever	...
U23	MM1/8	Spring for Cam Shaft	...
U24	3536	Bearing for Cam Shaft	...
U25	3557	Release Lever	...
U26	561	Fixing Screw for Platform Spindle	...
U27	3564	Pivot Pin for Release Lever	...
U28	3566	Spring for Release Lever	...

Sheet U.

SPARE**PARTS LIST**

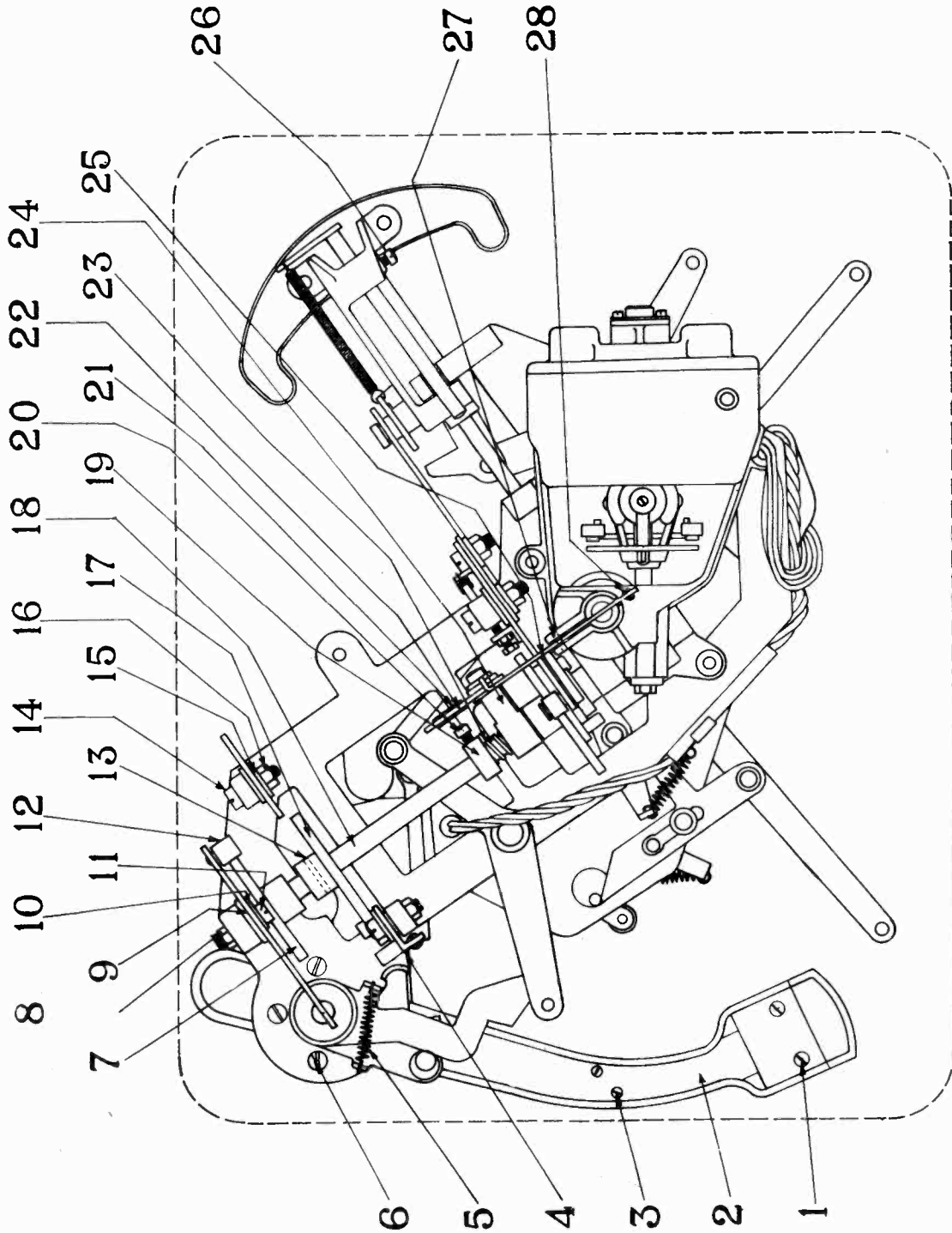
FOR OTHER DATA
SEE MAGNAVOX RC-10, RC-11

Sheet V.

TYPES No. R.C.10 & R.C.11 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART
V65	3561	Rivets for Platform	V 95	2551	Pick-up Arm for Piezo Crystal Head
V66	3537	Platform	V 96	3572	Catch Lever
V67	1835	Fixing Screw for Base Casting	V 97	1T1/26	Spring for Catch Lever
V68	UV1/17	Pivot Washer	V 98	726	Screw for Leather Brake Pad
V69	1807	Pivot Screw for Change-over Lever	V 99	AS1/21	Leather Brake Pad
	11/16	Spring Washer	V100	3571	Switch Lever
V70	3548	Change-over Lever with Knob		586	Switch Block
V71	3555	Change-over Plate	V101	2332	Cover for Switch Block
V72	2194	Rivets for Change-over Plate		594	Fixing Screw for Cover
V73	3501	Base Casting	V102	3551	Selector Lever
V74	3507	Unit Plate	V103	591	Switch Contact Spring
V75	3554	Indicator Plate	V104	JJ1/26	Fixing Screw for Contact Spring
V76	2194	Rivets for Indicator Plate	V105	2352/4	Rivets for Switch Block
V77	3584	Regulator Lever	V106	JJ1/17	Rubber Grommet for Leads
V78	B2/12	Fixing Screw for Regulator Lever	V107	3579	Link for Auto Trip
V79	JJ1/51	Cover for Change-over Block R.C.10		2009	Stud for Link
	2463	" " " " R.C.11	V108	2352/4	Rivet for Link
V80	JJ1/30	Change-over Block		2519/4	Collar for Link
V81	M1/9	Fixing Screw for Change-over Block	V109	3516	Pick-up Base
V82	730	Rubber Bush for Trip Lever	V110	3512	Fixing Screw for Base Casting
V83	3570	Auto Trip Base Plate	V111	731	Friction Washer for Operating Lever
V84	3612	Fixing Screw for Auto Trip Base Plate	V112	1151	Friction Spring for Operating Lever
V85	672	Spring for Trip Lever	V113	2547	Operating Lever complete with Trip Lever
V86	1835	Fixing Screw for Motor			
V87	2526	Trip Lever	V114	G13/24	Retaining Coil for Operating Lever
V88	2476	Rivet, Collar and Washer	V115	1152	Friction Adjusting Screw
V89	3577	Clutch Operating Lever	V116	B7/3	Felt Pad for Operating Lever
V90	3574	Switch Control Lever	V117	3596	Friction Plate
V91	2194	Rivets for Switch Plate	V118	3550	Selector Link
V92	3553	Switch Plate	V119	3556	Knock-off Lever
V93	3573	Switch Link	V120	3608	Spring for Knock-off Lever
V94	2476	Rivet, Collar and Washer	V121	2528	Rivet, Collar and Washer
V95	2501	Pick-up Arm for Magnetic Head	V122	3560	Change-over Link

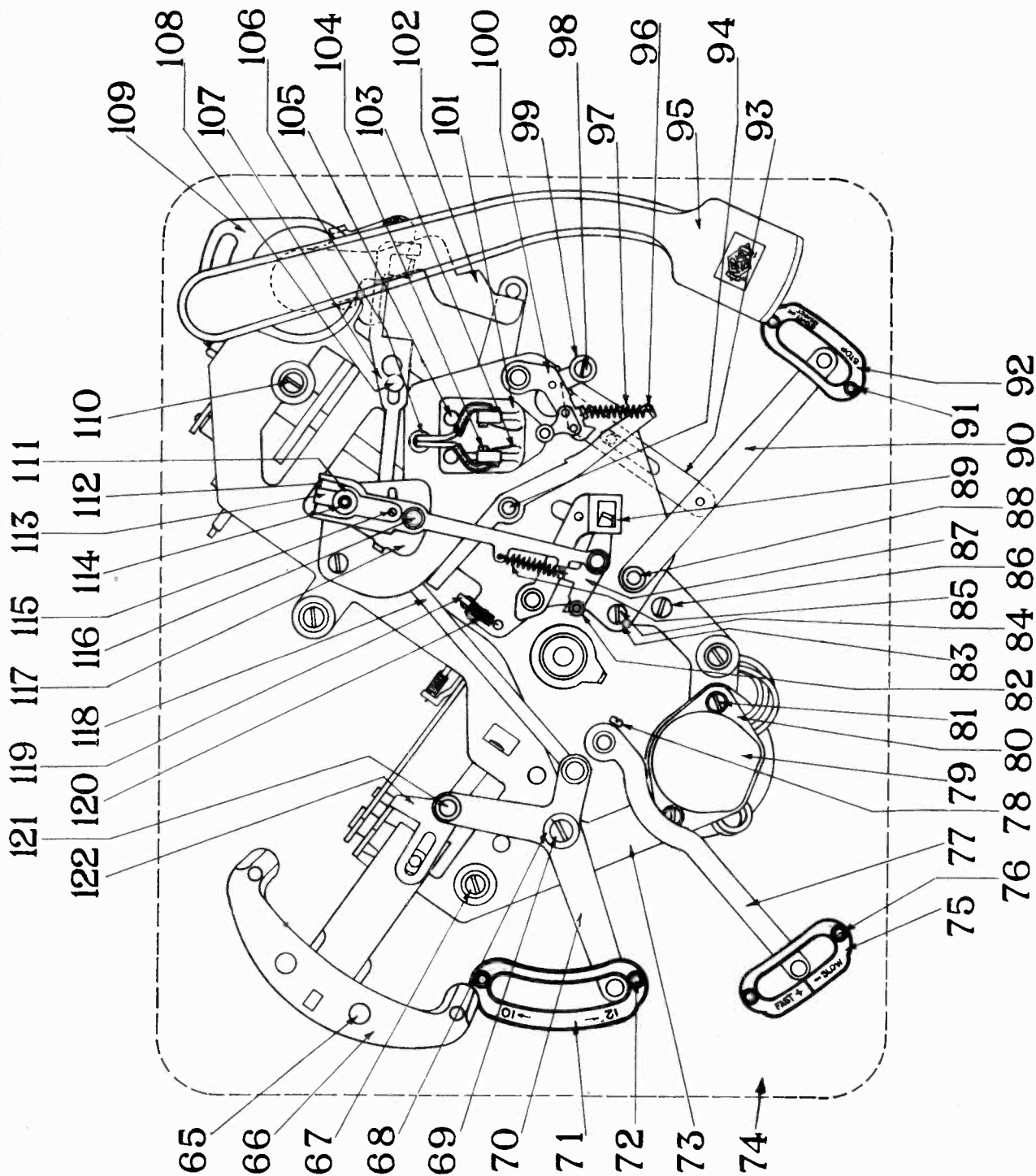
Diagram U



FOR OTHER DATA
SEE MAGNAVOX

17440

Diagram V



MODELS RC-10, RC-11

GARRARD ENG. & MFG. CO. LTD.
SPARE PARTS LIST

Sheet W.

TYPES No. R.C.10 & R.C.11 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
W123	3504	Pivot Bracket with Spindle		W164	1071	Fixing Screw for Pivot Spindle	
W124	555	Balls for Pick-up Arm Pivot		W165	3515	Pivot Spindle for Pick-up Arm	
W125	3516	Pick-up Base		W166	3503	Pick-up Bracket	
W126	2747	Rubber Pad for Pick-up Rest		W167	2513	Fixing Screw for Pick-up Bracket	
W127	3513	Pick-up Rest		W168	3539	Platform Spindle and Plate	
W128	WB11/22	Washer for Pick-up Rest		W169	3502	Platform Support	
W129	G.7/9	Nut for Pick-up Rest		W170	3611	Fixing Screw for Platform Clip	
W130	2516	Bottom Washer for Pivot Spindle		W171	WB11/11	Washer for Fixing Screw	
W131	3615	Retaining Collar for Pivot Spindle		W172	3594	Pin for Bracket	
W132	2551	Pick-up Arm (Piezo Crystal Type)		W173	3569	Bracket for Platform Clip	
W133	2555	Cover Plate for Crystal Cartridge		W174	3567	Platform Clip only	
	1145	Crystal Cartridge				Platform Clip complete	
W134	2511/2	Fixing Screw for Cover Plate		W175	3592	Pin for Platform Clip	
W135	AS1/28	Fixing Screw for Collar for Pivot Spdle.		W176	2190	Spring for Platform Clip	
W136	3525	Eccentric Pin for Pick-up Lever		W177	2775	Record Spindle Complete (Non-slip)	
W137	6A/10	Split Pin		W178	2450	Springs, Record Spindle Sleeve, Set	
W138	15/19	Washer for Eccentric Pin		W179	H8/2.	Turntable Covering and Eyelet	
W139	15/18	Spring Washer		W180	2487	Turntable	
W140	3522	Pick-up Arm Lever		W181	3562	Spring for Clutch	
W141	3523	Pick-up Lever		W182	3531	Clutch Body	
W142	561	Fixing Screw for Pick-up Lever		W183	3532	Clutch Lever	
W143	3518/2	Pin for Lifting Spindle		W184	3598	Roller for Platform Cam Lever	
W144	561	Fixing Screw for Adjusting Collar		W185	DD1/16	Screw for Stop Lug	
W145	3521	Adjusting Collar		W186	DD1/15	Nut for Stop Lug Screw	
W146	3563	Lifting Collar		W187	3543	Platform Cam Lever	
W147	E6/3	Pin for Lifting Collar		W188	3545	Platform Lever	
W148	3520	Lifting Lever			1807	Screw for Eccentric	
W149	M1/14	Screw for Clip for Lead		W189	UV1/17	Washer for Eccentric	
W150	3595	Clip for Pick-up Lead			CC1/6	Nut for Screw	
W151	3626	Pick-up Lead		W190	3546	Eccentric for Platform Lever	
W152	3349	Cam Bearing Spindle		W191	678	Pin for Spring	
W153	561	Fixing Screw for Cam Bearing Spindle		W192	1843	Spring for Platform Lever	
W154	3552	Overthrow Lever		W193	3547	Drag Link	
W155	1835	Pivot Screw, Collar, Washer and Nut		W194	3641	Drag Stud	
W156	584	Spring for Overthrow Lever		W195	3542	Platform Trip Lever	
W157	678	Pin for Spring		W196	3540	Platform Support Spindle	
W158	3510	Rubber Fixing Washer for Unit Plate		W197	3565	Spring for Platform Support	
W159	3508	Rubber Sleeve		W200	CC1/23	Fixing Screw for Unit	
W160	3509	Rubber Collar		W201	2290	Fixing Cup	
W161	3511	Steel Fixing Washer for Unit Palte		W202	1845	Top Washer for Fixing Screw	
W162	M1/14	Fixing Screw for Earthing Tag		W203	3607	Suspension Spring	
W163	CC2/27	Earthing Tag		W204	UV1/17	Bottom Washer for Fixing Screw	
				W205	2392	Lock Nuts for Fixing Screw	

SPARE PARTS LIST

Sheet X.

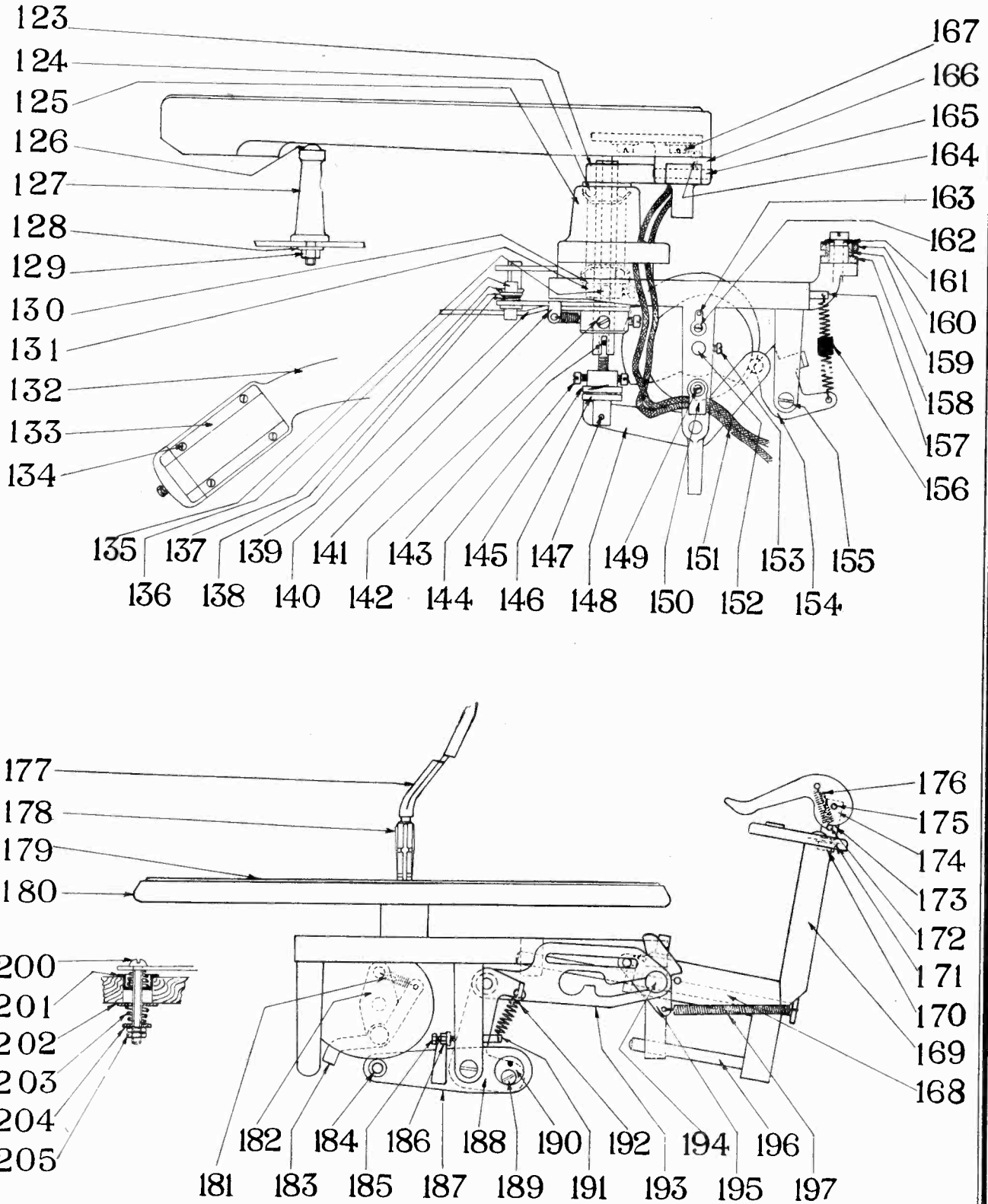
TYPES No. R.C.10 & R.C.11 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
X 1	3583	Clutch		X33	MM1/8	Spring for Bearing	
X 2	1914	Pin for Clutch		X34	MM1/14	Plunger	
X 3	1962/2	Bush for Cross Shaft		X35	MM1/20	Spring for Plunger	
X 4	1963	Cross Shaft Gear		X36	MM1/9	Thrust Ball	
X 5	1914	Pin for Cross Shaft Gear		X37	MM1/6	Rotor Shaft Bearing	
X 6	1962/2	Bush for Cross Shaft		X38	3586	Rotor Shaft only	
X 7	3582	Cross Shaft		X39	3618	Bush for Rotor	
X 8	3585	Motor Cover		X40	3610	Rotor complete with Shaft	
X 9	809	Fixing Screw for Motor Cover		X41	3587	Name Plate	
X10	E.6/3	Pivot Pin for Regulating Brake			V2/12	Fixing Screws for Name Plate	
X11	2181	Grommet for Leads		X42	3614	Spring Washer for Stator Fixing Screw	
X12	3624	Stator (complete with Copper Bands and Coils)		X42	JJ1/10	Fixing Screw for Stator	
				X44	3505	Frame for Motor	
X13	CC2/27	Earthing Tag		X45	JJ5/2	Governor Collar	
X14	3625	Stator Coils (complete with Leads)		X46	5/24	Fixing Screw for Governor	
X15	2/12	Fixing Screw for Bearing Plate		X47	5/20	Governor Ball	
X16	MM1/10	Rear Bearing Plate with Bush		X48	5/21	Washer for Governor Ball	
X17	3506	End Cover		X49	5/24	Screw for Governor Ball	
X18	M1/9	Fixing Screw for End Cover		X50	5/27	Governor Spring	
X19	3581/2	Fixed Spindle Insert		X51	DD5/1	Governor Sleeve and Disc	
X20	3580	Main Spindle with Fibre Gear		X52	3591	Release Spindle	
X21	1838/3	Retaining Coil		X53	DC2/8	Fixing Screws for Main Spindle	
X22	3581/1	Fixed Spindle		X54	1928	Thrust Plate for Bearing	
X23	1840	Bush for Main Spindle		X55	1927	Ball Race	
X24	JJ7/2	Collar for Regulating Shaft		X56	555	Thrust Balls for Main Spindle	
X25	3588	Regulating Shaft (complete with Cam)		X57	MM1/6	Rotor Shaft Bearing	
X26	6A/10	Split Pin		X58	2/12	Fixing Screw for Bearing Plate	
X27	15/19	Washer for Regulating Shaft		X59	MM1/9	Thrust Ball for Rotor Shaft	
X28	15/18	Spring Washer for Regulating Shaft		X60	MM1/12	Front Bearing Plate with Bush	
X29	3590	Spring for Regulating Brake		X61	2392	Nut for Thrust Screw	
X30	3589	Regulating Brake		X62	MM1/17	Thrust Screw	
X31	B7/3	Felt Pad for Regulating Brake		X63	MM1/8	Spring for Bearing	
X32	MM1/7	Cone Washer for Bearing		X64	MM1/7	Cone Washer for Bearing	

GARRARD ENG. & MFG. CO. LTD.

MODELS RC-10, RC-11

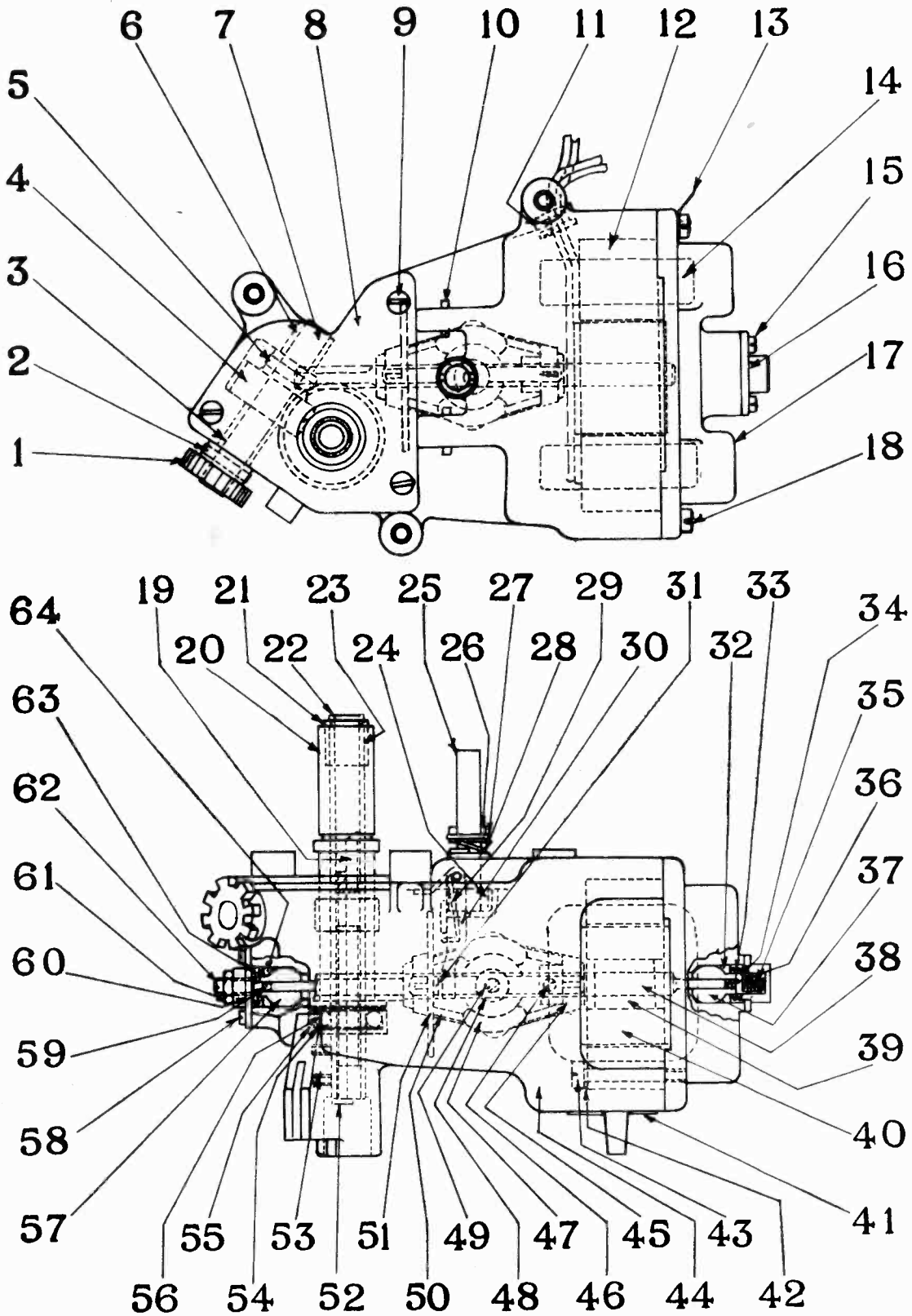
Diagram W



MODELS RC-10, RC-11

GARRARD ENG. & MFG. CO. LTD.

Diagram X



MODELS RC-10, RC-11

GARRARD ENG. & MFG. CO. LTD.

SPARE PARTS LIST

Sheet Y.

TYPES No. R.C.10 & R.C.11 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART
Y 1	3583	Clutch		Y33	MM1/8	Spring for Bearing
Y 2	1914	Pin for Clutch		Y34	MM1/14	Plunger
Y 3	1962/2	Cross Shaft Bush		Y35	MM1/20	Spring for Plunger
Y 4	1963	Cross Shaft Gear		Y36	MM1/9	Thrust Ball
Y 5	1914	Pin for Cross Shaft Gear		Y37	MM1/6	Armature Spindle Bearing
Y 6	1962/2	Cross Shaft Bush		Y38	3735	Armature complete with Spindle
Y 7	3582	Cross Shaft		Y39	3721	Armature complete, less Spindle
Y 8	3585	Motor Cover		Y40	V2/12	Fixing Screws for Name Plate
Y 9	809	Fixing Screw for Cover		Y41	3705	Name Plate
Y10	E6/3	Pivot Pin for Regulating Brake		Y42	3614	Spring Washer for Field Fixing Screws
Y11	2181	Grommet for Leads		Y43	JJ1/10	Fixing Screw for Field
Y12	3734	Field Pack complete with Coils, etc.		Y44	3505	Motor Frame
Y13	3709	Field Coils complete with Leads		Y45	JJ5/2	Governor Collar
Y14	2/12	Fixing Screws for Bearing Plate		Y46	5/24	Fixing Screw for Governor Collar
Y15	3707	Rear Bearing Plate		Y47	5/20	Governor Ball
Y16	3701	Brush Carrier		Y48	5/21	Washer for Governor Ball
Y17	M1/9	Fixing Screw for Brush Carrier		Y49	5/24	Screw for Governor Ball
Y18	CC2/27	Earthing Tag		Y50	5/28	Governor Spring
Y19	3581/2	Fixed Spindle Insert		Y51	DD5/1	Governor Sleeve and Disc
Y20	3580	Main Spindle		Y52	3591	Release Spindle
Y21	1838/3	Retaining Coil		Y53	DC2/8	Fixing Screw for Main Spindle
Y22	3581/1	Fixed Spindle		Y54	1928	Thrust Plate
Y23	1840	Bush for Main Spindle		Y55	1927	Ball Race
Y24	JJ7/2	Collar for Regulating Shaft		Y56	555	Thrust Balls for Main Spindle
Y25	3588	Regulating Shaft complete with Cam		Y57	MM1/6	Armature Spindle Bearing
Y26	6A/10	Split Pin		Y58	MM1/9	Thrust Ball for Armature Spindle
Y27	15/19	Washer for Regulating Shaft		Y59	2/12	Fixing Screws for Bearing Plate
Y28	15/18	Spring Washer for Regulating Shaft		Y60	MM1/12	Front Bearing Plate
Y29	3590	Spring for Regulating Brake		Y61	2392	Nut for Thrust Screw
Y30	3589	Regulating Brake		Y62	MM1/17	Thrust Screw
Y31	B7/3	Felt Pad for Regulating Brake		Y63	MM1/8	Spring for Bearing
Y32	MM1/7	Cone Washer		Y64	MM1/7	Cone Washer for Bearing

SPARE PARTS LIST

Sheet Z.

TYPE R.C.11 MOTOR & RESISTANCE.

MOTOR—

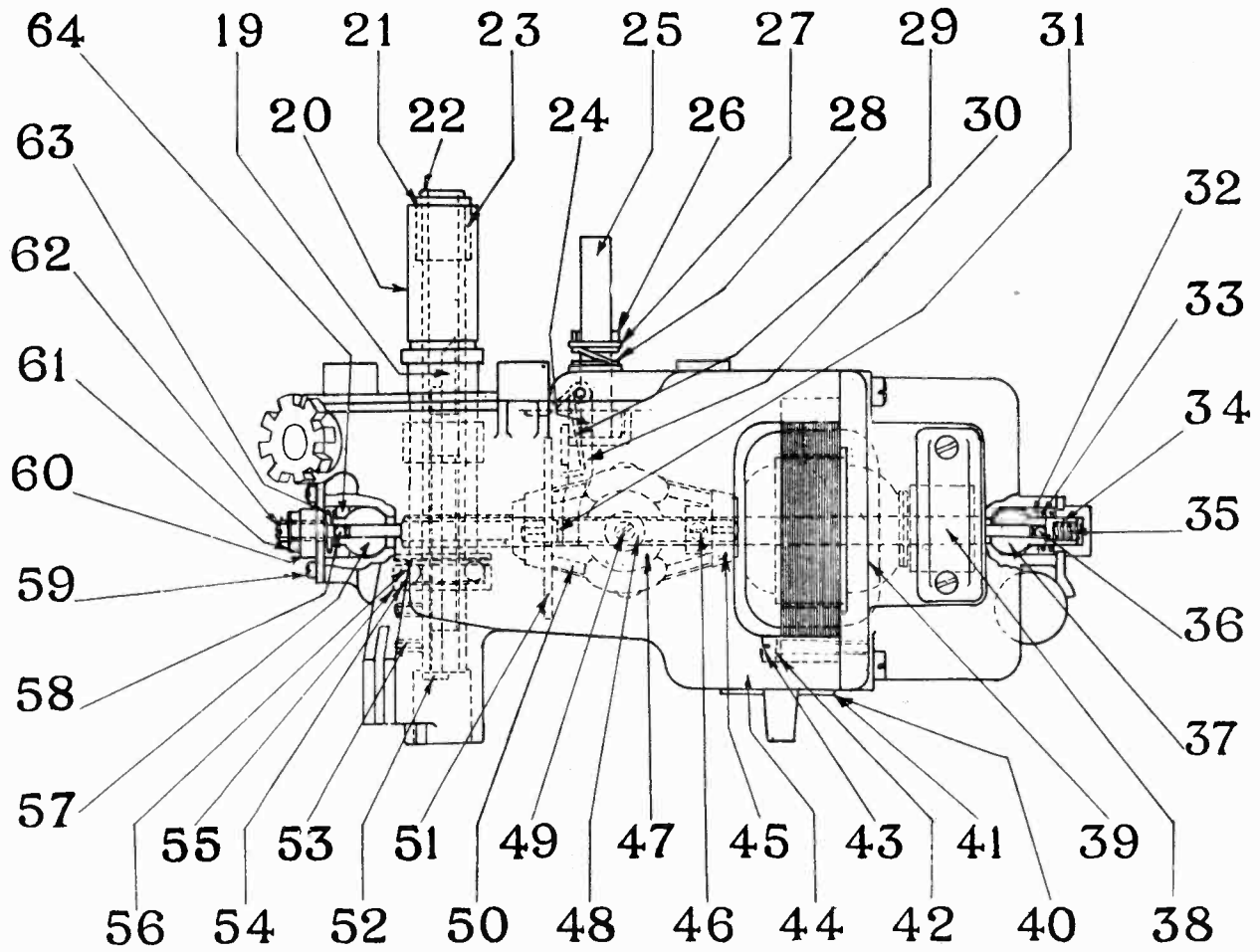
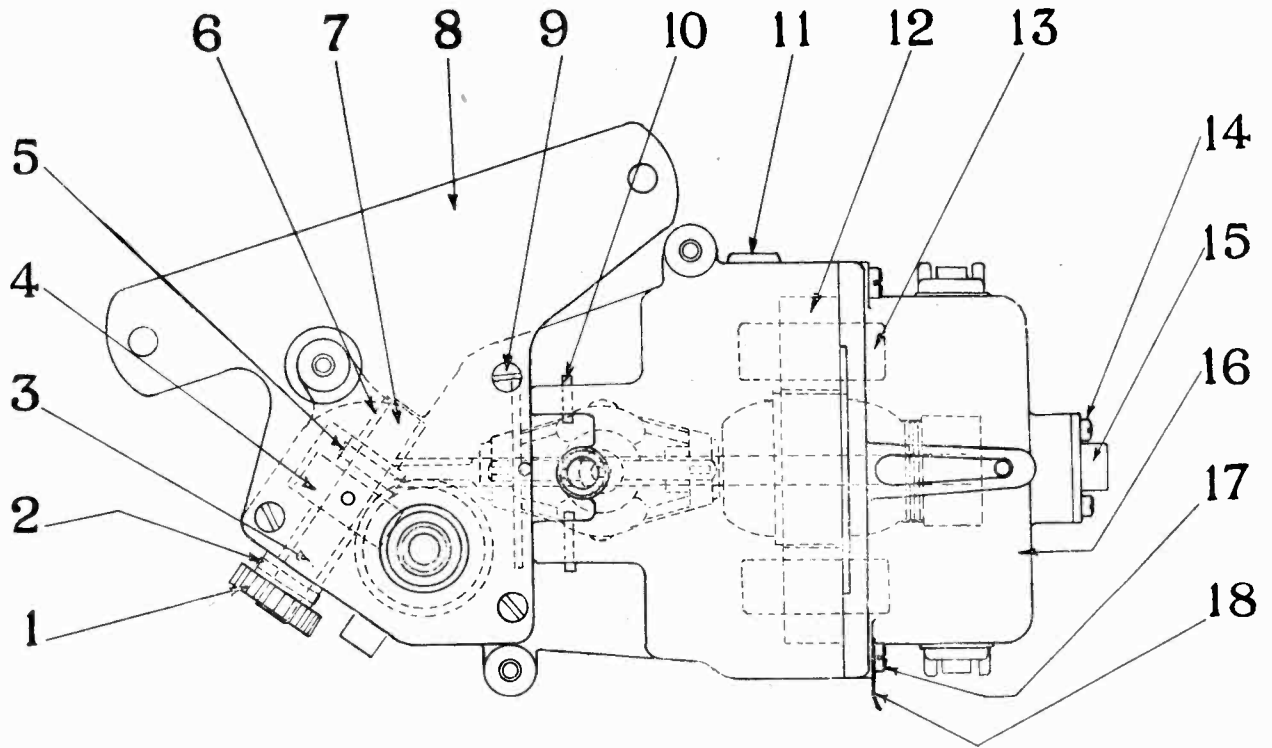
RESISTANCE—

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART
Z65	G2/14	Fixing Screw for Brush Insulator		Z76	2471	Insulator for Lead
Z66	3702	Brush Insulator		Z77	2557	Asbestos Tube for Lead
Z67	3710	Brush Holder		Z78	WB11/22	Spring Washer
Z68	3711	Rivet for Brush Holder		Z79	G7/9	Nut for Fixing Screw
Z69	2337	Condenser		Z80	3514	Fixing Screw
Z70	M1/14	Fixing Screw for Mounting Plate		Z81	WB11/22	Spring Washer for Bracket
Z71	3713	Mounting Plate for Brush Gear		Z82	WB16/12	Spring Washer for Element
Z72	3703	Carbon Brush		Z83	2464	Cover for Resistance
Z73	3712	Brush Pressure Lever		Z84	2576	Resistance Element (Wound complete)
Z74	JJ7/11	Split Pin for Brush Pressure Lever		Z85	2475	End Plate for Element
Z75	1836	Spring for Brush Pressure Lever		Z86	G7/9	Nuts for Centre Rod
				Z87	2474	Centre Rod
				Z88	2461	Bakelite Bracket
						Resistance Complete

MODELS RC-10, RC-11

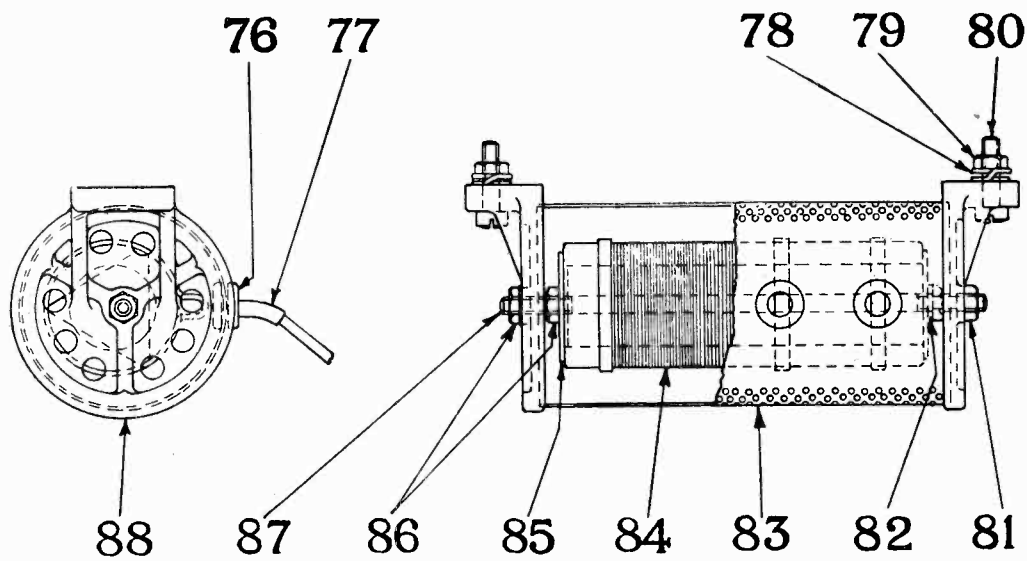
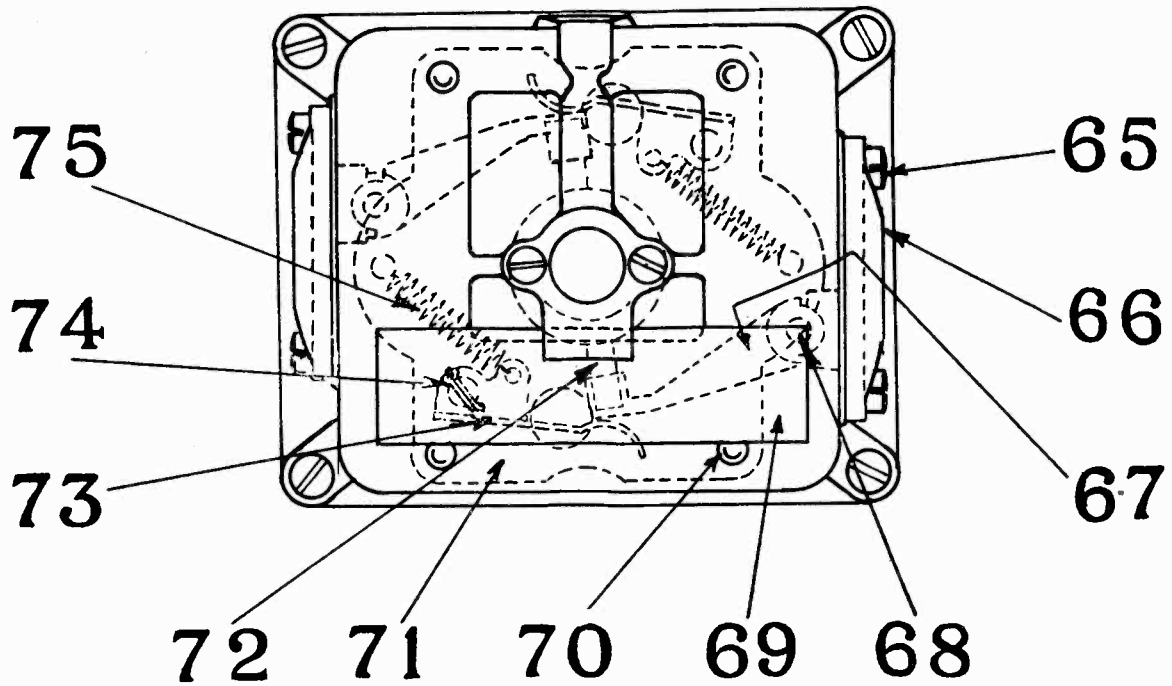
GARRARD ENG. & MFG. CO. LTD.

Diagram Y



GARRARD ENG. & MFG. CO. LTD. MODELS RC-10, RC-11

Diagram Z



MODELS RC-10, RC-11

GARRARD ENG. & MFG. CO. LTD.

**SPARE PARTS LIST FOR
"GARRARD" PICK-UPS.**

Sheet G.

Standard Pick-up Unit. Used on: Types RC4, 5, 6, 8, 50 and 51 Type "E" Pick-up Unit. Used on: Types RC10 and 11 Record Changers. Types "E", "F", and "G" Radio Gram. Units.

Record Changers. Types A and B Radio Gram. Units.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G 1	652	Pick-up magnet.	
G 2	549	Pick-up body.	
G 3	552	Pole pieces.	
G 4	554	Screw for pole piece.	
G 5	553	Needle screw.	
G 6	550	Pick-up cover.	
G 7	1194	Rubber washer for hum bucking coil.	
G 8	551	Cover fixing screw.	
G 9	653	Adjusting plate.	
G 10	CC2/26	Connecting tags.	
G 11	555	Bush for sleeve with ball and spring	
G 12	1967	Rubber magnet packing.	
G 13	1125	Small rubber washer for hum buck'g coil	
G 14	2191	Top connecting U piece.	
G 15	554	Screw for connecting piece.	
G 16	654	Top damping rubber.	
G 17	795	Screw for adjusting plate.	
G 18	See below	Hum-bucking coil.	
G 19	See below	Pick-up coil.	
G 20	656	Armature.	
G 21	655	Bottom damping rubber.	
G 22	2191	Bottom connecting U piece.	

Pick-Up Coils (Std. & Type "E").

- Red Band - 6000 ohms Pick-up coil.
- Black Band - 2000 ohms Pick-up coil.
- Green Band - 700 ohms Pick-up coil.
- Orange Band - Hum-bucking coil (Standard Unit only)

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G23	2506/3	Rivet.	
G24	2506/2	Connecting Plate.	
G25	2536	Earthing Tag.	
G26	2508	Magnet.	
G27	795	Adjusting Plate Screw.	
G28	653	Adjusting Plate.	
G29	—	Empire silk tube.	
G30	2534	Insulating strip.	
G31	2506/1	Base plate.	
G32	2531	Pole Piece fixing screw.	
G33	656	Armature.	
G34	655	Damping Rubber (Bottom).	
G35	553	Needle screw..	
G36	see below	Bobbin.	
G37	654	Damping Rubber (Top).	
G38	2505	Pole piece.	
G39	2507	Side plate.	

"Piezo" Crystal Pick-up. Used on: Types RC4, 5, 6, 8, 50 and 51 Record Changers. Types A and B Radio Gram. Units.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G43	1141	Body.	
G44	1145	Crystal Cartridge.	
G45	1142	Fixing Plate "A".	
G46	—	Needle screw.	
G47	1144	Fixing screws.	
G48	1143	Fixing Plate "B".	
G49	—	Empire Sleeveing.	
G50	CC2/26	Connecting Tags.	
G51	556	Connecting piece.	
G52	555	Bush for sleeve with spring and ball.	

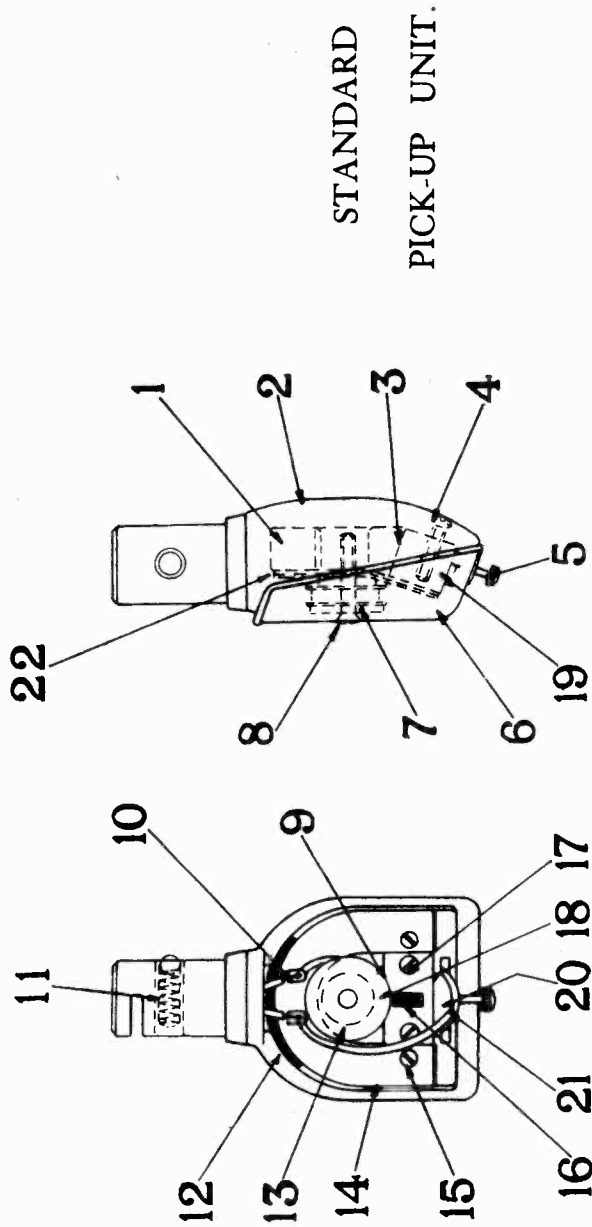
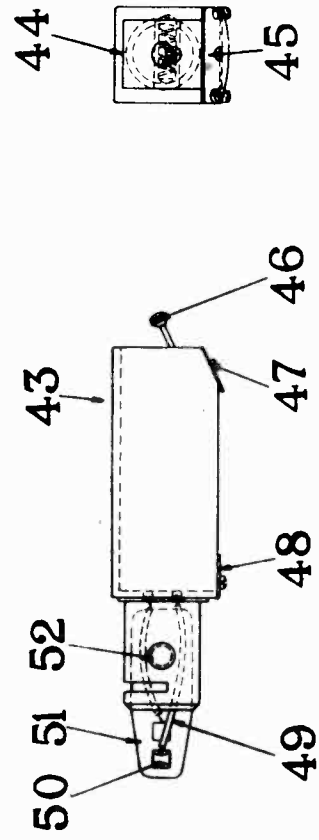
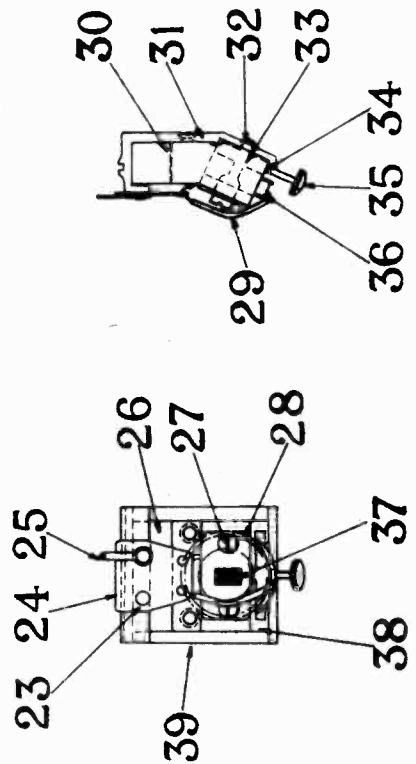


Diagram G

"PIEZO" CRYSTAL PICK-UP.



TYPE "E" PICK-UP UNIT.



MODELS RC-10, RC-11,
RC-30, RC-31,
RC-40, RC-41

GARRARD ENG. & MFG. CO. LTD.

MODELS RC-50, RC-50C,
RC-50X, RC-51,
RC-51C, RC-51X

FOR ADJUSTMENTS ONLY
SEE MAGNAVOX

OPERATING INSTRUCTIONS (ALL MODELS EXCEPT 50 SERIES)

These Record Changers will play any number of records up to eight 10in. or eight 12in. A specially designed spindle is supplied to prevent record slip.

- To operate, proceed in the following order:
 1. Insert needle—of the type that will play ten or more records—in the pick-up; it can be lifted to do this.
 2. Move the left hand knob so that it is pointing to the number indicating the size of records to be played. Place the record spindle in position, the sloping part leaning towards the record platform.
 3. Raise the record clip and place any number—up to eight—records on the record spindle, their lower edge resting on the record platform, then lower record clip.
 4. Move the right hand knob to "start." The motor will start and the changer operate. When the last record has been played it will automatically stop.
- To remove records, withdraw the record spindle.
- To reject a record, move the right hand knob to the reject position. The Record Changer can be stopped by moving the right hand knob to the "stop" position.

Connected to the "start" and "stop" knob is the reject mechanism. If the changer is switched off while playing a record, the reject comes into operation when switching on again; the pick-up returning to its rest position.

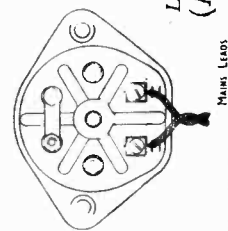
NOTE. If the Record Changer has been stopped for any reason with the pick-up arm not on the rest, the arm should not be interfered with but the motor re-started and the arm allowed to return to the rest.

INSTALLATION (ALL MODELS EXCEPT 50 SERIES)
The "GARRARD" R.C.10 and R.C.11 Record Changers are supplied with spring mounting to prevent mechanical feed-back occurring between the loud-speaker and the pick-up, and clearance should be left between the unit plate edges and the cabinet to allow the changer to float freely.

A template is supplied with each Record Changer and the instructions on it should be carefully followed.

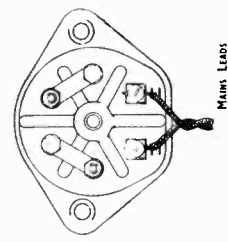
VOLTAGE. On installation, the links in the terminal block should be set to the correct position to correspond with the voltage of the power supply, as shown on diagram below.

CONNECT BOTH BARS THIS FOR 200/250 VOLTS



Dia. 2.

CONNECT BARS THIS FOR 100/130 VOLTS



Dia. 3

Link Connections for (ALL MODELS)

FOR MODELS: RC-30, -30A, -31, -40, -41, ALSO 50 SERIES

GENERAL DESCRIPTION.

The "GARRARD" R.C.30 and R.C.31 Record Changers will play any number of records up to eight 10in. and 12in., mixed in any order. A specially designed record spindle is supplied to prevent record slip.

The table below gives the values of the resistor and characteristics of the various types of pick-ups:—

D.C. Resistance of Coil	Coding Colour on Coil	Fixed or Variable Resistor Shunt	Impedance at 1,000 C.P.S.	Output at 1,000 C.P.S.
2,000 ohms	Black Band	50,000 ohms	7,000 ohms	0.5V R.M.S.
6,000 ohms	Red Band	100,000 ohms	20,000 ohms	1.2V R.M.S.
Piezo Crystal		500,000 ohms		

GENERAL DESCRIPTION (ONLY RC-10, RC-11)

The "GARRARD" R.C.10 and R.C.11 Record Changers will play any number of records up to eight 10in. or eight 12in., but not mixed. A specially designed record spindle is supplied to prevent record slip.

DIMENSIONS. (ALL MODELS EXCEPT 50 SERIES)

The cabinet space required for fitting is 15½in. long by 13in. wide with 5in. clearance above and 4½in. clearance below unit plate.

VOLTAGE. (ALL MODELS)

R.C.10—A.C. MODEL, suitable for 100/130 and 200/250 volts 50/60 cycles.
R.C.11—A.C./D.C. MODEL, suitable for 100/130 and 200/250 volts D.C. and A.C. 25/60 cycles.

PICK-UP.

Supplied complete with either the "GARRARD" Magnetic or Piezo Crystal Type.

SPEED.

Turntable speed is normally set at 78 r.p.m. It can be varied by means of the indicator lever.

MAINTENANCE.

The motor only requires occasional lubrication at intervals, depending upon the length of time the Record Changer is used. Lift off the turntable and the oil holes (diagram 1) are accessible. A few drops of "GARRARD" or thin lubricating oil are sufficient.

To gain access to the left hand motor bearing, set the left hand knob to the 10in. position.

RECORDS should be reasonably flat and clean to obtain good reproduction. Care should be taken in storing to prevent contact with dirt and dust which set up abrasive action and cause rapid wear.

NEEDLES. Any good quality needle capable of playing ten or more record sides are suitable.

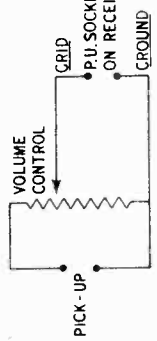
MODELS RC-50, RC-50C,
RC-50X, RC-51,
RC-51C, RC-51X

GARRARD ENG. & MFG. CO. LTD.

MODELS RC-10, RC-11,
RC-30, RC-31,
RC-40, RC-41

PICK-UP AND VOLUME CONTROL. (ALL MODELS)

If the volume control of the amplifier or radio receiver is inoperative when switched over for gramophone reproduction, a separate volume control should be connected to the pick-up as shown in diagram 9.



It is advisable where a separate volume control is not necessary, to fix a resistor of an equivalent value across the pick-up.

The table below gives the values of the resistor and characteristics of the various types of pick-ups:—

Resistance of Coil.	D.C. Resistance	Coding Colour on Coil.	Resistor Shunt.	Impedance at 1,000 C.P.S.	Output at 1,000 C.P.S.
2,000 ohms	50,000 ohms	Black Band	7,000 ohms	7,000 ohms	0.5V R.M.S.
6,000 ohms	100,000 ohms	Red Band	29,000 ohms	29,000 ohms	1.25V R.M.S.
Piezo Crystal	500,000 ohms				2.0V R.M.S.

With the Piezo Crystal Pick-up a reduction in bass response can be achieved by substituting for the value given above a resistance of 250,000 ohms.

NOTE. (ALL MODELS)

- After installing, verify that the Changer is level by placing a spirit level on a record on the turntable. If not level, adjust by means of the spring mounting fixing screws. Finally, the nuts and threads of the spring mounting fixing screws should be coated with a locking paint such as shellac, to prevent the nuts working loose due to vibration.
- When adapting an AC/DC (Universal) Radio Receiver, Amplifier or one using a D.C. power Pack for the reproduction of gramophone records, a pick-up transformer or condensers in series with the pick-up leads should be fitted, otherwise the pick-up circuit becomes alive. Also, the leads from the radio set or amplifier to the pick-up should be as short as possible in every case.

3. If any difficulty should arise in matching the pick-up to the amplifier write to us giving full details of the amplifier together with Model and Serial Number of the Record Changer.

SERVICE. ADJUSTMENTS (ALL MODELS)

MOTORS. If the motor fails to start when the control knob is turned to "start," first check the power supply and ascertain if current is reaching the motor terminals.

Next examine the terminal block and see that the leads and screws are tight; also examine the switch contacts, clean and adjust if necessary.

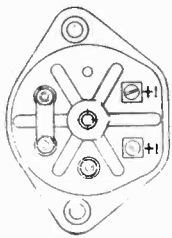
If a thick oil has been used to lubricate the motor bearings the motor will appear weak or will not start. It will be necessary to dismantle the motor and clean away all traces of the thick oil. It is therefore essential to lubricate the motor bearings with a good quality thin oil.

Should the motor get too hot, first see that the voltage change-over links are set correctly to correspond with the voltage of the power supply.

To check the motor windings insert a milliammeter in either motor lead. The maximum current consumption should not exceed:—

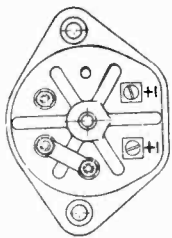
- 200/250 volts range 0.11 amps.
- 100/130 volts range 0.22 amps.
- 0.13 amp. on both A.C. ranges.
- 0.22 amp. on both D.C. ranges.

Link Connections for (ALL MODELS)



Diag. 4.

CONNECT THUS FOR 200/250 VOLTS.



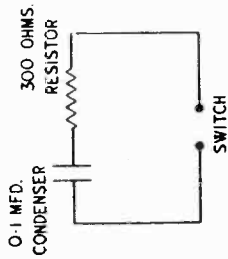
Diag. 5.

CONNECT THUS FOR 100/130 VOLTS.

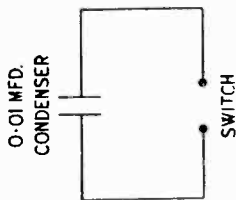
A RED terminal block cover is fitted to the A.C./D.C. model. Where A.C. power supply only is to be used, a BROWN cover is fitted.

INTERFERENCE. (ALL MODELS)

If switch clicks are excessive and unduly audible in the loud-speaker, connect a condenser or condenser and resistor across the switch contacts as shown in diagrams 6 and 7.



Diag. 6.



Diag. 7.

The condensers should have a working voltage of at least 300 volts A.C.

SPEED SETTING. (ALL MODELS EXCEPT 50 SERIES)

Due to the wide voltage range of the motors it may be necessary on some power supplies to make a slight re-adjustment of the speed indicator lever so that the speed of the turntable corresponds with that shown on the indicator scale.

To set on alternating current power supply, 50/60 cycles use the "GARRARD" Stroboscopic Speed Indicator enclosed with each record changer. To set speed on direct current power supply the turntable speed should be checked with a watch. Now remove the turntable and carefully loosen the screw holding the indicator lever to the vertical brake shaft, move the indicator lever to the centre position on the indicator plate and tighten up the screw. The speed should now be correct.

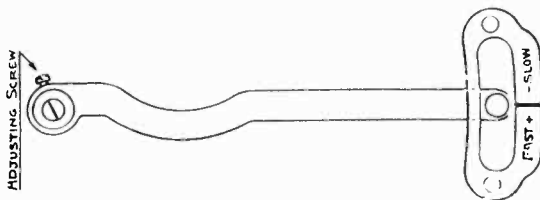


Diagram 8.

MODELS

RC-10, RC-11,
RC-30, RC-31,
RC-40, RC-41

GARRARD ENG. & MFG. CO. LTD.**MODELS**

RC-50, RC-50C,
RC-50X, RC-51,
RC-51C, RC-51X

If at the end of a record the auto trip does not operate, that is the pick-up remains at the end of a record, first see that the record has a run off groove in its centre, as only records with run off grooves can be played automatically on Record Changers. If the record is in order, increase the tension of the friction spring by turning the friction adjusting screw (on diagram 1) in a counter-clockwise direction; about half a turn is all that should be necessary. This screw is accessible on removing the turntable.

When the changer operates before the end of a record or a bumping or tapping noise is audible, first examine the trip lever rubber and if worn give it a half turn to present a new surface to the striker. If badly worn, renew. If trip lever rubber is in good condition then reduce the tension of the friction spring by giving the adjusting screw "E" half a turn in a clockwise direction.

THE AUTO SWITCH.

The auto switch is operated by levers controlled by the position of the record spindle.

Should the switch not operate when the last record has been played, see that the record spindle is free in the main spindle. It should move about $\frac{1}{16}$ in. when pressed down and rise an equal amount when released. Check that the associated levers are free and their springs attached. Connected to the auto switch is a brake acting on the turntable. If the brake becomes worn it will allow the turntable to overrun, resulting in the first record not dropping when the record changer is switched on. In this case the leather brake pad should be turned to present a new surface to the turntable rim.

PICK-UP DROPPING POSITION.

The pick-up arm has been finely adjusted so that the needle comes on to the 10in. record in a $9\frac{1}{8}$ in. diameter circle and 12in. records in a 11 $\frac{1}{8}$ in. diameter circle. These positions were arrived at after checking a very wide selection of records of various makes.

There may be a few records where the record track starts further away from the centre, (i.e. nearer the edge), and in these exceptional cases the needle may alight on the record a few grooves from the start of the record. If the pick-up dropping position were set for these exceptional records it would not be suitable for average records.

Should the dropping position of the pick-up require adjustment the pick-up adjusting screw—accessible through a hole in the unit plate—should be turned with the Changer in its start position; that is, with the pick-up arm on its rest.

The pick-up adjusting screw should be turned either to the right or left, according to requirements. A quarter of a turn in either direction will give you the maximum adjustment. After adjustment, switch on, check the dropping position and readjust if necessary.

If desired the pick-up height can be adjusted by loosening the set screw in the collar at the bottom of the pick-up arm lifting spindle and turning the collar, whilst holding the spindle.

CAUTION. When making any adjustments to the Pick-up Arm, it should NEVER on any account be forced into position. If the turntable is turned by hand it should NEVER be turned backwards.

If the pick-up does not run into the record-grooves after alighting on the record edge, see that the record changer is level by placing a spirit level on a record on the turntable.

Make sure that the flexible wire leading to the pick-up is not twisted or held in such a manner as to prevent the free movement of the pick-up arm; also see that the associated levers are free.

If readings in excess of the above figures are obtained, the motor unit or coils should be returned for examination.

Wavy or watery reproduction from records is often due to dry governor pads. These should be lubricated by saturating the felt pads with oil.

BRUSHES (ALL MODELS)

Periodical examination of the carbon brushes should be made. They should be replaced when worn to within $\frac{3}{32}$ in. of the holder. To remove, unscrew the two screws fixing the brush holder to the motor frame and withdraw the brush assembly.

The brushes can be cleaned by lightly scraping the contact surface with a pen-knife.

Replace the brushes in the same holders, the same way round.

REMOVING MOTOR.

If the motor has to be removed from the Record Changer, disconnect the switch leads, remove the motor fixing screws and the motor can be withdrawn.

PICK-UP (ALL MODELS)

Record Changers, Piezo Crystal and "Garrard" Magnetic type Pick-ups have different pick-up arms. To convert from magnetic to crystal pick-up or vice-versa, it is therefore necessary to change the pick-up arm. To remove the pick-up arm, first detach the pick-up lead from the clip on the leg of the main casting, then lift the pick-up arm to the vertical position.

Now loosen the screw holding the pivot pin and push out the pin; the arm can then be removed. The new arm can be fitted by reversing the procedure described above.

If reproduction ceases or becomes distorted, first make sure that the amplifier is in order. Should this be found satisfactory, a slight adjustment to the pick-up may be necessary or the damping rubber may need renewing.

To examine pick-up proceed as follows:—Remove the pick-up cover by unscrewing centre screw. By viewing the front of the pick-up, examine armature to see that it is in the centre of the gap between the pole pieces.

If it is touching one of the pole pieces it must be re-centred. To do this, loosen the two screws holding the adjusting plate, sliding the latter until the armature is in the centre, then tighten the screws.

If the armature will not retain its centre position it, will be necessary to renew the damping rubber. This can be done by removing the adjusting plate, replacing the rubber and reassembling the plate.

Adjust the plate until armature is centred before tightening the screws. Distortion can be caused by dirt or foreign matter in the gap between the pole pieces. To remedy, remove the adjusting plate and damping rubber and clean gap.

The pick-up coil winding can be checked for continuity with an ohmmeter, the D.C. resistance of the winding should be approximately that given in the table on page 6.

If a Piezo Crystal Pick-up is suspected, the crystal cartridge should be returned to the manufacturers for examination. A continuity test cannot be carried out on Piezo Crystal Pick-ups with an ohmmeter.

NOTE. Crystal Cartridges must NOT be opened. If this is done, the manufacturers will disclaim all responsibility.

AUTO TRIP MECHANISM.

The satisfactory operation of the Record Changer depends upon the operation of the auto. trip. Occasional adjustment of the auto. trip friction spring may therefore be necessary.

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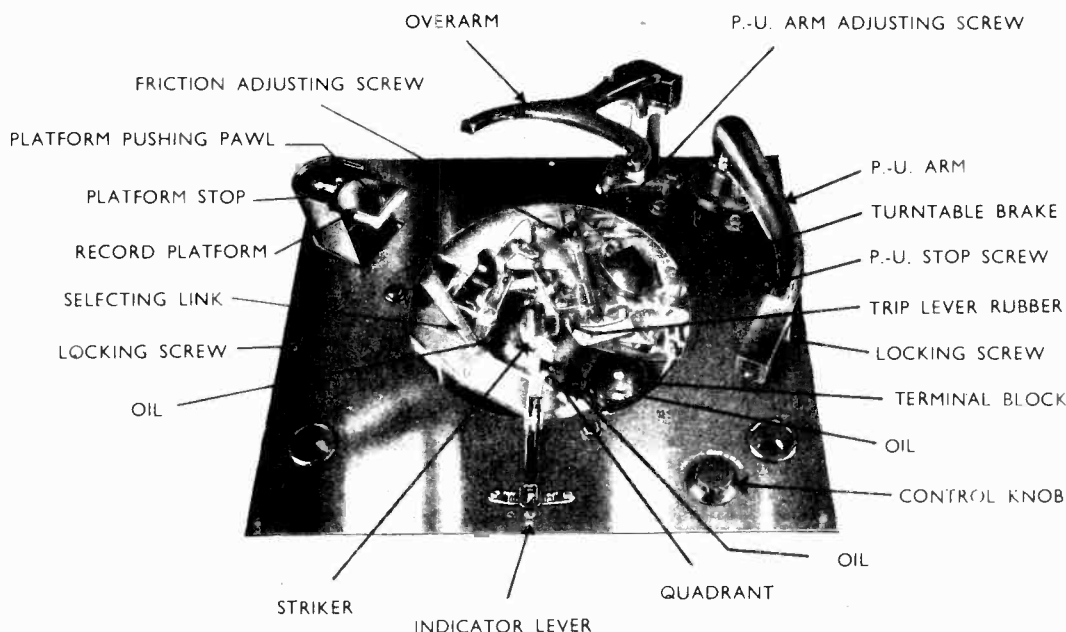
MODELS RC-50, RC-50C,
RC-50X, RC-51,
RC-51C, RC-51X

Diagram 1 Top of Record Changer with Turntable removed.

OPERATING INSTRUCTIONS.

1. Insert a needle of a type suitable for playing 10 records or more in the pick-up head, by turning it counter-clockwise to bring the needle hole into view, then turn it back.
2. Place record spindle in position, the sloping part leaning towards the record platform.
3. Raise the overarm, place the records, any number up to eight—10in, 12in. or mixed—on the record spindle their lower edge resting on the platform, and lower overarm until it rests upon the top record.
4. Turn control knob to "start" position and close lid of cabinet.

The Record Changer will commence to play and after playing the last record will automatically stop. To remove records raise the overarm and withdraw the record spindle. The record changer can be stopped at any time by turning the control knob to the "stop" position. When switching on again the rejector comes into operation and the pick-up lifts and returns to the "rest" position.

NOTE.

If for any reason the changer has been stopped with the pick-up arm not on the rest, the arm must NOT be interfered with but the motor restarted by turning the control knob to "start" and the pick-up arm allowed to return to its normal position on the pick-up rest.

RECORD DROPPING AND SELECTING.

Should trouble be experienced with Record dropping, first see that the turntable brake is set correctly. (See under Auto Switch).

NOTE.

When brake pad is set correctly, the turntable will stop with pick-up arm on the rest, and the platform pushing pawl free to depress. If turntable over-runs so that the platform pushing pawl is against the 10-in. selecting stop the first record—if 12-in.—will not drop.

If pick-up arm or platform does not select correctly the appropriate records, see that the selecting links and associated levers, diagram 1, are free.

SPEED SETTING.

Due to the wide voltage range of the motors it may be necessary on some power supplies to make a slight re-adjustment of the speed indicator lever so that the speed of the turntable corresponds with that shown on the indicator scale.

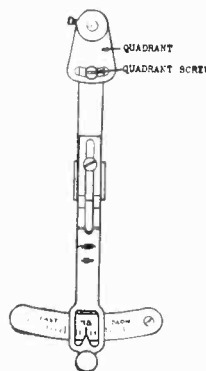


Diagram 8.

TO REMOVE MOTOR.

If the motor has to be removed from the Record Changer proceed as follows:—

Disconnect the motor power supply leads from the switch and terminals, also remove the packing plate from the base of the Record Changer. Next unscrew the platform operating lever from underneath the motor casting. Hold the motor by one hand and unscrew the three motor fixing screws, motor can now be withdrawn.

When replacing the motor, see that the timing of the motor and cam gear is correct; the mark on each gear must coincide when the changer is in the playing position.

POWER CONSUMPTION.

R C 50	230 volts 50 cycles—12.5 watts.
R. C. 51	230 volts 50 cycles—32.0 watts
	230 volts Direct Current—38.0 watts.

MODELS RC-50, RC-51

GARRARD ENG. & MFG. CO. LTD.

SPARE PARTS LIST

Sheet O.

FOR OTHER DATA
SEE MAGNAVOX RC-50, RC-51

TYPES R.C.50 & R.C.51 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
O-1	1872	Pivot Pin		O-147	2702	Record Platform	
O-2	G2/14	Screw for Pivot Pin		O-148	2713	Screw for Platform Lever	
O-4	2439	Pick-up Arm		O-149	2713	Screw for Pawl	
O-5	3513	Pick-up Rest		O-150	2709	Pawl (Platform)	
O-6	547	Pick-up Stop Screw		O-151	2751	Rivet for Platform	
O-7	2775	Record Spindle Complete (Non-Slip)		O-152	2708	Platform Stop	
O-8	1984	Pivot Screw, Collar and Washer		O-153	809	Fixing Screw for Platform Stop	
O-10	2487	Turntable		O-154	WB11/22	Washer for Fixing Screw, 809	
O-13	678	Stud for Spring, RC50		O-155	2722	Platform Support Assembly	
	772	Stud for Spring, RC51		O-156	2736	Retaining Clip	
O-14	1901	Spring for Clutch Overthrow Lever		O-157	2723	Platform Support Spindle	
O-15	1979	Clutch Overthrow Lever		O-158	2712	Platform Lever with Screw and Bush	
O-16	2118	Packing Plate RC50		O-159	2725	Tilting Lever and Link	
	2196	Packing Plate, RC51		O-160	2724	Operating Spindle for Platform	
O-17	2182	Screws & Washers, Pkg. Plate, RC50		O-161	2223	Pick-up Lead, RC50	
	J11/10	Screws & Washers, Pkg. Plate, RC51			2224	Pick-up Lead, RC51	
O-19	1807	Pivot Screw, Collar and Washer		O-162	2733	Pin for Overarm Spring	
O-20	G7/9	Lock Nut for Adjusting Nut		O-163	2704	Overarm Bracket	
O-21	B7/5	Locking Screw for Adjusting Nut		O-164	2739	Spring for Overarm	
O-23	M1/14	Fixing Screw for Follower Retaining Spindle		O-165	2732	Pivot Spindle for Overarm	
	1912	Spring for Pressure Lever		O-166	2734	Overthrow Lever	
O-24	1912	Spring for Pressure Lever		O-167	2705	Overarm	
O-25	1913	Pressure Lever		O-168	2754	Leather Pad for Overarm	
O-26	1941	Lifting Lever		O-169	G7/9	Nut for Pick-up Rest	
O-27	M1/14	Screw for Pick-up Balance Weight			WB11/22	Washer for Pick-up Rest	
O-28	1939	Pick-up Balance Weight		O-170	2392	Lock Nuts for Fixing Screw	
O-29	1930A	Cover for Pick-up Arm Base		O-171	UV1/17	Bottom Washer for Fixing Screw	
O-30	1982	Pick-up Arm Bracket		O-172	2752	Suspension Spring	
	1894	Screw for Pick-up Arm Bracket		O-173	1845	Top Washer for Fixing Screw	
O-31	1870	Lifting Screw		O-174	2290	Fixing Cup	
O-32	1938	Lifting Tube		O-175	CC1/23	Fixing Screw	
O-33	B8/2	Turntable Covering and Eyelet		O-176	2747	Rubber Pad for Pick-up Rest	
O-142	UV1/17	Steel Washer		O-177	2504	Rubber Pad for Overarm	
O-143	1933	Rubber Step Washer		O-178	2450	Springs, Record Spindle Sleeve, Set	
O-144	1932	Rubber Distance Washer					
O-146	2701	Record Platform Bracket					

SPARE PARTS LIST

Sheet P.

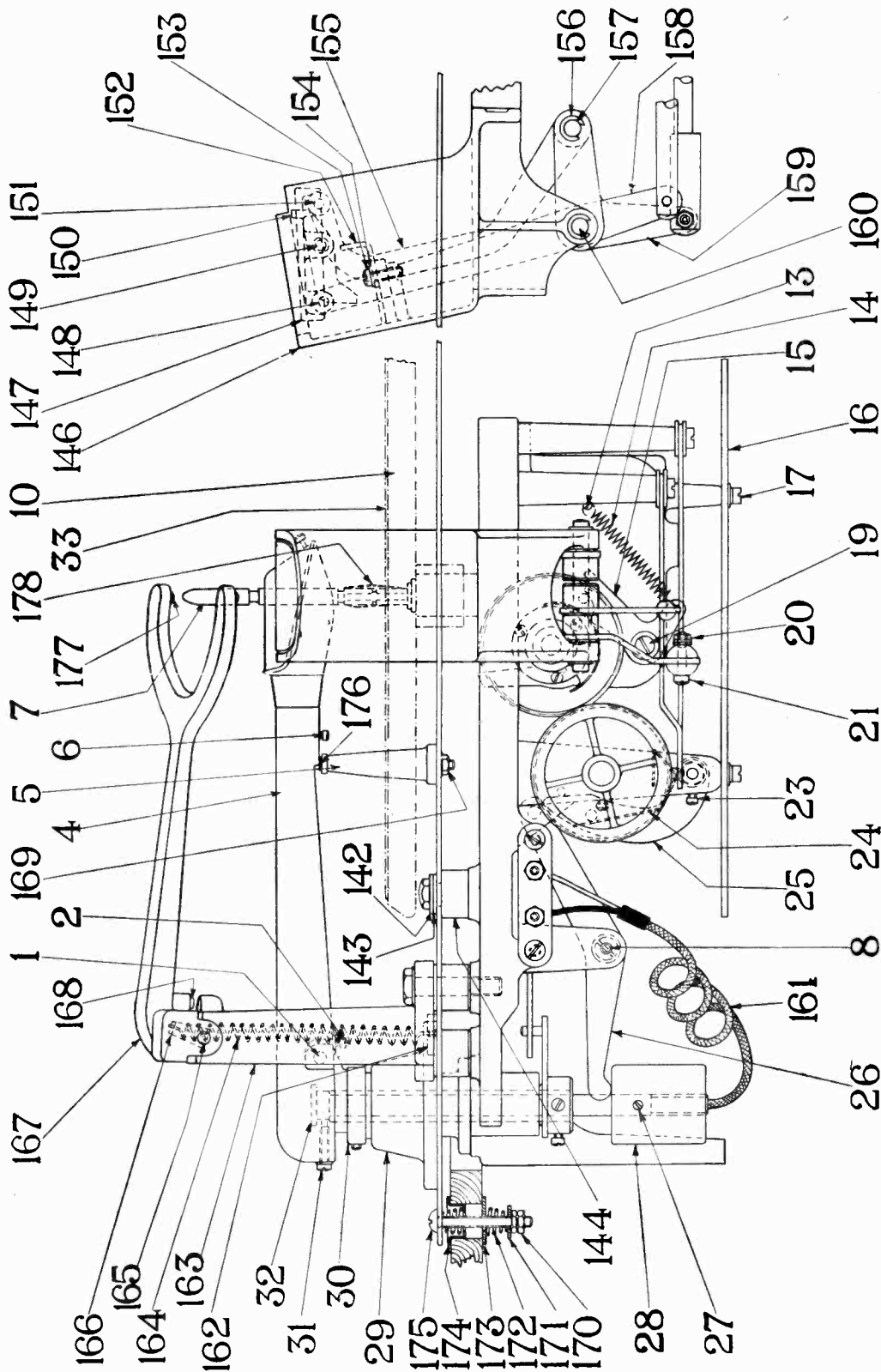
TYPES R.C.50 & R.C.51 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
P-34	15/9	Indicator Lever		P-79	2546/8	Rivet, Bush and Washer	
P-38	1947	Clutch Trip Lever		P-80	2546/4	Trip Lever	
P-39	1945	Auto Trip Base Plate		P-81	730	Rubber Bush for Trip Lever	
P-40	2477	Rivet, Collar and Washer		P-82	EE13/3	Clip for Leads	
P-41	1836	Spring for Clutch Trip Lever			635	Screw for Clip	
P-42	G13/12	Nut for Selector Spindle		P-83	15/14	Regulator Plate	
P-43	1946	Knock-off Lever		P-84	743	Screw for Regulator Plate	
P-44	1151	Friction Spring		P-85	15/12	Screw for Quadrant Lever	
P-45	2546	Operating Lever with Trip Lever		P-86	1895	Quadrant Lever	
P-46	G13/24	Retaining Coil		P-87	B2/12	Screw for Quadrant	
	731	Friction Washer		P-88	15/10	Quadrant	
P-47	1158	Friction Plate		P-89	2742	Unit Plate	
P-48	1152	Adjusting Screw		P-90	1200	Needle Cup	
P-49	1944	Connecting Link		P-92	2477	Rivet, Collar and Washer	
P-50	DC2/13	Rubber Grommet		P-93	1956	Cam Selector Link	
P-51	J11/26	Screw for Contact Spring		P-94	672	Spring for Cam Selector Link	
P-52	586	Switch Block		P-95	1968	Striker, Complete with Bush	
	2332	Switch Cover		P-96	1957	Delay Lever, with Pin	
	594	Screw for Cover		P-99	1934	Fixing Screw for Base Casting	
P-53	591	Switch Contact Spring		P-179	2707	Bracket Cover Plate	
P-54	2199	Screw for Brake Pad Lever		P-180	2/12	Screw for Cover Plate	
P-55	650	Screw for Pick-up Base		P-181	2735	Fixing Screw for Overarm Bracket	
P-56	CC13/6	Screw for connecting Link		P-182	KK1/18	Washer for Fixing Screw 2735	
P-57	1929	Pick-up Base		P-183	15/19	Washer for Control Lever Spindle	
P-58	M1/14	Screw for Pick-up Base Cover		P-184	B2/12	Fixing Screw for Connector	
P-59	1943	Control Lever		P-185	583	Brake Pad Lever	
P-62	2477	Rivet, Collar and Washer		P-186	2436	Pick-up Arm Connector	
P-63	AS1/21	Leather Brake Pad		P-187	IT1/26	Spring for Catch Lever	
	726	Screw for Brake Pad		P-188	J11/51	Cover for Change Over Block	
P-64	1949	Switch Lever		P-189	J11/50	Change Over Block	
P-65	1951	Switch Link		P-190	1809	Bakelite Knob	
P-66	1948	Catch Lever		P-191	B7/3	Felt Pad for Operating Lever	
P-67	2477	Rivet, Collar and Washer		P-192	2528	Rivet, Washer and Collar	
P-68	1952	Stop Lever		P-193	2730	Selector Lever	
P-69	15/12	Screw for Stop Lever		P-194	600	Spring for Selector	
P-70	1978	Screw for Reject Lever		P-195	678	Stud for Spring	
P-71	1836	Spring for Reject Lever		P-196	1807	Pivot Screw, Collar and Washer	
P-72	1950	Reject Lever		P-197	2731	Selector Link	
P-73	678	Stud for Spring 1836		P-198	1807	Pivot Screw, Collar and Washer	
P-74	1985	Quadrant for Knock-off Spindle		P-199	2706	Instruction Plate	
P-78	M1/9	Fixing Screw, Change Over Block		P-200	2737	Fixing Screw for Bracket	

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MODELS RC-50,
RC-51

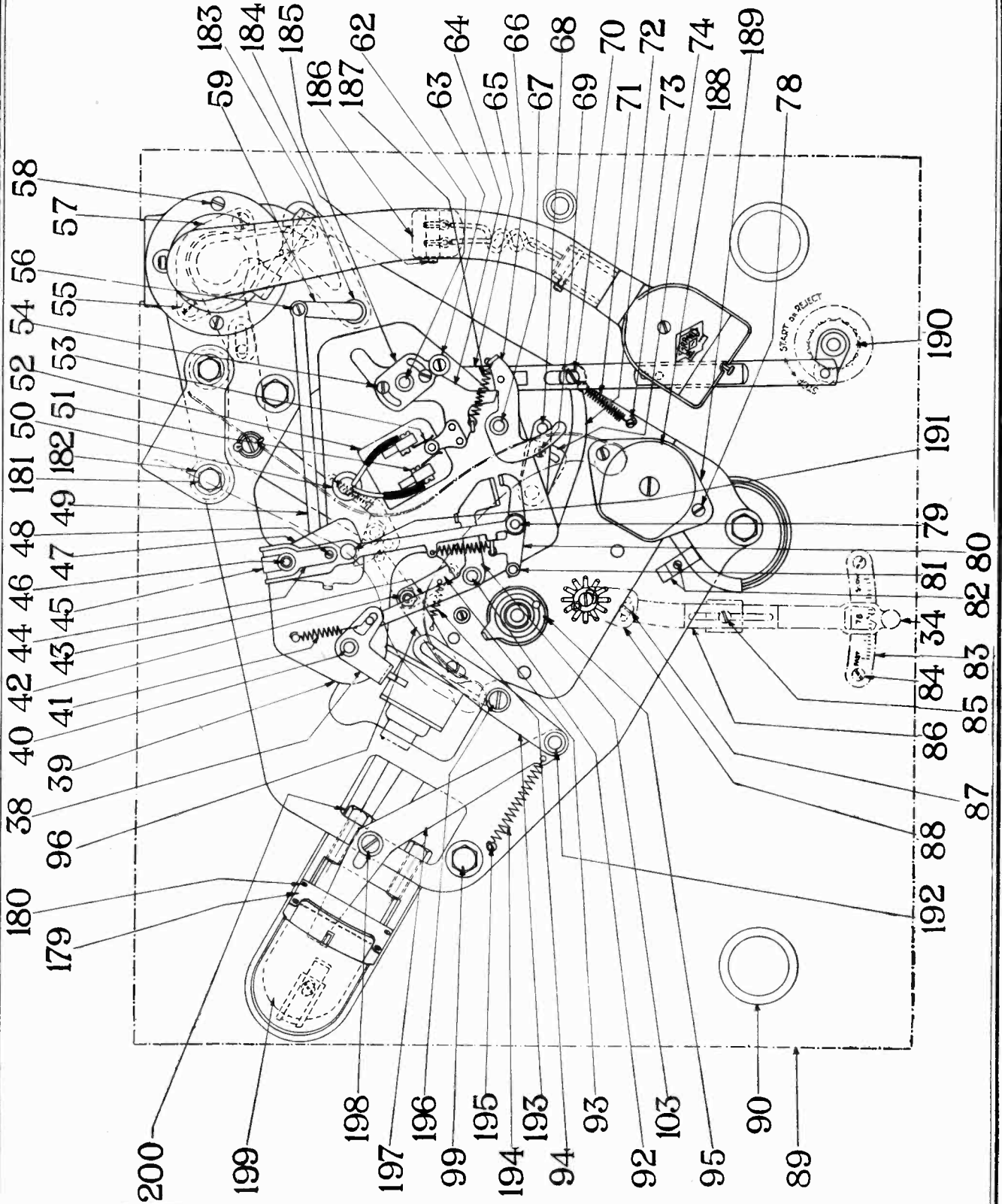
Diagram 0



MODELS RC-50, RC-51

GARRARD ENG. & MFG. CO. LTD.

Diagram P



GARRARD ENG. & MFG. CO. LTD.

MODELS RC-50,
RC-51

SPARE PARTS LIST

Sheet Q.

TYPES R.C.50 & R.C.51 RECORD CHANGERS.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
Q-22	1889	Cam Gear		Q-137	EE1/14	Screw for Cam End Plate	
Q-104	1940	Pick-up Arm Lever		Q-138	1959	Cam End Plate	
	561	Fixing Screw for Pick-up Arm Lever		Q-139	1843	Spring for Switch Knock-off Lever	
Q-105	2720	Cam Shaft		Q-140	M1/14	Screw for Stop Operating Lever	
Q-106	2043	Pick-up Operating Lever		Q-141	1942	Stop Operating Lever and Bush	
Q-107	1971	Adjusting Spindle		Q-201	2721	Cam Follower Retaining Spindle	
	1986	Spring Washer for 1971		Q-202	2719	Platform Cam	
Q-108	M1/14	Fixing Screw for Terminal Strip		Q-203	2756	Driving Pin for Cam	
Q-109	1975	Terminal Nut		Q-204	2718	Platform Operating Lever & Pin 1819	
Q-110	1973	Pick-up Terminal Strip		Q-205	2728	Tilting Push Rod	
Q-111	1953/3	Spring for Latch		Q-206	2717	Adjusting Nut	
Q-113	1958	Selector Lever and Spindle		Q-207	WB16/12	Spring Washer for Locking Nut	
Q-114	607	Screw for Cam Gear		Q-208	2716	Platform Push Rod	
Q-125	1987	Motor Fixing Screws		Q-209	B7/5	Locking Screw for Adjusting Nut	
Q-127	1821	Release Lever, RC50			G7/9	Nut for Locking Screw	
	2119	Release Lever, RC51			WB16/12	Spring Washer for Locking Nut	
Q-128	678	Stud for Spring		Q-210	JJ1/41	Pivot Washer	
Q-129	529	Pivot Pin for Release Lever		Q-211	1807	Pivot Screw	
Q-130	584	Spring for Release Lever			1803	Distance Collar	
Q-131	1051	Split Pin for Lever 1977		Q-212	2745	Base Casting	
Q-132	1977	Switch Operating Lever		Q-213	2729	Tilting Operating Lever and Pin 1819	
Q-133	1951	Switch Operating Link		Q-214	R9/14	Pin for Push Rod	
Q-134	2044	Latch for Pick-up Operating Lever		Q-215	1972	Collar for Knock-off Spindle	
Q-135	2746	Cam Main, Complete					
Q-136	1953	Switch Knock-off Lever RC50					
	2109	Switch Knock-off Lever, RC51					

SPARE PARTS LIST

Sheet R.

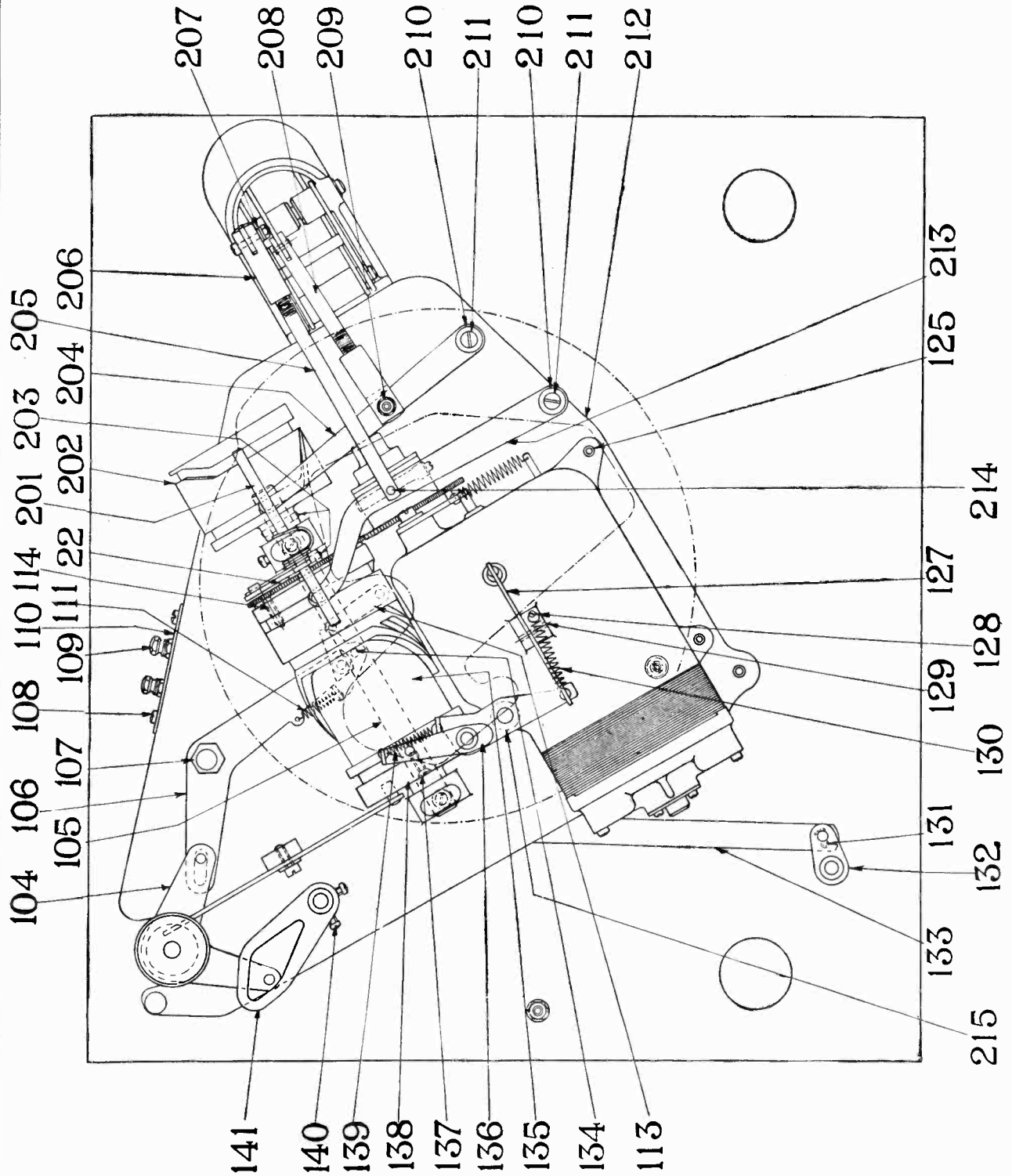
TYPE R.C.50 MOTOR.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
R 1	V2/12	Screw for Clutch Spring		R53	5/24	Screw for Governor Ball	
R 2	610	Clutch		R54	M1/14	Screw for Motor Cover	
R 3	1964	Clutch Gear		R55	JJ7/11	Split Pin for Operating Lever	
R 4	561	Screw for Cross Shaft Bush		R60	5/21	Governor Ball Washer	
R 5	1963	Cross Shaft Gear		R61	5/20	Governor Ball	
R 6	1914	Pin for Cross Shaft Gear		R62	5/24	Governor Fixing Screw	
R 7	1961	Cross Shaft		R63	JJ5/2	Governor Collar	
R 8	1841	Fibre Gear for Main Spindle		R64	1823	Release Spindle	
R 9	LL7/3	Regulating Brake Swivel		R65	DC2/8	Fixing Screws for Fixed Spindle	
R10	JJ1/7	Felt Pad for Regulating Brake		R66	1928	Thrust Plate	
R16	JJ1/17	Grommet for Leads		R67	555	Thrust Balls	
R21	JJ7/11	Split Pin for Regulating Brake		R68	1927	Ball Race Cage	
R22	JJ7/4	Regulating Brake Operating Lever		R69	V2/12	Screws for Name Plate	
R23	JJ7/10	Spring for Regulating Brake		R72	2489	Front Bearing for Rotor Spindle Complete	
R24	5/27	Governor Sp.ing					
R26	1980	Motor Frame		R73	JJ1/10	Fixing Screw for Stator	
R27	1/9	Fixing Screw for Rotor Shaft Bearing		R74	2776	Stator Pack with Copper Bands	
R30	1892	Stop Pin for Overthrow Lever		R75	2229	Coils for Stator	
R31	1962	Cross Shaft Bush		R76	2492	End Cover for Motor	
R32	1964/3	Clutch Lever		R77	MM1/12	Bearing Plate	
R33	613	Spring for Clutch		R78	2392	Nut for Thrust Screw	
R41	1965	Cover for Clutch Case		R79	MM1/17	Thrust Screw	
R42	1964/2	Clutch Case		R80	2/12	Fixing Screw for Bearing Plate	
R43	1960	Motor Cover		R79	MM1/8	Spring for Bearing	
R44	1839	Main Spindle with Fibre Gear		R82	MM1/9	Thrust Ball	
R45	1838/2	Fixed Spindle Insert		R83	MM1/7	Cone Washer for Bearing	
R46	1838/3	Retaining Coil for Fixed Spindle		R84	MM1/6	Rotor Spindle Bearing	
R47	1838	Fixed Spindle		R85	2498	Fixing Screw for End Cover	
R48	1969	Regulating Shaft with Cam		R86	2759	Distance Collar for Stator	
R49	6A/10	Split Pin for Regulating Shaft		R87	3610	Rotor	
R50	15/19	Washer for Regulating Shaft		R88	2491	Rotor Spindle only	
R51	KK7/3	Spring Washer for Regulating Shaft		R89	2740	Name Plate	
R52	JJ7/2	Collar for Regulating Shaft		R90	3618	Bush for Rotor	

MODELS RC-50, RC-51

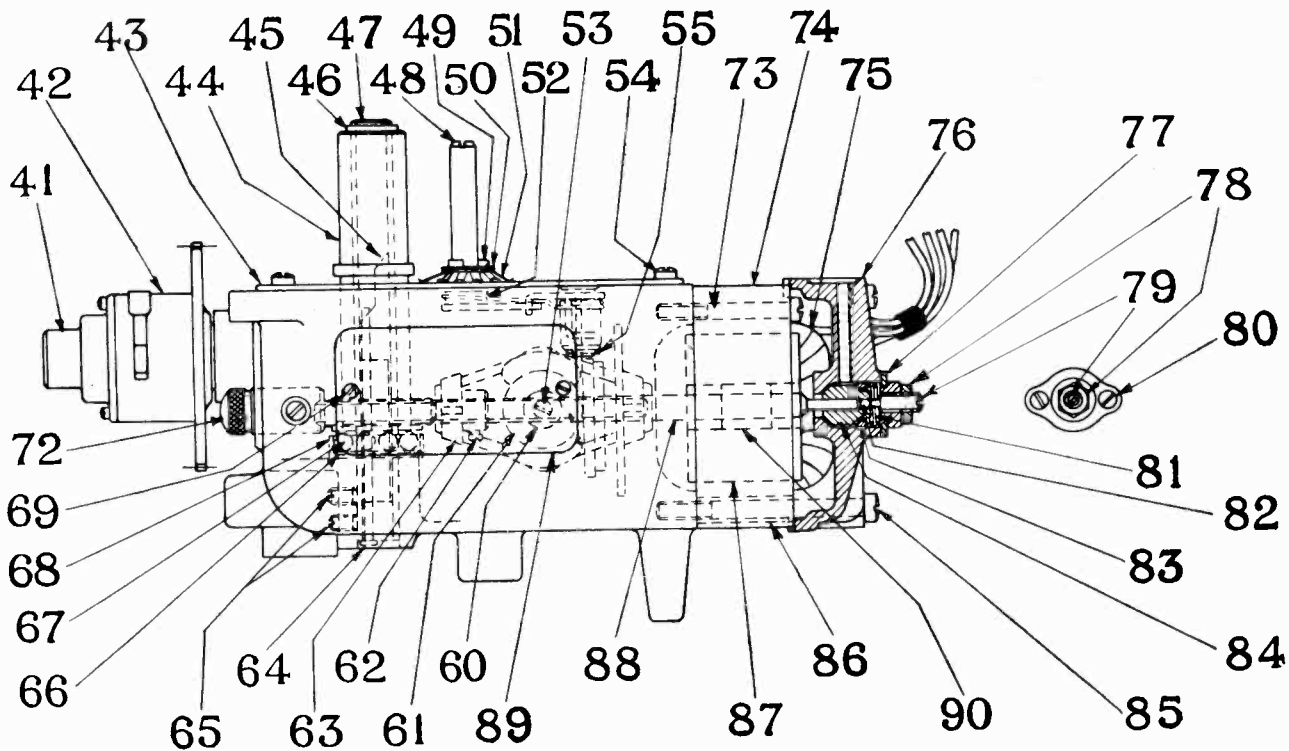
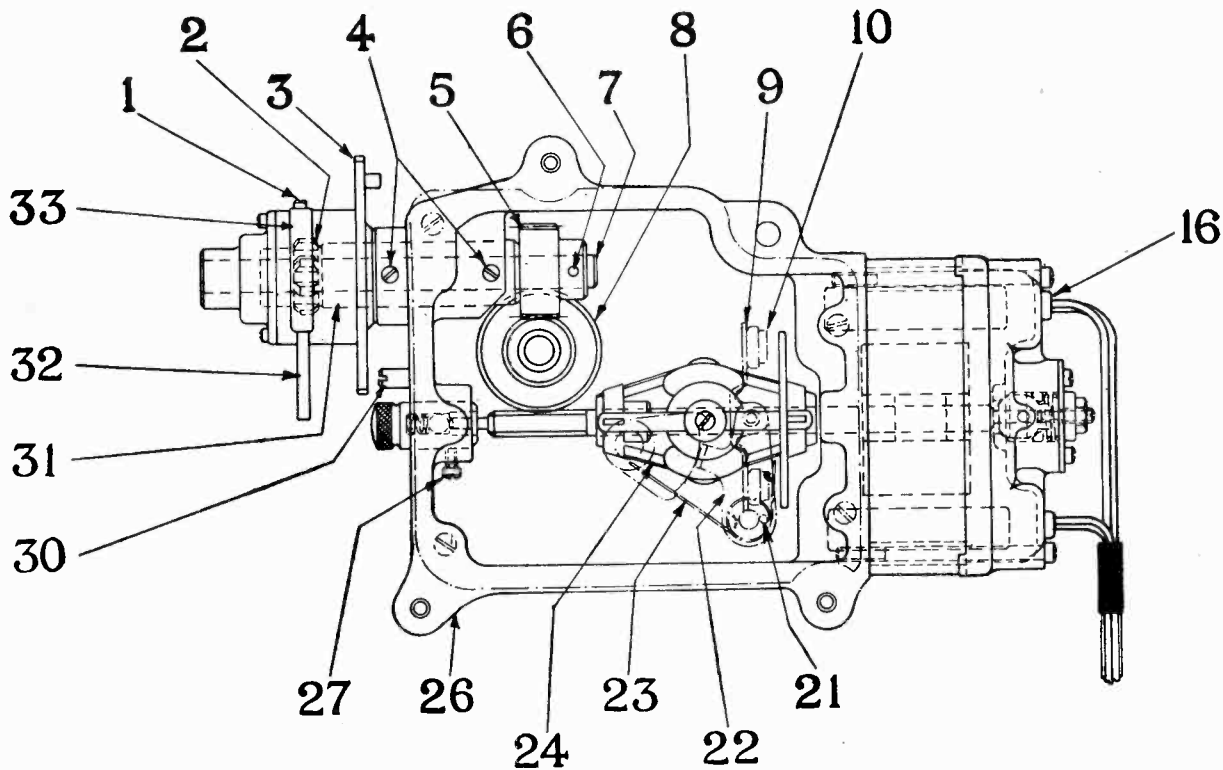
GARRARD ENG. & MFG. CO. LTD.

Diagram Q



GARRARD ENG. & MFG. CO. LTD.

Diagram R



MODELS RC-50, RC-51

GARRARD ENG. & MFG. CO. LTD.

SPARE PARTS LIST

Sheet S.

TYPE R.C.51 MOTOR

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
S 1	V2/12	Screw for clutch spring.		S33	1964/3	Clutch lever.	
S 2	610	Clutch.		S34	613	Spring for clutch lever.	
S 3	1964/1	Clutch gear.		S35	1965	Cover for clutch case.	
S 4	561	Screw for cross shaft bush.		S36	1964	Clutch case and gear complete.	
S 5	1963	Cross shaft gear.		S37	M.1/14	Motor cover fixing screws.	
S 6	1914	Pin for cross shaft gear.		S38	2103	Main spindle complete.	
S 7	1961	Cross shaft.		S39	2106	Fixed main spindle.	
S 8	1841	Fibre gear.		S40	2106/3	Retaining coil.	
S 9	LL7/3	Swivel for regulating brake.		S41	2106/2	Fixed spindle insert.	
S10	JJ7/7	Felt brake pad.		S42	5/28	Governor spring.	
S11	DD5/1	Governor sleeve and disc.		S43	5/24	Governor ball screw.	
S12	DD1/3	Thrust ball.		S44	JJ.1/15	Field pack fixing screws.	
S13	2100	RC51 Armature complete.		S45	LL.2/1	Field pack complete less coils.	
S14	AD1/16	Brush carrier bush.		S46	2099	Field coils (2 connected)	
S15	HH2/10	Felt pad.		S47	HH.3/8	Commutator washer.	
S16	HH2/9	Thrust disc.		S48	WB.1/5	Bearing Cover.	
S17	B5/9	Armature thrust ball.		S49	B.1/7	Bearing cover screw	
S18	B1/7	Bearing cover fixing screws.		S50	HH.2/7	Felt Washer.	
S19	LL2/4	Brush carrier.		S51	LL.2/7	Leatheroid Shield.	
	LL2/5	Brush Carrier Fixing Screw.		S52	LL.2/6	Pin for coil.	
S20	2101	Motor frame.		S53	5/20	Governor ball.	
S21	JJ7/11	Split pin.		S54	5/21	Governor ball washer.	
S22	JJ7/4	Brake operating lever.		S55	5/24	Governor fixing screws.	
S23	JJ7/10	Brake Spring.		S56	DD.5/3	Governor Collar.	
S25	2337	Condenser.		S57	2107	Release spindle.	
S26	B1/7	Fixing screws for condenser clip.		S58	DC.2/8	Main spindle fixing screws.	
S27	830	Washer for condenser clip.		S59	1928	Ball race thrust plate.	
S29	1/9	Screw for bearing.		S60	555	Main spindle thrust balls.	
S30	1905	Armature shaft bearing.		S61	1927	Ball race case.	
S31	1892	Clutch stop pin.		S62	V2/12	Name plate screw.	
S32	1962	Cross shaft bush.		S63	1994	Name plate.	

SPARE PARTS LIST

Sheet T.

TYPE R.C.51 MOTOR & RESISTANCE.

MOTOR—				RESISTANCE—			
NUMBER NUMBER	NUMBER REFERENCE	NAME OF PART	PRICE	DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
T64	15/19	Washer.		T21	2471	Insulator for Lead	
T65	6A/10	Split pin.		T22	2557	Asbestos Tube for Lead	
T66	2105	Brake shaft and cam.		T23	M1/9	Fixing Screw for Adaptor Plate	
T67	KK7/3	Spring washer for brake shaft.		T24	2490	Adaptor Plate	
T68	2104	Motor cover.		T25	WB11/22	Spring Washer	
T70	2181	Rubber grommet.		T26	G7/9	Nut for Fixing Screw	
T71	CC2/27	Earthing tag.		T27	3514	Fixing Screw for Bracket	
T72	HH2/22	Washer for brush cap.		T28	WB11/22	Spring Washer for Bracket	
T73	WB2/16	Brush cap.		T29	WB16/12	Spring Washer for Element	
T74	HH2/11	Brush spring.		T30	2464	Cover for Resistance	
T75	DC2/8	Brush tube fixing screw.		T31	2576	Resistance Element (wound complete)	
T76	HH2/23	Brush tube.		T32	2475	End Plate for Element	
T77	HH2/13	Carbon brush.		T33	G7/9	Nuts for Centre Rod	
T78	2181	Rubber Grommet		T34	2474	Centre Rod	
T79	JJ1/43	Washer.		T35	2461	Bakelite Bracket	
T81	HH2/15	Condenser clips.				Resistance Complete	

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MODELS RC-50,
RC-51

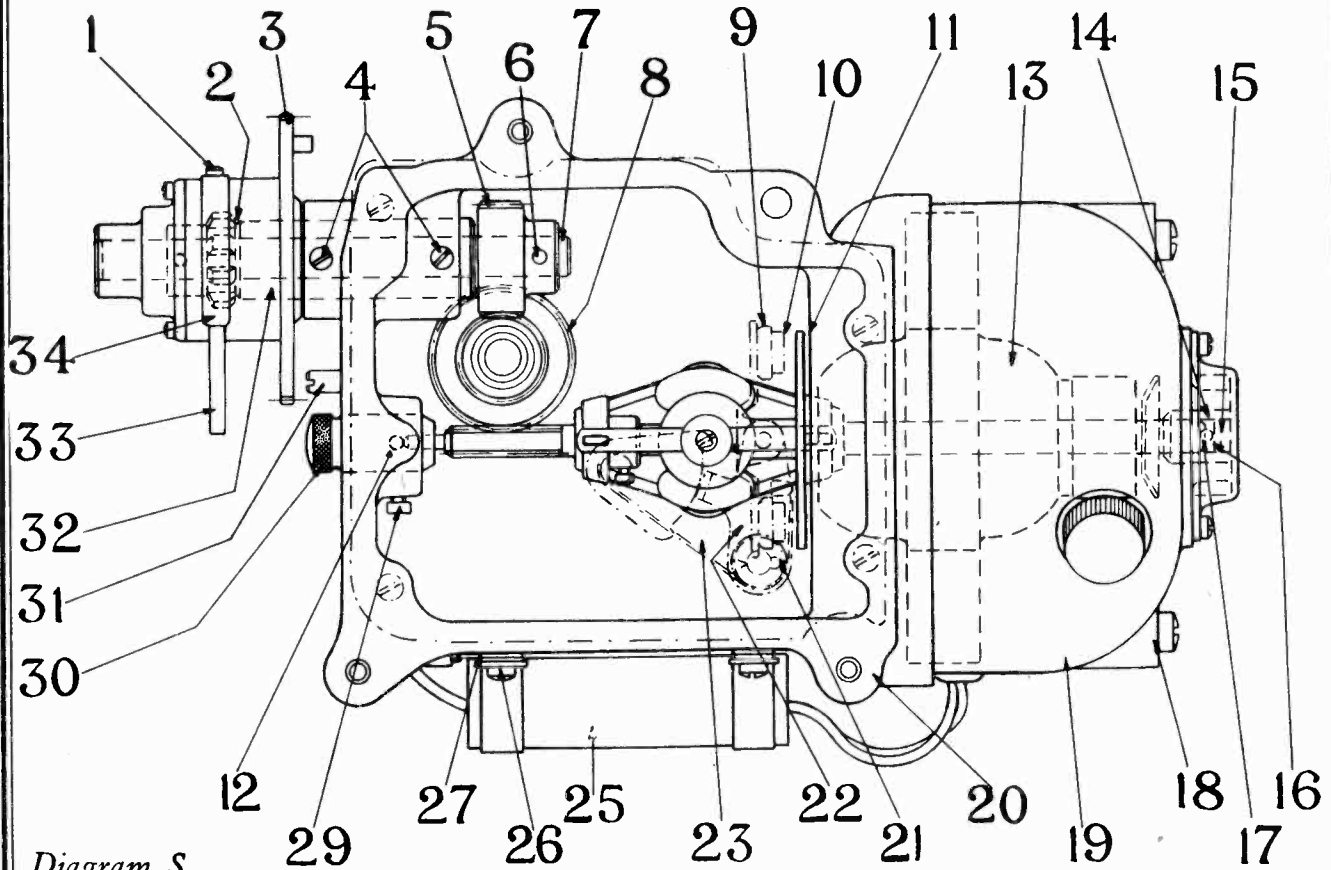
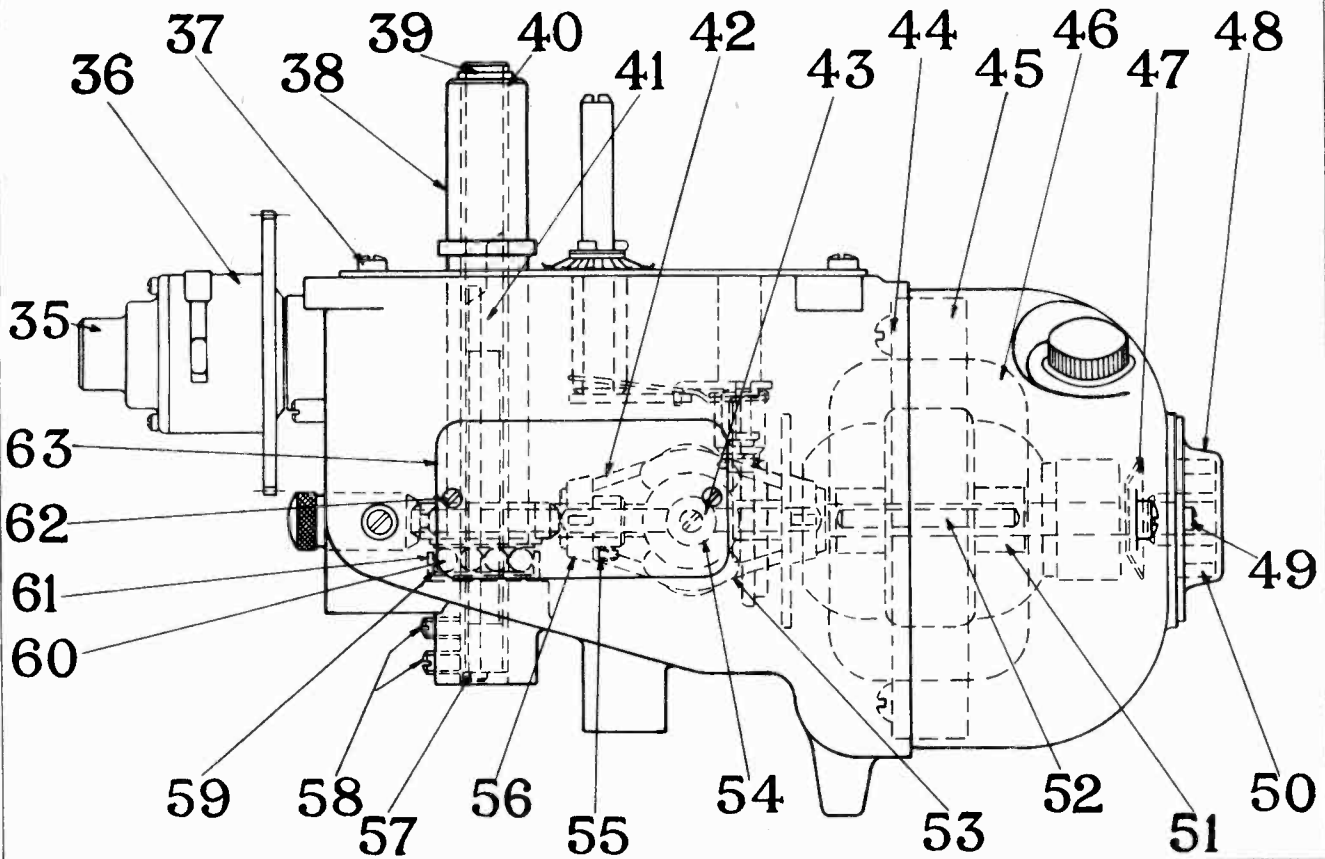


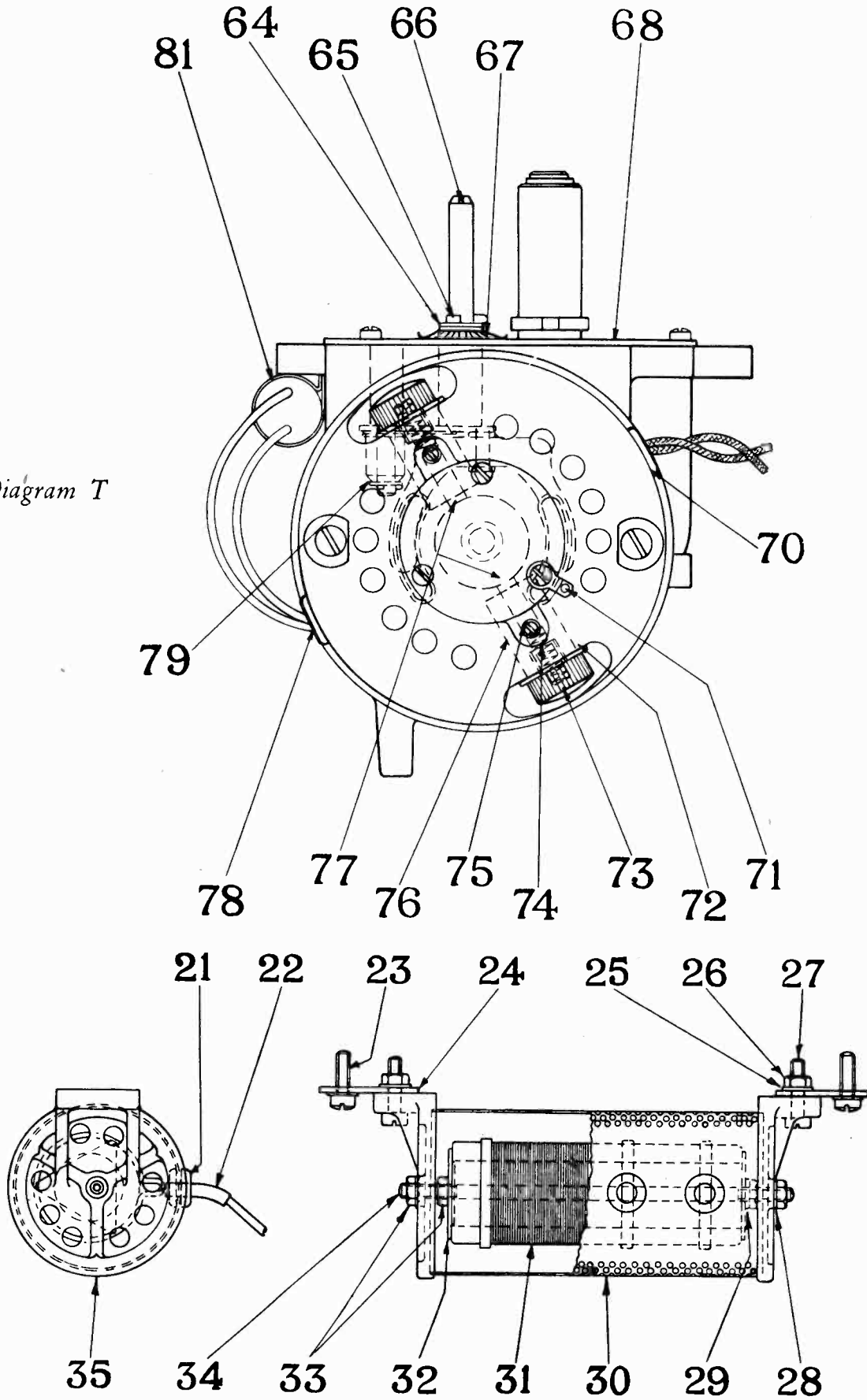
Diagram S



MODELS RC-50, RC-51

GARRARD ENG. & MFG. CO. LTD.

Diagram T



GARRARD ENG. & MFG. CO. LTD.

FOR ADJUSTMENTS ONLY

SPARE PARTS LIST FOR
"GARRARD" PICK-UPS.

Sheet G.

SEE MAGNAVOX MODEL RC-50

Standard Pick-up Unit. Used on: Types RC4, 5, 6, 8, 50 and 51
Record Changers. Types A and B Radio Gram. Units.

Type "E" Pick-up Unit. Used on: Types RC10 and 11 Record Changers.
Types "E", "F", and "G" Radio Gram. Units.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G 1	652	Pick-up magnet.	
G 2	549	Pick-up body.	
G 3	552	Pole pieces.	
G 4	554	Screw for pole piece.	
G 5	553	Needle screw.	
G 6	550	Pick-up cover.	
G 7	1194	Rubber washer for hum bucking coil.	
G 8	551	Cover fixing screw.	
G 9	653	Adjusting plate.	
G10	CC2/26	Connecting tags.	
G11	555	Bush for sleeve with ball and spring	
G12	1967	Rubber magnet packing.	
G13	1125	Small rubber washer for hum buck'g coil	
G14	2191	Top connecting U piece.	
G15	554	Screw for connecting piece.	
G16	654	Top damping rubber.	
G17	795	Screw for adjusting plate.	
G18	See below	Humbucking coil.	
G19	See below	Pick-up coil.	
G20	656	Armature.	
G21	655	Bottom damping rubber.	
G22	2191	Bottom connecting U piece.	

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G23	2506/3	Rivet.	
G24	2506/2	Connecting Plate.	
G25	2536	Earthing Tag.	
G26	2508	Magnet.	
G27	795	Adjusting Plate Screw.	
G28	653	Adjusting Plate.	
G29	—	Empire silk tube.	
G30	2534	Insulating strip.	
G31	2506/1	Base plate.	
G32	2531	Pole Piece fixing screw.	
G33	656	Armature.	
G34	655	Damping Rubber (Bottom).	
G35	553	Needle screw.	
G36	see below	Bobbin.	
G37	654	Damping Rubber (Top).	
G38	2505	Pole piece.	
G39	2507	Side plate.	

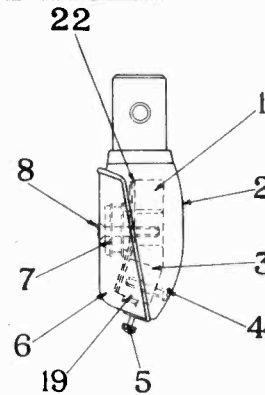
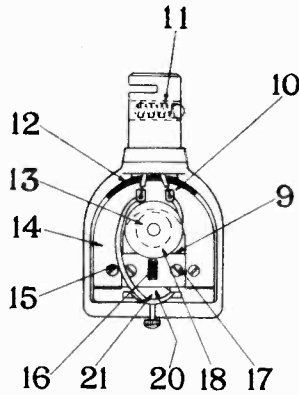
"Piezo" Crystal Pick-up. Used on: Types RC4, 5, 6, 8, 50 and 51 Record Changers. Types A and B Radio Gram. Units.

DIAGRAM NUMBER	REFERENCE NUMBER	NAME OF PART	PRICE
G43	1141	Body.	
G44	1145	Crystal Cartridge.	
G45	1142	Fixing Plate "A".	
G46	—	Needle screw.	
G47	1144	Fixing screws.	
G48	1143	Fixing Plate "B".	
G49	—	Empire Sleeving.	
G50	CC2/26	Connecting Tags.	
G51	556	Connecting piece.	
G52	555	Bush for sleeve with spring and ball.	

Pick-Up Coils (Std. & Type "E").

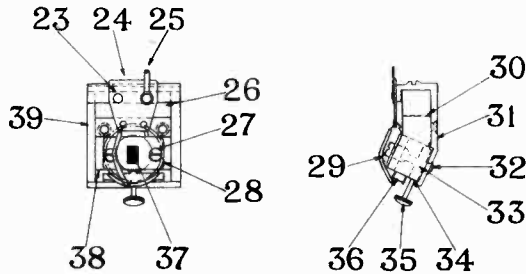
- Red Band - 6000 ohms Pick-up coil.
- Black Band - 2000 ohms Pick-up coil.
- Green Band - 700 ohms Pick-up coil.
- Orange Band Humbucking coil (Standard Unit only)

Diagram G

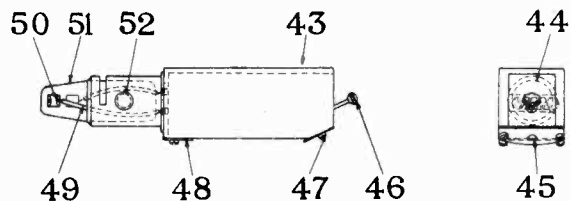


STANDARD
PICK-UP UNIT.

TYPE "E" PICK-UP UNIT.



"PIEZO" CRYSTAL PICK-UP.



INSTALLATION INSTRUCTIONS

Section I—Chassis Connections

A brown fabric-covered cable with a single-prong plug attached is provided for interconnecting the Recorder and Radio Receiver. This cable plug is to be inserted in the phono jack of the radio receiver. If the radio receiver is not provided with a jack consult your Recorder Dealer for connection requirements. Several methods of making connections to a receiver not provided with a phono jack are described in the following section.

Section II—Special Chassis Connections**Method No. 1—(For Receivers Equipped with Two Phono Terminals and a Phono Switch)**

Secure a phono jack, General Electric stock No. RB-1030. Drill properly spaced mounting holes in the chassis rear apron near the phono terminals for mounting the jack. Wire the center terminal of the jack to the high terminal of the phono terminal board. Also interconnect the ground terminals of the phono terminal board and the jack. The Recorder brown fabric-covered cable with a single-prong plug can now be connected to the receiver circuit through this jack.

Method No. 2—(For Receivers Equipped with Phono Terminals or Leads But No Phono Switch)

Consult the instruction pamphlet which was supplied with your receiver to determine which phono terminals or leads are for connection to a record player. There may be three or four terminals or leads depending upon the type of radio. Determine which terminal or lead is connected to the high side of the volume control. For radio operation, there will be a connection between this volume control terminal or lead and the radio diode load. On a three-terminal board, the remaining terminal or lead will be chassis ground. On a four-terminal board, one of the remaining terminals or leads will be chassis ground and the other a diode return.

Secure a double-pole, double-throw switch, General Electric stock No. RS-3065, and a phono jack, General Electric stock No. RB-1030. Mount the switch and jack on the chassis rear apron or on the cabinet shelf near the phono terminals. A small metal plate such as shown in Fig. 5 is one method of easily mounting the switch and jack. Interconnect the phono terminals, switch and jack as shown in Fig. 2. Solder all wire connections. The Recorder brown fabric-covered cable with a single-prong plug can now be connected to the receiver circuit through the jack.

Method No. 3—(For Receivers Not Equipped with Phono or Pin-jack Terminals)

First, pull the receiver power cord plug out of the power supply receptacle; then remove the receiver chassis from the cabinet to allow access to the high side of the volume control. Unsolder the lead from the high side of the volume control and solder it onto one lead of a two-conductor shielded pair. This becomes the diode load lead. Solder the other conductor of the shielded pair to the high side of the volume control. This becomes the volume control lead. This shielded pair should be long enough to extend to the rear of the chassis. Solder the shields to the chassis.

Secure a double-pole, double-throw switch, General Electric stock No. RS-3065, and a phono jack, General Electric stock No. RB-1030. Mount the switch and jack on the chassis rear apron or on the cabinet shelf. A small metal plate such as shown in Fig. 5 is one method of easily mounting the switch and jack. Referring to Fig. 2 "Switch Connections for 3 Terminals," perform the connection requirements as shown. The chassis ground lead is the shield of the two-conductor shielded pair. The Recorder brown fabric-covered cable with a single-prong plug can now be connected to the receiver circuit through the jack.

Section III—Loud-speaker Connections

Connecting the Recorder into the loud-speaker circuit is accomplished by using the remaining brown fabric-covered cable with four terminal connections. Two of the connections have pin plug terminals. The remaining two have pin plug socket terminals. These terminal provisions make possible quick connection into radio loud-speaker circuits which are equipped with pin plug terminals. The following procedure will assure quick and satisfactory results.

(A) For Single Speaker Receivers Equipped with Pin Plug Terminals. (See Fig. 3.)

- (1) Locate the pin plug terminal board on the speaker and pull off the two chassis lead connections.
- (2) Connect the chassis leads to the pin plug terminal connections on the Recorder cable.
- (3) Connect the socket terminal connections of the Recorder cable to the pin plug terminals on the

loud-speaker. The black Recorder lead should be connected to the loud-speaker terminal which is grounded to the frame.

(B) For Dual Series-connected Speaker Receivers Equipped with Pin Plug Terminals. (See Fig. 3.)

- (1) Pull off the two chassis lead connections.
- (2) Connect the chassis leads to the pin plug terminal connections of the Recorder cable.
- (3) Connect the socket terminal connections of the Recorder cable to the vacant loud-speaker plug terminals. The black Recorder lead should be connected to the terminal of the larger loud-speaker which is grounded to the frame.

(C) For Dual Parallel-connected Speaker Receivers Equipped with Pin Plug Terminals. (See Fig. 3.)

- (1) Cut the chassis-to-speaker leads a few inches from the first loud-speaker to which the leads connect. To the two ends coming from the loud-speaker solder pin plug terminals, General Electric stock No. RT-952. To the two ends coming from the chassis solder socket terminals, General Electric stock No. RT-954.
- (2) Connect the pin plug terminal connections of the Recorder cable to the socket terminals just soldered.
- (3) Connect the socket terminal connections of the Recorder cable to the pin plug terminals just soldered.

Section IV—Special Loud-speaker Connections

If the loud-speaker in your radio receiver is not provided with pin plug terminal connections then your dealer or serviceman should be called upon to install plug connections.

To install plug connections the following procedure is recommended:

(A) Loud-speakers with output transformers mounted on the loud-speaker fall into two general classes; those which have rigid terminals for output transformer secondary leads and those which have insulated wire leads for output transformer secondary leads and which have the leads connected to a terminal post mounted on the loud-speaker frame.

- (1) If the output transformer has rigid secondary terminals, unsolder the voice coil leads from the terminals. (See Fig. 4.) Mount the special terminal board, found in an envelope in the Recorder, on the loud-speaker frame. Solder the two voice coil leads to the pin plug terminals. Interconnect the rigid terminals of the output transformer with the two remaining terminals on the special terminal board. Loud-speaker connections between radio and recorder can now be made as described for the case of a single speaker with plug terminals, Section IIIA.
- (2) If the output transformer leads are of insulated wire which are in turn connected to a terminal board (see Fig. 4), proceed as follows: Disconnect the leads from the terminal board and replace the terminal board with the special terminal board enclosed. Solder the voice coil leads to the pin plug terminals and solder the output transformer secondary leads to the two remaining terminals on the special terminal board. Loud-speaker connections between radio and recorder can now be made as described for the case of a single speaker with plug terminals, Section IIIA.

(B) For Loud-speakers Which Do Not Have Output Transformers Attached

- (1) Determine which two leads coming from the chassis are the secondary leads from the output transformer.
- (2) Cut these two leads somewhere near the chassis. To the two ends coming from the loud-speaker solder pin plug terminals, General Electric stock No. RT-952. To the two ends coming from the chassis solder socket terminals, General Electric stock No. RT-954.
- (3) The Recorder-loud-speaker connections can now be made as in the case of a single speaker receiver described in Section IIIA.

Section V—Matching Output Transformer Impedances

The Recorder matching transformer is located on the underside of the motorboard panel. It is connected at the factory to match a 3.5-ohm output transformer secondary impedance. Transformer taps are provided for matching 1.75- and 7-ohm impedances. When connecting the Recorder

into the loud-speaker circuit, check the output transformer secondary impedance and match this impedance as nearly as possible by using the proper tap on the Recorder matching transformer. The tap lead colors on the Recorder matching transformer are: 7 ohms—green, 3.5 ohms—yellow and red, 1.75 ohms—yellow and green.

The majority of General Electric receivers produced during the past three years have 3.5-ohm output transformer secondary impedances. Where two speakers were used in series, this impedance was 7 ohms. Where two speakers were used in parallel, this impedance was 1.75 ohms.

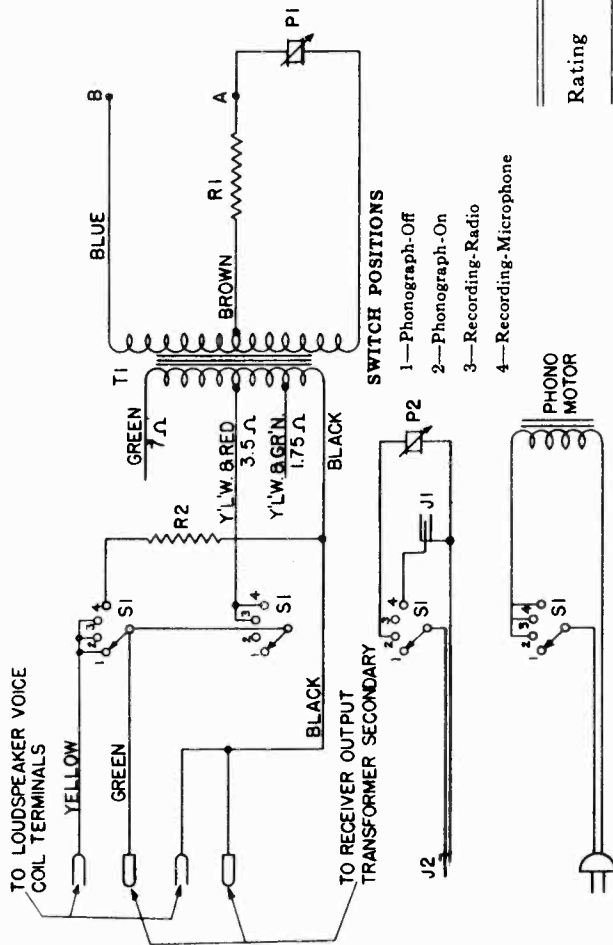


Fig. 6. Schematic Diagram

RECORDING ADJUSTMENTS

Cutting Head Pressure

The pressure is controlled by means of the adjustment screw located midway back on top of the recording arm. The pressure should be adjusted so that by inspection with a magnifying glass, the uncut portion of the record between the grooves is the same width as the groove. At no time should pressure be great enough to cut through the acetate surface enough to show the metal base of the record. A clockwise rotation of the setscrew increases pressure.

Cutting Arm Adjustment

The adjustment at the rear and underneath the cutting arm, controls the height above the record blank at which

the cutting arm rides. This should be adjusted so that when resting in the recording position on the record, the setscrew of the cutting head rides half way down in the needle screw gap.

Lead Screw Follower Arm Pressure Adjustment

The pressure is varied by the phosphor bronze spring adjustment underneath the phono assembly on the follower arm. The pressure should be great enough so that when the recording head is in the recording position, this phosphor bronze spring should rest at the bottom of the lead screw groove. Too great pressure will cause binding, while too little pressure is liable to cause overlapping of the grooves.

Section VI—Cutting Head Driving Power Adjustment

The recorder matching transformer is also provided with two output taps to allow adjustment of the driving power applied to the cutting head. For the majority of receivers with an undistorted audio power output rating of more than two watts, the tap connection as made at the factory will be satisfactory. However, cases may arise, when this Recorder is used in conjunction with a receiver of 1 to 3 watts undistorted power output rating, where increased driving power for the cutting head is needed. In these cases the blue lead of the Recorder matching transformer should be connected to the high side of the cutting crystal and the brown lead and resistor disconnected. *Caution—Care must be exercised not to use this Recorder with receivers of large output rating when the blue tap lead is connected. Injury to the cutting head may result.*

Section VII—Removal of Home Recorder Connections

Disconnect the Recorder cables from the radio chassis and loud-speaker. Connect the socket terminals of the chassis leads to the pin plug terminals of the loud-speaker voice coil leads. The receiver is now ready to operate as a conventional radio and the Home Recorder is free to be transported elsewhere.

GENERAL INFORMATION

Model JM-7 Home Recording Record Player is a portable unit designed to operate in conjunction with any radio receiver having more than one watt undistorted output.

The selector switch when turned to "Phonograph-Off" will disconnect the recorder from the radio circuits and will allow normal radio operation. The "Phonograph-On" setting of the switch converts the recorder into a conventional record player and starts turntable rotation. The "Recording-Radio" position permits radio program recording. Recording through the microphone is provided on the "Recording-Microphone" position.

Rating	Power Supply (Volts)	Frequency (Cycles per Second)	Power Consumption (Watts)
A6	115-125	60	35
A5	115-125	50	35

PARTS DESCRIPTION LIST

- J1 Microphone jack
- J2 Chassis connection plug
- P1 Crystal cutter
- P2 Crystal pick-up
- R1 39,000 ohms, 1/4 W. carbon resistor
- R2 3.9 ohms, 1/4 W. wire-wound flexible resistor
- S1 Selector switch
- T1 Output transformer

MODELS JM-6, JM-7

GENERAL ELECTRIC CO.

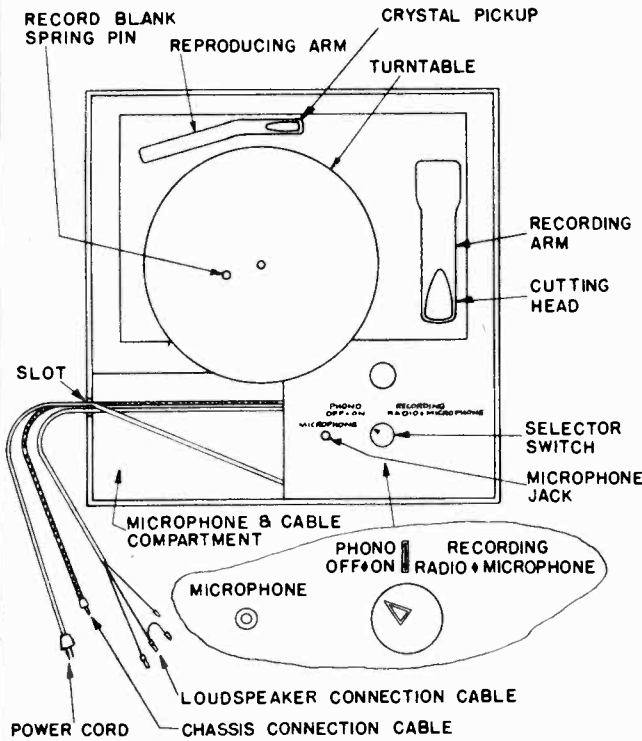
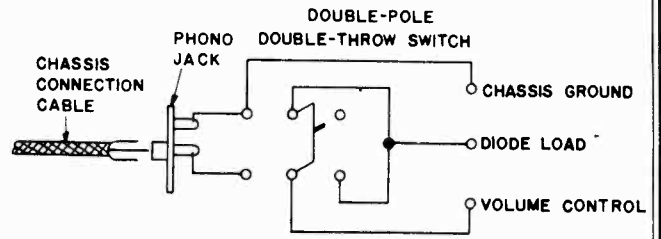
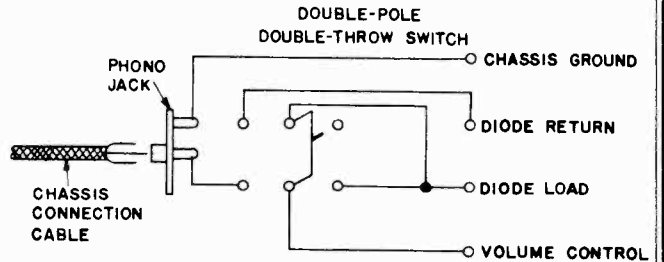


Fig. 1. Control Location



SWITCH CONNECTIONS FOR 3 TERMINALS



SWITCH CONNECTIONS FOR 4 TERMINALS

Fig. 2. Phono Terminals, Jack, and Switch Connections

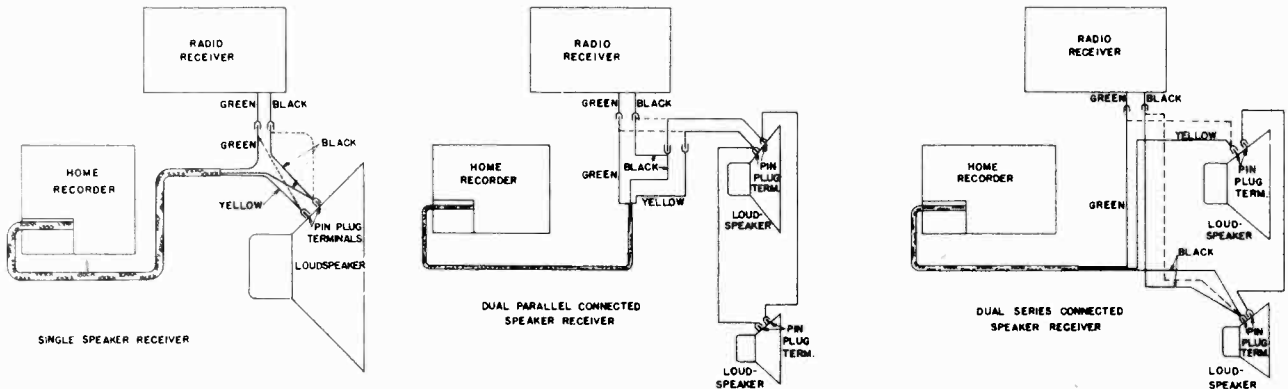


Fig. 3. Loud-speaker Connections

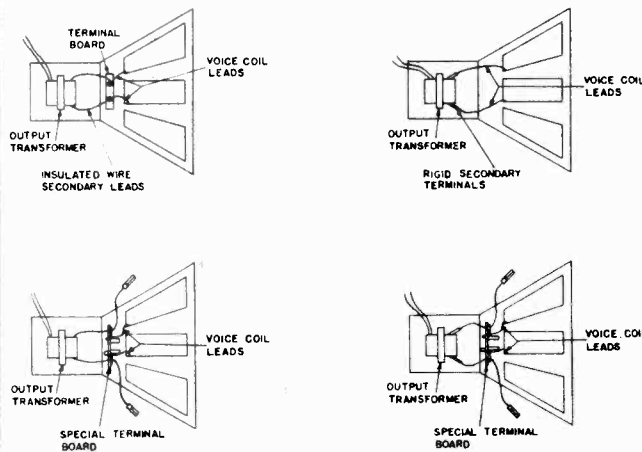


Fig. 4. Special Loud-speaker Connections

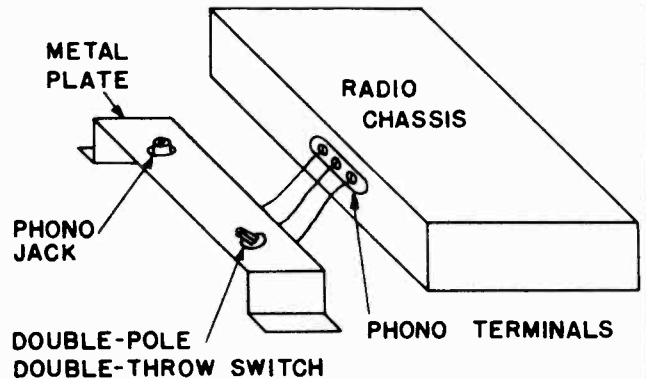


Fig. 5. Typical Jack and Switch Mounting

GENERAL ELECTRIC CO.

MODELS JM-6 AND JM-7

Stock No.	Description	List Price
*RB-086	BOARD—Terminal board (4 lug)	\$0.10
RB-1036	BOARD—Special terminal board for speakers	.25
*RC-8157	CORD—Power cord	.25
RC-8191	CABLE—Single-conductor shielded cable and plug	.60
RC-8192	CABLE—Three-conductor cable and terminal assembly	.70
RF-019	FEET—Cabinet feet (Pkg. 5)	1.0
RF-756	FASTENERS—Lid fasteners	.20
RH-801	HANDLE—Cabinet handle	1.00
RH-903	HINGE—Lid hinge (Pkg. 2)	.15
RK-1002	KNOB—Control switch knob	.20
*RN-008	NUT—Switch retaining nut (Pkg. 5)	.10
RN-102	NEEDLE CUP—Rubber needle cup	.10
RN-202	NAMEPLATE—Switch nameplate	.05
RN-203	NAMEPLATE—Microphone nameplate	.05
RN-145	PLUG—Piano plug (Pkg. 5)	.25
*RO-1397	RESISTOR—39,000 ohms, $\frac{1}{4}$ W. carbon (R-1) (Pkg. 5)	.70
RS-300	RESISTOR—3.9 ohms, $\frac{1}{4}$ W. wire wound (R-2)	.15
RS-303	SOCKET—Microphone jack	.10
RS-3092	SWITCH—Selector switch (S-1)	.90
RS-4012	SPRING—Control knob retaining spring (Pkg. 10)	.10
RS-6001	SCREW—Motorboard anchoring screw and washer	.60
RT-482	TRANSFORMER—Output transformer	1.60
LEAD SCREW AND HOUSING ASSEMBLY		
RH-121	HOUSING—Turntable spindle housing assembly	\$1.65
RN-014	NUT—Lead screw end thrust screw nut	.10
RS-8011	SCREW—Lead screw and pinion assembly	1.10
RS-8012	SCREW—Lead screw and thrust screw	.10
RS-8013	SCREW—Turntable spindle locking screw and nut (Pkg. 3)	.05
RS-9020	SHAFT—Turntable spindle	.75
RX-089	ASSEMBLY—Housing assembly complete	4.00
MISCELLANEOUS ASSEMBLY		
RB-1125	BRACKET—Follower arm stop bracket	.10
RP-9008	PLATE—Base plate	2.10
RS-632	SUPPORT—Cutter arm rest support	.35
MOTOR ASSEMBLY		
RB-1123	BRACKET—Bearing retainer mounting bracket assembly	.45
RC-2036	COVER—Main motor cover assembly	.70
RF-512	FIELD—Field and core assembly (60 cy)	7.00
RM-145	MOTOR—60 cycle motor complete	12.00
RM-146	MOTOR—50 cycle motor complete	12.75
RP-326	PULLEY—Rotor drive pulley	.20
RP-411	ROTOR—Rotor assembly (60 cycle)	.40
RR-853	RING—Rotor shaft pulley support ring	.10
RS-9009	SCREW—Rotor shaft pulley setscrew (Pkg. 5)	.05
MOTOR MOUNTING AND PLATE ASSEMBLY		
RB-639	BUSHINGS—Motor mounting rubber bushings (Pkg. 3)	.10
* Used on previous receivers.		
CUTTER ARM ASSEMBLY		
RA-420	ARM—Cutter arm complete	\$12.00
RC-2034	CUSHION—Crystal bumper cork (Pkg. 2)	.05
RC-5006	CRYSTAL—Crystal cutter with leads	11.50
*RS-876	SCREW—Crystal tension screw (Pkg. 10)	.10
RS-4022	SPRING—Crystal tension spring	.10
RS-8008	SCREW—Cutter arm pivot screw (Pkg. 2)	.10
CUTTER ARM PIVOT ASSEMBLY		
RA-421	ARM—Follower arm complete	.65
RB-640	BUSHING—Pivot post bushing	.70
RL-957	LEVER—Cutter arm lift lever	.15
RP-2006	PLATE—Pivot saddle plate assembly	.65
RP-2007	PLATE—Pivot straddle plate	.25
RS-4024	SPRING—Pivot post helical spring	.10
RS-8015	SCREW—Saddle bushing setscrew (Pkg. 2)	.15
RS-8016	SCREW—Follower (copper strip) adjustment screw and nut (Pkg. 3)	.05
RW-128	WASHER—Follower arm shaft washer (Pkg. 5)	.05
RX-091	ASSEMBLY—Pivot post lock washer and nut mounting assembly	1.15
BRACKET—Rubber-rimmed wheel mounting bracket.		
RB-1124	HOLDER—Tension spring holder (Pkg. 5)	\$0.20
RH-119	HAIRPIN COTTER—Rubber-rimmed wheel retaining cotter (Pkg. 3)	.05
RP-2005	PLATE—Motor mounting plate	.35
RS-631	SLEEVE—Motor mounting bushing sleeve (Pkg. 3)	.10
RS-4008	SPRING—Rubber-rimmed wheel tension spring (Pkg. 2)	.05
RS-8010	SCREW—Motor mounting screw (Pkg. 5)	.05
RW-923	WHEEL—Turntable drive wheel (Rubber-rimmed)	.60
RX-088	ASSEMBLY—Motor mounting plate complete with bracket and wheel	1.35
TONEARM REST ASSEMBLY		
RC-2035	CUSHION—Tonearm support bumper (Pkg. 2)	.05
RS-630	SUPPORT—Tonearm rest support	.25
TONEARM AND PIVOT ASSEMBLY		
RC-2037	CLIP—Pickup cord clip (Pkg. 3)	.05
RC-2038	CUSHION—Tonearm pivot damper felt (Pkg. 3)	.05
RC-8205	CABLE—Pickup lead cable	.35
RP-410	POST—Tonearm post and pivot assembly	1.05
*RP-509	PICKUP—Tonearm crystal pickup	6.40
RS-876	SCREW—Crystal needle screw (Pkg. 10)	.10
RS-8014	SCREW—Crystal pickup mounting screw (Pkg. 5)	.05
RT-934	TONEARM—Tonearm less pickup	.70
RX-090	ASSEMBLY—Tonearm post mounting washers and nut	.10
TURNTABLE ASSEMBLY		
RP-409	PIN—Retractable pin	.05
RS-4021	SPRING—Retractable pin spring	.05
RS-8007	SCREW—Retractable pin spring screw (Pkg. 5)	.10
RT-933	TURNTABLE—10-inch weighted turntable	3.60

Prices Subject to Change without Notice

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GENERAL ELECTRIC CO.

This automatic record-changing equipment has been designed to be simple and fool proof. Very little attention will be required over long periods of operation. When adjustments are required the following instructions will save much work and time.

Operating Instructions

The record changer is designed to automatically play eight 10-inch or seven 12-inch standard 78 r.p.m. phonograph records on one side. The last record remains on the turntable and is repeated.

To shift from playing 10-inch records to 12-inch records all that is necessary is to set the shift lever (D) opposite the 12-inch index.

Motor Adjustments

The speed of the motor turntable is controlled by a governor which allows correct adjustment of the turntable rotation to 78 r.p.m.

A check of the turntable speed may be made by placing a piece of paper under a record on the turntable and counting the revolutions in a minute.

The gears and bearings are properly lubricated for long periods of operation. A ball and socket oil hole is located under the motor cam. Use a small quantity of SAE No. 10 oil when oiling these gears. If the motor chatters or runs uneven, place a few drops of light oil on the governor felt.

Record Removing Arm

The arm is adjusted so that it will always leave one record on the turntable. This is done to prevent the phonograph needle from damaging the covering on the turntable.

Stop the motor in such a position that the unloading lever (O) Fig. 12, can swing by and clear the cam (P). Now by pulling the reject lever (L) Fig. 12, it will be found possible to swing the record removing arm over to where it just touches the edge of the record. The mechanism should move freely without binding. Place one record on the turntable and measure from the top of this record down to the base plate. This distance should be 1 inch. Now swing the record removing arm over and see that the finger just misses the top of the record. The record removing arm should rest on the stop screw which is located under the arm. This stop screw prevents the arm from dropping low enough to remove the last record.

If the record removing arm raises a record from the turntable, and drops it back in place without removing it, check the lift adjustment stud (V) Fig. 12. This adjustment consists of an eccentric stud which is provided with a locknut, and is made by loosening the locknut and turning the eccentric stud. The lift adjustment should be set so that the hole in the center of the record just clears the turntable spindle when the arm is in operation.

Trip Mechanism

The tonearm lift lever (L) Fig. 12 latches with the square pin (U) on the unloading lever assembly (O), and holds this lever assembly out of engagement with the motor cam (P) while a record is being played. The square pin should engage the notch approximately one-half its depth. The depth of engagement is adjusted by the eccentric washer and screw (J).

The oval head screw (R) serves as a pivot for the lift lever. This screw should allow the lift lever to be raised by the latch bar to its maximum height without binding but also without any additional play.

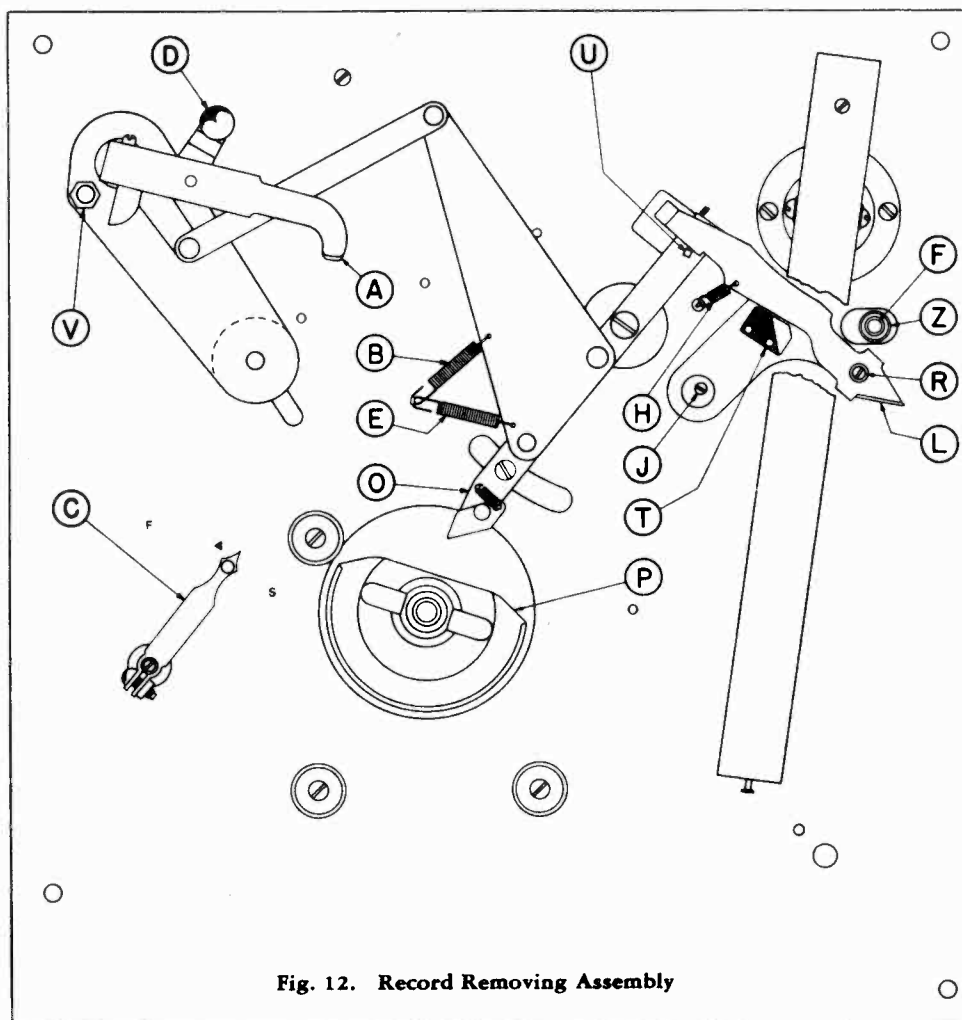


Fig. 12. Record Removing Assembly

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The spring (E) is used to return the unloading lever (O) until the square pin engages the notch.

The spring (B) is used to pull the unloading lever into a position to engage with the motor cam when the trip mechanism releases the square pin.

The mechanism is designed to trip on a spiral trip groove record when the phonograph needle is $1\frac{3}{4}$ inches from the edge of the hole in the center of the record.

When eccentric or oscillating trip groove records are used, tripping is effected by means of the hardened steel pin in the end of the tonearm lift crank (S) Fig. 15 engaging the serrated block on the trip lever (T) Fig. 12. Note that there must be a minimum of $\frac{1}{2}$ inch play between the end of the pin and the block, when, with a short needle ($\frac{5}{8}$ inch minimum length) the pickup is resting on one record on the turntable.

Shift Mechanism 10 to 12 Inch

This mechanism is manually controlled by the lever (D) Fig. 12 and has three functions. First, the Record Removing Mechanism is directly shifted by the movement of the control lever and is put in a position to handle the records desired. Second, the tonearm stop (F) Fig. 12 is directly shifted from the 10-inch record position to the 12-inch record position by the movement of the control lever and places the tonearm in the correct position to play 12-inch records. Third, an automatic mechanism is provided for changing the tonearm stop from the 12-inch record position back to the 10-inch record position. This shift takes place *after* the control lever has been moved, and at a time during the cycle of normal operation of the unit when the phonograph needle is elevated above the playing surface of the record. The purpose of this delayed shifting of the tonearm stop is to prevent the phonograph needle from being dragged across the playing surface of a 12-inch record, if the control lever were for any reason thrown from the 12-inch position to the 10-inch position.

If, after putting the control lever in the 10-inch record playing position and the unit run through its complete cycle, the tonearm stop fails to shift to the 10-inch record position, check the tonearm stop latch (G) Fig. 13. This latch should be so adjusted that the latch dog clears the notch in the dashpot support plate (K) Fig. 13 by slightly less than $\frac{1}{4}$ inch when the latch bar (O) Fig. 12 is in the farthest position which the cam (P) Fig. 12 will carry it. Adjustment is made by loosening the clamping screw, and shifting the cam (M) Fig. 13 to the desired position.

If the tonearm stop (F) Fig. 12 shifts from the 12-inch record position to the 10-inch record position simultaneously as the control lever (D) Fig. 12 is moved from the 12-inch record position to the 10-inch record position, then check the pickup stop latch (G) Fig. 13. This latch must work freely with no binding. If the pickup stop latch works freely but the dashpot support plate (K) Fig. 13 is not being swung far enough for the notch to engage the pickup stop latch (with the control lever (D) Fig. 12 in the 12-inch record position), then adjust the cam (W) Fig. 13. This adjustment must be set so that the latch just drops into the notch with practically no clearance.

CAUTION: If any change is made in the setting of the cam (W) Fig. 13 then all of the adjustments described under "Tonearm Lowering Mechanism" must be checked.

TONEARM LOWERING MECHANISM

The tonearm lowering mechanism has two functions. First it lowers the phonograph needle gently to the surface of the record approximately $\frac{1}{2}$ inch in from the edge of the record. This is accomplished by the stop (X) Fig. 15 on the underside of the tonearm coming in contact with the floating collar (Z) Fig. 12 on the dashpot stem as the tonearm swings outwardly. Note that as the tonearm stops strikes the floating collar, the collar is tilted against the dashpot stem, the dashpot stem acting as a stop. The tonearm support shelf now comes

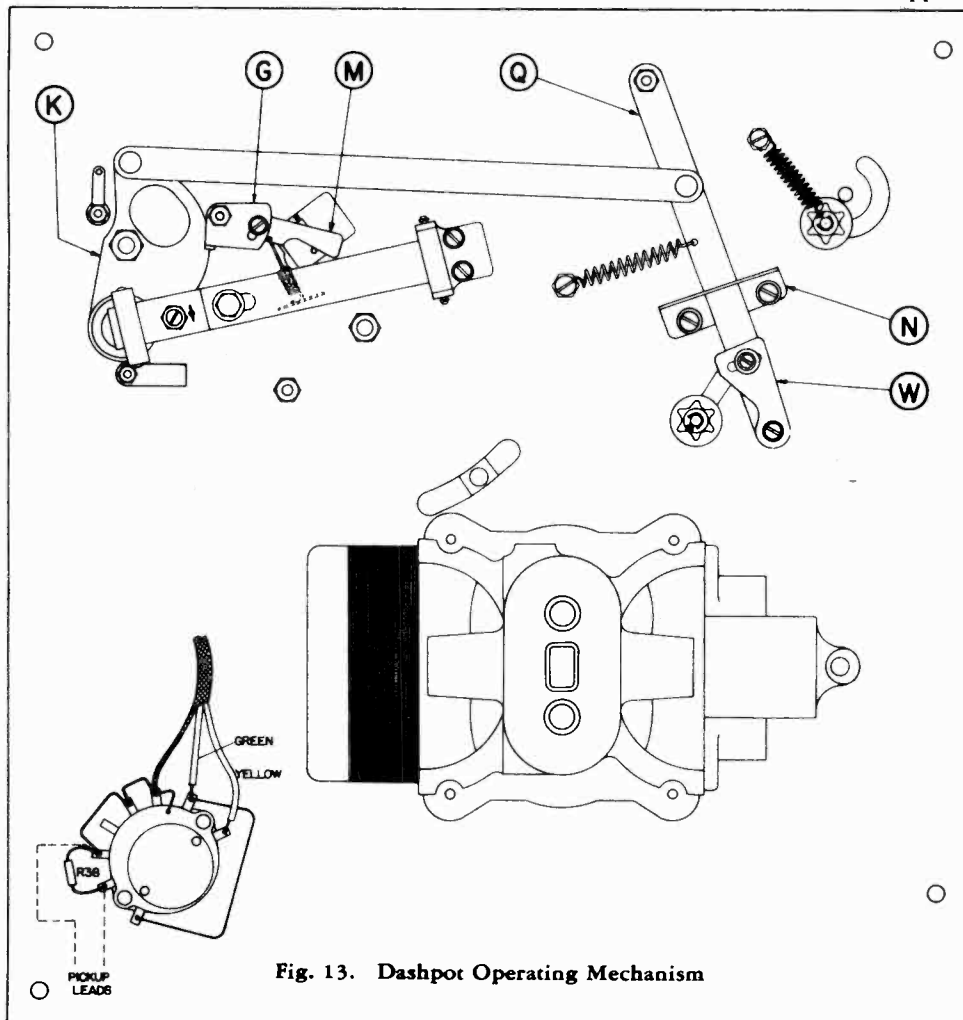


Fig. 13. Dashpot Operating Mechanism

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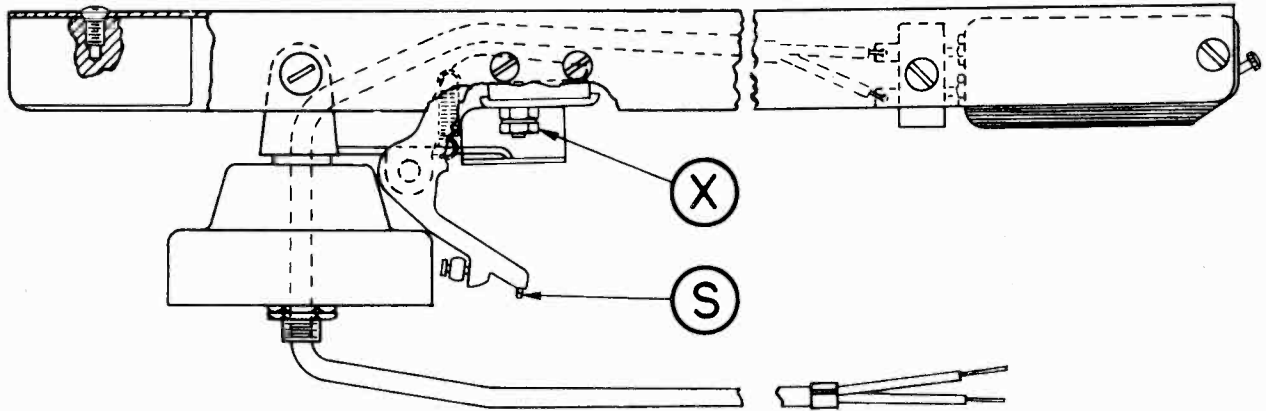


Fig. 15. Tonearm

to rest on the tip of the dashpot and the tonearm is lowered until the phonograph needle comes to rest on the record.

The second function of the tonearm lowering mechanism concerns the feeding of the needle in toward the center of the record so that the needle will enter the playing groove. This feeding in of the needle takes place after the needle comes in contact with the record and at a time when the tip of the dashpot drops away from the tonearm support shelf allowing the floating collar (Z) Fig. 12 to right itself. As the floating collar drops back to its normal position the needle is fed in toward the center of the record.

If the tonearm descends too fast or too slow, adjust the speed of descent by turning the knurled thumb nut (I) Fig. 14 on the dashpot.

If the phonograph needle is not being lowered on the surface of the record approximately $\frac{3}{8}$ inch in from the edge of the record, the following adjustments will have to be checked. CAUTION: As each adjustment is dependent upon the preceding adjustment, all adjustments must be made in the order given or unnecessary trouble will be experienced.

1. Set the control lever (D) Fig. 12 in the 12-inch record playing position, and with a 12-inch record on the turntable, stop the unit with the tonearm in the maximum raised position. Then check the clearance between the underside of the tonearm support shelf and the tip of the dashpot. This clearance must be very slight or the tonearm will tend to bounce as it is lowered. There must be sufficient clearance however to allow the tonearm to swing out far enough so that the stop (X) Fig. 15 on the underside of the tonearm will tilt the floating collar (Z) Fig. 12 against the dashpot stem and form a positive stop. If adjustment is required, the height of the dashpot may be regulated by loosening the nuts on the bottom of the lift lever stud (W) Fig. 14 and changing their position on the stud. To raise the dashpot turn the nuts clockwise. Be sure to lock the nuts tightly together after adjustment is made.

2. Start the unit in motion and allow the tonearm to descend. If the needle does not set down on the record approximately $\frac{3}{8}$ inch in from the edge of the record, change the position of the stop (X) Fig. 15 on the underside of the tonearm until the needle does set down approximately $\frac{3}{8}$ inch in. To adjust the position of the stop (X) Fig. 15 turn the screw on the side of the tonearm.

3. Set the control lever (D) Fig. 12 in the 10-inch record playing position, and with a 10-inch record on the turntable, stop the unit with the tonearm in the maximum raised position. Now grasp the tonearm and swing it outwardly to make sure it is firmly against the stop. Now start the unit in motion. The needle should set down on the record approximately $\frac{3}{8}$ inch in from the edge of the record. If adjustment is required, loosen the clamping screws which hold the stop plate N Fig. 13 on the underside of the base plate, sufficiently so that the stop plate may be tapped with gentle blows in the direction desired. To allow the needle to be set down farther away from the center of the record, move the stop plate in a direction away from the dashpot. After resetting the stop plate, lock it in place and repeat the procedure outlined from the beginning of adjustment No. 3. When the adjustment is completed, give the stop plate locking screws a final tightening to assure that the stop plate is firmly located, or the lever (Q) Fig. 13 in snapping from the 12-inch record playing position to the 10-inch record playing position will shift the stop plate from its correct setting.

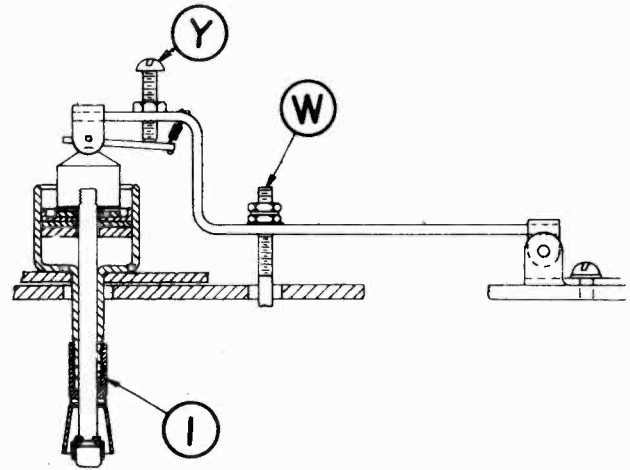


Fig. 14. Dashpot and Lift Lever

4. With control lever (D) Fig. 12 in the 10-inch record playing position and with a 10-inch record on the turntable, stop the unit with the tonearm in the maximum raised position. Then check the clearance between the underside of the tonearm support shelf and the tip of the dashpot. This clearance must be very slight (see adjustment No. 1). If adjustment is required, the height of the dashpot may be regulated by means of the adjusting screw (Y) Fig. 14 on the underside of the dashpot lift lever. Be sure to tighten the lock nut after making this adjustment.

Stock No.	Description	List Price
RECORD UNLOADING ASSEMBLY		
RA-310	ASSEMBLY—Unloading lever assembly and record unloading arm (O & A)	3.75
RA-406	ARM—Record unloading arm assembly (A)	1.75
RL-922	LEVER—Shift lever (from 10 in. to 12 in.) (D) . . . . .	.75
RP-103	PLATE—Shift plate (10 in. to 12 in.) washers and unloading arm stud	\$1.50
RP-104	PIN—Unloading lever stop pin and screw . . . . .	.10
RP-105	PAWL—Pawl, spring, pivot, and pin . . . . .	.30
RS-434	SPRING—Pawl tension spring on end of unloading lever (Pkg. of 5) . . . . .	.10
RS-860	SCREW—Arm adjustment screw and lock nut . . . . .	.10
RS-435	SPRING—Unloading lever springs (Pkg. of 2) (B&E) . . . . .	.10
RS-385	STOP—Arm stop stud and lock nut (V) . . . . .	.20
RS-436	SPRING—Shift lever tension spring (Pkg. of 5)10
RS-861	SCREW—Unloading lever pivot screw and washers10

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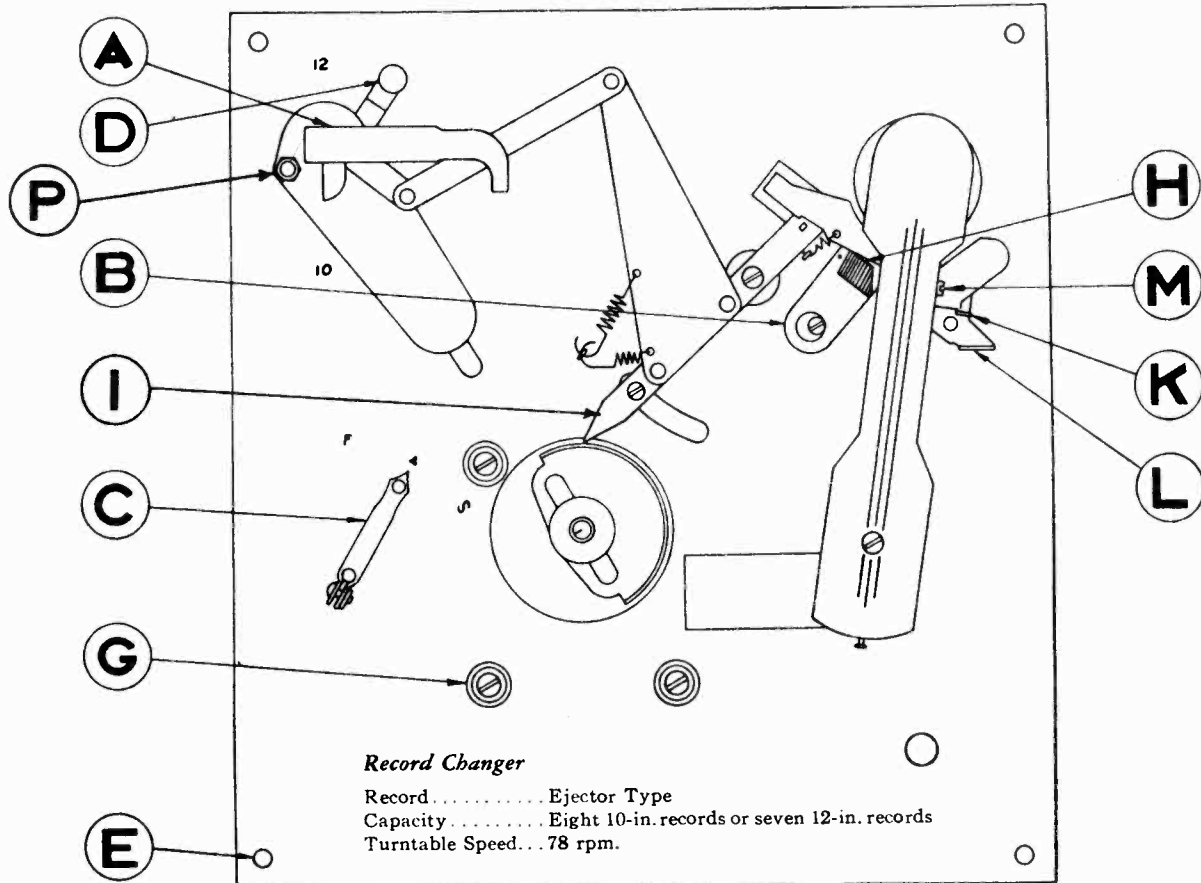


Fig. 8. Automatic Record Changer Mechanism

AUTOMATIC RECORD CHANGER

The record-changing mechanism used in this receiver has been designed to be simple and fool-proof. Under normal operating conditions, service difficulties should be negligible. Occasionally, however, certain adjustments may be required. These adjustments are explained in the following paragraphs. It is important when servicing the automatic record changer to have it placed on a level support. It is also important to refrain from forcing the mechanism if there is a tendency to bind or jam, since bent levers and possibly broken parts may result.

Operating Instructions and Service Adjustments

The record changer is designed to automatically play eight 10-inch or seven 12-inch standard 78 RPM phonograph records on one side. The last record remains on the turntable and repeats until more records are placed on the turntable or the mechanism is stopped.

To play 12-inch records, referring to Figure 8, pull the thumb stop (K) on the right-hand side of the tonearm forward which allows the needle to locate on the edge of the record, also push the knob (D) at the left rear corner of the changer from 10 inch to 12 inch as marked on the base plate. Either 10-inch or 12-inch records may be repeated as often as desired by lifting the record removing arm (A) to an upright position.

To reject a record from the turntable while playing, pull the lever (L) at the right side of the turntable.

Motor Adjustments

The speed of the turntable motor is controlled by a governor which allows correct adjustment of the turntable rotation to

78 revolutions per minute. A pointer is provided under the turntable and the base plate is marked "F" and "S" to indicate direction to move pointer for faster or slower operation. A check of the turntable rotational speed may be made by placing a piece of paper under a record on the turntable and counting the number of times it rotates past a fixed point in one minute.

The motor bearings and gears are properly lubricated for long operation under normal weather conditions. If the motor chatters or runs uneven, place a few drops of light machine oil on the governor felt.

Trip Mechanism

While playing a record, the tonearm lifting mechanism (L) and the record removing arm (A) are held out of engagement with the motor cam by means of a latch which is formed by the vertical square pin in the pointed latch lever (I) and the notch in the side of the tonearm lift lever (L). This pin should engage the notch approximately one-half its depth, and is adjusted thus by means of an eccentric washer and screw in the trip lever (B) upon which is mounted the cerrated block (H).

The latch is held closed by means of a spring between the latch bar and the trip lever. Be sure the parts work freely without binding so that they will latch when the latch bar swings back past the notch after a record has been removed.

The record changer is designed to trip on an eccentric trip groove record. The eccentric trip is effected by means of a hardened steel pin which is pressed into the end of the tonearm lift crank. This pin ratchets over the top of the grooves in the cerrated block (H) on the trip lever (B). When the eccentric groove in the record swings the tonearm back and

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forth it pushes the latch out of engagement. Care should be taken to insure that there is at least $\frac{1}{2}$ in. clearance for the end of the pin to raise over the serrations to provide the ratchet action, when using a short phonograph needle riding on top of one record on the turntable.

The oval head machine screw, which serves as a pivot at the right-hand end of the left lever (L), should be set at such a height to allow the lift lever to be raised by the latch bar and so the roller is able to pass under the end of the lift lever without binding and also without too much clearance.

Unloading Mechanism

The record changer is intended to be operated with at least one record on the turntable in order to prevent the needle from damaging the turntable covering.

The motor mounting screws (G) should be adjusted so that the elevation of the turntable from the base plate to the top of one record is one inch.

The set screw and lock nut on the projecting member under the record removing arm (A) is provided for adjusting the elevation of the record separating and lifting finger. This screw should be adjusted so that the finger will remove the second record on the table but barely rise over, and not remove, the first record.

Record Lift Adjustment

To adjust the lift of a record while removing it from the turntable shaft and table the latch bar (I) should be placed in a position at its farthest throw against the face of the cam mounted on the motor spindle. Place a record between the separating finger and lever (A), the same way as the changer holds it while removing it. Let the other side of the record lie on top of the first record on the table. Adjust the lift by means of the eccentric stud and nut (P) at the left of the record removing assembly until the center hole of the record is off the turntable shaft and swings free of it.

Tone Arm Lowering

To adjust for the proper lowering of the tone arm on the edge of a 10-inch record (the difference for the 12-inch record

is adjusted at the factory) the screw above the shelf on the right side of the tone arm is provided for moving the tone arm stop right or left until the needle will lower to approximately $\frac{1}{8}$ in. from the edge of the record.

To adjust the proper vertical clearance of the tonearm vertical pivot bearing, two jam nuts are provided on the end of the pivot sleeve, under the changer base plate. These nuts may be adjusted to take up unnecessary play.

Dash Pot Adjustment

Place the tonearm of the record changer in the position which results when the latch bar (I) is against the turntable motor cam at its furthest operating throw. (This position is the other extreme of the operating cycle as shown on Figure 8.) The tonearm stop should be against the cone-shaped cup of the dash pot while in the 10-inch position.

Raise or lower the dash pot plunger by means of the two lock nuts which control the lift of the dash pot lever under the changer base plate. Adjust these two nuts so that there is a clearance of a post card thickness between the dash pot leather tip and the under-side of the tonearm shelf.

Lowering Speed of Dash Pot

The top of the dash pot is provided with a knurled screw cap for adjusting the lowering speed of the dash pot. In case the tone arm descends too fast, put a drop of light machine oil on the plunger above this cap and allow it to work into the felt packing gland. Tighten or loosen the cap to obtain the desired lowering speed.

Crystal Pickup

The pickup used in the phonograph unit is of the piezo electric crystal type. The crystal cartridge (#1 Fig. 9) is a factory sealed unit and no adjustments are provided. The pickup and tonearm assembly should require very little servicing and if treated with reasonable care should perform its function without attention for long periods of time.

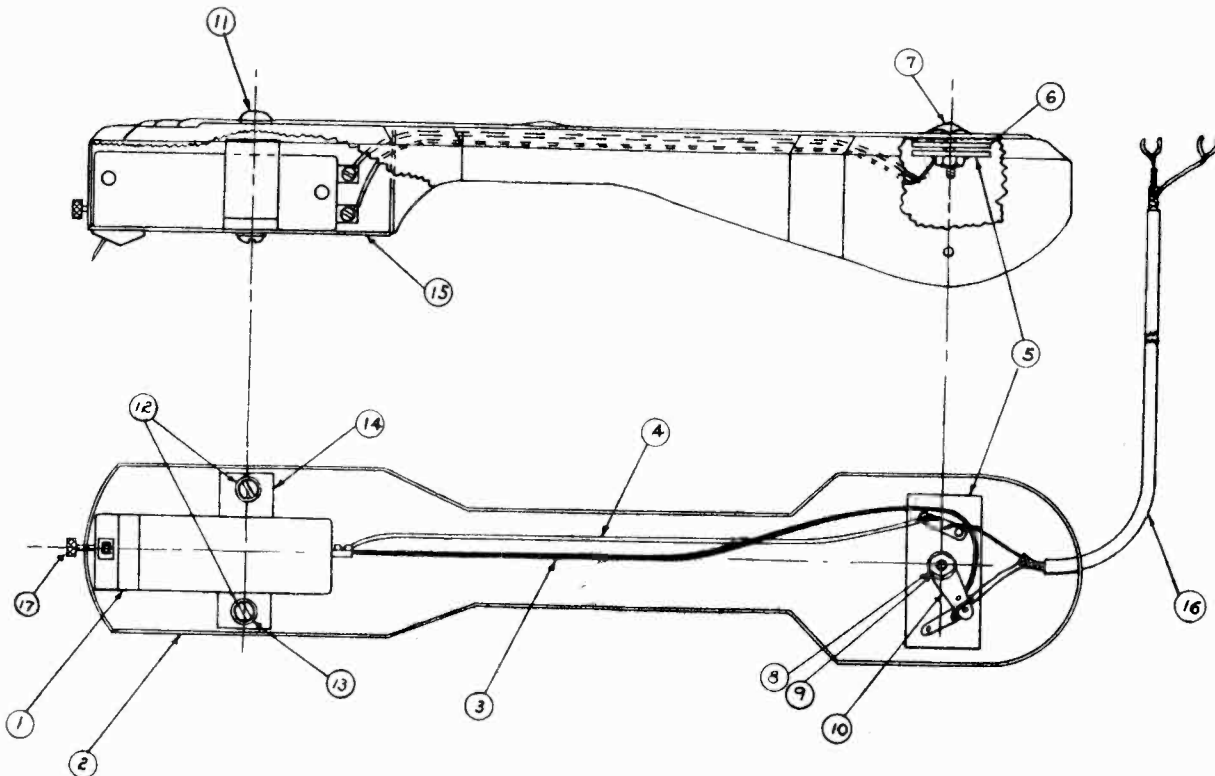


Fig. 9. Piezo Electric Crystal Pickup

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Stock No.	Description	List Price	Stock No.	Description	List Price
RPS-301	SWITCH—Radio-Phono Switch.....	\$1.00	RPP-004	PICKUP—Pickup Unit Complete.....	\$11.00
RPX-002	SPRING ASSEMBLY—Suspension Springs, Washer and Bolt Assembly for Motor Board—One Bolt, Two Springs, One Rubber Tubing, One Washer and Two Nuts.....	.50	RPP-005	PLATE—Pickup Cartridge Plate (15)....	.15
RPA-003	ASSEMBLY—Latch Bar and Pawl Assembly (1).....	\$1.55	RPS-013	SCREW—Needle Screw (17).....	.05
RPB-001	BASE PLATE—14" x 15" Base Plate (Brown Enamel Finish).....	3.20	RPS-014	STRIP—Terminal Strip Assembly (5)....	.50
RPC-001	CAM—Motor Cam.....	.85	RPW-010	WIRE—Lead Wire (Black) (3).....	.10
RPH-001	HANDLE—Mechanism 10 in.-12 in. Change Handle.....	.75	RPW-011	WIRE—Lead Wire (White) (4).....	.10
RPL-001	LEVER—Lift Lever Complete.....	1.30	TONEARM SUPPORT AND OPERATING ASSEMBLIES		
RPL-002	LEVER—Motor Speed Regulator Lever..	.30	RPA-005	ASSEMBLY—Tonearm Base and Lift Mechanism Complete.....	4.00
RPL-003	LEVER—Trip Lever Complete.....	1.00	RPB-002	BASE—Tonearm Base Only (with Mtg. Screws).....	.55
RPP-001	PIN—Groove Pin for Mounting Unloading Arm.....	.10	RPB-003	BRACKET—Bracket Upon Which Tonearm is Mounted.....	1.00
RPP-002	PLATE—Sliding Plate for Mounting Unloading Arm.....	.85	RPB-004	BUSHING—Tonearm Support Bushing....	.15
RPP-003	PLATE—Turntable Drive Plate (metal)..	.C	RPC-005	CRANK—Tonearm Lift Crank.....	1.75
RPR-001	RIVET—Rivet for Fastening Latch Knee to Latch Bar (Pkg. of 10).....	.05	RPH-002	HOOK—Tonearm Support Hook.....	.10
RPR-002	ROLLER—Roller Used in Crescent-shaped slot.....	.10	RPN-001	NUT—Nut for Holding Pivot in Tonearm Base (Upper).....	.10
RPS-001	SCREW—Latch Bar Mounting Screw.....	.10	RPN-002	NUT—Nut for Holding Pivot in Tonearm Base (Lower).....	.10
RPS-002	SCREW—Lift Lever Screw (Pkg. of 5)....	.20	RPP-006	PIN—Lift Crank Cotter Pin (Pkg. of 10)..	.05
RPS-003	SCREW—Motor Cam Set Screw (Pkg. of 10).....	.25	RPS-015	SCREW—Tonearm Adjusting Screw (M)...	.10
RPS-004	SCREW—Screw Which Holds Unloading Mechanism to Sliding Plate (Pkg. of 10).....	.50	RPS-016	SCREW—Tonearm Support Adjusting Screw, Lock Washer, Spring Washer and Nut.....	.15
RPS-005	SCREW—Sliding Plate Spring Stud (Pkg. of 10).....	.10	RPS-017	SCREW—Tonearm Support Mounting Screw (Pkg. of 10).....	.05
RPS-006	SCREW—Trip Lever Mounting Screw (Pkg. of 10).....	.10	RPS-018	SPRING—Lift Crank Spring (Pkg. of 5)...	.10
RPS-007	SPRING—Latch Bar Coil Spring.....	.10	RPS-019	STOP—Adjustable Needle Stop (K).....	.10
RPS-008	SPRING—Latch Bar Pawl Tension Spring (Pkg. of 5).....	.60	RPS-020	SUPPORT—Upper Tonearm Support (Bracket).....	.30
RPS-009	SPRING—Lift Lever Spring (Pkg. of 5)....	.15	RPS-021	SUPPORT—Lower Tonearm Support.....	.50
RPS-010	SPRING—Sliding Plate Coil Spring (Pkg. of 5).....	.15	RPW-012	WASHER—Lift Crank Washer (Pkg. of 10).....	.05
RPS-011	SPRING—Speed Regulator Lever Spring (Pkg. of 5).....	.25	RPW-013	WASHER—Washer Used Above and Below Tonearm Bracket Bearing (Pkg. of 10)..	.10
RPS-012	STUD—Unloading Arm Bumper Stud and Nut (P).....	.25	UNLOADING ARM ASSEMBLY		
RPT-001	TURNTABLE—12 in. Turntable (Complete).....	2.75	RPA-006	ASSEMBLY—Unloading Arm Assembly (Complete).....	1.75
RPW-001	WASHER—Eccentric adjustment Washer for Trip Lever.....	.10	RPS-022	SCREW—Unloading Arm Adjusting Screw, Nut and Lock Washer.....	.10
RPW-002	WASHER—Sliding Plate Washer (Pkg. of 5).....	.10	DASH POT ASSEMBLY		
RPW-003	WASHER—Sliding Plate Washer (1/4 in. Hole) (Pkg. of 5).....	.15	RPC-006	CAP—Dash Pot Adjusting Cap.....	.25
RPW-004	WASHER—Star Mounting Washer (1/4 in. Hole) (Pkg. of 10).....	.20	RPD-001	DASH POT—Dash Pot Only.....	1.00
RPW-005	WASHER—Turntable Drive Washer (Rubber).....	.05	RPF-001	FELT—Dash Pot Adjusting Cap Felt (Pkg. of 10).....	.40
RPW-006	WASHER—Washer Used Between Latch Bar and Base Plate (Pkg. of 10).....	.25	RPL-001	LEATHER—Dash Pot Leather (Pkg. of 5).....	1.00
RPW-007	WASHER—Washer Used Under Star Washer (Pkg. of 10).....	.10	RPL-002	LEVER—Dash Pot Lift Lever, Screw and Nut.....	.20
RPW-008	WASHER—Star Tension Washer (Pkg. of 10).....	.20	RPN-003	NUT—Dash Pot Mounting Nut (Pkg. of 5).....	.40
RPW-009	WASHER—Trip Lever Mounting Washer (Pkg. of 10).....	.10	RPP-007	PLUNGER—Dash Pot Plunger Assembly....	.70
MOTOR ASSEMBLIES			RPS-023	SPACER—Dash Pot Lift Lever Spacer....	.15
RPM-001	MOTOR—Motor Complete with Cam—78 R.P.M. 115 V. 60 Cycles.....	17.50	RPS-024	SPRING—Dash Pot Lift Lever Spring (Pkg. of 5).....	.10
RPM-002	MOTOR—Motor Complete with Cam—78 R.P.M. 115 V. 50 Cycles.....	17.50	RPW-014	WASHER—Dash Pot Felt Washer (Pkg. of 10).....	.30
RPM-003	MOTOR—Motor Complete with Cam—78 R.P.M. 115 V. 40 Cycles.....	19.00	RPW-015	WASHER—Dash Pot Washer (Small) (Pkg. of 5).....	.15
RPM-004	MOTOR—Motor Complete with Cam—78 R.P.M. 115 V. 25 Cycles.....	19.00	RPW-016	WASHER—Dash Pot Washer (Large) (Pkg. of 5).....	.25
RPX-001	MOUNTING ASSEMBLY—Motor Mounting Spacer, Two Rubber Washers, Plain Washer, and Screw.....	.15	RPW-017	WASHER—Dash Pot Weight Lock Washer (Pkg. of 10).....	.10
PICKUP AND TONEARM ASSEMBLIES			RPW-018	WEIGHT—Dash Pot Weight.....	.10
RPA-004	ARM—Tone Arm (2).....	1.10	MISCELLANEOUS ASSEMBLIES		
RPC-002	CRYSTAL—Crystal Cartridge Assembly (1).....	6.75	RPB-005	BOARD—Terminal Board for Pickup Leads.....	.15
RPC-003	CLAMP—Cartridge Support Clamp (14)....	.35	RPB-006	BOARD—Resistor Board (Chassis Front Center).....	.10
RPC-004	CORD—Pickup Extension Cord (16).....	.25	RPC-007	CABLE—Phonograph Input Cable.....	.40
RPK-001	KNOB—Blank Tonearm Knob (Diamond Shape) (7).....	.35	RPC-008	CORD—Phonograph Power Cord (Complete).....	.80
			RPP-008	PLATE—Radio-Phono Switch Plate.....	.25
			*RPP-009	PLUG—Two Contact Male Connector (RP-025) Plug—Round.....	.20
			RPR-003	RESISTOR—330,000 Ohm 1/4 Watt Carbon (Pkg. of 5).....	.70
			(RQ-119)		
			RECORD CHANGER MECHANISM ASSEMBLY		
			RPA-001	ASSEMBLY—Unloading Arm and Latch Bar Assembly.....	4.75
			RPA-002	ASSEMBLY—Latch Bar Assembly.....	2.80

GENERAL ELECTRIC CO.

MODEL LRP-158

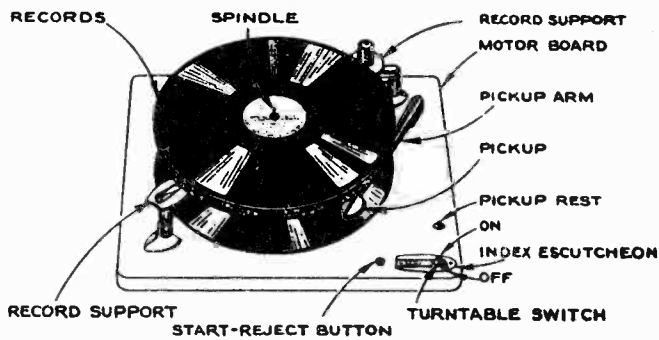


Fig. 1

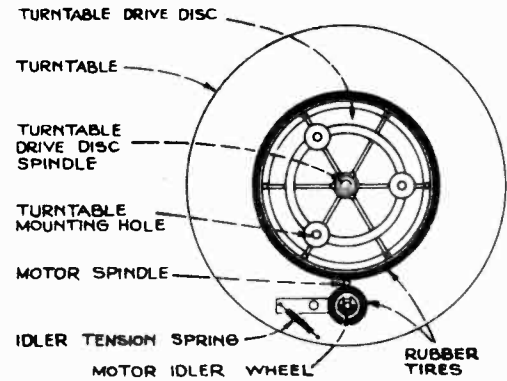


Fig. 2

GENERAL

This record changer is designed to operate on a 110 volt 60 cycle power supply. It will automatically play twelve 10-inch or ten 12-inch records at a single loading. It will not play 10-inch and 12-inch records intermixed. The various controls are shown in Fig. 1.

OPERATION

Before loading, see that the pickup is in the rest position. If it is locked in some position other than on the rest, remove any records that might be on the supports and complete the change cycle by throwing the turntable switch ON. The pickup will follow through a change cycle and stop on the pickup rest. Throw the turntable switch OFF and the mechanism is ready for loading.

For 10-inch records, turning the record support in the near left-hand corner one half a turn counterclockwise will position both the record support and the record separator for the smaller diameter records. For 12-inch records the record support should be turned one half a turn clockwise.

With the turntable switch ON, pressing the Start-Reject button will start the mechanism and the entire series of records will play without any further attention. After the last record has been played, the pickup will return to its rest and the turntable switch should be turned OFF.

To reject a record, press the Start-Reject button.

CAUTIONS

1. Never use force to start or stop the motor or any part of the record changing mechanism.
2. The use of warped or damaged records may cause the mechanism to jam.
3. The use of cracked or chipped records may damage the sapphire.
4. The records should not be left on the record posts or on the turntable as they may warp, particularly in warm climates.
5. The use of warped records may result in unsatisfactory reproduction since they tend to slide on one another. Warped records may be flattened by placing them on a flat surface and loading them with a heavy flat article for a few days.
6. If the mechanism should stall, throw the turntable switch OFF and remove the records from the posts. Start the turntable by throwing the switch ON and allow the pickup arm to complete its cycle. (See Service Adjustments.)
7. Do not tighten the copper-plated, cone-pointed screws until final adjustment has been made.

LUBRICATION

The LRP-158 turntables are driven by a drive disc screwed to the turntable. It is important that the drive motor spindle and the rubber tire on the friction drive disc as well as that on the idler wheel be kept clean and free from oil, grease, dirt, or any foreign material at all times. Any quick drying naphtha is satisfactory for cleaning these parts. The drive motor bearing is lubricated from felt washers at the bottom and top. A light machine oil should be used at these points.

On all bearing surfaces except the motor bearings Houghton Stayput No. 320 should be used. On all other surfaces Lubriplate No. 110 is recommended.

REPLACEMENT OF SAPPHIRE

The sapphire is cemented in the pickup with a rubber cement (such as Goodrich Plasticon). To remove the sapphire grasp it firmly with a pair of tweezers, give it a few turns to loosen the cement and then pull it out. Much easier handling of the sapphire will result if the tweezers are first notched with a file as shown. Naphtha may be used as a thinner should difficulty with the cement be experienced.

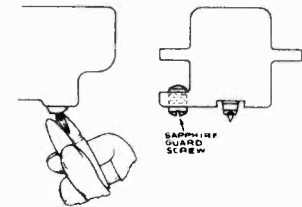


Fig. 3

Before inserting the new sapphire it should be dipped in the rubber cement, previously thinned with naphtha. After insertion, clean the point with naphtha.

TO REMOVE THE TURNTABLE

To remove the turntable, loosen setscrews "A" and raise the turntable (see Fig. 7).

TO REMOVE THE PICKUP ARM

One of the pickup arm bearings has a slotted head and can be turned out to facilitate removal of the pickup arm. Raise the pickup arm and loosen the bearing setscrew. Turn the bearing partly out through the hole in the side of the pickup arm and lift the arm off.

FOR OTHER DATA SEE RCA RP-158

MODEL LRP-158

GENERAL ELECTRIC CO.

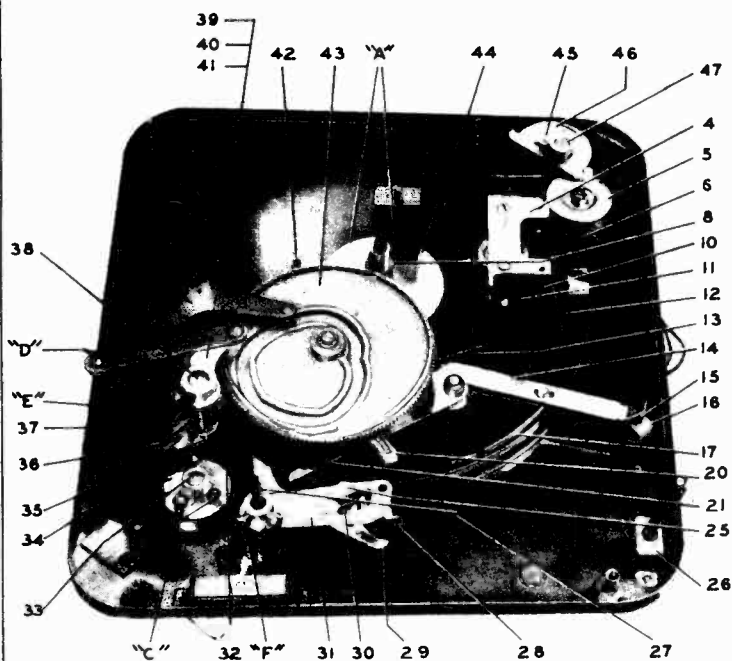


Fig. 4

DESCRIPTION OF PRINCIPAL PARTS

Symbol	Function
1	Lift rod cushion
2	Oval head screw
3	Pivot arm spring
4	Bottom bearing and bracket
5	Record support belt drum
6	Motor field coil assembly

Symbol	Function
7	Steel ball for tone arm bearing
8	Drive gear
9	Record separator cap
10	Motor mounting bracket
11	Motor mounting grommet
12	Motor tension spring
13	Tone arm lever spring
14	Reject lever
15	Reject button
16	Speed nut for reject button
17	Drive belt
18	Record separator shaft bottom spring
19	Record separator spring
20	Ratchet lever
21	Tone arm lever
22	Separator support
23	"C" washer
24	"C" washer
25	Trip lever stud
26	ON-OFF switch
27	Lift rod
28	Trip pawl
29	Tone arm return lever
30	Trip lever pawl spring
31	Trip lever
32	Index finger
33	Record separator swivel shaft
34	Record separator belt drum
35	Record separator belt drum spring
36	Drive pin
37	Tone arm segment
38	Record separator shaft
39	Record separator lever
40	Record separator link
41	Record separator crank
42	Ratchet lever spring
43	Main cam
44	Drive shaft cam
45	Record support shaft cam pin
46	Record support shaft cam
47	Record support and shaft

CYCLE OF OPERATION *

When the Record Support is turned to its desired position, the Record Separator post is positioned by means of a belt drive (17). Loading the record supports pushes the separator shaft (38) down against its spring and carries the tone arm segment (37) free of the index finger (32). When the Start-Reject button is pressed, the reject lever (14) is moved in and pushes the ratchet lever (20) out of the eccentric step in the main gear (43) shaft and releases the drive cam pawl. The drive cam pawl engages with the toothed wheel, carrying the drive gear (8) with it as it revolves. Revolving with the drive gear are the main cam and gear (43). The tone arm elevating lever rides on the ridge of the main cam (43), raising the tone arm by means of the elevating rod (27). The stud on the tone arm lever (21) rides in the top track on the main cam (43), moving the tone arm out and pushing on the trip lever stud (25). As the trip lever (31) moves out, the tone arm return lever (29) is carried along with it, by the trip lever stud (25) and by the stud on the main cam top track.

until the knife is carried high enough to be moved in, by action of spring (19) over the top of the record. The separator shaft continues to turn until the knife supports all but the bottom record, and the shelf moves out from under the bottom record, allowing it to drop to the turntable. The separator shaft reverses rotation and the tone arm lever (21) moves away from the trip lever stud, moving the tone arm in. The tone arm return lever (29) pushes against the trip lever stud (25), moving the trip lever (31) in.

The index finger (32) on the tone arm return lever (29) moves against the separator shaft (38) to insure proper landing position of the tone arm. The tone arm elevating lever rides down on the main cam ridge (see Fig. 11) thus lowering the elevating rod and tone arm. The knife is returned to its original position by the separator shaft, allowing the stack of records to rest on the shelf. As the sapphire moves in to the first music groove the feed-in spring (see Fig. 10) on tone arm return lever (29) pushes against the stud (25) on the trip lever (31).

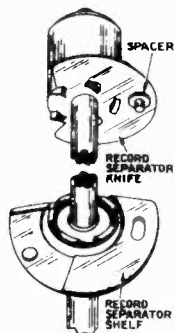


Fig. 5

The stud on the separator lever (39) follows the main cam (43) bottom track, directing the motion of the lever (39), link (40) and crank (41) which rotates the record separator shaft (38).

Record Gauging and Releasing:

The record separator knife turns with the shaft and strikes the edge of the bottom record. The separator shaft continues to revolve as the teeth on the inner circumference of the knife ride up on the shelf teeth

As the record begins to play the ratchet lever (20) rides down into the eccentric step on the main gear shaft and blocks the drive cam pawl, disengaging it from the drive cam wheel. The drive gear and main gear stop rotating.

* The cycle of operation can be studied conveniently by pushing the Start-Reject button and revolving the turntable by hand. Eight turntable revolutions are required for one change cycle.

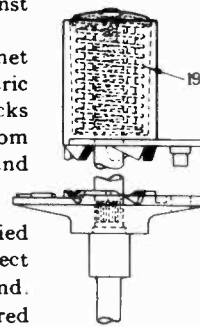


Fig. 6

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MISCELLANEOUS SERVICE HINTS

Symptom	Check
Tone arm continues to repeat playing top record of the stack.	Check adjustment E. Record separator shaft, or the spring on which it rests, is binding on the shaft bushing. Pin on record separator shaft is binding in its slot. Shaft spring is too weak.
Improper landing on 10- and 12-inch records.	Check adjustment F. Feed-in spring bent too far in front of tone arm return lever.
Irregular landing on 10- and 12 inch records.	Check adjustment C. Insufficient tension on belt.
Loud clicking noise resulting from drive cam pawl slipping out of teeth in cam wheel.	Check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud.
Mechanism jams Tone arm continues to come down in rest position.	Check adjustment E. Record separator shaft or the spring on which it rests is binding on the shaft bushing. Pin on record separator shaft is binding in its slot. Shaft spring is too strong.
Trips continuously.	Reject button is binding in its bushing. Reject lever spring is too weak or the reject lever is binding on its guide slots.
Sapphire strikes motorboard.	Bend the pickup arm support bracket until the sapphire clears the motorboard by approximately 3/32 of an inch.

REPLACEMENT PARTS LIST
MODEL LRP-158

Stock No.	Symbol No.	Description	List Price	Stock No.	Symbol No.	Description	List Price
PICKUP AND ARM ASSEMBLIES				MOTORBOARD ASSEMBLIES			
RA-430		ARM—Pickup arm shell only	\$1.00			(Cont.)	
RA-431		ARM—Pivot arm and shaft—less spring	.95	RL-974	20	LEVER—Ratchet lever	\$0.80
RC-5013		CRYSTAL—Pickup crystal cartridge, sapphire and shielded cable	5.00	RL-975	14	LEVER—Reject lever	.25
RC-2072	1	CUSHION—Lift rod cushion (rubber)	.20	RL-976	21	LEVER—Tone arm lever	.45
RN-016		NUT—Speed nut to hold cable in arm	.05	RL-977	29	LEVER—Tone arm lift lever	.15
RP-2021		PLATE—Bottom plate for pickup arm—less screws	.10	RL-978	21	LEVER—Tone arm return lever	.45
RR-949		ROD—Lift rod—less cushion	.50	RL-979	37	LEVER—Tone arm segment—fastens on record separator shaft—less screw	.50
RS-8030	27	SCREW—No. 4-40 x 1/4 in. headless setscrew for pickup arm	.05-5	RL-980	25, 28, 31	LEVER—Trip lever—less pawl spring	.65
RS-8031		SCREW—No. 4-40 x 1/4 in. screw to mount crystal	.05-5	RN-017	16	NUT—Speed nut for reject button	.05-5
RS-8032		SCREW—No. 4-40 x 1/4 in. headless setscrew for pickup crystal (oval point)	.10-5	RP-421	36	PIN—Drive pin for record separator shaft end bushing	.05
RS-8033		SCREW—No. 4-40 x 1/4 in. screw for pickup arm bottom plate	.05-5	RP-422	45	PIN—Record support shaft cam pin	.05
RS-8034		SCREW—No. 6-32 x 1/4 in. headless setscrew for pickup arm	.05-5	*RP-169		PLUG—2 prong male for motor and switch leads	.35
*RS-4017	3	SPRING—Pivot arm spring	.05	RR-950		RATCHET—Ratchet wheel for turntable spindle	.40
RS-521		STUD—Pivot arm spring stud and nut	.10	RS-8035	2	SCREW—Oval head screw for record separator cap	.10
MOTOR ASSEMBLY							
(60 CYCLES)							
RB-401	4	BEARING—Bottom bearing and bracket	.40	RS-8036		SCREW—No. 8-32 x 1/4 in. cone point setscrew for ratchet wheel	.05
RB-402		BEARING—Top bearing and bracket	.40	RS-8037		SCREW—No. 8-32 x 1/4 in. setscrew for ratchet wheel	.05
RB-210	10	BEARING—Motor mounting bracket	.40	*RS-887		SCREW—No. 10-32 x 1/4 in. cone point set-screw for record separator crank trip lever and drum	.30-5
RL-378	6	COIL—Motor field coil assembly	1.50	*RS-8004		SCREW—No. 10-32 x 1/4 in. setscrew for drum, tone arm segment, record separator crank, and trip lever	.05-5
RM-159		MOTOR—105-125 volts, 60 cycle	6.75	RS-641	38	SHELF—Record separator shelf and shaft	1.10
RP-420		PAD—Rotor thrust pad	.05	RS-642		SPACER—Record separator spacer (Washer)	.05
RP-413		ROTOR—Motor rotor complete with fan	1.75	RS-4053		SPRING—Cam pawl and ratchet lever spring	.10
RS-961		SLEEVE—Motor spindle sleeve for 50 cycle conversion	.25	*RS-4017		SPRING—Motor idler arm spring	.05
MOTORBOARD ASSEMBLIES							
RA-432		ARM—Motor idler arm—less wheel	.25	RS-4054	12	SPRING—Motor tension spring	.10
RB-303	7	BALL—1/4 in. steel ball for tone arm bearing	.05	RS-4055	42	SPRING—Ratchet lever spring	.10
*RB-302		BALL—Bearing ball for spindle	.05	RS-4056	35	SPRING—Record separator belt drum spring	.10
RB-647		BEARING—Turntable spindle bearing	.20	RS-4057	18	SPRING—Record separator shaft bottom spring	.10
RB-648	17	BELT—Record support to separator belt	.25	RS-4058	19	SPRING—Record separator spring	.20
RB-1049		BOARD—Motorboard complete with all riveted and welded posts, studs, bearings, and support	7.50	RS-4059		SPRING—Reject button spring	.10
RB-649		BRACE—Angle brace, or bottom support bracket and spindle bearing plate	.65	RS-4060		SPRING—Reject lever spring	.10
RB-650		BUSHING—Record separator shaft end bushing	.30	RS-4061	13	SPRING—Tone arm lever spring	.10
RB-651	15	BUTTON—Reject button	.10	RS-4062		SPRING—Tone arm return lever spring	.10
RC-2073	44	CAM—Drive shaft cam and pawl—less spring	.70	RS-4063	30	SPRING—Trip lever pawl spring	.10
RC-2074	43	CAM—Main cam	1.50	RS-643	47	SUPPORT—Record support and shaft (left hand front post)	1.70
RC-2075	46	CAM—Record support shaft cam	.40	RS-644	22	SUPPORT—Separator support (2 used)	.50
RC-2076	9	CAP—Record separator cap	.50	*RS-3061	26	SWITCH—ON-OFF switch	.30
RD-602		DISC—Turntable drive disc and spindle—less rubber tire and turntable	2.50	RS-962	33	SWIVEL—Record separator swivel and shaft	.75
RD-429	34	DRUM—Record separator belt drum	.40	*RT-937		TIRE—Rubber tire only for drive disc	.75
RD-430	5	DRUM—Record support belt drum	.40	RT-945		TURNTABLE—Turntable finished plate only	1.10
RE-231		ESCUTCHEON—Index escutcheon	.30	*RW-125		WASHER—"C" washer for motor idler arm or idler wheel	.05-2
*RG-304	11	GROMMET—Rubber grommet for motor mounting	.10	RW-134	23	WASHER—"C" washer for ratchet lever, tone arm lift lever, or tone arm lift rod	.05
RS-640		KNIFE—Record separator knife	1.10	*RW-127	24	WASHER—"C" washer for tone arm lever, tone arm return lever, record support belt drum, link, or cam	.05
RL-973	39, 40	LEVER—Link and lever assembly—fastens on record separator shaft	.65	RW-135		WASHER—Felt washer for tone arm bearing	.05
				RW-136		WASHER—Felt washer for turntable spindle bottom bearing	.05
				*RW-922		WHEEL—Motor idler wheel	.55

* Used on previous record players.

Prices subject to change without notice.

MODEL LRP-160

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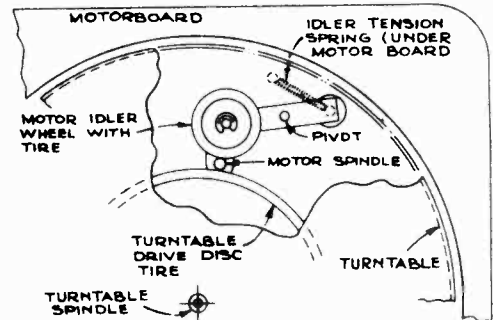
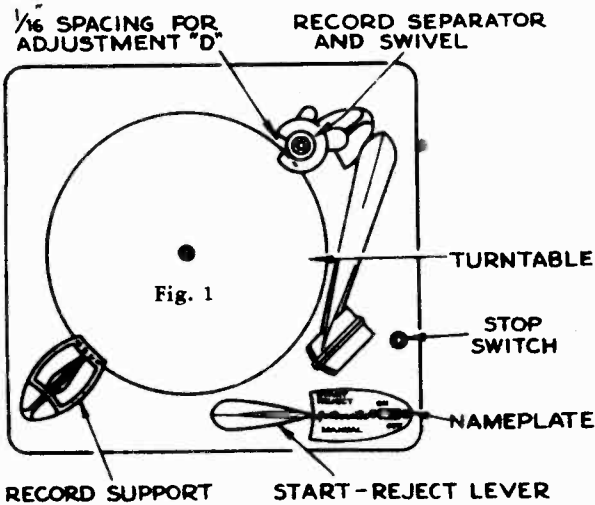


Fig. 2

RECORD SUPPORT START-REJECT LEVER
GENERAL

This record changer is designed to operate on a 110-volt 60-cycle power supply. It will automatically play twelve 10-inch or ten 12-inch records at a single loading. It will not play 10-inch and 12-inch records intermixed. The various controls are shown in Fig. 1.

OPERATION

Before loading, see that the pickup arm is in its rest position. If it is locked in some position other than on the rest post, remove any records that might be on the record supports and complete the change cycle by throwing Power Switch ON and turning the Control Lever to START-REJECT position and release. The turntable will revolve and the pickup will swing through its cycle of motion, and come to rest on the Stop Switch, turning OFF power.

The record support in the front left-hand corner must be turned for its correct position for 10-inch or 12-inch records as required. Turning the front record support automatically positions the rear support.

With the changer loaded and the turntable switch ON, pushing the START-REJECT lever to its "Start" position will start the change cycle allowing the first record to drop to the turntable and the pickup arm to move into playing position. The whole series of records will play through without further attention. When the last record is played, the pickup comes to rest on the Stop Button switch, thus shutting OFF the motor.

To reject a record being played, push the "START-REJECT" lever to "START-REJECT" position and let go.

For automatic operation, each record must have the standard eccentric groove.

CAUTIONS

Before servicing the automatic changer, inspect the assembly to see that all gears, cams, springs, levers, etc. are correctly assembled and in good working order.

1. Never use force to start or stop the motor or any part of the record changing mechanism.
2. Warped or damaged records may cause the mechanism to jam. When jamming occurs, the safety clutch slips, causing a clicking sound.
3. A cracked or chipped record may damage the sapphire.
4. Warped records may slide on one another while playing and result in unsatisfactory reproduction.
5. Do not leave the records on the record posts or on the turntable as they may warp, particularly in warm climates. Warped records may be flattened by placing them on a flat surface with a heavy flat article placed on top of them for a few days.
6. If, for any reason, the mechanism stalls, turn off the turntable switch and remove the records from the posts. Start the turntable by turning the switch ON and allow the pickup arm to complete its cycle.
7. Do not tighten copper-plated, cone-pointed screws until final adjustment has been made.

PICKUP SERVICE

Specifications

Output at 400 cycles	0.5 volts
Impedance at 1000 cycles	75,000 ohms

Replacement of Complete Unit

Simply slide the unit out of the tone arm and insert a new one.

Replacement of Sapphire

CAUTION: Never bend the sapphire support wire. Slide the pickup forward out of the arm.

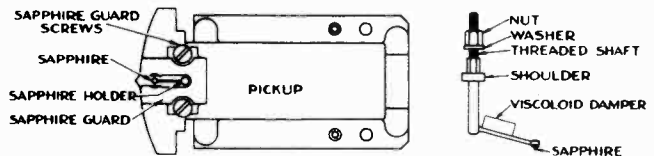


Fig. 3

The nut on the sapphire holder assembly is locked by a light cement (such as Glyptal). Extreme care should be used when loosening the nut so that the twisting motion does not break the crystal.

Remove the two screws holding the sapphire guard in place and take the guard off. Remove the small nut and washer on the threaded shaft of the sapphire holder and push the shaft through the hole in the viscoloid until the sapphire holder assembly comes free.

Insert threaded shaft of replacement sapphire holder through viscoloid and replace the washer and nut. Make sure that the flat sides of the shaft are firmly in place in the clamp and then tighten the nut very carefully so as not to strip the threads nor break the crystal. Replace the sapphire guard, positioning it by means of the oversize screw slots. Make certain that the sapphire and its supporting wire are centered in the guard. Tighten the guard screws. Before using, check to see that the sapphire projects far enough beyond the guard so that the guard will not strike the record. If necessary, bend the guard a little. Apply a drop of light cement (such as Glyptal) to the sapphire nut holder.

Bend the spring contacts to make good contact with the slides in the tone arm.

Tone Arm Feed-in Spring

When the sapphire comes down on the record, the feed-in spring (shown in adjustment sketch, Fig. 10) acts to push the tone arm toward the music grooves. The spring should be adjusted to do this without causing the sapphire to skip grooves. This action is also related to cabinet leveling.

Cabinet Leveling

If the sapphire fails to enter the starting groove, raise the right-hand side of the cabinet by inserting thin spacers under the legs. If the pickup slides over a few grooves, raise the left-hand side of the cabinet.

Sapphire Pressure

In these mechanisms, the correct pressure is from 1 to 1 1/4

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ounces, measured at the sapphire. Adjust the spring (3) in the tone-arm base if necessary.

LUBRICATION

The drive motor bearing is lubricated from felt washers at the bottom and top. A light machine oil should be used at these points.

On all bearing surfaces except the motor bearings Houghton Stayput No. 320 should be used. On all other surfaces Lubriplate No. 110 is recommended.

Do not oil the record separator shaft.

It is important that the drive motor spindle and the rubber tire on the friction drive disc as well as the idler wheel be kept clean and free from oil, grease, dirt, or any foreign material at

all times. Any quick drying naphtha is satisfactory for cleaning these parts.

TO REMOVE THE TURNTABLE

To remove the turntable, loosen setscrews "A" shown in Fig. 7 and lift turntable up.

TO REMOVE PICKUP ARM

One of the tone arm bearings has a slotted head and can be turned out to facilitate removal of the tone arm. Raise the tone arm and loosen the bearing setscrew. Turn the bearing partly out through the hole in the side of the tone arm and lift the arm off.

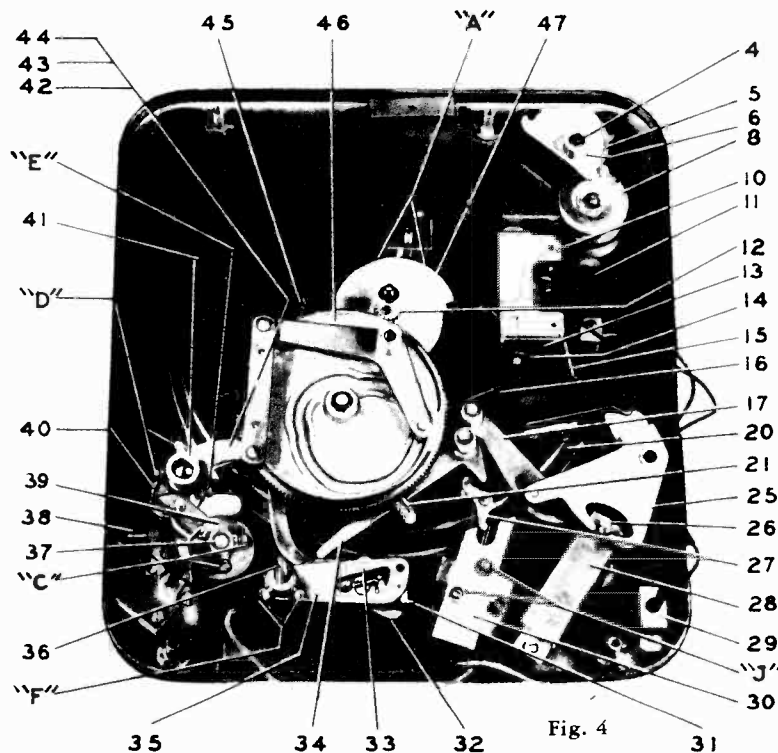


Fig. 4

Symbol	Function
1	Rubber cushion
2	Screw
3	Pivot arm spring
4	Record support shaft
5	Record support cam
6	Pin
7	Ball bearing
8	Record support belt drum
9	Cap
10	Bearing and bracket
11	Motor field coil
12	Drive gear
13	Motor mounting bracket
14	Rubber grommet
15	Motor tension spring
16	Tone arm lever spring
17	Control lever
18	Record separator shaft spring
19	Record separator spring
20	Drive belt
21	Ratchet lever
22	Record separator support
23	"C" washer
24	"C" washer
25	Control cam
26	Stop switch stud
27	Shorting switch pawl
28	Stop switch
29	ON-OFF switch
30	Shorting switch
31	Trip pawl
32	Tone arm return lever
33	Stud
34	Tone arm lever
35	Trip lever
36	Tone arm elevating rod
37	Record separator swivel shaft
38	Belt drum spring
39	Belt drum
40	Tone arm segment cam
41	Record separator shaft
42	Record separator crank
43	Record separator link
44	Record separator lever
45	Ratchet lever spring
46	Main cam and gear
47	Drive cam

CYCLE OF OPERATION

When the Record Support is turned to its desired position, the Record Separator post is positioned by means of a belt drive (20). Loading the Record Supports pushes the separator shaft (41) down against its spring and carries the tone arm segment cam (41) down against its spring and carries the tone arm segment cam (41) free of the index finger. When the Start-Reject Lever is operated, the control lever (17) is moved in and pushes the ratchet lever (21) out of the eccentric step in the main gear (46) shaft and releases the drive cam pawl. The drive cam pawl engages with the toothed wheel, carrying the drive gear (12) with it as it revolves. Revolving with the drive gear are the main cam and gear (46). The tone arm elevating lever rides up on the ridge of the main cam (46), raising tone arm by means of the elevating rod (36). The stud on the tone arm lever (34) rides in the top track on the main cam (46), moving the tone arm up and pushing on the trip lever stud (33). As the trip lever (35) moves out, the tone arm return lever (32) is carried along with it, by the trip lever stud (33) and by the stud on the main cam top track.

The stud on the separator lever (44) follows the main cam (46) bottom track, directing the motion of the lever (44), link (43) and crank (42) which rotates the record separator shaft (41).

Record Gauging and Releasing

The record separator knife turns with the shaft and strikes the edge of the bottom record. The separator shaft continues to revolve as the teeth on the inner circumference of the knife ride up on the shelf teeth until the knife is carried high enough to be moved in, by action of spring (19) in Fig. 6 over the top of the record. The separator shaft

continues to turn until knife supports all but the bottom record, and the shelf moves out from under the bottom record, allowing it to drop to the turntable.

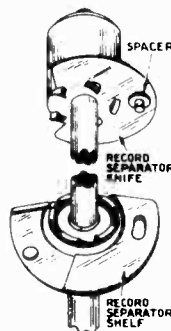


Fig. 5

The separator shaft reverses rotation and the tone arm lever (34) moves away from the trip lever stud, moving the tone arm in. The tone arm return lever (32) pushes against the trip lever stud (33), moving the trip lever (35) in.

The index finger on the tone arm return lever (32) moves against the separator shaft (41) to insure proper landing position of the tone arm. The tone arm elevating lever rides down on the main cam ridge

(see Figs. 10 and 11) thus lowering the elevating rod and tone arm. The knife is returned to the original position by the separator shaft, allowing the stack of records to rest on the shelf.

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As the record begins to play the ratchet lever (21) rides down into the eccentric step on the main gear shaft and blocks the drive cam pawl, disengaging it from the drive cam wheel. The drive gear and main gear stop rotating and the tone arm lever (34) moves into cam to maintain disengagement.

The cycle of operation can be studied conveniently by pushing the reject lever and revolving the turntable by hand. Eight turntable revolutions are required for one change cycle. Block up the motor, so it is disengaged from the drive disc, to permit easier manual rotation of the turntable.

SERVICE ADJUSTMENTS

MECHANISM TIMING

*Mechanism jams.
General irregularity of operation.*

With the ratchet lever and the pawl on the drive shaft cam in playing position as shown, remove the bottom support bracket. Remove the "C" washer on the main cam shaft and slip the cam down far enough that it can be rotated with respect to the drive gear. Then rotate it until the timing notch is positioned as shown. Put the main gear back in mesh with the drive gear, replace the "C" washer, place the elevating lever on the cam ridge. Make certain the separator lever train is in its correct position and replace the bottom support bracket.

TURNTABLE BOTTOM BEARING POSITION

Turntable does not turn freely.

Loosen the bottom bearing screws "B" (Fig. 8), and position the bottom bearing plate until the turntable revolves freely. Tighten the screws and check by applying a.c. to the turntable motor, allowing it to reach full speed, then pull motor away from friction drive disc and noting that the turntable continues to make at least twelve revolutions.

SPACING BETWEEN RECORD POSTS

Records strike separator post or fail to stay on record shelf.

Turn the record support post to the ten-inch position. Loosen setscrews "C" (Fig. 9), hold the separator post against the end of its slot in the motorboard and turn the belt drum to take up any slack in the belt. Tighten the zinc-plated, blunt-nosed screw and check to see that a ten-inch record fits the posts as shown. Then tighten the copper-plated, cone-pointed screw.

The twelve-inch position is adjusted after that of the ten-inch, by changing the support post to take the twelve-inch record, and turning the eccentric stop until the edge of the record is halfway up on the record support bevel while the other edge is against the record separator post.

RECORD SHELF TIMING

Records do not drop at proper time.

Place a ten-inch record on the posts. Loosen the setscrews "D" (Fig. 9), and turn the record separator shaft until the edge of the record-separating knife is one-sixteenth inch away from the edge of the record. The teeth on the inner circumference of the knife should be resting in the bottom of their slots at the time the adjustment is made. Tighten the zinc-plated screw first, run through cycle several times as a check, then tighten the copper-plated screw.

SEGMENT HEIGHT OR RADIAL POSITION

Tone arm continues to repeat playing of top record or jams when part way in on record.

Take all records off the posts. Loosen the setscrew "E" (Fig. 9 and Fig. 10). Set the record separator segment-cam so that the index finger of the tone arm return lever rides on the middle of the segment-cam, as shown. Rotate the segment-cam until it is in such a position that the index finger will not ride off either end. Check to see that the index finger rides in over top of the cam when the record shelf is depressed by the weight of one record. Tighten the setscrew.

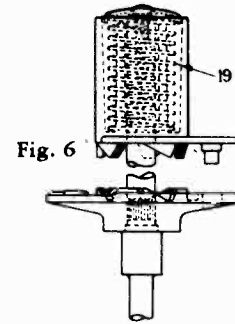


Fig. 6

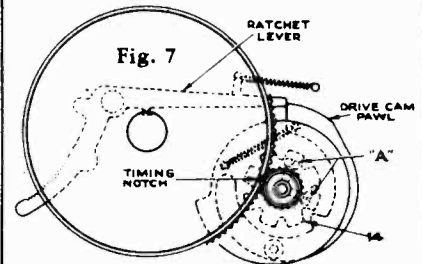


Fig. 7

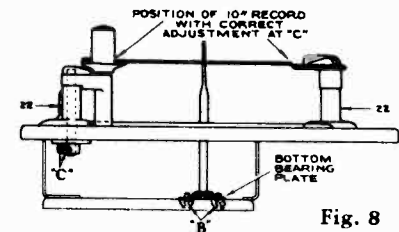


Fig. 8

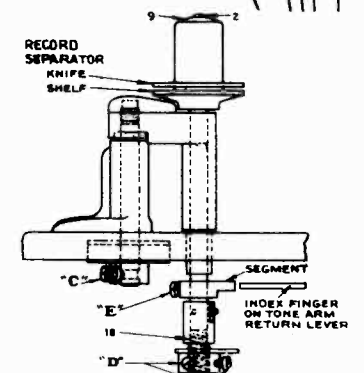
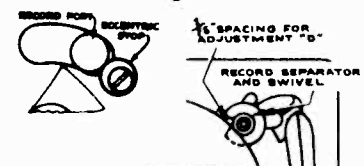


Fig. 9

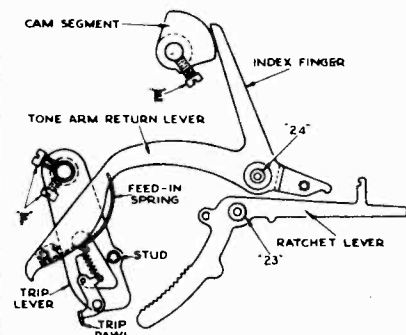


Fig. 10

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PICKUP ARM POSITION WITH RESPECT TO TRIP LEVER

Sapphire does not land at correct point on 10-inch record.

Place a ten-inch record on the turntable and rotate the changer through cycle until the sapphire is just ready to land. Make sure that the index finger of the pickup arm return lever is against the record separator shaft and that the tone arm trip lever stud is held firmly against the return lever. Loosen the setscrews "F" (Fig. 11) and move the pickup arm to the correct landing position. See that there is a 1/32 inch clearance between the pickup arm bearing and the setscrew collar. Tighten the zinc-plated screw, run the changer through cycle several times as a check, then tighten the copper-plated screw.

Correct dimension from outside edge of spindle to sapphire 4 1/8 inches.

The twelve-inch landing position is automatically maintained.

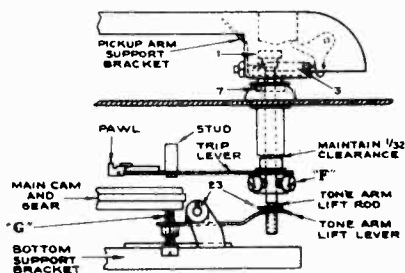


Fig. 11

PICKUP ARM HEIGHT WHILE IN CYCLE

Top of pickup arm strikes stack of records or sapphire fails to clear the records on the turntable.

Rotate the changer through cycle until the pickup arm has risen to its maximum height above the turntable but has not begun to move out. At this point adjust the screw "G" (Fig. 11), until the distance between the turntable and sapphire is one and three-sixteenths inch. Tighten the locknut.

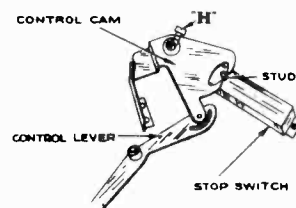


Fig. 12

CONTROL CAM POSITION

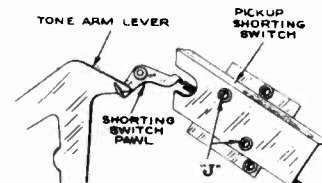
Mechanism fails to start or automatic stop switch is inoperative in "automatic" position.

Set the control lever to "automatic." Loosen set-screw "H" (Fig. 12), and move the control cam until the stud on stop switch is centrally located as shown. Tighten setscrew "H."

POSITION OF PICKUP SHORTING SWITCH

No output or noise during cycle.

Loosen screws "J" (Fig. 13). Position the switch to obtain 1/8-inch clearance between the switch blades when the tone arm is in playing position. Tighten screws "J." Make certain that the pawl is on the correct side of the long leaf spring in the shorting switch.



Symptom	Check
Mechanism trips continuously.	Check to see that the ratchet lever engages drive cam pawl at end of change cycle. Bend lever if necessary. Check adjustment "H." Bend the control cam flat spring for greater pressure.
Turntable does not stop automatically.	Check for bind in stop button bushing. Bend the flat bracket that limits outward movement of the trip lever, so that pickup lands on the stop button.
Turntable fails to start.	Check spacing of stop switch contacts to be certain that weight of stop button does not open them.
Loud clicking noise resulting from drive cam pawl slipping out of teeth in cam sprocket.	Check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud. Any jam will cause the clutch to slip and produce clicking sound.
Mechanism jams.	
Irregular landing on 10- and 12-inch records.	Check adjustment "C." Insufficient tension on belt.
Tone arm continues to repeat playing top record of the stack.	Check adjustment "E." Record separator shaft, or the spring on which it rests, is binding on the shaft bushing. Pin on record separator shaft is binding in its slot. Shaft spring is too weak. Do not tighten setscrews "D" enough to distort the housing of the separator shaft spring. Do not oil the record separator shaft.
Tone arm continues to come down in rest position.	Check adjustment "E." Record separator shaft or the spring on which it rests is binding on the shaft bushing. Pin on record separator shaft is binding in its slot. Shaft spring is too strong.
Sapphire strikes motorboard.	Bend the pickup arm support bracket until the sapphire clears the motorboard by approximately 1/8 of an inch.
Separator knife jams on last record of the stack.	Check the separator knife edge. It should not be sharp enough to dig in the record and carry the record up with it.

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REPLACEMENT PARTS LIST
MODEL LRP-160

Stock Number	Symbol	Description	List Price	Stock Number	Symbol	Description	List Price
PICKUP AND ARM							
RA-434		ARM—Pickup arm shell—less crystal, cable and pivot arm	\$2.50	RB-302		BALL—Bearing ball for spindle	\$0.05-2
RA-435		ARM—Pivot arm and shaft for pickup arm, less spring	.75	RB-647		BEARING—Turntable spindle bearing	.20
RC-8234		CABLE—Shielded pickup cable—connects pickup to shorting switch	.40	RB-648	20	BELT—Record support to separator belt	.25
RC-5014		CRYSTAL—Pickup crystal cartridge with sapphire and holder	6.50	RB-1051		BOARD—Motorboard with all welded or riveted studs, posts, or bearings—less operating mechanism	8.00
RC-2072	1	CUSHION—Rubber cushion for pickup arm elevating rod	.20	RB-649		BRACE—Angle brace, or bottom support bracket and bearing plate	.65
RD-603		DAMPER—Viscoloid damper for sapphire holder	.10	RB-650		BUSHING—Record separator shaft end bushing	.30
RG-111		GUARD—Needle guard	.10	RB-652		BUTTON—Stop switch button	.10
RN-018		NUT—Special nut and washer for sapphire holder	.30	RC-8235		CABLE—Shielded pickup cable and plug—connects shorting switch to amplifier	.60
RN-016		NUT—Speed nut to hold cable in pickup arm	.05	RC-2073	47	CAM—Drive shaft cam and pawl—less spring	.70
RR-949	36	ROD—Pickup arm elevating rod—less cushion	.50	RC-2074	46	CAM—Main cam	1.50
RC-965		SAPPHIRE—Sapphire and holder—less nut	3.50	RC-2075	5	CAM—Record support shaft cam	.40
RS-8038		SCREW—No. 2-56 x 1/8 screw to mount needle guard (2 required)	.05	RC-2076	9	CAP—Record separator cap	.50
RD-8030		SCREW—No. 4-40 x 1/4 headless setscrew for pickup arm	.05	RC-2077		COVER—Stop cover switch and stud	.25
RS-8034		SCREW—No. 6-32 x 9/32 headless setscrew for pickup arm	.05	RD-602		DISC—Turntable drive disc and spindle	2.50
RS-4065	3	SPRING—Pivot arm spring	.10	RD-429	39	DRUM—Record separator belt drum	.40
RS-521		STUD—Pivot arm spring stud, and nut	.10	RD-430	8	DRUM—Record support belt drum	.40
MOTOR ASSEMBLIES							
RB-401	10	BEARING—Bottom bearing and bracket	.40	RE-232		ESCUTCHEON—Index escutcheon ("Manual," "Automatic," "Start-Reject")	.30
RB-402		BEARING—Top bearing and bracket	.40	*RG-304	14	GROMMET—Rubber grommet for motor mounting	.10
RB-210	13	BRACKET—Motor mounting bracket	.40	RS-640		KNIFE—Record separator knife	1.10
RL-378	11	COIL—Motor field coil assembly	1.50	RL-982	17	LEVER—Index control lever and shaft	.95
RM-159		MOTOR—105-125 volts, 60 cycle	6.75	RL-973	43, 44	LEVER—Link and lever assembly—fastens on record separator shaft	.65
RP-420		PAD—Rotor thrust pad	.05	RL-983		LEVER—Manual lever	.35
RR-413		ROTOR—Motor rotor complete with fan	1.75	RL-974	21	LEVER—Ratchet lever	.60
RS-961		SLEEVE—Motor spindle sleeve for 50-cycle conversion of motor	.25	RL-976	34	LEVER—Tone arm lever	.45
MOTORBOARD ASSEMBLIES							
RA-432		ARM—Motor idler arm—less wheel	.25	RL-977		LEVER—Tone arm lift lever	.15
RB-303	7	BALL—3/32 steel ball for tone arm bearing	.05	RL-978	32	LEVER—Tone arm return lever	.45
				RL-979	40	LEVER—Tone arm segment—fastens on record separator shaft—less screws	.50
				RL-980	31, 33, 35	LEVER—Trip lever—less pawl spring	.65
				RN-019		NUT—Speed nut for stop switch button	.05-5
				RP-421		PIN—Drive pin for record separator shaft and bushing	.05
				RP-422	6	PIN—Record support shaft cam pin	.05
				RP-2022		PLATE—Index control lever plate and screw	.45
				RP-3012		PLUG—Female plug for motor extension cable	.35
				*RP-169		PLUG—Male plug for motor and switch leads and extension cable	.35
				RR-950		RATCHET—Ratchet wheel (drive cam sprocket) for turntable spindle	.40
				RS-4059		SPRING—Reject button spring	\$0.10
RS-8035	2	SCREW—Oval head screw for record separator cap	\$0.10	RS-4061	16	SPRING—Tone arm lever spring	.10
RS-8036		SCREW—No. 8-32 x 1/4-in. cone point setscrew for ratchet wheel (drive cam sprocket)	.05	RS-4068		SPRING—Tone arm return lever spring	.10
RS-8037		SCREW—No. 8-32 x 1/4-in. setscrew for ratchet wheel (drive cam sprocket)	.05	RS-4069		SPRING—Tone arm switch spring	.05
*RS-867		SCREW—No. 10-32 x 5/16-in. cone point setscrew for index lever plate	.30-5	RS-4063		SPRING—Trip lever pawl spring	.10
*RS-8004		SCREW—No. 10-32 x 5/16 in. setscrew for drum, tone arm segment, record separator crank, and trip lever	.05-5	RS-522		STUD—Tone arm switch pivot stud	.10
RS-641	41	SHELF—Record separator shelf and shaft	1.10	RS-643	4	SUPPORT—Record support and shaft	1.70
RS-642		SPACER—Record separator spacer (washer)	.05	RS-647	22	SUPPORT—Separator support (2 used)	.50
RS-4053		SPRING—Cam pawl and ratchet lever spring	.10	*RS-3061	29	SWITCH—On-Off switch	.30
RS-4066		SPRING—Index lever plate spring	.20	RS-3146	27, 30	SWITCH—Pickup shorting switch	.45
*RS-4017		SPRING—Motor idler arm spring	.05	RS-3147	26, 28	SWITCH—Stop switch—less leads	1.00
RS-4054	15	SPRING—Motor tension spring	.10	RS-962	37	SWIVEL—Record separator swivel and shaft	.75
RS-4067	45	SPRING—Ratchet lever spring	.10	*RT-937		TIRE—Rubber tire only for drive disc	.75
RS-4056	38	SPRING—Record separator belt drum spring	.10	RT-945		TURNTABLE—Finished turntable plate	1.10
RS-4057	18	SPRING—Record separator shaft bottom spring	.10	*RW-125		WASHER—"C" washer for motor idler arm or idler wheel	.05-2
RS-4058	19	SPRING—Record separator spring	.20	RW-134	23	WASHER—"C" washer for ratchet lever, tone arm lift lever, or tone arm lift rod	.05
				*RW-127	24	WASHER—"C" washer for tone arm lever, tone arm return lever, record support belt drum, link, or cam	.05-5
				RW-135		WASHER—Felt washer for tone arm bearing	.05
				RW-136		WASHER—Felt washer for turntable spindle bottom bearing	.05
				*RW-922		WHEEL—Motor idler wheel	.55

* Used on previous receivers.

Prices subject to change without notice

FOR ADDITIONAL INFORMATION
ON GENERAL ELECTRIC MODEL
LRP-160, SEE RCA RP-160.

GENERAL ELECTRIC CO.

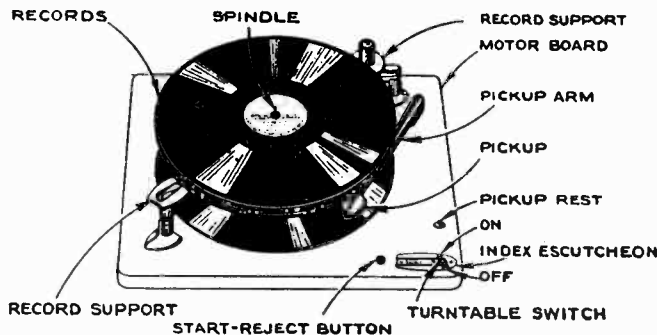


Fig. 1

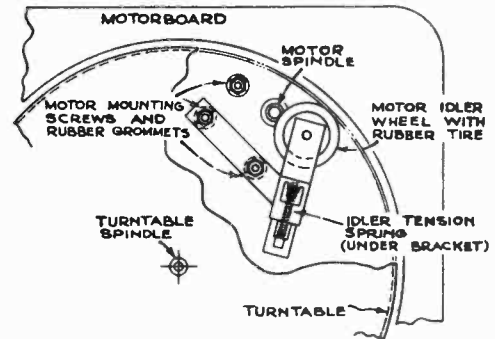


Fig. 2

GENERAL

This record changer is designed to operate on a 110-volt 50- or 60-cycle power supply. It will automatically play twelve 10-inch or ten 12-inch records, of the 78-rpm type, at a single loading. It will not play 10-inch and 12-inch records intermixed.

OPERATION

Before loading, see that the pickup arm is in its rest position. If it is locked, in some position other than on the rest post, remove any records that might be on the record supports and complete the change cycle by throwing the turntable switch ON. Follow the pickup through its change cycle, and when it drops on the first groove of the record throw the turntable switch OFF and carry the pickup to its rest post.

For 10-inch records, the record support in the near left-hand corner must be turned inward, and the record separator in the far right-hand corner must be lifted and put in the position nearest the spindle. For 12-inch records, the supports must be in the outer positions so as to accommodate the larger diameter records.

With the changer loaded and the turntable switch ON, pushing the start-reject button will start the change cycle, allowing the first record to drop to the turntable and the pickup arm to move into playing position. The whole series of records will play through without further attention, repeating the last record until the mechanism is turned off. The mechanism should be turned off and the pickup arm returned to its rest post just as the record commences a replaying.

To reject a record, push the start-reject button.

For automatic operation each record should have the standard eccentric groove.

50-cycle Conversion

To convert the record changer for use on a 50-cycle power source, motor spindle sleeve (Cat. No. RS-963) should be mounted over the motor spindle. (See Fig. 2.) This will increase the drive ratio so that the turntable speed will be 78 rpm.

MAINTENANCE**Lubrication**

The drive motor bearing is lubricated from felt washers at the bottom and top. A light machine oil should be used at

these points. On all bearing surfaces except the motor bearings Houghton Stayput No. 320 should be used. On all other surfaces Lubriplate No. 110 is recommended.

It is important that the drive motor spindle and the rubber tire on the idler wheel be kept clean and free from oil, grease, dirt, or any foreign material, at all times. Any quick drying naphtha is satisfactory for cleaning these parts.

Cautions

1. Never use force to start or stop the motor or any part of the record changing mechanism.
2. A cracked or chipped record may damage the sapphire.
3. Do not leave the records on the record posts or on the turntable as they may warp, particularly in warm climates. Warped records may slide upon one another and result in unsatisfactory reproduction. Warped records may be flattened by placing them on a flat surface with a heavy flat article placed on top of them for a few days.
4. Damaged or warped records may cause the mechanism to jam. When jamming occurs, the safety clutch slips, causing a clicking sound.
5. Do not tighten the copper-plated, cone-pointed screws until the final adjustment has been made.

Cabinet Leveling

If the sapphire fails to enter the starting groove, the cabinet may need leveling, by raising the right-hand side. If the pickup slides over a few grooves, the left-hand side of the cabinet needs raising.

Sapphire Pressure

In this player, the correct sapphire pressure is approximately 4 ounces, measured at the sapphire. This pressure may be adjusted at spring 3, Fig. 10.

To Remove the Turntable

To remove the turntable loosen setscrews "A" and lift the turntable up (see Fig. 6).

To Remove the Pickup Arm

One of the pickup arm bearings has a slotted head and can be turned out to facilitate removal of the pickup arm. Raise the pickup arm and loosen the bearing setscrew. Turn the bearing partly out through the hole in the side of the pickup arm and lift the pickup arm off.

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GENERAL ELECTRIC CO.

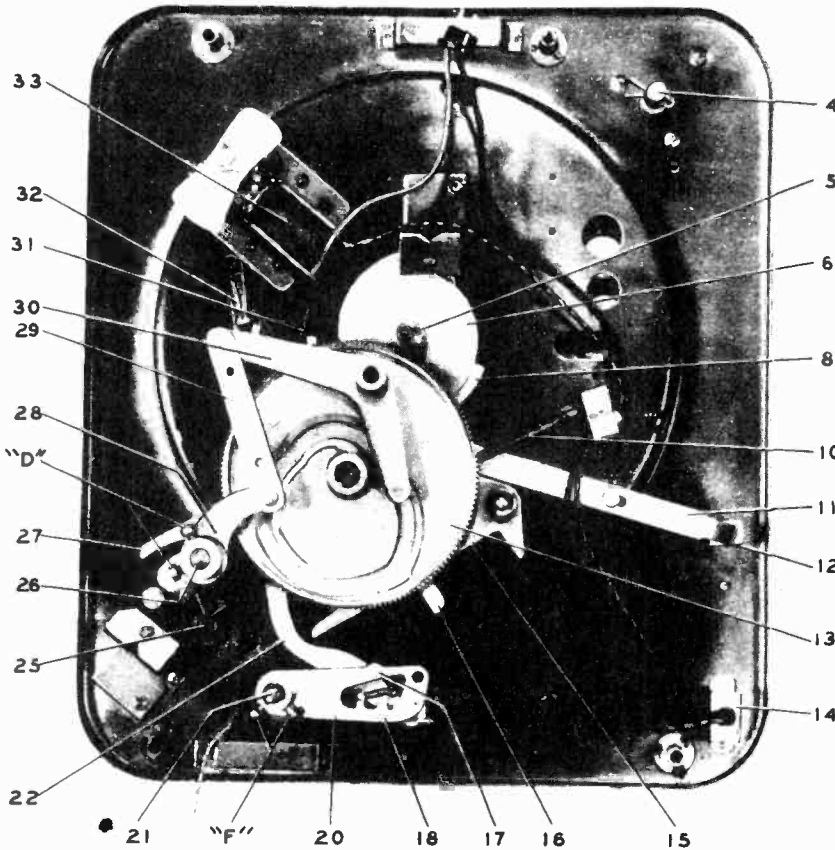


Fig. 3

Description of Principal Parts

Symbol	Function
1	Lift rod cushion
2	Screw
3	Pivot arm spring
4	Record support
5	Drive gear
6	Drive shaft cam
7	Steel ball bearing
8	Drive cam pawl
9	Record separator cap
10	Tone arm lever spring
11	Reject lever
12	Reject button
13	Main cam and gear
14	ON-OFF switch
15	Tone arm lever
16	Ratchet lever
17	Stud
18	Trip pawl spring
19	Record separator spring
20	Trip lever
21	Lift rod
22	Tone arm return lever
23	"C" washer
24	"C" washer
25	Record separator swivel shaft
26	Record separator shaft
27	Index finger
28	Record separator crank
29	Record separator link
30	Record separator lever
31	Ratchet lever spring
32	Idler wheel spring
33	Motor

CYCLE OF OPERATION*

When the Start-Reject button (12) is pressed, the reject lever (11) moves in and pushes the ratchet lever (16) away from the drive cam pawl (8). The pawl is thus released to engage with the cam sprocket of the "safety clutch" and revolves, carrying the drive gear (5) with it, starting the change cycle.

With the clutch engaged, the drive gear (5) transfers the rotation of the turntable spindle to the main cam and gear (13). The pickup arm elevating lever (15) rides on the ridge on the main cam (13), and raises the pickup arm by means of the lift rod (21). The stud (17) on the pickup arm lever (15) rides in the top track on the main cam (13) directing the horizontal movement of the pickup arm lever.

The pickup arm lever (15) pushes the trip lever stud (17), moving the trip lever (20) out, and carrying the pickup arm out. The pickup arm return lever (22) is carried along by the trip lever stud (17) and by the stud on the main cam top track.

The stud on the separator lever (30) follows the main cam bottom track, turning the separator shaft (26) through the separator link (29) and crank (28). The separator knife turns with the separator shaft and strikes the edge of the bottom record. The separator shaft (26) continues to revolve and the teeth on the inner circumference of the knife rides up on the shelf teeth until the knife is carried high enough against the

action of spring (19) to move in over the top of the bottom record. (See Fig. 5.) The separator shaft continues to turn until the knife supports the stack of records, and the shelf moves out allowing the bottom record to drop to the turntable.

The separator shaft reverses rotation; the pickup arm return lever (22) pushes on the trip lever stud (17) moving the trip lever (20) in, and carrying the pickup arm in.

The index finger (27) on the pickup arm return lever (22) moves against the separator shaft to insure proper landing position of the pickup arm. The pickup arm elevating lever (15) rides down on the main cam ridge, lowering the pickup arm by action of the lift rod (21).

The knife is returned to its original position by the separator shaft, allowing the stack of records to rest on the shelf. As the sapphire moves into the first music groove the ratchet

lever (16) rides down into the eccentric step on the main gear shaft blocking the drive cam pawl (8) and disengaging the pawl from the drive cam socket. The drive gear (5) and main gear (13) stop as the record begins to play, and the pickup arm lever (15) moves into the cam to maintain disengagement.

* The cycle of operation can be studied conveniently by pushing the Start-Reject button and revolving the turntable by hand. Eight turntable revolutions are required for one change cycle.

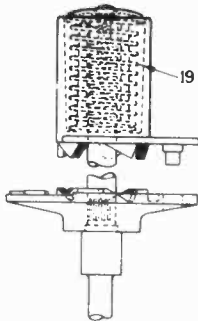


Fig. 4

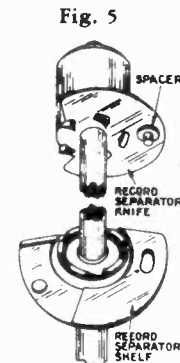
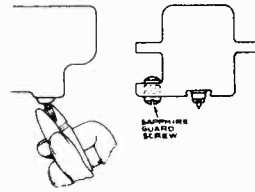


Fig. 5

GENERAL ELECTRIC CO.

REPLACEMENT OF SAPPHIRE

As an additional precaution against rough handling, the top of the sapphire is dipped in a rubber cement (such as Goodrich "Plasticon") before being inserted in the pickup. To remove the sapphire, grasp it firmly with a pair of tweezers, give it a few turns to loosen the cement and then pull it out. Much easier handling of the sapphire will result if the tweezers



are notched with a file as shown. Naphtha may be used as a thinner should difficulty with the rubber cement be experienced. Before inserting the new sapphire it should be dipped in the rubber cement previously thinned with naphtha. After insertion clean the point with naphtha if there is any doubt as to the presence of cement.

MISCELLANEOUS SERVICE HINTS

Symptom	Check
Mechanism trips continuously	Check to see that the ratchet lever (16) engages the drive cam pawl (8) at the end of the change cycle. Bend lever if necessary.
Loud clicking noise resulting from drive cam pawl (8) slipping out of teeth in cam sprocket. Mechanism jams.	Check mechanism timing adjustment. (See Fig. 6.) Make certain that the pickup arm lever (15) is not binding on its stud. Any jam will cause the clutch to slip and cause a clicking sound.
Sapphire strikes motorboard	Bend the pickup arm support bracket until the sapphire clears the motorboard by approximately 3/32 of an inch.
Separator knife jams on the last record of the stack	Check the separator knife edge. It should not be sharp enough to dig into the record and carry the record up with it.

FOR OTHER INFORMATION SEE
R.C.A. MODEL RP-162

REPLACEMENT PARTS LIST

Cat. No.	Symbol	Description	List Price	Cat. No.	Symbol	Description	List Price
PICKUP AND ARM ASSEMBLIES							
RA-430		ARM—Pickup arm shell only	\$1.00	RE-231		ESCUTCHEON—Index escutcheon	\$0.30
RA-431		ARM—Pivot arm and shaft—less spring	.95	RF-757		FERRULE—Pickup connector ferrule (insert)	.05
RC-5013		CRYSTAL—Pickup crystal cartridge, sapphire and shielded cable	5.00	RG-309		GROMMET—Rubber grommet for motor mounting (1 set)	.10
RC-2072		CUSHION—Lift rod cushion (rubber)	.20	RL-974	16	LEVER—Ratchet lever	.60
RN-016		NUT—Speed nut to hold cable in arm	.05	RL-975	11	LEVER—Reject lever	.25
RP-2021		PLATE—Bottom plate for pickup arm—less screws	.10	RL-976	15	LEVER—Tone arm lever	.45
RR-949	21	ROD—Lift rod—less cushion	.50	RL-977	22, 27	LEVER—Tone arm return lever	.45
RS-8030		SCREW—No. 4-40 x 1/4-in. headless set-screw for pickup arm	.05-5	RL-980	20	LEVER—Trip lever	.65
RS-8031		SCREW—No. 4-40 x 1/4-in. screw to mount crystal	.05-5	RL-981	29	LINK—Record separator link	.80
RS-8032		SCREW—No. 4-40 x 1/8-in. headless set-screw for pickup crystal (oval point)	.10-5	RN-017		NUT—Speed nut for reject button	.05-5
RS-8033		SCREW—No. 4-40 x 1/8-in. screw for pickup arm bottom plate	.05-5	RP-421		PIN—Drive pin for record separator shaft	.05
RS-8034		SCREW—No. 6-32 x 1/2-in. headless set-screw for pickup arm	.05-5	*RP-169		PLUG—Male plug for motor leads	.35
*RS-4017		SPRING—Pivot arm spring	.05	RR-950		RATCHET—Ratchet wheel (clutch sprocket) less screws	.40
RS-521		STUD—Pivot arm spring stud and nut	.10	RS-8035	2	SCREW—Record separator cap screw	.10
MOTOR ASSEMBLY							
RM-160		MOTOR—105-125 volts, 60 cycle	5.25	RS-8036		SCREW—No. 8-32 x 1/4-in. cone point screw for ratchet wheel	.05
RS-963		SLEEVE—Motor spindle sleeve for 50 cycle conversion	.25	RS-8037		SCREW—No. 8-32 x 1/4-in. screw for ratchet wheel	.05
MOTORBOARD ASSEMBLY							
RA-433		ARM—Idler wheel arm and stud	.25	*RS-867		SCREW—No. 10-32 x 1/8-in. cone point screw for link and trip lever	.30-5
*RB-302		BALL—1/8-in. dia. steel ball for turntable spindle	.05	*RS-8004		SCREW—No. 10-32 x 1/8-in. screw for link and trip lever	.05-5
RB-303		BALL—1/8-in. dial steel ball for pickup arm bearing	.05	RS-640		SEPARATOR—Record separator knife only	1.10
RS-644		BEARING—Record separator support and bearing	.50	RS-645	26	SHELF—Record separator shelf and shaft	1.10
RB-647		BEARING—Turntable spindle bearing	.20	RS-642		SPACER—Record separator shelf to knife spacer	.05
RB-1050		BOARD—Motorboard with all riveted and welded posts, studs, and bearings—less all operating parts	7.50	RS-4053		SPRING—Cam pawl spring	.10
RB-649		BRACE—Motorboard bottom brace and bracket	.65	*RS-4017	32	SPRING—Idler wheel arm spring	.05
RB-651		BUTTON—Reject button	.10	RS-4055	31	SPRING—Ratchet lever spring	.10
RC-2073		CAM—Cam and pawl	.70	RS-4058	19	SPRING—Record separator spring	.20
RC-2074		CAM—Main cam and gear	1.50	RS-1060		SPRING—Reject lever spring	.10
RC-2076		CAP—Record separator cap	.50	RS-4064		SPRING—Spring for uniter reject button	.10
RC-8233		CONNECTOR—Pickup lead connector—less insert	.05	RS-4061	10	SPRING—Tone arm lever spring	.10
				RS-4062		SPRING—Tone arm return lever spring	.10
				RS-4063	18	SPRING—Trip pawl spring	.10
				RS-646	4	SUPPORT—Record support	1.80
				*RS-3061	14	SWITCH—"ON-OFF" switch	.30
				RS-964		SWIVEL—Record separator swivel	2.75
				RT-946		TURNTABLE—Record turntable and spindle	2.80
				*RW-125		WASHER—"C" washer for idler wheel	.05-2
				RW-134	23	WASHER—"C" washer for ratchet lever, tone arm lever, or pickup pivot shaft	.05
				*RW-127	24	WASHER—"C" washer for tone arm return lever, tone arm lever, link, or cam	.05
				RW-135		WASHER—Felt washer for pickup arm bearing	.05
				RW-136		WASHER—Felt washer for turntable spindle bottom bearing	.05
				*RW-922		WHEEL—Idler wheel	.55

* Used on previous receivers.

Prices subject to change without notice.

MODEL SPEC. #T18J967-4
USED ON MODELS

GENERAL ELECTRIC CO.

H-79, H-118, HJ-119

The Model H-118 automatic phonograph mechanism plays up to twelve 10-inch records or ten 12-inch records. The record-changing mechanism is equipped with a cycle switch which during a record-changing cycle prevents power interruption, by pressing the turntable switch to "Off," until the tone arm is in the starting position.

OPERATION

Phono Key

To change from radio to phonograph reproduction press the "Phono-Tele" key. This operation likewise turns the power on if the radio has not been operating previously.

Phono Switch

This switch is located on the forward left-hand corner of the motorboard and starts or stops turntable operation.

Push-button Controls

On the forward right-hand corner of the motorboard are located four push-buttons which control the operation of the automatic record changer.

The forward button, marked "R" is the reject control. To reject a record being played or to start the record-changing cycle after the records have been placed on the holders, simply press this button down and then release.

The second button from the front, marked "M" is the manual button. When records are to be played manually, this button should be pressed down until it locks in the depressed position. The record mechanism now operates as any manual record player.

The third button, marked "12," when pressed, sets the mechanism to play automatically a series of 12-inch records.

The fourth button, marked "10," when pressed sets the mechanism to play automatically a series of 10-inch records.

Record Holder and Release Lever

Located in rear left-hand corner and in the forward right-hand corner are the record-holder posts supporting the record holders and release levers. The record holder is underneath the release lever on either post.

To load the holder with 10-inch records, clasp one of the record holders with the left hand and with the right hand lift the release-lever knob turning the release lever until the figure "10" is opposite the index. Do the same with the other record holder and release lever. Now rotate the entire record holder and release lever assembly until the holder is pointed in toward the center of the turntable. It may be necessary to raise the assembly slightly to start rotation. A certain position will be found when the holder is pointed toward the center where the assembly will settle into a recess. This is the correct position of the holder for loading.

To load the holder with 12-inch records, follow the above procedure except the release levers must be rotated with respect to the holders until the "12" markings are opposite their respective indices.

To remove records from the turntable, lift the holder assemblies and rotate the record holders until they clear the turntable area.

SERVICING

Oiling

The record-changer mechanism should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following six points. All points can be reached from above, through holes in the mounting plate, as follows:

No. 1 Three oil holes on motor gear housing. Reach

- No. 2 all three through two holes marked "A" on drawing.
- No. 3 drawing.
- No. 4 Through hole marked "B," drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 5 Through holes marked "C," see felt wick, and drop the oil directly upon it.
- No. 6 Through hole marked "D," see felt wick, and drop the oil directly upon it.

If squeaks are heard compare the squeak with and without a load of records, stacked records themselves sometimes squeak against a center pin. See that all five wicks are in position, including three 1/4-in. wicks in frame of Motor. See that each wick is thoroughly saturated (as it may not be if insufficient oil or too heavy oil has been used). Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil). If necessary, clean gummy wicks with kerosene. See that each is saturated with good oil; then, before replacing them, drop a little good oil into the holes.

Adjustments

There are three adjustments that can be made. All are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to remake any of these adjustments, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. (See Fig. 8.) This adjustment is made with a screwdriver from above—does not require removing Record Changer from cabinet. If needle comes down too far from edge of record, playing of records will not start at their beginning. Turn Needle-drop Adjustment Screw very slightly counterclockwise. If needle comes down too close to edge of record, needle may slip off edge of record. Turn the adjusting screw clockwise.

Compare also Paragraph 12 on page 11.
B. ADJUSTING DISTANCE FROM RECORD PIN AT WHICH TRIGGER WILL TRIP AND CHANGE-CYCLE WILL BEGIN. Turn Trip Adjusting Screw 18, toward the trigger for earlier tripping, or away from it for later tripping. This Record Changer does not depend, for automatic tripping, on the records being provided with any special grooves at end; it trips whenever needle comes within a certain distance of Record Pin. The factory adjustment is for 1 1/8 in. from center of Record Pin. This is the most generally satisfactory distance; no modern record will then be cut off before playing is finished, and none will fail to trip at end. For certain records of early manufacture, it may not be possible to find an adjustment that will always trip and never cut off.

C. ADJUSTING HEIGHT TO WHICH TONE ARM RISES. The arm should rise, during the change-cycle, high enough so that it clears by only 1/8 in. the record above it, next to be played. (Be careful, before deciding that adjustment is necessary, to see that the record at bottom of stack is not a warped one.) To make this adjustment, loosen the lock nut on Pickup Sleeve 22 (see Fig. 10) and turn the sleeve to lengthen or shorten Pickup Plunger 21. When correct adjustment is found, tighten lock nut again.

Motor Replacement

The service mechanic may be called upon to adapt the Record Changer to a different power supply. For this purpose, or in case of any service fault within Motor, remove entire Motor (with Record Pin and connecting gear drive) from the Record Changer, and replace it with a suitable new Motor. (In ordering a replacement Motor, specify the power

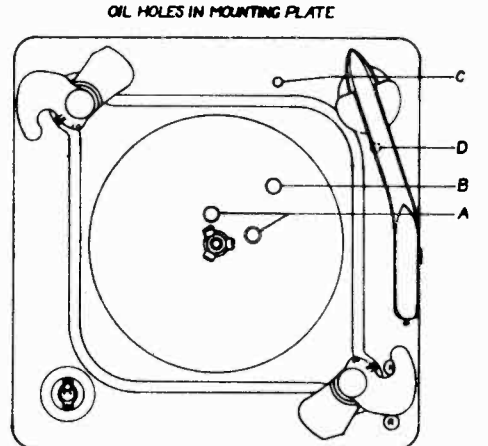
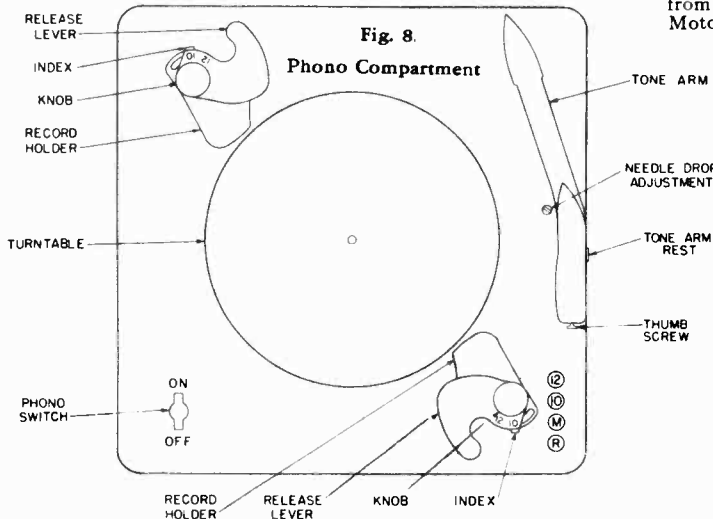


Fig. 9. Oiling Diagram

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supply.)

When mounting replacement Motor, it is most important to see that Record Pin is centered between the two posts of the Record Changer, that it stands perpendicular to Main Plate 53, and that it has not become bent so as to wobble. Even though the Posts are stout and not easy to bend, it is well to check them also, with a 12-in. combination square laid clear across the concave upper surface of Main Plate. When the new Motor has been attached, with three screws through Grommet Sleeves 51 (spacers) into its frame, and Record Pin is seen to revolve without appreciable wobble (a wobble would indicate that it has been bent in transit from factory) the correct position of Pin midway between the Posts can be accurately checked in this way: Place a single 12-in. record on the Record Holder, press "R" button, and turn turntable forward by hand. Immediately after the Record Holders open and let it fall, turn Turntable slightly backward, and with other hand support the record between the Record Holders; it can then be readily seen whether Record Pin is off center. If it is, remove the record and Turntable, and loosen slightly the screw or screws nearest the Record Holder to which record appeared closest. This should improve evenness of operation. However, unless the unevenness was very slight, it will be necessary for a permanent repair to insert a shim or two on one or more of the three screws (or change shims from one screw to another). The shims used are shaped like an ordinary washer, cut out at one side (see cut-away view at 52 in Fig. 11 showing a shim in place upon one of the Grommet Sleeves). Shims can readily be cut out with shears and punch from thin metal or cardboard. They should be inserted, around proper screws (when screws have been sufficiently loosened) between Motor Frame and metal Grommet Sleeve. Do not insert shims next to rubber grommet. In wiring up, consult schematic diagram for particular installation. Use only Underwriters' approved wire.

Trouble Shooting

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it—or that setscrews may work loose due to some external vibration. Damage from tampering is likely to take the form of bent parts; never bend any part during examination. Be careful, especially, never to push upward from below on Cam Connecting Rod Lift 37 while mechanism is operating; bending may result, and even slight bending here might interfere with correct timing of the cycle operations.

Among the principal trouble symptoms to which such causes may give rise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR STALLS DURING A CHANGE-CYCLE, BUT A SLIGHT FORWARD PUSH WITH THE HAND STARTS IT AGAIN. May be caused by

- Failure to lubricate properly. Oil thoroughly, per instructions above.
- Loose setscrews.
- Weakness of drive: line voltage may be abnormally low, or motor windings damaged.

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS. This indicates trouble in Motor windings. Unless the damage is easily seen and repaired, replace Motor, as above described.

3. MOTOR IS SLOW IN STARTING.

a. Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.

b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up, before concluding that Motor is defective, and proceeding as in Paragraph 2 above.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

a. Check oiling, as directed above. (If squeaks are heard, they will usually be found to come from the records—not from the mechanism.)

b. See that all setscrews are tight.

c. Examine Motor windings; especially the shading coils which encircle a portion of each laminated pole and make the Motor self-starting. If coils have been jarred loose at any point, they may be tightened accordingly.

5. CHANGER IS NOISY WHEN IN CYCLE. Check oiling.

6. MOTION OF TONE ARM TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM.

a. It may be found that, instead of trigger being actuated, there is stretching of Swivel Spring 95 (joining the lugs at

ends of Swivel Spreaders 90 and 91), allowing the Spreaders to open. Increase tension of Spring 95, by bending slightly the lug on either Spreader. If this increased tension causes needle to jump across the record, needle may be a little out of vertical, radially—it may "lean" toward center of record. To remedy this, grasp Pickup arm and twist it, very slightly, in a clockwise direction, so that it stands vertical, or even leans a little in outward direction.

b. If trigger is being properly actuated, probably Cam Lever 39 is binding against Sub-Plate 41. Look for dirt or obstructions; see that rivets are working freely. If the Lever engages Cam Lever Pawl 34, so that Lift 37 forces its roller up into the groove on Cam gear 82, and if setscrews are tight, the change-cycle must operate, as Cam Gear turns.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

a. Check Push-button Switch Unit 75: see whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel.

b. Examine Reject Rod 78. If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be restored in same way. Grasp the two ends and twist it slightly.

c. If Trigger 16 is being properly actuated but without starting a change-cycle, see directions above, Paragraph 6-b.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION. Check Push-button Switch Unit as in preceding paragraph. First see that button goes clear down; then follow its action through Manual Rod 77.

9. MOTOR STOPS IMMEDIATELY WHEN PHONO SWITCH IS TURNED OFF DURING A CHANGE-CYCLE (instead of continuing to run, as it should, until needle is again upon a record, and then stopping). Or—

10. TURNING PHONO SWITCH OFF FAILS TO STOP CHANGER AT ALL. Either of these two conditions would indicate failure of Cycling Switch 85. Cycling Switch operates normally to short-circuit the manual Changer Switch (which may be located in position shown at 54, or elsewhere) during change-cycle only. Such damage to Cycling Switch (not likely to occur) would necessitate returning the entire Changer to factory.

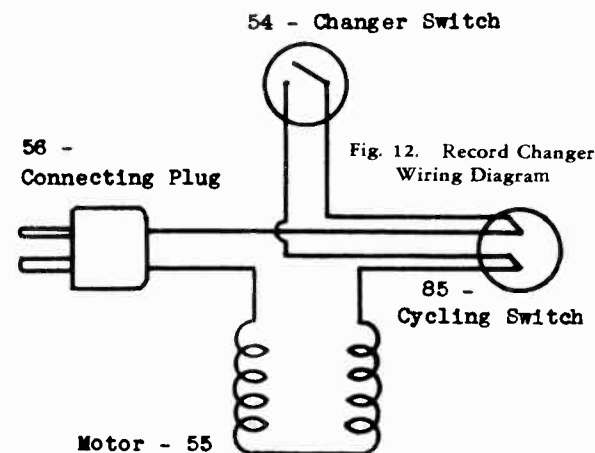
11. CHANGER FAILS TO REPEAT LAST RECORD. See Paragraph 6, above.

12. NEEDLE LANDS PROPERLY BUT FAILS TO MOVE OVER INTO RECORD GROOVE. Tone arm is normally impelled toward center of records by Lead Spring 97. Should a slight increase in its tension be found necessary, this can be easily obtained by bending the lug, to which it is attached, down against Main Plate. If tendency then appears for needle to jump across record, check angle of needle (see Paragraph 6-a above).

13. RECORDS FALL UNEVENLY UPON TURNABLE. Seldom objectionable, this is due to Record Pin not being correctly centered between Posts. If necessary, it can be corrected as described above; see "Motor Replacement."

14. LAST RECORD DROPS ON ONE SIDE ONLY. This suggests a Post bent out of perpendicular to Main Plate. Test with square as directed (see "Motor Replacement"). If Post must be straightened, be careful not to bend other parts.

15. CHANGER CONTINUES CYCLING. Due to failure of Lift 37 to fall back out of engagement with Cam Gear. Check the various rivets at which motion occurs, to find the



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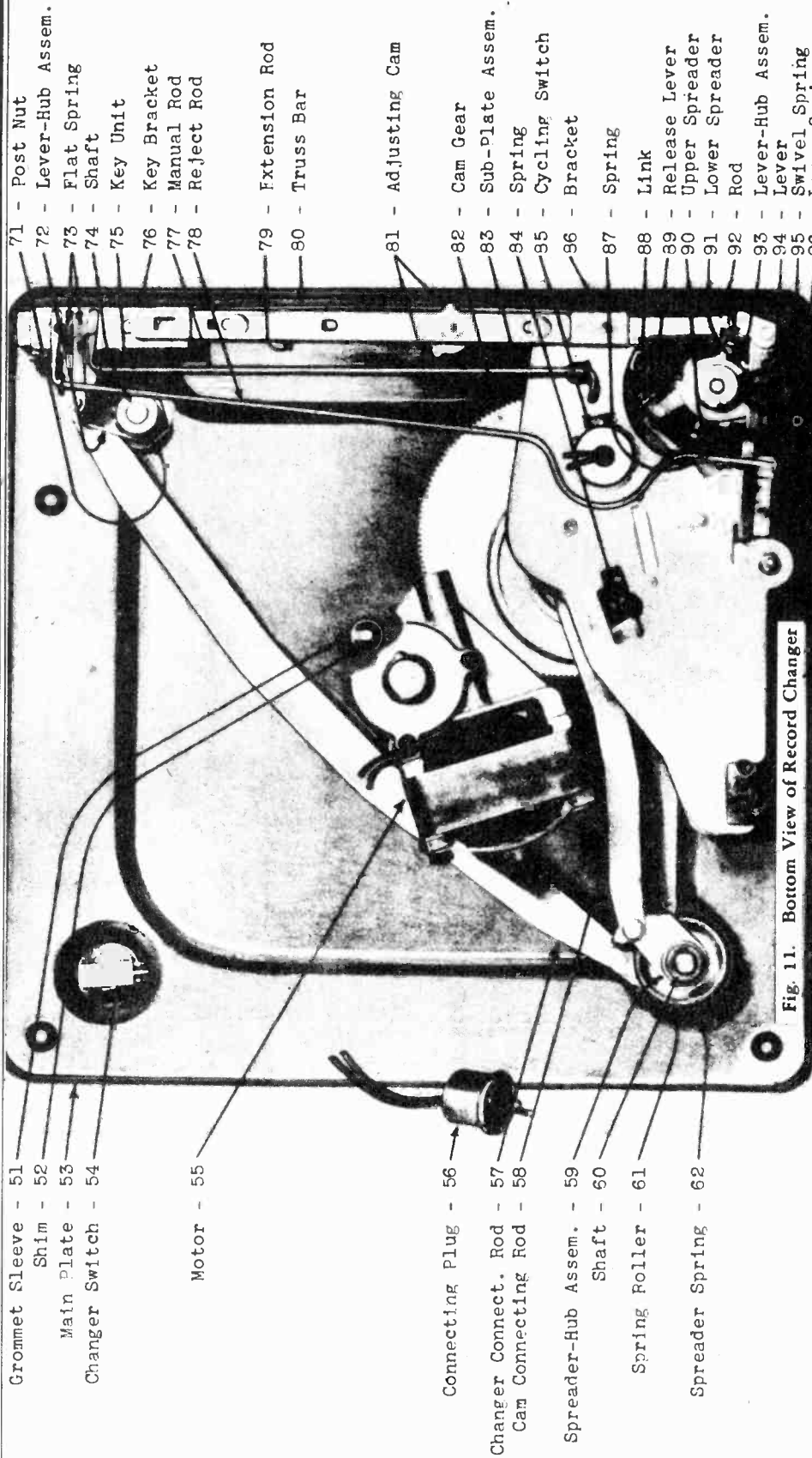


Fig. 11. Bottom View of Record Changer

- 1 - Grommet Sleeve
- 2 - Shim
- 3 - Main Plate
- 4 - Changer Switch
- 5 - Motor
- 6 - Connecting Plug
- 7 - Changer Connect. Rod
- 8 - Cam Connecting Rod
- 9 - Spreader-Hub Assem.
- 10 - Shaft
- 11 - Spring Follower
- 12 - Spreader Spring
- 13 - Post Nut
- 14 - Lever-Hub Assem.
- 15 - Flat Spring
- 16 - Shaft
- 17 - Key Unit
- 18 - Key Bracket
- 19 - Manual Rod
- 20 - Reject Rod
- 21 - Extension Rod
- 22 - Truss Bar
- 23 - Adjusting Cam
- 24 - Cam Gear
- 25 - Sub-Plate Assem.
- 26 - Spring
- 27 - Cycling Switch
- 28 - Bracket
- 29 - Spring
- 30 - Link
- 31 - Release Lever
- 32 - Upper Spreader
- 33 - Lower Spreader
- 34 - Rod
- 35 - Lever-Hub Assem.
- 36 - Lever
- 37 - Swivel Spring
- 38 - Lever Spring
- 39 - Lead Spring

point where friction or binding is interfering with freedom of motion.

16. RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME. See that Pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. SELECTOR PLATE FAILS TO SEPARATE BOTTOM RECORD FROM STACK. This is due either to a badly warped condition of the record, or to its being of a thickness very considerably different from those now in standard use. The design of both Release Levers and Record Holders is such as to accommodate a maximum variation in thickness and flatness of records, but

certain records may be found which are so far out as to be impracticable for use in automatic changers.

If Necessary to Disassemble the Changer

Before attempting to remove Sub-Plate Assembly 83, detach Push-button Switch Unit 75 from Main Plate. To do this, start with Switch Unit Truss Bar 80. Then take out the screw which holds left end of Adjusting Rod Lever 94. Next remove Adjusting Rod 92 and Adjusting Rod Extension 79. Take out the screw Spring 73; then the screws holding Push-button Switch Unit 75 to Main Plate. Rods 77 and 78 can then, with due care, be extracted without bending. Free the Cam Connecting Rod 58 by loosening setscrew holding Spreader and Hub Assembly 59. Sub-Plate Assembly can then be detached without bending parts. In reassembling, reverse the procedure.

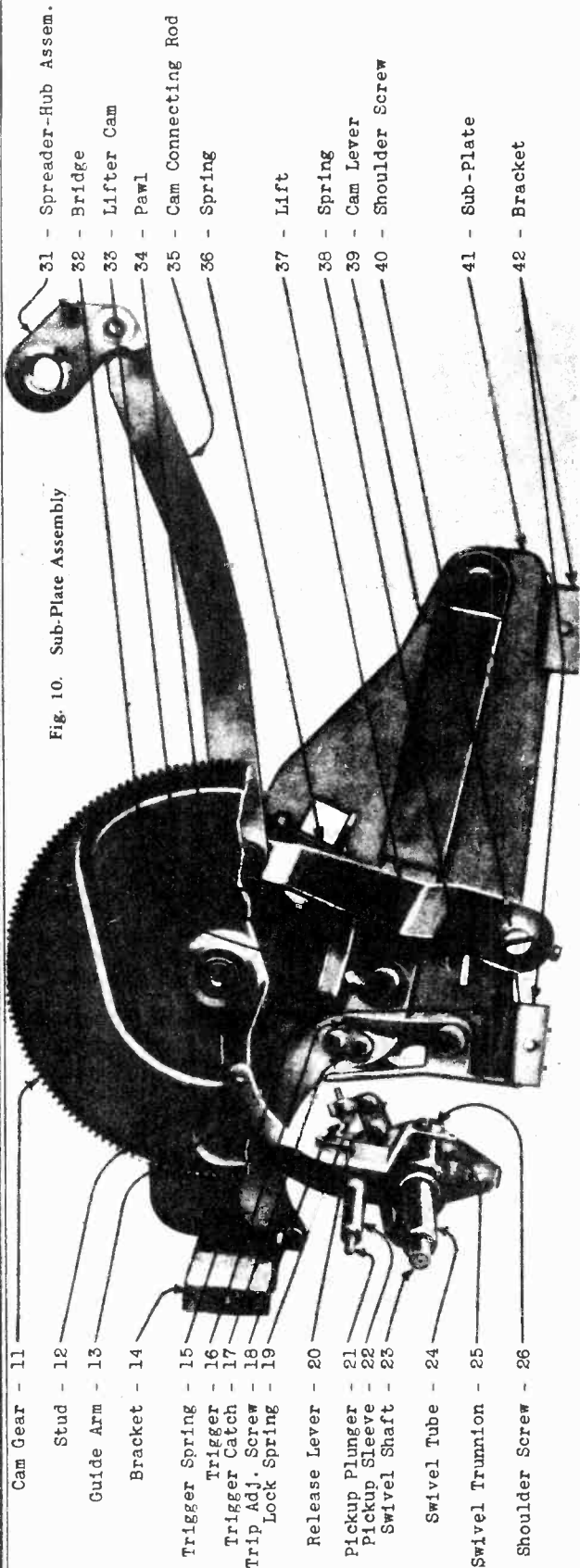
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Fig. 10. Sub-Plate Assembly



- Cam Gear - 11
- Stud - 12
- Guide Arm - 13
- Bracket - 14
- Trigger Spring - 15
- Trigger - 16
- Trigger Catch - 17
- Trip Adj. Screw - 18
- Lock Spring - 19
- Release Lever - 20
- Pickup Plunger - 21
- Pickup Sleeve - 22
- Swivel Shaft - 23
- Swivel Tube - 24
- Swivel Trunnion - 25
- Shoulder Screw - 26

- 31 - Spreader-Hub Assem.
- 32 - Bridge
- 33 - Lifter Cam
- 34 - Pawl
- 35 - Cam Connecting Rod
- 36 - Spring
- 37 - Lift
- 38 - Spring
- 39 - Cam Lever
- 40 - Shoulder Screw
- 41 - Sub-Plate
- 42 - Bracket

RA-412	ARM—Swivel guide arm assembly (13, 88)	75	RP-406	POST—Front or rear changer post with mounting washer and nut (71)	80	RS-483	SPRING—Adjusting screw lock spring (19) (Pkg. of 12)	25
RB-189	BRACKET—Adjusting rod bracket (86)	10	RP-407	POST—Swivel post with mounting washer and nut	75	RS-484	SPRING—Pick-up plunger spring (Pkg. of 3)	10
RB-190	BRACKET—Manual and rejection rod spring bracket (76)	10	RR-932	ROLLER—Rear post spring roller (61)	40	RS-485	SPRING—Pick-up lead spring (97) (Pkg. of 3)	25
RB-628	BUTTON—Switch push button (Pkg. of 4)	1.00	RR-933	ROD—Manual key rod (77)	10	RS-486	SPRING—Hinge pin spring (Pkg. of 6)	20
RC-1999	CLAMP—Crystal cartridge clamp and screws (Pkg. of 2)	25	RR-934	ROD—Rejection key rod (78)	15	RS-512	SWIVEL—Swivel shaft and head assembly (23)	90
RC-2000	COLLAR—Rear changer shaft collar and setscrew	60	RR-935	ROD—Cam connecting rod assembly (31, 35, 37, 58, 59)	1.40	RS-513	SLEEVE—Motor mounting grommet sleeve (51) (Pkg. of 3)	25
*RC-5000	CRYSTAL—Crystal cartridge assembly	6.00	RR-936	ROD—Adjusting rod assembly (79, 81, 92, 94)	1.60	RS-514	SWIVEL SPREADERS—Upper or lower swivel spreaders (90, 91)	20
RC-8146	CABLE—Pick-up cable and plug	.85	RR-937	ROD—Changer connecting rod assembly (57, 72)	2.20	*RS-859	SCREW—Needle screw	10
RG-109	GUIDE—Pick-up lifter guide	.40	RR-938	REST—Tone arm rest	20	RS-877	SCREW—Trunnion shoulder screw (Pkg. of 3)	25
RG-303	GROMMET—Motor mounting grommet (Pkg. of 6)	15	RS-473	SPRING—Selector plate spring (Pkg. of 5)	.10	RS-878	SCREW—Motorboard mounting screw (Pkg. of 4)	20
RG-707	GEAR—Cam gear assembly (11, 82)	2.40	RS-474	SPRING—Release trigger spring (15) (Pkg. of 3)	25	RS-935	SHAFT—Front changer shaft and pin (74)	60
RG-708	GEAR—Drive pinion gear assembly	.75	RS-475	SPRING—Cam connecting rod lift spring (Pkg. of 3)	25	RS-936	SHAFT—Rear changer shaft and pin (60)	.60
RH-113	HINGE—Adjusting rod hinge on switch unit (Pkg. of 3)	10	RS-476	SPRING—Pawl or extension rod spring (38, 79) (Pkg. of 3)	25	RS-3053	SWITCH—OFF-ON switch with lock washer and 16-inch leads (54)	.90
RK-069	KNOB—Changer post knob	\$0.25	RS-477	SPRING—Cam lever spring (36, 84) (Pkg. of 3)	25	RS-3054	SWITCH—Push-button switch unit (75)	1.70
RM-130	MOTOR—Motor and record pin assembly with mounting accessories, 115 V., 60 cycles, 78 rpm (55)	13.60	RS-478	SPRING—Rod or swivel guide arm spring (96, 87) (Pkg. of 3)	25	RT-918	TURNTABLE—1 1/2-inch mahogany flock turntable for Model H-118	2.20
RM-131	MOTOR—Motor and record pin assembly with mounting accessories, 115 V., 50 cycles, 78 rpm (55)	15.20	RS-479	SPRING—Changer spreader spring (62) (Pkg. of 2)	\$0.30	RT-220	TRUNK ARM—Tone arm assembly with lamp bracket and cord assembly	2.40
RM-132	MOTOR—Motor and record pin assembly, 115 V., 25 cycles, 78 rpm (55)	38.00	RS-480	SPRING—Swivel spreader spring (95) (Pkg. of 3)	.25	RX-070	ASSEMBLY—Pick-up plunger, sleeve and nut assembly (21, 22)	.65
RP-158	PLATE—Tone arm lift plate	.20	RS-481	SPRING—Manual and rejection rod spring (73) (Pkg. of 3)	.40	RX-071	ASSEMBLY—Stop lever and hub assembly (93)	.55
RP-159	PLATE—Sub-plate and lever assembly (14, 16, 17, 32, 34, 39, 41, 42, 83)	4.40	RS-482	SPRING—Motorboard mounting spring (Pkg. of 6)	25	RX-072	ASSEMBLY—Swivel tube and trunnion assembly (20, 24, 25)	1.00
RP-160	PLATE—Selector plate Assembly (Record holder and release lever)	3.80			15			
RP-405	PIN—Tone arm hinge pin (Pkg. of 6)	20						

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODEL LC-608

GENERAL ELECTRIC CO.

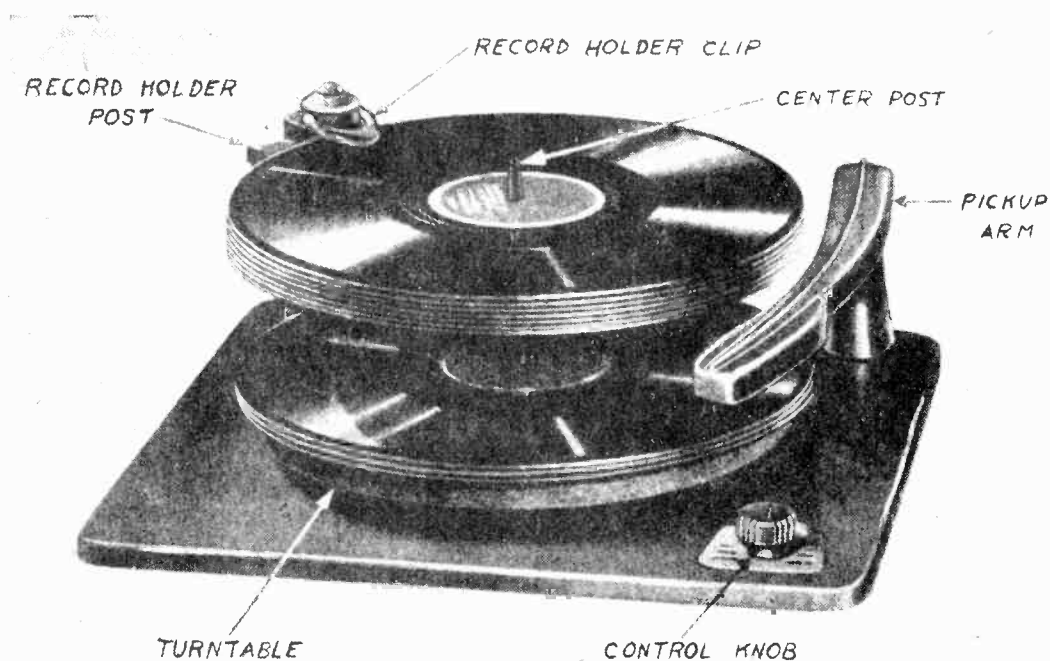


Fig. 1—Top View of Record Changer

This record changer will automatically play a series of twelve 10" or ten 12" records of the standard 78 R.P.M. type. The records must be all one size when loading, and may consist of less records than listed above. Records with or without a starting groove will operate the changer satisfactorily and the inside stopping groove may be a spiral or an eccentric. This means that any type of record, regardless of make, will operate the automatic mechanism. Records of any size up to 12" may be played manually.

The records are supported for automatic operation in two points, in the center by the center post, and on the edge by the record holder post.

CAUTIONS

1. Never use force to start or stop the motor or any part of the record-changing mechanism or pickup arm.
2. No damage will be done if you forget to turn off changer after it has played its entire load of records. It will simply repeat the last record until stopped.

TO PLAY RECORDS MANUALLY: MANUAL OPERATION

Manual operation is used for all home recordings and for single records if desired:

1. Remove the center post by pulling straight up.
2. Lift pickup arm several inches and move to the right side, clear of the turntable.
3. Place record on turntable with desired selection upward.
4. Turn the control knob to the "ON" position.
5. Place pickup on record so the needle enters the outside groove of the record.
6. Close lid of cabinet to eliminate the slight mechanical reproduction of sound by the needle.
7. Adjust volume control to desired level.
8. When the playing is finished, be sure turntable is stopped and pickup arm is in the rest position. Never leave the pickup arm with the needle resting on a record or the turntable.

RECORD CHANGER PARTS

RM-155R	Motor	Motor 60 Cycle	.....\$5.75
RS-3120R	Switch	On-off Switch	..... .45
RK-1046R	Knobs	Knobs (Plastic)	..... .10
RE-223R	Plate	Escutcheon Name Plate	..... .20
RS-9037R	Lift	Lift Spindle	..... .05
RT-943R	Arm	Tone Arm	..... .85
RX-106R	Lever	Return Lever Assembly (Pickup)	..... 1.50
RX-107R	Head	Complete Ejector Head Assembly	..... 3.50
RE-644R	Button	Buttons (Plastic)	..... .15
RC-2059R	Clamp	Record Holder & Indicator (Plastic)	..... .20
RT-942R	Turntable	Turntable	..... 1.70
RP-419R	Post	Center Turntable Post	..... 1.35
RC-5011R	Crystal	Crystal Cartridge	..... 4.50
RX-105R	Gear	Pinion Gear & Bearing Center Spindle Assembly	..... 2.50
RG-719R	Gear	Main Gear Assembly	..... 4.00
		SPRINGS	
RS-4041R	Spring	Record Clamp Spring	..... .05
RS-4042R	Spring	Lever Link Spring	..... .03
RS-4043R	Spring	Pickup Arm Tension Spring	..... .05
RS-4044R	Spring	Size Switch Mounting Spring	..... .05
ES-4045R	Spring	Reject Lever Spring	..... .10
RS-4040R	Spring	Record Changer Mtg. Spring, 1/2 doz.	..... .10

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

STARTING THE CHANGER

Turn the control knob counter-clockwise to the "ON" position; after the turntable has attained speed, turn the control knob all the way counter-clockwise to the "REJ." position for a few seconds and release. The bottom record will fall on the turntable and the unit will automatically play the entire stack of records. If the changing cycle should fail to start, repeat the above operation.

REJECTING A RECORD

To reject a record, it is only necessary to turn the control knob counter-clockwise to the "REJ." position for a few seconds and release. A record can be rejected anytime the needle is in contact with the record.

UNLOADING THE CHANGER

Turn the control knob to the "OFF" position and remove the center post by pulling straight up. The played records may now be easily removed after which the center post should be replaced. The center post must be turned as it drops into place in only one position.

FOR OTHER DATA SEE RADIO PRODUCTS COMPANY MODEL RC-50 SERIES

GENERAL INDUSTRIES CO.

MODEL K
MODELS L, 17

MODEL "L" (17) AUTOMATIC RECORD CHANGER

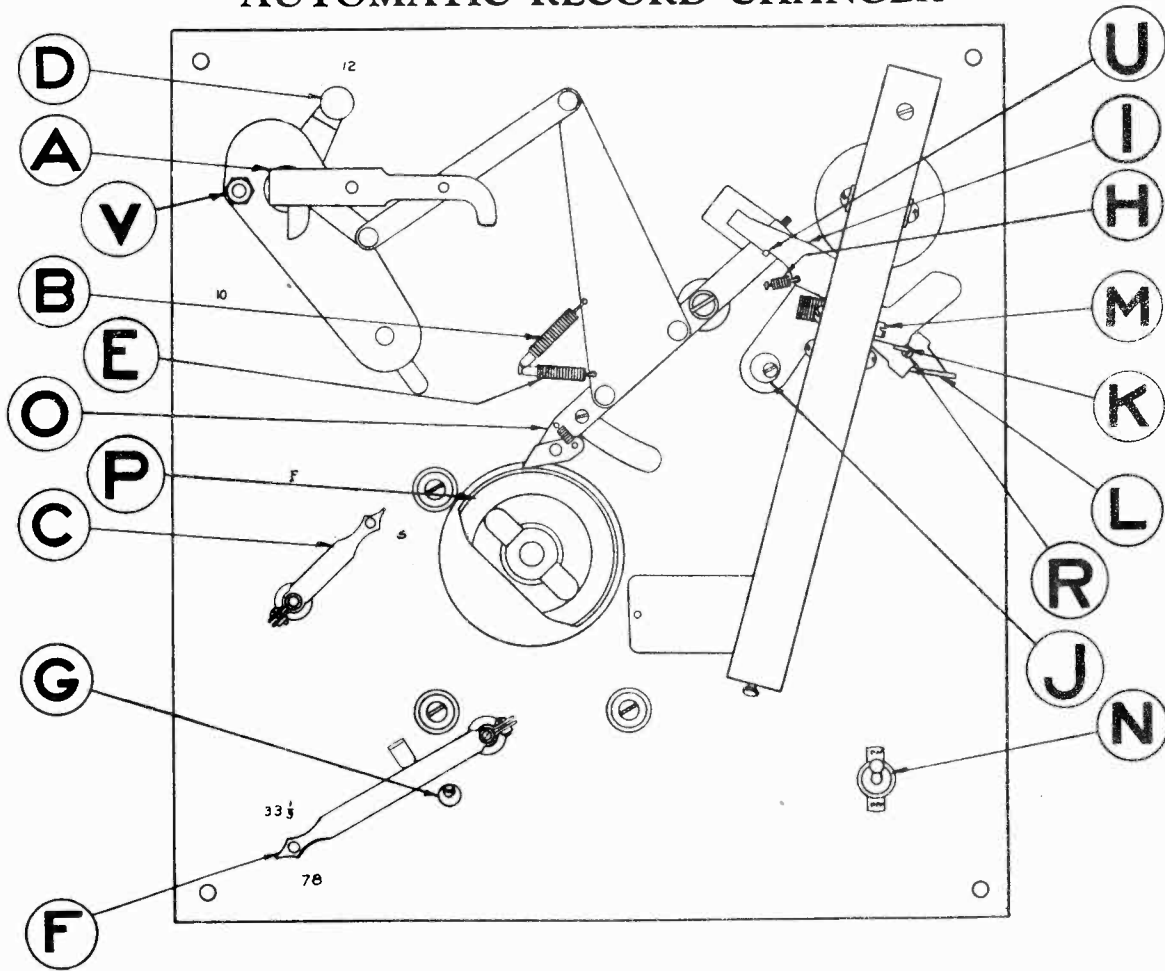
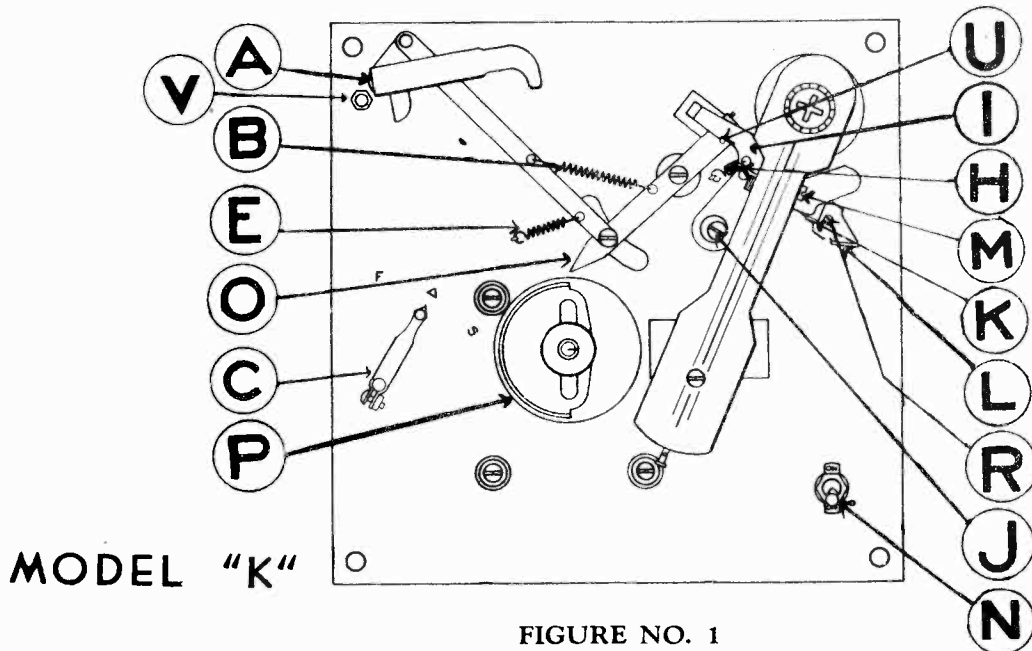


FIGURE NO. 1



MODEL "K"

FIGURE NO. 1

When eccentric or oscillating trip groove records are used, tripping is effected by means of the hardened steel pin in the end of tone arm lift crank at S Fig. 2 engaging the serrated block on the trip lever at T Fig. 2. There must be a minimum of 1/32"

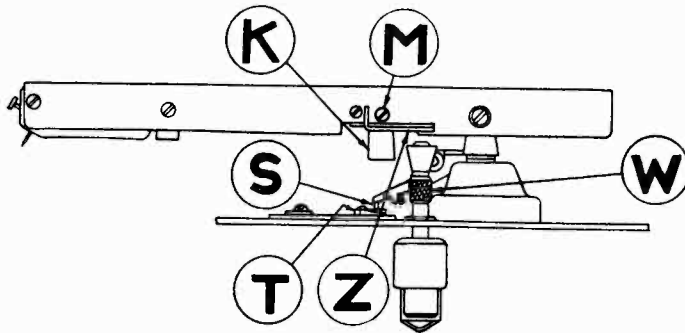


FIG. NO. 2

play between the end of the pin and the block, when, with a short needle, (5/8" Minimum Length) the pickup is resting on one record on the turntable. If the pressure of the pin on the block is not sufficient to insure operation, then check the pressure spring which is located up under the pickup.

The oval head pivot screw at R Fig. 1 serves as a pivot for the lift lever at I Fig. 1. This screw should allow the lift lever to be raised by the latch bar to its maximum height without binding but also without any additional play.

If the Record Changer fails to trip, see if the phonograph needle is jumping out of a worn record trip groove. Next make certain that all parts of the mechanism work freely and smoothly. If it is found that the latch bar at O Fig. 1 is not dropping in far enough to engage the cam at P Fig. 1, then check the tension of the trip spring at B Fig. 1.

RECORD REMOVING MECHANISM

The Record Changer is adjusted so that it will always leave one record on the turntable. This is done to prevent the phonograph needle from damaging the covering on the turntable.

In case the Record Removing Mechanism fails to operate smoothly, proceed as follows: First make certain that all parts work freely with no binding in pivots or bearings, and that the record removing arm assembly rests on the stop screw at Q Fig. 3. Next stop the motor in such a position that the latch bar at O Fig. 1 can swing by and clear the cam at P Fig. 1. Place just one record on the turntable and measure from the top of this record down to the base plate. This distance should be one inch. Now by pulling the reject lever at L Fig. 1 first, it will be found possible to swing the record removing finger at Y Fig. 3 over to where it just touches the edge of the record. If the adjustment is correct, the record removing finger should just barely rise over the edge of the first record. If adjustment is required it can be made by means of the stop screw at Q Fig. 3. In the event the record removing arm raises the record from the turntable and drops it back in place without removing it, check the lift adjustment at V Fig. 1. This adjustment consists of an eccentric stud which is provided with a lock nut, and is made by loosening the lock nut and turning the eccentric stud. The lift adjustment should be set so that the hole in the center of the record just clears turntable spindle when the Record Changer is in operation.

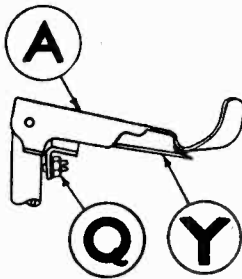


FIG. NO. 3

PICKUP LOWERING MECHANISM

The pickup lowering mechanism has two functions. First, it lowers the phonograph needle gently to the surface of the record. Second, it feeds the needle toward the center of the record so that it will enter the playing groove.

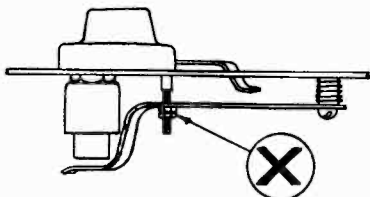


FIG. NO. 4

If the pickup descends too fast or too slow, adjust the speed of descent by turning the knurled thumb nut on the dashpot sleeve at W Fig. 2.

The unit is adjusted at the factory so that the needle will be set down approximately 3/32" in from the edge of the record. An adjusting screw is provided on the side of the pickup at M Fig. 2. If the needle is being lowered onto the playing surface of the record, and the adjusting screw at M Fig. 2 fails to correct the condition proceed as follows: First stop the record changer, with the pickup in the maximum raised position and check the clearance between the underside of the pickup shelf at Z Fig. 2 and the tip of

the dashpot. This clearance should be very small as otherwise the pickup will tend to bounce as it is lowered. There must be sufficient clearance however to prevent the pickup shelf from rubbing on the tip of the dash pot, or the pickup will not swing out far enough to allow the adjustable stop at K Fig. 2 to come to rest against the dashpot. Check this clearance in both 10" and 12" record positions. If adjustment is required, the height of the dashpot may be regulated by loosening the nuts on the bottom of the lift lever stud at X Fig. 4 and changing their position on the stud. To raise the dashpot turn the nuts clockwise, to lower the dashpot turn the nuts counter-clockwise. Be sure to lock the nuts tightly together after the adjustment is made.

GENERAL INDUSTRIES CO.

MODEL K
MODELS L, 17MODEL K only

OPERATING INSTRUCTIONS

The Model "K" Record Changer plays eight 10" Records automatically. The last record remains on the turntable and repeats as long as the Record Changer is in operation.

Records may be repeated as often as desired by raising the record removing arm at A Fig. 1 to the upright position.

To reject a record and play the next record below it, pull the latch lever at L Fig. 1 forward.

MODELS L and 17 only OPERATING INSTRUCTIONS

The Model "L" Record Changer plays seven 12" or eight 10" Records automatically. The last record remains on the turntable and repeats as long as the Record Changer is in operation.

Records may be repeated as often as desired by raising the record removing arm at A Fig. 1 to the upright position.

To reject a record and play the next record below it, pull the latch lever at L Fig. 1 forward.

To adjust the record removing arm to handle 10" records set the record removing arm change lever at D Fig. 1 opposite the number 10 stamped on the base plate. For 12" records set the lever opposite the number 12.

To adjust the pickup to play 10" records, push the pickup stop at K Fig. 1 back. (Away from the pickup needle). For 12" records pull the stop forward (toward the needle) as far as it will go.

Some units are equipped with two speed motors, and others with 78 RPM motors. When the two speed motor is used change from one speed to the other by simply moving lever at F Fig. 1 to position desired.

To start motor, throw switch (supplied on some models) at N Fig. 1 on the "on" position.

MODELS K, L and 17

MOTOR LUBRICATION

The motor installed in the Record Changer is governor controlled, with all gearing enclosed, and leaves the factory lubricated for proper operation. For maximum satisfaction, lubricate the motor at regular intervals with SAE No. 10 oil. Please do not use any other grade of oil.

The governor disc engages with a ring of hard felt. This felt is impregnated with a lubricating solution sufficient for proper operation for approximately a year under normal conditions. It may be necessary, however, if the motor shows a tendency to chatter or waiver, to apply a drop or two of oil to this felt ring.

MODELS K, L and 17

MOTOR SPEED

The motor speed is adjusted by means of a lever at C Fig. 1 which is mounted under the turntable. The direction of swing to fast or slow is indicated by the legends F and S on the base plate.

33-1/3 RPM — 78 RPM SHIFT

MODELS L and 17

(Two-speed motors only)

ONLY

Move the speed change lever at F Fig. 1 as far as it will go in the direction of swing indicated by the legends 33-1/3 and 78 on the base plate.

If adjustment of the speed change lever is required for any reason, proceed as follows: First loosen the screw which clamps the lever to the motor shaft. This shaft is provided with a screw-driver slot in the end. Next, using a screw driver, turn this shaft in a clockwise direction until you feel it strike the stop. The motor is now in the 33-1/3 RPM position. Now set the lever against the lug provided in the base plate and opposite the legend 33-1/3 and tighten the clamp screw. This places the lever in the correct position on the motor shaft. The final step is the adjustment of the eccentric bushing at G Fig. 1 which limits the throw of the lever. First loosen the screw which holds the eccentric bushing. Next, throw the speed change lever to its farthest 78 RPM position, (using care that the lever does not slip on the motor shaft). Then turn the eccentric bushing around until it touches the side of the lever, and tighten it in place with the screw provided.

MODELS K, L, and 17

TRIP MECHANISM

The trip mechanism is the trigger that sets the Record Changer in motion. This is done by allowing the latch bar at O Fig. 1 to drop in front of, and be actuated by the cam at P Fig. 1. This cam is driven by the motor and is in motion as long as the motor is running. If this mechanism does not operate smoothly, the precautions outlined in succeeding paragraphs should be observed.

First of all, make sure that the square pin in the latch lever at U Fig. 1 latches properly in the notch in the lift lever at I Fig. 1. When latched, the notch should be engaged approximately one-half of its depth. The depth of engagement is adjusted by means of the eccentric washer and locking screw at J Fig. 1. Now run the Record Changer through its cycle. If the square pin fails to engage the notch in the lift lever, first check the tension of the latch spring at H Fig. 1 to insure that the notch can engage the pin. Next check the tension of the reset spring at E Fig. 1. This reset spring should not be under tension when the latch bar is latched but should have enough tension when the latch bar drops back off of the cam to cause the square pin to over travel the notch in the lift lever.

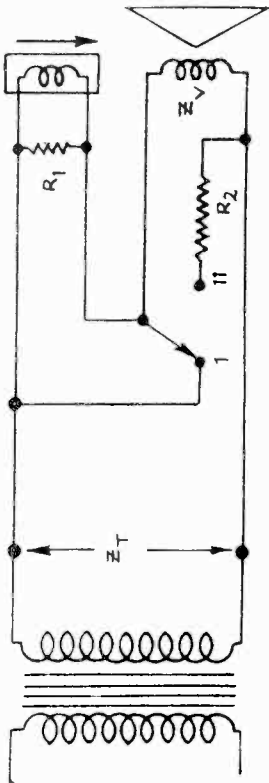
IMPORTANT — Before attempting to change the tension of any spring, be sure that the parts involved work freely without any tendency to bind, as of course any binding condition would preclude proper operation.

The Record Changer is adjusted at the factory to trip on a spiral trip groove record when the phonograph needle is 1 3/4" from the edge of the hole in the center of the record.

MODELS R70, R70L
MODELS R90, R90L

GENERAL INDUSTRIES CO.

MAGNETIC CUTTER



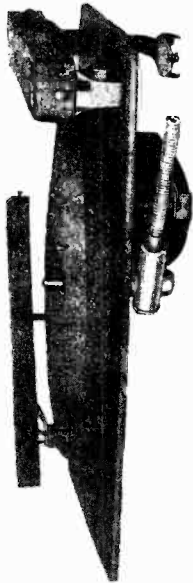
MATCH TO OUTPUT
STAGE IMPEDANCE.
(PUSH-PULL OR
SINGLE TUBE)

CUTTING HEAD
RESISTANCE, R_c
I - RADIO
II - RECORDING
 Z_v = VOICE COIL
 Z_T = IMPEDANCE

FIG. A

TYPICAL VALUES OF COMPONENTS

R_c OHMS	R_1 OHMS	Z_v OHMS	R_2 OHMS	Z_T OHMS	MONITORING ATTENU- ATION BELOW NORMAL PLAYING LEVEL DB.
4	10	4	1	4	20
4	12	6	1.5	6	14
4	12	8	5.3	8	8
4	12	10	11	10	6
4	12	15	2.6	15	5



Model GI-R70

A suggested circuit for inclusion of the magnetic cutter in the voice coil circuit is shown in Figure A. While other arrangements are equally satisfactory, this hookup can be used on all standard radio sets and amplifiers.

In connection with the table "Typical values for components", best results will be obtained where it is possible to use values between 6 and 8 ohms for Z_t and Z_v .

A volume indicator is necessary to prevent cutting too heavily. For this purpose a medium speed voltmeter can be connected across the cutting head in parallel with R_1 . Where R_c has a value of 4 ohms as shown, the voltage peaks should be about 1 volt on speech and 1½ volts on music. **Important** when connecting a voltmeter in parallel with R_1 , the value of R_1 must be increased to the point parallel will equal the values for R_1 and the voltmeter in if the voltmeter has a resistance equal to the values for R_1 it of course can be substituted for R_1 .

To cut an approximation of the standard commercial recording characteristic with the crystal cutter, a 50,000 ohm resistor should be placed in series with the cutter. To emphasize high frequencies, this resistor should be shunted with a condenser between .001 to .01 mfd. To emphasize low frequencies the series resistor should be varied up to 250,000 ohms.

A volume indicator is necessary to prevent cutting too heavily. For this purpose a rectifier type AC voltmeter, 1,000 ohms per volt, 0-150 volts scale, can be connected as indicated by "V. I." in Fig. B. For normal recording the voltage peaks should be about 100 volts.

Important crystal cutters must be protected from temperatures higher than 120° F., voltages in excess of 350 volts RMS and from DC voltages.

CRYSTAL CUTTER

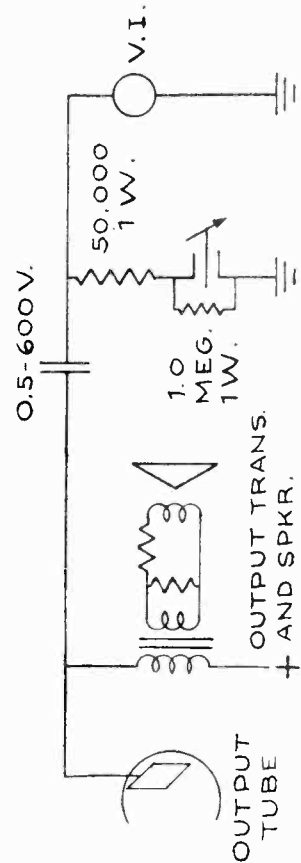


FIG. B

GENERAL INDUSTRIES CO.

MODELS R70, R70L
MODELS R90, R90L

AMPLIFIER

The amplifier should be capable of at least 5 watts output in order to keep harmonic distortion down to a reasonable level and preferably have triode output or beam tubes with inverse feedback. Frequency response should be reasonably flat within the audible range. Hum level should be low enough so that hum is not discernible at the loud speaker with the volume adjusted to recording level. The amplifier should be stable at full volume and "microphonic"

tubes avoided. If the amplifier and recorder unit are to be installed in the same cabinet, all conditions of mechanical resonance and feed back must be avoided to preclude the possibility of recorded "rumble". The cabinet should be substantially built of comparatively heavy materials. If cabinet resonance is encountered, wooden braces glued to the inside surfaces of the cabinet will sometimes serve to correct this condition.

RECORDING FROM RADIO

For radio recording, it is desirable to leave the speaker connected for monitoring purposes. In Fig. A the circuit components are arranged for reducing the speaker volume during recording as shown in the table.

Referring to Fig. B, an "L" pad is shown in the voice coil circuit for reducing speaker volume during recording. When the radio is being used without recording this "L" pad should of course be disconnected.

RECORDING FROM MICROPHONE

When recording from microphone the speaker must be disconnected to prevent feed back and a resistor of the same value as the speaker voice coil substituted for the

voice coil, in order that the proper load impedance be reflected back to the output tubes.

PLAYBACK PICKUP

The crystal pickup leads may be connected directly to the phonograph input terminals provided on most amplifiers and radio receivers, or may be connected between "grid" and "ground" of the radio receiver's second detector tube if no other connection is provided. The "ground" connection

should be made to the outer conductor, or shield, of the pickup cable, while the inner wire of the cable should be connected to the "grid" of the tube. If these connections are reversed, an A. C. hum will be heard in the loud speaker when the equipment is arranged for playing records.

MICROPHONE

For making microphone recordings through the audio amplifier of a radio receiver, quite satisfactory results will usually be forthcoming by use of a diaphragm type crystal microphone of reputable manufacture, connected to the phonograph input terminals of the radio receiver. Correct polarity of connections to the microphone cable should be observed, the same as for connecting the pickup cable. The shield of the cable should connect to "ground." This ar-

angement will usually afford sufficient volume for microphone recording, although the microphone cannot be expected to produce the same loud speaker volume as is obtained in playing records with the pickup connected to the amplifier. The phonograph pickup delivers approximately from 1 to 2 volts to the input of the amplifier, while the microphone is capable of furnishing only approximately 1/100th of this voltage or from .01 to .02 volts.

PRE-AMPLIFIER FOR MICROPHONE

If it is within the scope of the constructor's knowledge and ability, the assembly and installation of a microphone pre-amplifier will prove to be a material aid in microphone recording service. The purpose of the pre-amplifier is to amplify the impulses generated by the microphone, before

being fed into the audio frequency amplifier, so that the amplifier will produce about the same amount of volume to the recording head, or cutter, whether recordings are made from microphone or from radio reception.

RECORDING MECHANISM ADJUSTMENTS

Before attempting to make recordings, after the recorder has been set up and properly connected to the amplifier or radio receiver, first make an inspection of the various

adjustments provided on the recorder, and make whatever corrections necessary to insure correct depth and spacing of the grooves cut into the record surface, as follows:

PROPER ENGAGEMENT OF FEED SCREW

With the recording arm raised to an angle of approximately 45 degrees, the follower arm (refer to Fig. 7) should be noticed to be completely disengaged from the lateral feed so that the recording arm may be moved horizontally across the turn-table. With the recording arm lowered to a position so that the bottom of the nose of the arm is 2 inches above the turn-table, the tongue of the phosphor bronze spring should just clear the lateral feed screw. The adjustment for this height may be accomplished by an adjustment of the phosphor bronze spring screw. In making this ad-

justment, note that the end of the adjusting screw bears against the phosphor bronze spring when the recording arm is lowered to recording position.

The pressure of the phosphor bronze spring, bearing against the lateral feed screw, should be sufficiently great so that the knife-edge tongue will not have a tendency to climb out of the grooves in the feed screw. The pressure should not be too great, however, or too much power will be required from the motor, producing "wows."

ADJUSTMENT OF CUTTING ARM AND HEAD

When the recorder is packed for shipment, all adjustments are in correct order, however, as these adjustments may become altered to some extent in handling the equip-

ment during installation, some correction of the adjustments may be required to restore them to their original positions.

MODELS R70, R70L
MODELS R90, R90L

GENERAL INDUSTRIES CO.

HEIGHT OF RECORDING ARM ABOVE RECORD

By referring to Figure 7, it will be observed that the correct height of the recording arm above the surface of the record (arm lowered to recording position) is $\frac{1}{4}$ inch. As the arm height has a definite bearing upon the uniformity of the groove cut into the record, this adjustment is very important, and the $\frac{1}{4}$ inch measurement should be made with an accurately calibrated steel scale. If the height of the arm is found to be incorrect, an adjustment of the ARM HEIGHT ADJUSTMENT SCREW should be made so that the lower edge of the front end of the arm is EXACTLY $\frac{1}{4}$ inch. To make this adjustment, raise the arm to its vertical position and loosen the lock nut which holds the adjustment screw in position.

The connecting wires from the cutting head should not be allowed to double up between the arm and arm platform, but should feed freely through the hole in the plat-

form as the arm is lowered. Otherwise, the wires doubled up may prevent the arm from coming to rest on the head of the height adjustment screw.

There is little likelihood that the arm height adjusting screw will get out of adjustment due to the lock nut becoming loosened. However, there is the possibility that the recording arm may be roughly handled by the operator. If the arm were to be forced backwards after having been raised to its vertical position,— or if, while being lowered to its horizontal position to the right of the turn-table, the arm were dropped or forced downward, the plate on which all of the recording mechanism is mounted, may be bent or sprung slightly. This would destroy the $\frac{1}{4}$ inch height adjustment, and readjustment of the arm height adjusting screw would be necessary to bring the nose of the recording arm to exactly $\frac{1}{4}$ inch above the record surface.

DEPTH OF CUT ADJUSTMENT

The depth of cut is regulated by an adjustment of the flat head screw on the top of the recording arm, FIGURE 2.

Turning the screw to the right (clockwise) increases the depth of cut.

Turning the screw to the left (counter-clockwise) decreases the depth of cut.

Observe that the leads connecting to the cutting head are shaped to form an "S," FIGURE 3, and that these wires are kept in the clear—not touching the balance spring. Also, the wire leads should not be permitted to droop (arm horizontal) so that they will rub on the turn-table.

Make a trial cut of a dozen or so grooves on a blank recording disc and observe the depth of cut by use of a strong

magnifying glass. The correct depth of cut will cause the width of the groove to be about the same or slightly greater than the width of the "land" or uncut portion of record surface between grooves.

In criticalness of adjustment, one turn of the depth of cut adjustment screw makes a noticeable difference in the depth of the groove, therefore, the adjustment should be made in quarter or half turns rather than in complete turns either way.

The thread of shaving cut from the record surface should be firm, although neither coarse and stiff, nor light and "fluffy." The machine is cutting correctly if the total shaving cut from one surface of a $6\frac{1}{2}$ " record, when wadded up or rolled into a ball, is approximately $\frac{3}{8}$ " in diameter.

ADJUSTMENT OF RECORDING ARM MOUNTING

The recording arm assembly is mounted on the upper end of the pivot post (Fig. 7) and held in correct position by means of the two hex-head set screws as illustrated in Fig. 8. In the event the recording arm should become loosened on the pivot post, the vertical position of the arm with respect to the pivot post, and also the horizontal position of the arm with respect to the follower arm should be observed, before tightening the hex-head set screws.

(a) The end of the pivot post should be flush with the bushing on the top side of the arm platform (FIGURES 4, 7, and 9) and when the recording arm is lowered to its hori-

zontal position, a small gap should exist between the pivot post bushings X and Y, FIGURE 4.

(b) Place the follower arm in a position so that it touches the follower arm stop located close to the motor underneath the recorder suspension plate, and place the recording arm in a position which allows the cutting stylus to rest on the record approximately $1\frac{3}{8}$ inches from the turn-table center post. This will provide a maximum playing time of approximately 2 $\frac{1}{5}$ minutes for the $6\frac{1}{2}$ " record, $3\frac{1}{2}$ minutes for the 8", and 5 minutes for the 10" discs.

MAKING A TRIAL RECORDING

After it has been determined that all of the aforementioned adjustments are in correct order, and the machine is cutting correctly, a trial record should be made to determine the correct level of volume for recording.

During recording, the tone control should be set to its treble or high pitch position to avoid the possibility of losing high frequencies in the recording.

In making microphone recordings, place the microphone

at a distance of about 10 to 18 inches for the speaking voice, and at correspondingly greater distances for recording vocal or instrumental musical renditions. When recording speech, the microphone should not be spoken into at close range, as lip sounds and sounds of breathing will be recorded, and because of shock to the microphone diaphragm due to sudden bursts of sound impulses entering the microphone, the voice is caused to be recorded unnaturally.

INSPECTION OF TRIAL RECORDING

After the trial recording has been made, an inspection of the record should be made, both visually and aurally. In viewing the grooves cut into the record surface, it will be observed that modulation laid in the grooves due to the lateral movement of the cutting stylus, caused by amplified electrical impulses fed into the cutting head, have caused the grooves to assume a "wavy" characteristic. It is this "wavy" characteristic of the groove which produces reproduction of recorded sounds, by causing the phonograph needle, during playback, to simulate the lateral excursion of the cutting stylus during recording, resulting in a reproduction of sounds exactly as they were recorded. The magnitude of the electrical impulses reaching the cutting head, governed by the loudness of sounds entering the microphone

and by the degree of amplification of sounds through the audio amplifier, determines the amplitude of the "wavy" characteristic of the groove. It can be seen that the use of too great a volume during recording would tend to cause over-cutting between grooves. If the wall of record material between grooves were cut completely through into the adjacent groove, the playback needle would readily jump grooves and the record would be rendered useless. If the grooves are not completely overcut, although sufficient volume has been used in recording to cause a very thin wall of record material to be left between grooves, the point of the playback needle in reproducing the record would tend to push the thin wall of material over into the adjacent groove. If this occurred, "echo" or "ghost" would be per-

GENERAL INDUSTRIES CO.

INSPECTION OF TRIAL RECORDING (Cont'd)

ceptible in playing the record. "Echo" is the faint reproduction of recorded sound as the playback needle travels in the adjacent groove following the groove in which the actual recording is contained, while the "ghost" is the faint

reproduction of recorded sound as the playback needle travels in the adjacent groove preceding the groove in which the actual recording is contained.

PROPER RECORDING LEVEL

If the recording is made at too low a volume level, the modulation laid in the grooves during recording will cause the grooves to be only slightly "wavy," and the volume produced when playing the record will be inadequate. If the volume control is turned up in playing the record to compensate for the lack of recorded volume, surface noise caused by friction of the phonograph needle riding in the groove will be quite noticeable. After making a few trial recordings, the operator will be able to determine the proper setting of the volume control to provide the correct level

of volume for recording.

If the volume is controlled while recording is in progress, this should be done slowly as any abrupt change in volume will be definitely noticeable when playing the record. When recording, the volume control serves only as a means for adjusting the average volume on the record, and the expression of instrumental music or vocal passages will be impaired if loud and soft passages are compensated for by either decreasing or increasing the volume.

TONE CONTROL

In playing records, the use of the amplifier tone control will be found effective in diminishing record surface noise.

which may be accomplished without impairing the fidelity of reproduction.

IMPORTANT NOTES

CUTTER HEAD LEADS

The cutting head connecting leads should be kept as short as possible, and in the clear, free from other connecting leads and wires. If any microphonism or audio feed-back is encountered during recording, which manifests itself in the

form of a howl or whistle in playing the record, grounding one side of the voice coil circuit will usually correct this condition.

LEVELING OF RECORDER

To derive the best operation from the recorder, the instrument should be placed so that the turn-table is level, in

order for the cutting head to be correctly balanced in its mounting.

LUBRICATION

Although frequent oiling of the motor is not required, the use of a small amount of oil judiciously applied, two or three times a year, will suffice to maintain the equipment in good order.

1. Remove the turn-table by applying upward pressure to the rim of the table, at the same time lightly tapping the end of the turn-table center post with a small tool.
2. Apply several drops of SAE No. 10 pure mineral oil to the side of the motor shaft, allowing the oil to run down into the upper bearing.

3. Oil the idler wheel bearing, using only one or two drops of the oil so that it will not run out onto the rubber rim of the wheel.
4. The lower motor bearing may be lubricated by saturating the felt wick which surrounds the lower end of the motor shaft.
5. Make an application of two or three drops of oil to the recording arm pivot post, which may be seen by raising the arm to its vertical position. Place the oil on the pivot post between the two large metal bushings of the recording arm mounting.

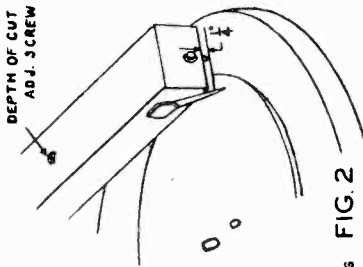


FIG. 2

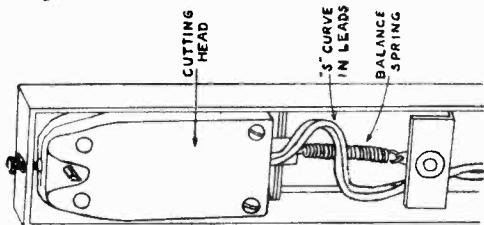


FIG. 3

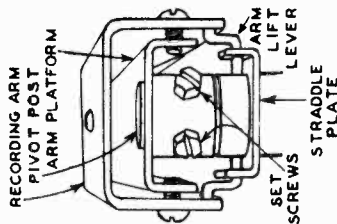


FIG. 8

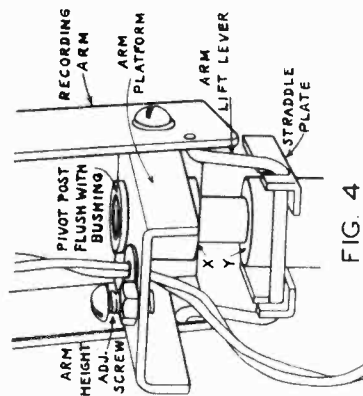
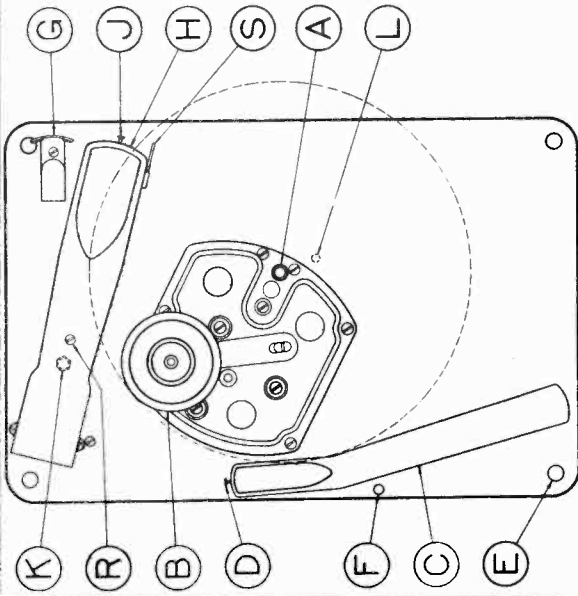


FIG. 4

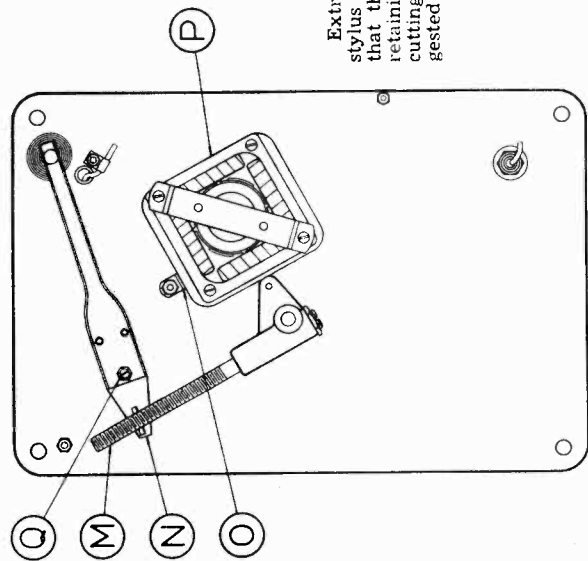
MODELS R70, R70L
MODELS R90, R90L

GENERAL INDUSTRIES CO.

MODEL GLR70



TOP VIEW WITH TURNTABLE REMOVED



BOTTOM VIEW UNDER BASE PLATE

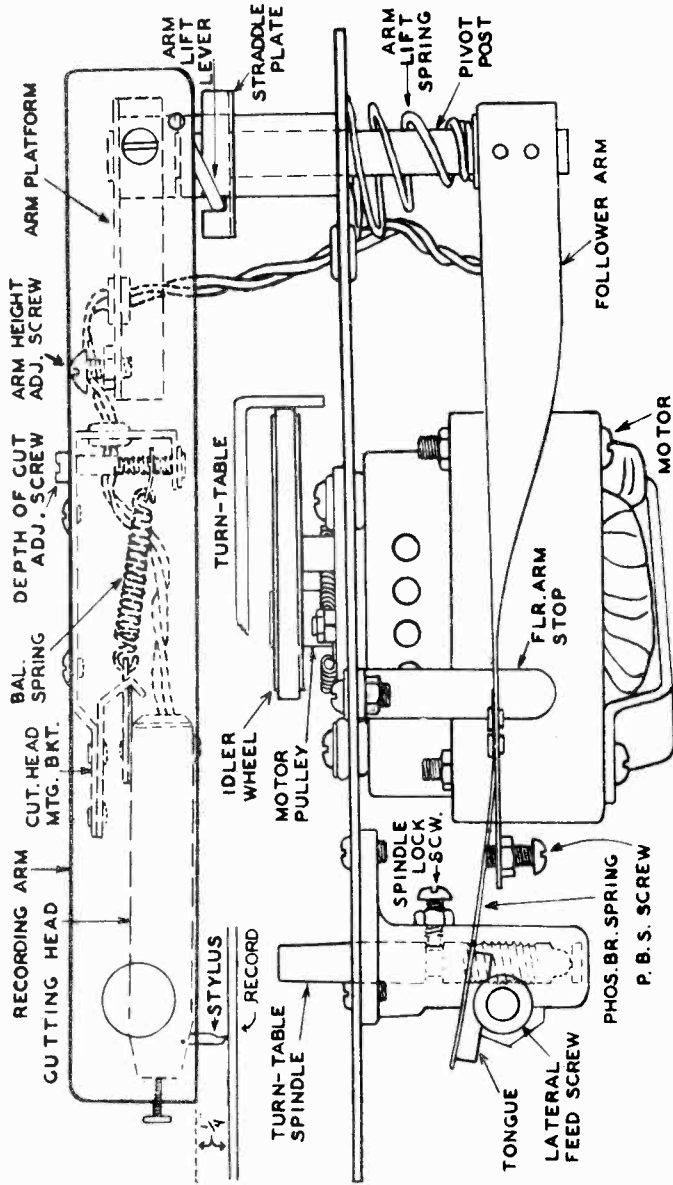


FIG. 7

PRECAUTIONS WITH REGARD TO CUTTING STYLUS

Extreme care should be exercised to see that the cutting stylus is held in the cutting head tightly. Owing to the fact that the cutting stylus is of very hard steel and that the retaining screw is hardened also, there is a tendency for the cutting stylus to become loosened in the head, and it is suggested that the retaining screw be given a little tightening

turn each time a recording is made.

Under no circumstances allow the Cutting Stylus to rest on the table top or any other metal because ITS POINT IS RAZOR SHARP and it will be dulled if this precaution is not taken and a new Stylus will have to be purchased.

R70L, single speed recording assembly,	RM4 motor, low pressure pickup
R70, " " " "	" " " " , standard " "
R90, dual " " " "	" " " " , standard pressure crystal pickup
R90L, " " " "	" " " " , low pressure crystal pickup

GENERAL INDUSTRIES CO.

MODELS R70, R70L
MODELS R90, R90L

HOW TO PLACE RECORD ON TURNTABLE

Place blank record disc on turntable in such a manner that the retractable pin (L) protrudes through one of the three holes near the center of the record. This is absolutely necessary to prevent the record from slipping and ruining the recording. When it is desired to play an ordinary record, place record on turntable—weight of record will cause pin to depress into turntable and friction between record and table is sufficient to prevent slippage.

CAUTION

To obtain best results in playing back Home Recordings, a special needle for that purpose should be used.

HOW TO CUT RECORDS

Start motor, raise cutter arm from rest position to angle of approximately 45 degrees and move inward until white mark on front of cutter arm is just inside record periphery. Lower arm gently as far as it will go—if stylus does not contact record, the arm must be raised to re-locate. The record is now being cut. Inside limit of travel of recording arm will be indicated by a "clicking" sound, due to follower arm (N) contacting the adjustable stop (O). When this is heard, raise cutter arm immediately and place on rest (G). During time of cutting, fine threads will accumulate about ½ inch inside stylus. These threads are carried to the center spindle or turntable shaft by means of the thread collector (S) attached to the inside of the cutter arm.

PHONOGRAPH PLAYBACK

With phonograph reproducing needle in pickup arm (C) start motor and place arm on record.

CUTTING HEAD AND ARM ADJUSTMENTS

There is a possibility that these adjustments may have been altered after leaving our factory, if so, the following information should be sufficient to make the proper readjustments.

With record blank on turntable, cutting stylus in cutting head and cutting arm lowered on the record, the cutting stylus clamp screw (J) should be centered in the slot through which it protrudes. This condition should occur when the underside of the nose of cutter arm is approximately ¼ inch above record surface. If this height of the arm differs appreciably, adjustments may be made by adjusting screw and lock nut (K). A cut of at least ten turns should now be made on the record blank. Remove record and hold so light is reflected from surface just cut, then relative width of cut can be observed.

When properly adjusted, grooves are just about as wide as space between grooves. For readjustments, turn adjusting screw (R) to right or clockwise to increase depth and width of cut and to left or counter clockwise to decrease the depth or width. Turn screw in quarter or half-turns only as this adjustment is very critical. When cutting head is properly adjusted and arm is raised to approximately 45 degrees, cutting stylus screw (J) should just rest on bottom of slot and cutting head almost floating.

(K) Adjusting Screw and Lock Nut for proper spacing between cutter arm and record.

(L) Retractable Pin in turntable for driving home recording disc.

(M) Lead Screw.

(N) Follower Arm and Spring Cam. This arm and cam mesh with lead screw (M) to provide lateral motion of cutter arm during recording.

(O) Adjustable Stop for lateral motion of follower arm.

(P) Rim Drive Electric Motor. Be sure Voltage and Cycles are correct for your Power Line.

(Q) Adjusting Screw for proper tension of spring cam on lead screw (M).

(R) Adjusting Screw by which the tension on the cutter head equalizing spring may be varied for different types of records.

(S) Thread Collector.

(A) Turntable Shaft.

(B) Rubber-tired Drive Wheel. By means of a spring, this wheel contacts the steel pulley on the motor and the inside flange of the turntable, driving the table in clockwise rotation.

(C) Pickup Arm.

(D) Needle Set Screw.

(E) Mounting Holes. Solid mounting, rubber washers or springs may be used when bolting recorder in cabinet to absorb possible vibration.

(F) Pickup Rest Post.

(G) Cutter Arm Support Rest. Holds cutter arm out of the way during playback and also removes all strain on cutter head equalizing spring.

(H) Cutter Arm. At all times except when actually recording, cutter arm is placed on cutter arm support rest (G).

(J) Cutting Stylus Clamp Screw.

HOW TO REPLACE NEEDLES

See that needle is securely fastened by means of small thumb screw (D) on the front of the pickup arm (C). We recommend the use of needles ½ inch in length. Detailed information concerning length of needles and quality can be had by consulting your local dealer.

HOW TO INSERT CUTTING STYLUS

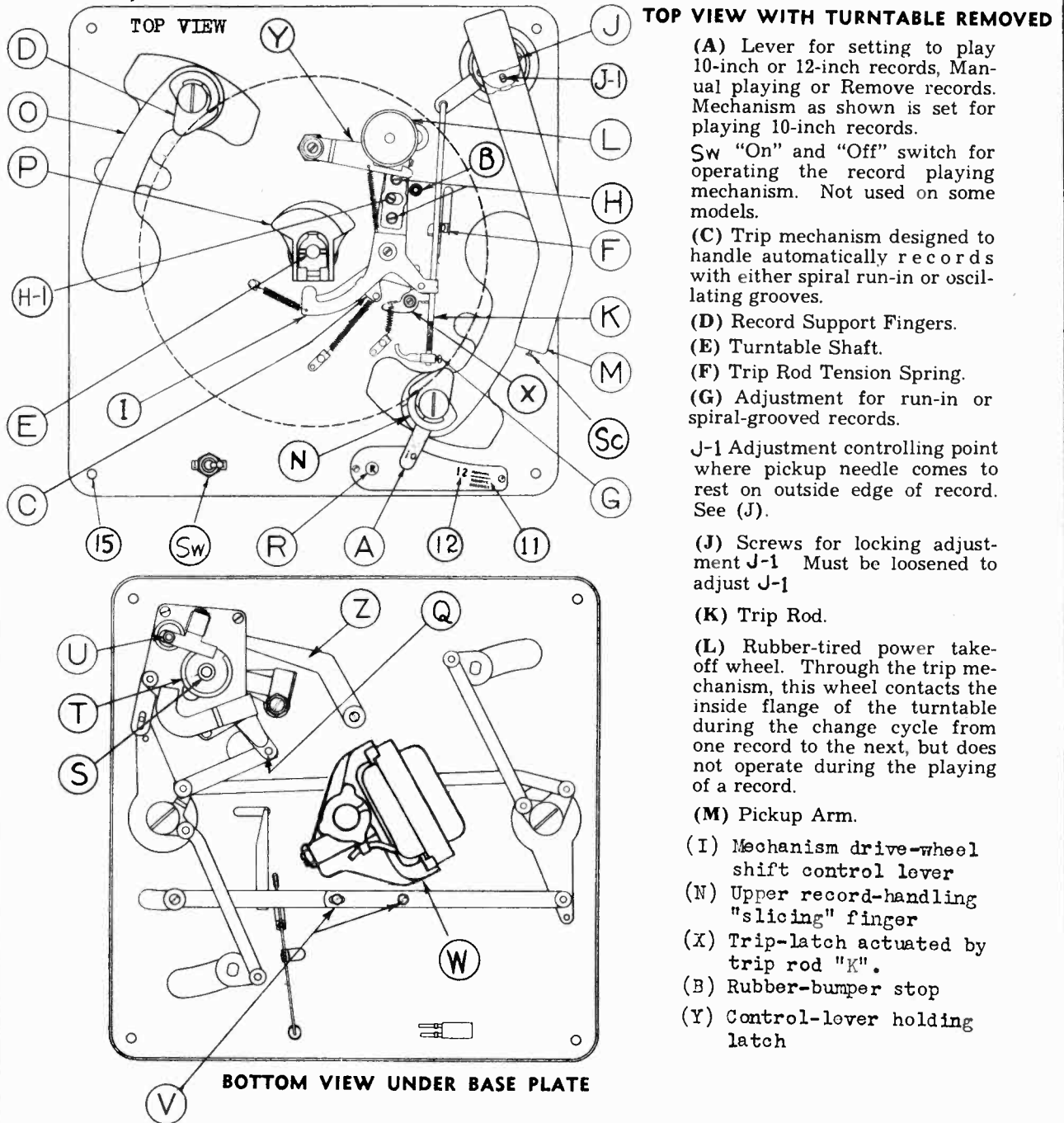
Raise arm (H) to vertical position, or nearly so, loosen screw (J) and insert stylus or cutting needle in under side of the cutter head, making sure that point of screw (J) bears on the flattened portion of the stylus or cutting needle. Then, tighten screw firmly.

Screw (J) should be checked for tightness before each recording as both screw and cutting stylus are made of a hard material and may become loosened.

Extreme care should be taken to see that cutting stylus does not rest on turntable top or any other metallic object because of its razor-sharp point which may be dulled if these precautions are not taken.

MODELS C120, C120L,
C125, C125L

GENERAL INDUSTRIES CO.



TOP VIEW WITH TURNABLE REMOVED

(A) Lever for setting to play 10-inch or 12-inch records, Manual playing or Remove records. Mechanism as shown is set for playing 10-inch records.

Sw "On" and "Off" switch for operating the record playing mechanism. Not used on some models.

(C) Trip mechanism designed to handle automatically records with either spiral run-in or oscillating grooves.

(D) Record Support Fingers.

(E) Turntable Shaft.

(F) Trip Rod Tension Spring.

(G) Adjustment for run-in or spiral-grooved records.

J-1 Adjustment controlling point where pickup needle comes to rest on outside edge of record. See (J).

(J) Screws for locking adjustment J-1. Must be loosened to adjust J-1.

(K) Trip Rod.

(L) Rubber-tired power take-off wheel. Through the trip mechanism, this wheel contacts the inside flange of the turntable during the change cycle from one record to the next, but does not operate during the playing of a record.

(M) Pickup Arm.

(I) Mechanism drive-wheel shift control lever

(N) Upper record-handling "slicing" finger

(X) Trip-latch actuated by trip rod "K".

(B) Rubber-bumper stop

(Y) Control-lever holding latch

BOTTOM VIEW UNDER BASE PLATE

SC Needle Set Screw—Thumb type set screw supplied on Models C120, C125. Flush type set screw on Models C120L, C125L.

(O) Record Support Arm.

(P) Master Trip Cam.

15 Assemble mounting studs and shock absorbing springs when installing in cabinet.

(R) Reject Button. By pressing this button, changing mechanism operates immediately regardless of needle position on the record. Also by pressing this button, the first record will drop on turntable.

(U) Adjusting screw for setting vertical movement of tone arm. If properly set, no further adjustment will be necessary.

(V) Adjustable Tie Bar used for positioning record support arms. The adjustment of this bar properly made should require no further attention.

H-1 Adjustment controlling position of power take-off wheel (L). See (Y).

H Screws for locking adjustment (X). Must be loosened to adjust (X).

12 Position for Lever "A" when playing 12-inch records.

11 Position for Lever "A" for Manual playing or Removing Records.

(W) Drive motor

(T) Pick-up lifting cam

(Z) Holding-latch cam-follower lever

(Q) Record-drop actuating lever

(S) Camshaft

GENERAL INDUSTRIES CO.

MODELS C120, C120L,
C125, C125LDESCRIPTION OF TRIP MECHANISM

- (1) In order to automatically change records, the record changer mechanism must first be put in motion. The trigger which accomplishes this purpose is the trip mechanism. The trip mechanism is actuated by the trip grooves at the end of the music grooves in all standard records.
- (2) All commercial records manufactured in recent years have either an eccentric (oscillating), or spiral (run-in) type of trip groove.
- (3) This record changer will trip on any standard eccentric trip groove. It will also trip on any spiral trip groove provided that the spiral does not terminate at a larger diameter than that for which the trip mechanism is adjusted.
- (4) To observe the operation of the trip mechanism, it is necessary to first remove the turntable and then move lever (A) to either the 10 or 12 inch position.
- (5) To follow the action of the trip mechanism on eccentric trip groove records, it will be seen that as the pickup arm (M) swings inwardly, the trip rod (K) moves toward the pickup base until the serrations on the trip rod seen at (K) are in contact with the knife edge of the trip latch (X). If the pickup arm (M) is now moved outwardly, the serrations at (K) will engage with the trip latch (X) permitting the trip cam lift lever (C) to be released so that it will drop in and engage the trip cam (P).
- (6) To observe the action of the trip mechanism on spiral trip groove records, swing the pickup arm (M) inwardly until the trip dog (G) comes in contact with the trip latch (X) and releases trip cam lift lever (C).
- (7) The reject button (R) it will be noted also operates to trip the mechanism by imparting motion to latch (X).
- (8) After trip cam lift lever (C) has been released so that it can engage trip cam (P) the forces required to operate the balance of the trip mechanism are derived from the motor (W).
- (9) As trip cam (P) engages trip cam lift lever (C), cam (P) is hinged upwards so that it engages the pulley control lever (I) and forces pulley (L) into positive frictional engagement with the inside of the turntable rim.
- (10) To keep pulley (L) in engagement with the turntable rim after lever (I) walks off of cam (P), lever (I) is engaged by latch (Y) and the tripping operation is complete.
- DESCRIPTION OF SPEED REDUCER AND CAM SHAFT
- (11) Driven by the pulley (L) through a double worm and gear reduction, the cam shaft (S) carries cams which control the pickup arm movements, the dropping of records and at the conclusion of the change cycle, the release of latch (Y).
- (12) Cam (T) which is mounted on the lower end of cam shaft (S) raises and lowers the pickup arm (M) through a rocker arm and push rod.
- (13) The positioning of the pickup arm (M) for 10 or 12 inch records is controlled by two cams just above the lower cam shaft bearing. The lower of these cams (with short throw) positions the pickup for 12 inch records and the upper cam (with long throw) positions the pickup for 10 inch records.

MODELS C120, C120L,
C125, C125L

GENERAL INDUSTRIES CO.

- (14) An examination of the pickup positioning cams will reveal spring fingers at the termination of the cam rise. These spring fingers are provided to urge the pickup needle into the starting groove on records which do not have lead in grooves.
- (15) When lever (A) is set in the 10 or 12 inch position the pickup positioning cam follower is shifted up or down so as to engage the proper cam. The pickup positioning cam follower can easily be distinguished by the coil spring mounted thereon and linking the cam follower to its extension. This coil spring will extend, preventing damage, if for any reason the pickup arm (M) becomes obstructed while the pickup positioning cam is forcing the pickup arm (M) inwardly.
- (16) Just above the pickup positioning cams is the pickup return cam which has the function of swinging the pickup arm (M) outwardly when the mechanism has been tripped.
- (17) The last and uppermost cam operates through cam follower (Z) to release the pulley latch (Y) thus disengaging pulley (L) from the turntable rim at the completion of the change cycle.
- (18) On the upper side of the latch control cam is mounted a roller which engages lever (Q) and actuates the record handling fingers (D) through the connecting links provided.
- (19) To adjust the spiral trip to operate farther from the center of the record, loosen the set screw holding dog (G) and move the dog (G) away from the end of the trip rod (K). (Read paragraph 20 before making adjustment.)
- (20) Dog (G) is set at the factory to trip when the pickup needle is 1-3/4" from the edge of the hole in the record center. This standard setting is correct for all late recordings and all but a very few of the older ones. To facilitate the location of dog (G) it is best to hold a scale with the end touching the turntable pin (E) and in such a manner that the pickup needle will swing directly above the scale graduations. As noted above the trip should release when the pickup needle reaches the 1-3/4" graduation. Note: If for any reason the position of the pickup arm (M) with relation to the pickup base becomes changed, the trip dog (G) may require resetting. For this reason always check to see that the pickup is being lowered correctly onto the edge of the record before adjusting dog (G). (This pickup adjustment is covered in paragraph 34.)
- MECHANISM FAILS TO TRIP
- (21) If the mechanism fails to trip always examine the trip grooves on the record first before attempting to make any adjustments. The record grooves may be badly worn or scratched in such a manner as to cause the pickup needle to jump the grooves. Also try a new pickup needle as the needle may have been damaged.
- (22) The trip rod (K) is held in contact with the trip latch (X) by the trip rod tension spring (F). If the eccentric trip fails to operate, it may be necessary to increase the pressure of spring (F) against trip rod (K) but before changing the adjustment, first, make sure that the trip rod does not

ADJUSTMENT OF SPIRAL TRIP MECHANISM

GENERAL INDUSTRIES CO.

MODELS C120, C120L,
C125, C125L

(24) If the trip mechanism still works in a faulty manner after the foregoing precautions have been taken, next check the trip latch (X) and the trip cam lift lever (C) to make sure that they work freely and do not bind on the studs on which they are mounted. If either of these levers are scraping on the base plate, make sure that the studs which carry them have not worked loose.

(25) If the lever (C) moves freely when it clears the trip latch (X) but does not swing into the path of the trip cam (P) then the spring which connects to lever (C) is either stretched or missing. If lever (C) makes a loud click when it drops in, the rubber bumper, against which it should strike, has worked up and should be pressed back into place.

CHANGE MECHANISM DRIVE PULLEY FAILS TO ENGAGE

(26) If the trip mechanism functions in a satisfactory manner and pulley (L) is latched in position to engage the turntable rim but does not contact the turntable rim with sufficient pressure to insure operation, loosen screws at (H) and move the pulley control lever extension outwardly a distance which will bring pulley (L) into positive contact with the turntable rim. Caution: This adjustment is very critical and should be carefully made. If pulley (L) is forced too tightly against the turntable rim the latch (Y) will stick at the completion of the change cycle and prevent the pulley from becoming disengaged from the turntable rim. As an aid to making this adjustment, it is well to scribe a line on the pulley control lever at the end of the pulley control

bind in the bearing where it is linked to the pickup base, second, be sure that the trip rod floats freely, third, examine the serrations at (K) to be certain that the sharp edges have not been damaged, fourth, remove any dirt which may be embedded in the serrations and which would prevent the trip latch (X) from being engaged, fifth, examine the knife edge of trip latch (X) to see if it has become damaged.

Note: Do not increase the pressure of spring (F) against trip rod (K) any more than is necessary to insure operation of the eccentric trip as excessive spring pressure will cause, first, jumping of the pickup needle out of spiral trip grooves at the tripping point, second, the eccentric tripping action will require more power and the needle may jump the grooves and fail to trip altogether.

(23) If the pickup needle shows a tendency to jump grooves on all records and fails to trip, make sure that the pickup arm (M) swings freely. If the pickup base is rubbing on the base plate, loosen the set screw at the very top of the pickup base and raise the pickup base until it clears the base plate with the pickup needle resting on a record on the turntable. (Note: On late type units a dog pointed set screw is used and no change in position of the pickup base can be made.) Caution: On older type units where the pickup base is adjustable care must be exercised when loosening the pickup base set screw, to prevent rotation of the pickup base with reference to the shaft on which it is carried as otherwise the pickup positioning adjustment will be disturbed. (See paragraph 34.)

MODELS C120, C120L,
C125, C125L

GENERAL INDUSTRIES CO.

MECHANISM TRIPS DURING PLAYING CYCLE

(30) If the mechanism trips during the playing of a record and before the pickup arm has swung inwardly to the point where the trip is adjusted to operate on spiral trip groove records, the following conditions should be checked: Weak or missing reset spring on latch (X). Defective shoulder on trip latch (X) or rounded corner on cam lift lever (C), permitting lever (C) to slip off of the shoulder on trip latch (X). Rubber bumper (B), against which pulley control lever (I) strikes, may have worked up away from the base plate, permitting lever (I) to over travel and lock tripod (K) against trip latch (X). Note: Where overtravel of lever (I) due to lever (I) not striking bumper (B) causes tripping during the playing cycle it is possible that either a weak reset spring on latch (X) or a damaged shoulder on latch (X) is a contributing factor.

PICKUP ARM STICKS OR JAMS

(31) If during normal operation of the unit the pickup arm acts as though it were jammed in any manner the following procedure should be followed: First stop motor (W), next remove the turntable and then trip the mechanism. The pickup arm (M) should now be capable of free motion between the normal limits of its travel. (From edge of base plate into within approximately 1" of the center pin (E) depending on the adjustment of trip dog (G).) If trip dog (G) will not slip by the lug against which it strikes on trip latch (X) or the serrations at (K) on trip rod (K) hang up on trip

lever extension, so that it can be seen how far the extension is being moved each time. Before making any adjustment it is also advisable to check the set screw in pulley (L) to make sure that pulley (L) is tight and not turning on the shaft which carries it.

(27) If latch (Y) fails to hold pulley (L) in position, check the latch to make sure that the latch fingers have not been bent. Next check the spring on lever (Z) to make sure that the spring is not defective or missing.

MECHANISM REPEATS

(28) If the mechanism repeats (continues to change records without playing them), the pulley (L) may not be disengaging from the turntable rim. This failure to disengage may be due to the following: Faulty action of the latch (Y). (See "Caution" in paragraph 26.) A defective or missing return spring on pulley control lever (I). A defective or missing spring on lever (Z). Lever (Z) may be bent so that it is not contacting the pulley release cam. (See paragraph 17.) (29) If pulley (L) disengages at the completion of the change cycle and immediately re-engages, the trip mechanism is at fault and it is suggested that the following be checked: Reject button (R) may be sticking in the depressed position. The trip cam (P) may be sticking in the raised position. The reset spring on trip latch (X) may be defective or missing. The stud on which pulley control lever (I) is mounted may have worked loose and should be tightened.

GENERAL INDUSTRIES CO.

MODELS C120, C120L,
C125, C125L

enough to rest properly on one record on the turntable. (Recommended needle length 5/8".) If the timing of the pickup lift is not correct, loosen the set screw holding lift cam (T) on shaft (S) and relocate the cam. (The relative position of the remaining cams is fixed.)

ADJUSTMENT OF PICKUP LOWERING POINT

To adjust the pickup arm (M) so that it will be lowered to the correct point on the outside of the record, first shift the lever (A) to the 10" position and then stop the mechanism with the pickup positioning cam follower at the point of maximum rise of the pickup positioning cam. (See paragraphs 13, 14 and 15.) Now raise the pickup arm to the vertical position and loosen screws at (J) so that the arm (M) can be moved with relation to the pickup base but not too freely. Next holding the pickup base so that it will not turn, force the pickup arm (M) toward the record centering pin (E). Now place a scale under the pickup needle with the end of the scale touching the record centering pin (E). Next, carefully pull the pickup arm (M) outwardly until the pickup needle is 4-45/64" from the pin (E). Raise the pickup arm (M) and tighten the locking screws at (J) being careful not to move arm (M) outwardly past the correct setting before tightening the screws. This adjustment will automatically take care of 12" records as well as 10" as will be seen by moving lever (A) to the 12" position and running the unit through its cycle. If the pickup arm (M) always lowers in the 12" position regardless of the position of lever (A) the pickup positioning cam follower is sticking in the down position.

latch (X) and prevent trip rod (K) from sliding by trip latch (X) then investigate the following: Rubber bumper (B) pushed upwards away from base plate and permitting lever (I) to overtravel. Excessive pressure exerted against trip rod (K) by spring (F). Trip rod (K) bent. An extension on trip latch (X), which extends rearwardly along trip rod (K), may be bent or broken. The function of this extension is to swing trip rod (K) clear of trip latch (X) as soon as tripping takes place.

RECORD SUPPORT ADJUSTMENT

(32) An examination of the unit will disclose that the front record support has fixed positions determined by dedents which are located by lever (A). The rear record support (O) however is adjustable. If the record supports are not the correct distance apart, loosen screws as shown at (V) and move the rear record support (O) to the proper position. Caution: Before making this adjustment always make sure the lever (A) is firmly located in the proper dedent and the three motor mounting screws are tight. (Alignment of record centering pin (E) is dependent upon correct motor mounting.)

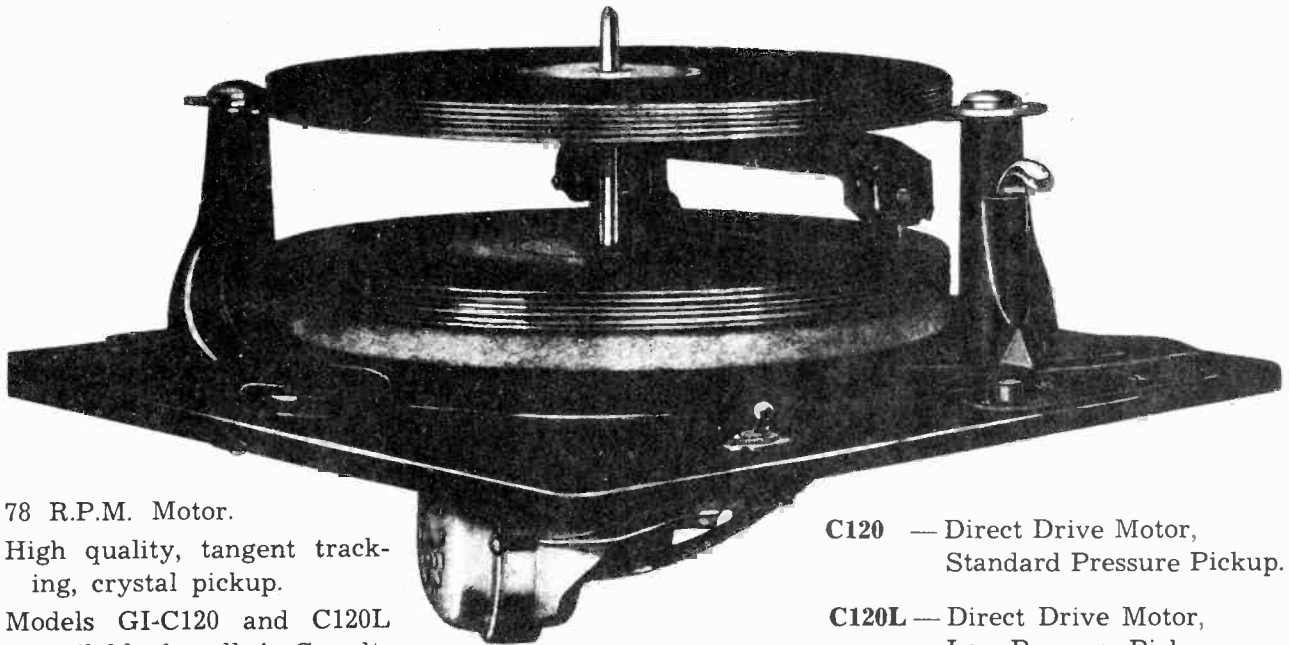
PICKUP ARM LIFT ADJUSTMENT

(33) The height to which pickup arm (M) is lifted during the change cycle may be adjusted by the screw (U). In making this adjustment make sure that the pickup arm will not lift high enough to strike the bottom record on the record supports. Also make sure that the pickup needle drops low

MODELS C120, C120L,
C125, C125L

GENERAL INDUSTRIES CO.
CHIPPING OF RECORDS

(35) The record supports (D) and the record separating fingers (N) are so designed that no chipping of standard records will take place unless through rough handling the fingers (N) become bent. For proper operation the fingers (N) must be perfectly flat. To straighten the fingers (N) it is necessary to remove the large headed screws which hold the fingers in place after which the fingers (N) can be disassembled. Ordinarily straightening can be accomplished by holding the main part of finger (N) through which the clamping screw passes with one hand and then taking hold of the sickle shaped part of (N) with the fingers of the other hand, bending the sickle shaped part until it is lined up with the main body. After bending lay the finger (N) on a flat surface to make sure the straightening has been properly done.



78 R.P.M. Motor.

High quality, tangent tracking, crystal pickup.

Models GI-C120 and C120L available for all A. C. voltages and cycles and for AC-DC.

Models GI-C125 and C125L available for all A. C. voltages and cycles.

Base plate 14" x 14" x 3/8".

Height above lower edge of base plate 5-7/16".

Depth below lower edge of base plate 3-1/2".

C120 — Direct Drive Motor, Standard Pressure Pickup.

C120L — Direct Drive Motor, Low Pressure Pickup.

C125 — Rim Drive Motor, Standard Pressure Pickup.

C125L — Rim Drive Motor, Low Pressure Pickup.

GENERAL INDUSTRIES CO.

MODELS RC-130,
RC-130L

again at the end of the record to stop the motor. This is the small button located to the rear and left of the dial.

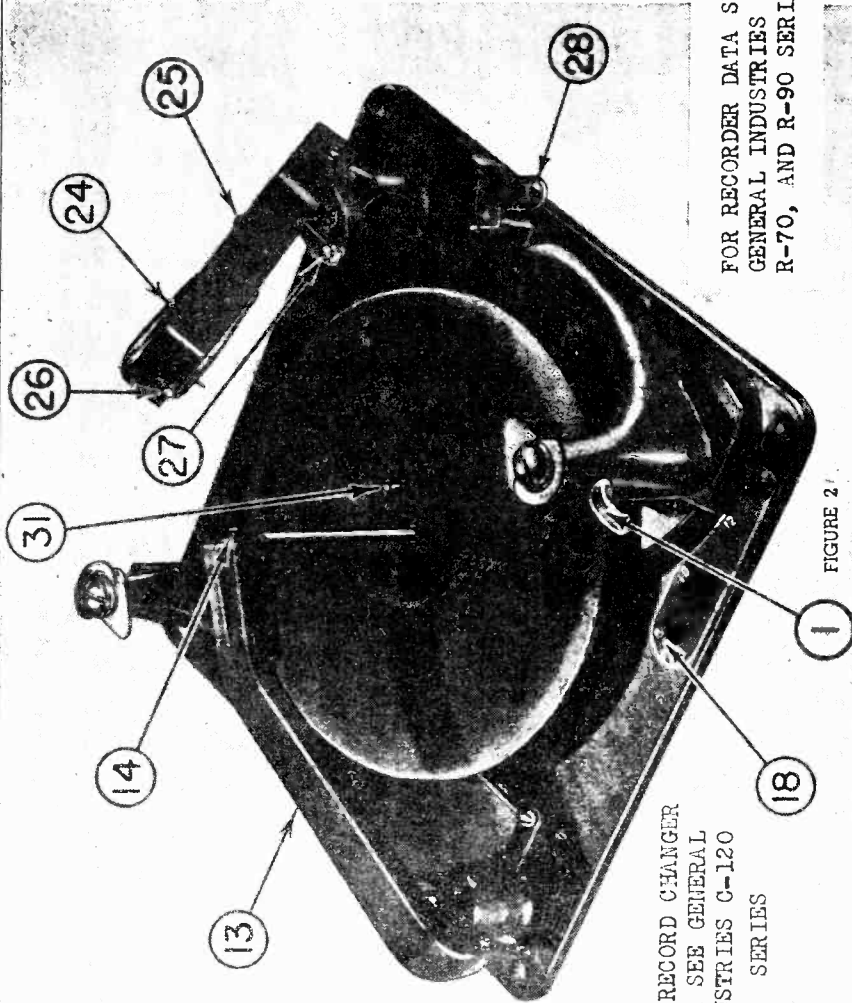
PLAYING RECORDS MANUALLY.

- (1) Move the lever (1-Fig. 2) to the manual position.
- (2) Place the record to be played on the spindle of the turntable.
- (3) Push the motor switch to start the motor.
- (4) Lift up the pickup and place on the smooth outer rim of the record.
- (5) Adjust the volume and tone control to suit your requirements. After the record has been finished, remove the pickup and return it to the left, press the motor switch button to stop the turntable and remove the record. Never leave a record on the turntable, as it is apt to warp. Always return the pickup to its rest after the record has been played. This phonograph will permit playing of records of any size up to and including 12" records.

PLAYING RECORDS AUTOMATICALLY.

- (1) Set the lever (1-Fig. 2) to 10 or 12 depending on which size records are to be played. Ten 12 inch or twelve 10 inch records can be stacked on the changer at one time. Do not mix ten and twelve inch records. After the records to be played have been selected, line them up with the center holes and slip them on to the center post of the turntable.
- (2) Push the motor switch to start the motor.
- (3) Push the reject button to place the first record in place. The records will be played in order and the last one will be repeated until the motor is turned off.
- (4) Adjust the volume and tone control to suit your requirements.
- (5) To reject a record, push the reject button and the next record will fall into the playing position. After the last record has been played turn the motor off and return the pickup to its rest. To remove records, move the support post lever to the "remove records" position and lift the records off the turntable. Never leave records on the support posts or the turntable except while playing the phonograph.

NEEDLES. Always use a good grade of needle for playing records, as you will obtain better tone quality and longer life from your records. Do not use fibre, bamboo, or cactus needles. If ordinary steel needles are employed, never use them for more than one playing of a record. A needle which has once been used should never be reinserted into the pickup again, as the point becomes worn and will never fit in the groove properly again.



FOR RECORD CHANGER
DATA SEE GENERAL
INDUSTRIES G-120
SERIES

FOR RECORDER DATA SEE
GENERAL INDUSTRIES
R-70, AND R-90 SERIES.

FIGURE 2

SETTING UP RECORD CHANGER. Before plugging in line plug be sure the automatic record changer is properly set up for operation. The bracket to which the pickup arm (13-Fig. 2) is fastened should be removed as it is used for shipping purposes only. The bracket (28-Fig. 2) to which the recording arm (24-Fig. 2) is fastened should be removed and screwed on the position shown (28-Fig. 2). The turntable is next placed on the spindle and re-
 volved until it drops into position.

SELECTOR SWITCH. Turn this knob to Position 2, to connect the set for phonograph operation.

VOLUME CONTROL. Turn this control to the right. The dial will become illuminated, showing that the power is connected. Wait about 30 seconds for the amplifier to become properly heated before attempting to play the phonograph. Use this control to adjust the volume of the phonograph in the same manner as it is used to adjust the volume of the radio.

RECORD CHANGER. Adjust this control to suit your own individual requirements. Turn to the extreme left for emphasis on the high notes or treble and turn to the extreme right to accentuate the bass notes. When this control is turned toward the right, the needle scratch will be reduced.

PICKUP. The pickup (13-Fig. 2) is the small arm located at the left of the turntable. To insert a needle, lift up the pickup, loosen the thumb screw (14-Fig. 2) and insert the needle in the small hole underneath the arm. Next, tighten the screw securely to clamp the needle in place.

MOTOR SWITCH. Push this switch once to start the motor; push again.

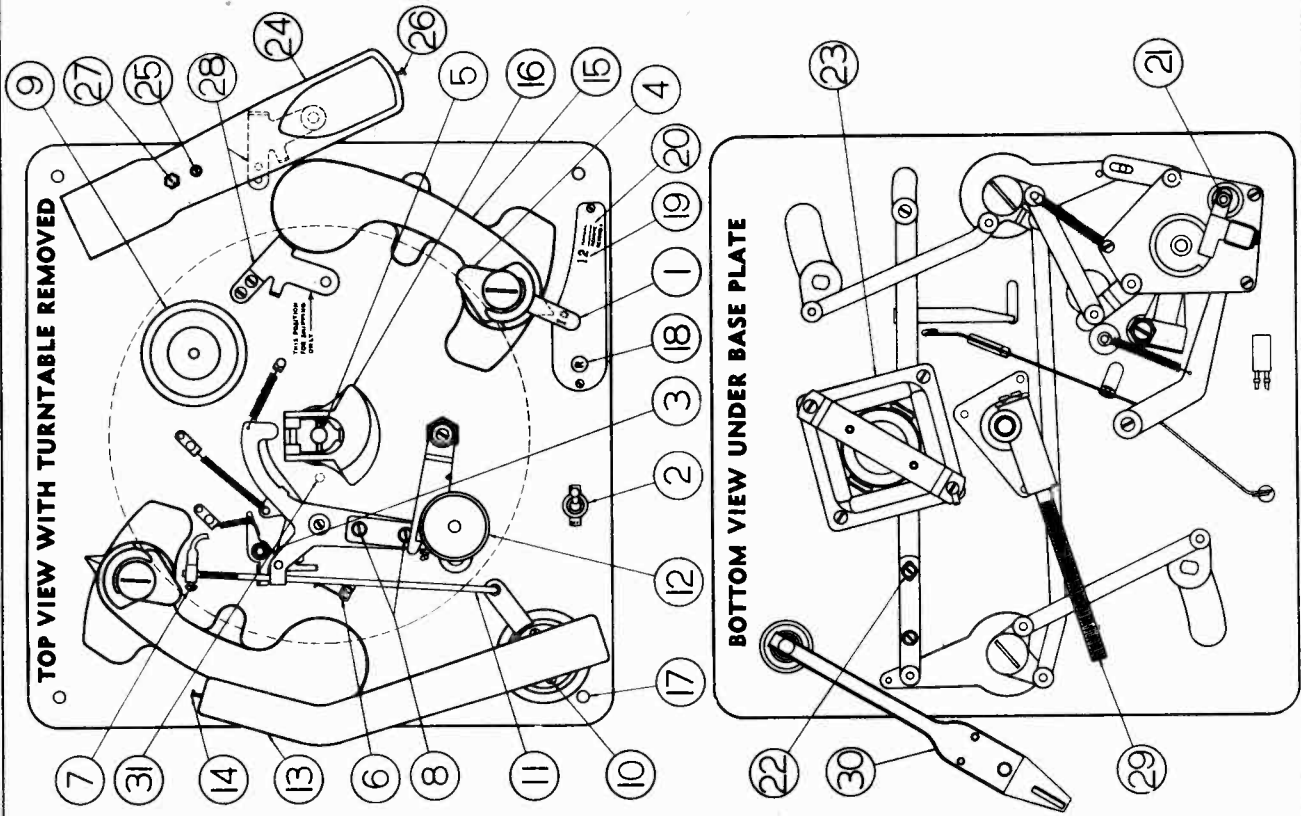
MODELS RC-130,
RC-130L

GENERAL INDUSTRIES CO.

RC-130 - 78 RPM MOTOR, STANDARD PRESSURE CRYSTAL PICKUP
RC-130L - 78 " " , LOW PRESSURE CRYSTAL PICKUP

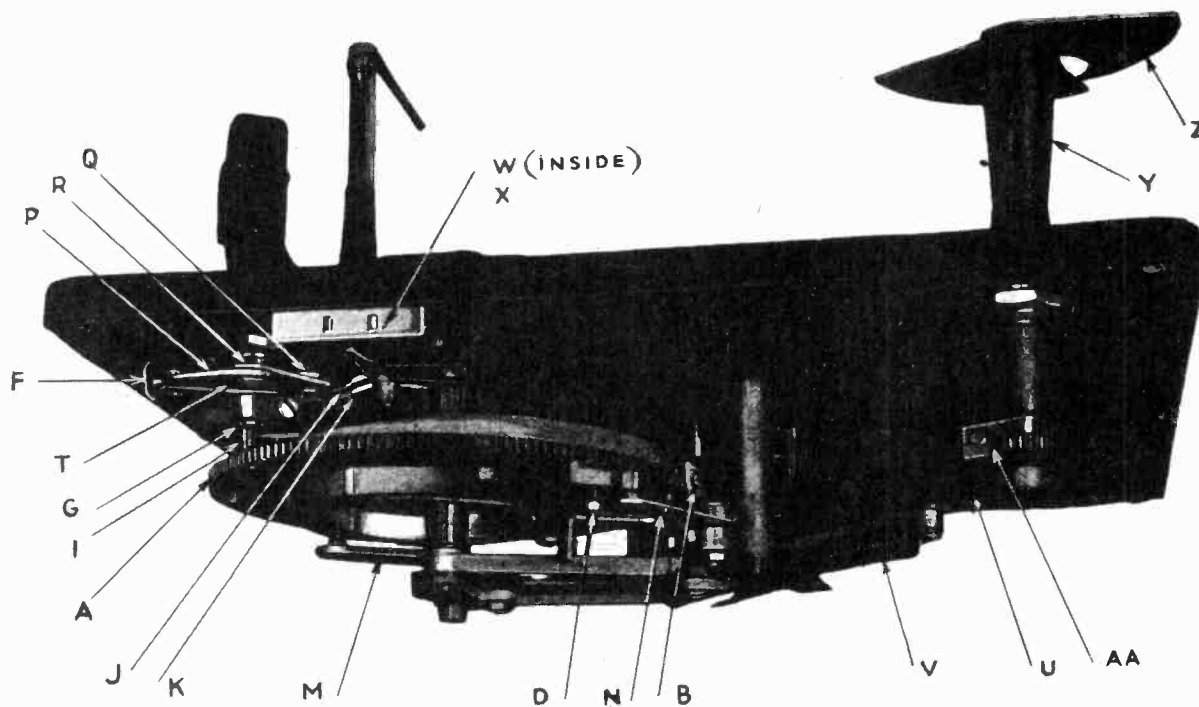
RECORD CHANGER SERVICING

- (1) Lever for setting to play 10-inch or 12-inch records, Manual playing or Remove records. Mechanism as shown is set for playing 10-inch records.
- (2) "On" and "Off" switch for operating the record playing mechanism. Not used on some models.
- (3) Trip mechanism designed to handle automatically records with either spiral run-in or oscillating grooves.
- (4) Record Support Fingers.
- (5) Turntable Shaft.
- (6) Trip Rod Tension Spring.
- (7) Adjustment for run-in or spiral-grooved records.
- (8) Adjusting lock screws for controlling position of power take off wheel (12).
- (9) Rubber-tired Drive Wheel. By means of a spring, this wheel contacts the steel pulley on the motor and the inside flange of the turntable; driving the table in clockwise rotation.
- (10) Adjusting screws for locking tone arm in position so that needle will rest properly on edge of record.
- (11) Trip rod.
- (12) Rubber-tired power take-off wheel. Through the trip mechanism, this wheel contacts the inside flange of the turntable during the change cycle from one record to the next, but does not operate during the playing of a record.
- (13) Pickup Arm.
- (14) Needle Set Screw.
- (15) Record Support Arm.
- (16) Master Trip Cam.
- (17) Mounting Holes. Rubber washers or springs should be used when bolting changer in cabinet to absorb possible vibration.
- (18) Reject Button. By pressing this button, changing mechanism operates immediately regardless of needle position on the record. Also by pressing this button, the first record will drop on turntable.
- (19) Position for Lever (1) when playing 12-inch records.
- (20) Position for Lever (1) for Manual playing, Removing records or Cutting records.
- (21) Adjusting screw for setting vertical movement of tone arm. If properly set, no further adjustment will be necessary.
- (22) Adjustable Tie Bar used for positioning record support arms. The adjustment of this bar properly made should require no further attention.
- (23) Rim Drive Electric Motor. Be sure Voltage and Cycles are correct for your Power Line.
- (24) Cutter Arm. At all times except when actually recording, cutter arm is placed on cutter arm support rest (28).
- (25) Adjusting Screw by which the tension on the cutter head equalizing spring may be varied for different types of records.
- (26) Cutting Stylus clamp screw.
- (27) Adjusting screw and lock nut for proper spacing between cutter arm and record.
- (28) Cutter arm support rest. Prevents interference with reproduction and also removes all strain on cutter-head equalizing spring. Full lines show shipping position—dotted, Installation Position.
- (29) Lead Screw.
- (30) Follower Arm and Spring Cam. This arm and cam mesh with lead screw (29) to provide lateral motion of cutter arm during recording.
- (31) Depressible Pin in turntable for driving home recording disc.

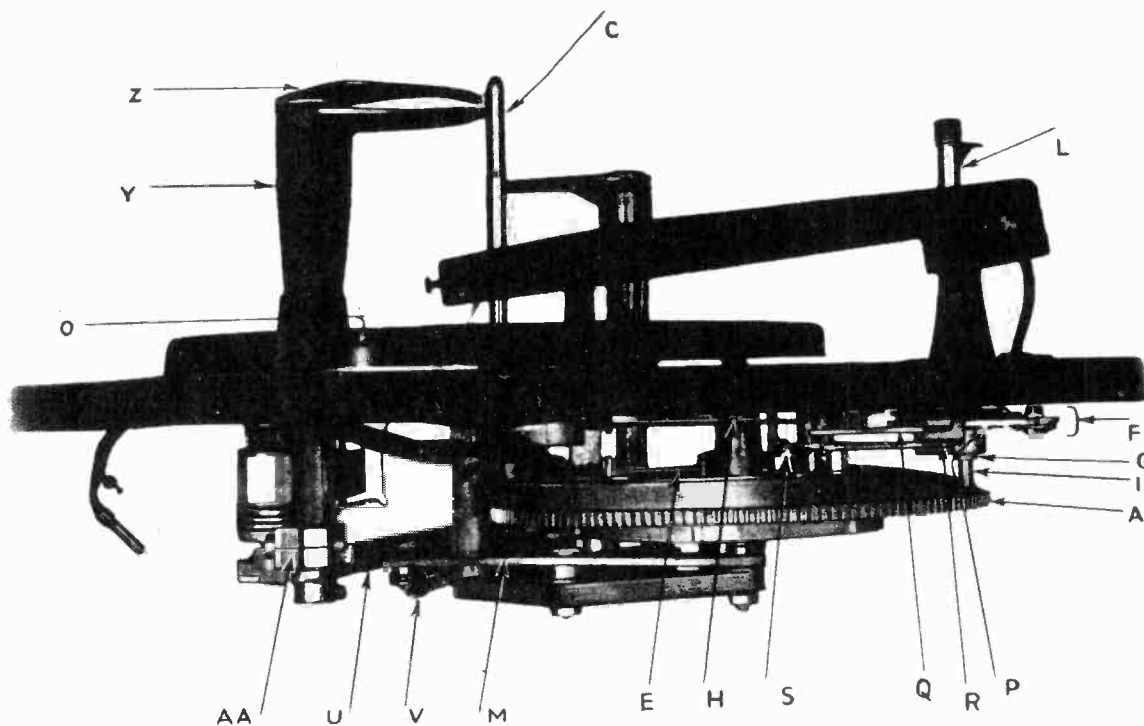


GENERAL INSTRUMENT CORP.

MODELS 101,
102



REAR VIEW



SIDE VIEW

MODELS 101,
102

GENERAL INSTRUMENT CORP.

This Record Changer will play automatically a series of standard 10- or 12 inch records of the type generally available today, or records of any size up to 12 inches changed manually. This Changer does not require any adjustment by operator for playing different size records. Stacks of mixed sizes may be played but *this is not recommended or guaranteed*. Records of the last few years with the standard eccentric or spiral finishing groove will operate the automatic mechanism.

Before operating the record changer, detach the pick-up arm which is fastened to the record spindle post for shipping purposes. Remove the two shipping bolts (the bolts with the red heads) which are located underneath the mounting board for the record changer. The record changer should float freely on the mounting springs.

This record changer is designed for operation on 110-120 volts, 60 cycles and will automatically play 12 ten inch records, 10 twelve inch records or a mixed stack of ten and twelve inch records not exceeding a total of ten records.

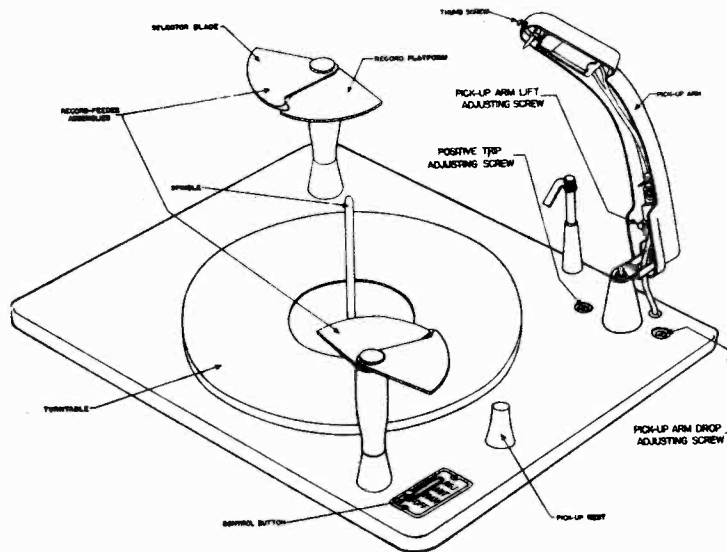
RECORDS

For automatic operation use only the standard commercial type 10 and 12 inch records which are of uniform thickness. Home recording type records or records which are smaller in size and thickness can be played singly by operating the phonograph manually.

The use of records which have become warped, cracked or badly chipped along the edge may cause the changer mechanism to jam and damage the instrument.

Do not leave records on the changer selector blades when not in use as they are liable to warp, particularly so in warmer climates. Keep your records in a record file (album or cabinet) when not in use.

Warped records may be satisfactorily straightened by placing them between two flat surfaces and protected on each side by a thin sheet of paper. Place a suitable weight on top and leave in this position for a few days.



CONTROLS AND OPERATION

The control button is located in the lower right hand corner of the motor panel and is indexed for four positions:—"OFF", "MAN", (manual operation), "AUT", (automatic operation) and "REJ" (reject).

MANUAL OPERATION

Pull upward on the record feeder assemblies and rotate one-half turn. Place a record of either the ten or twelve inch size over the center spindle. Insert a good quality needle in the tone arm and tighten securely with the thumb screw. Push the switch to the first or "Manual" position which starts the phonograph motor. Then place the pick-up arm over the record with the needle in the starting groove. When the record has been played through, place the pick-up arm in its rest position and slide the control button to the off position.

AUTOMATIC OPERATION

Rotate both record feeder assemblies until they fall into a locked

position. Examine the edge of all records to be played and make sure it is suitably rounded or beveled and does not have any imperfections which might cause the selector blades to fail to separate the lower record. Load the center spindle with records limited to twelve 10" size, ten 12" size or ten mixed 10" and 12" size. Use a long playing type needle when playing a series of records automatically.

Move the control button to the "REJ" (reject) position and release. The changer will automatically play through the entire stack of records, repeating the last record until the control button is moved to the "OFF" position.

Caution. Do not move the control button to the off position except after completion of the change cycle.

To reject a record before it has been played through, move the control button to the "REJ" (reject) position and release. The changer will go through a complete cycle and drop the next record in order.

GENERAL INSTRUMENT CORP.

MODELS 101,
102

NEEDLES

High quality needles are important to your enjoyment of phonograph music. Use only long playing chromium needles when playing several records automatically. Steel needles may be used for a single playing when operating the record changer

manually.

To unload the record stack after moving the control button to the "off" position, lift and turn the record feeder assemblies so that the records may be lifted clear off the center spindle.

ADJUSTMENTS

Caution—Before attempting to make any adjustments on this record changer, it is imperative that the following instructions be carefully read and thoroughly understood.

Three adjustment points are provided to maintain positive action throughout the change cycle.

THE POSITIVE TRIP ADJUSTMENT

The function of the Positive Trip is to start a complete change cycle after a record has been played through. This change takes place when the needle reaches the conventional Eccentric Center Groove or the last concentric groove on records lacking the Eccentric center groove, but which are recorded sufficiently near the center so that the positive trip comes into operation.

Adjustment of the Positive Trip will be necessary only when the change cycle commences before a standard record has been fully played or when the change cycle lags considerably after a standard record has been played.

The Positive Trip can be adjusted to operate at a definite point from the center of the spindle in the following manner. Remove the snap button covering the hole on the **left side** of the pick-up arm pivot. Using a small screw driver turn the screw appearing through this hole. (**Caution:** This screw can be turned only one-half turn or 180 degrees. Therefore, slight adjustments are all that should be required). A slight turn to the right or in a clockwise direction makes the trip operative earlier in the playing cycle or farther from the center of the record. Turning this screw slightly to the left or in a counter-clockwise direction causes the positive trip to operate later in the playing cycle or nearer the center of the record.

PICK-UP ARM DROP POINT ADJUSTMENT

This record changer is provided with an adjustment controlling the position at which the pick-up arm is dropped on the outer edge of the record. This adjustment has a constant relationship for 10 or 12 inch records. Therefore, one adjustment on either size record will suffice. To make this adjustment, remove the snap button on the **right side** of the pick-up arm pivot and with a small screwdriver, rotate the exposed screw head slightly.

(**Caution:** This screw also can be rotated only one-half turn or 180 degrees. Therefore, slight adjustments are all that should be required.) Turning to the right or in a clockwise direction causes the needle to drop farther from the edge of the record. Turning to the left or counter-clockwise direction causes the needle to drop nearer the edge of the record. The proper position for the needle to drop is approximately $\frac{1}{8}$ " from the edge of the record and in the blank space at this point, that is — in the space at the edge of the record where there are no grooves.)

PICK-UP ARM LIFT ADJUSTMENT

This record changer is designed so that the pickup will start at the proper position on the top record of 12 ten inch records on the turntable. This is based upon the use of a needle which is inserted with approximately $\frac{5}{16}$ " protruding from the underside of the tone arm. Adjustment for this is readily available by lifting the pick-up arm to its maximum position. Turning the hexagon headed screw thus exposed on the underside of the pick-up arm makes the adjustment. Turning the screw to the left or counter-clockwise raises the operating position of the pick-up arm and turning the screw to the right, or clockwise, lowers its position.

OILING

The motor and mechanism in this changer should not require any oiling under normal operating conditions. Should oiling be

necessary after long hard usage, a few drops of fine oil on the moving parts should be sufficient.

MECHANISM:

Do not rotate *turntable* in reverse direction or bend or strain *turntable spindle* when loading or unloading records.

RECORDS:

Do not use warped records; records with rough, square, or uneven edges; records that are extra thin or extra thick.

Do not use other than standard 10 inch or 12 inch records.

Do not leave records on *record platforms*. This will cause warpage.

CAUTION — Read Carefully

This Changer is designed and built to play standard 10- and 12-inch records in good condition automatically. To obtain the benefit of satisfactory operation it is necessary that instructions be followed explicitly and in no case use force, as this may cause damage.

MODEL 101

This Changer mechanism is operated by the main cam (A) which actuates all parts. The main cam (A) is engaged with the pinion (B) on the turn table starting dog (C) by release of the starting dog (D). The starting dog is released by the latch lever (E) when it is moved by the sweep assembly (F) attached to the tone arm pivot shaft (G), or by the control lever (H). The upper side of the main cam (A) raises and lowers the tone arm thru the lift pin (I) and swings the tone arm by the sweep assembly (F). A stud in the main cam (A) resets the 10 inch and 12 inch (I) stop levers and throws the mixer assembly (L) to the clear position.

The lower side of the main cam (A) drives the record feed lever (M) and has a notch at one side which latches the main cam (A) in home position by engagement with the homing lever (N).

The control lever (H) is operated by a stud in the control slide (O). In manual position one leg of this lever holds the starting dog (D) out of engagement. In automatic position the starting dog (D) is permitted to fall into engagement but is reset by another part of the control lever (H). In reject position the control lever (H) engages the latch lever (E), releasing the starting dog (D).

The sweep assembly (F) carried on the tone arm pivot shaft (G) consists of (1) positioning plate (P) which works against the stop levers (J-K), (2) Positive trip lever (Q) which strikes the latch lever (E) when tone arm is swung toward center, (3) Sweep Lever (R) which engages the pawl (S) on the latch lever (E) moving same to release starting dog (D) when tone arm swing is reversed.

These three parts are held on a bushing held on the tone arm pivot shaft (G) by a clamp. Connection between the sweep lever (R) and the positioning plate (P) is by a horseshoe spring (T). This horseshoe spring (T) deflects when the tone arm swings in to complete change cycle providing the "kick in" force to enter the needle in the playing groove.

The record feed lever (M) on the under side of the main cam (A) drives the record feed link (U) through the relief spring (V). This lever pulls on the spring in operation and rests against a stud in the record feed link (U) when at home position.

STONE ARM

If tone arm rise is incorrect, raise tone arm and adjust hexagon head screw which lift pin (I) strikes. To adjust needle drop point remove button at right hand side of tone arm and with small screw driver rotate slotted stud slightly. Clockwise rotation causes the needle to drop closer to the edge of the record. Counter clockwise rotation causes the arm to drop farther in on the record.

The difference in drop points for 10 inch and 12 inch records is fixed by stop levers (J-K) and should not be changed unless they have been damaged. If tone arm always drops in one position, check toggle lever spring (W) inside of stop bracket (X).

The following procedure should be followed in re-installing a tone arm that has been removed. Hold sweep lever assembly (F) under tone arm pivot shaft (G) bearing with sweep lever assembly (F) roller en-

gaged in main cam (A). Insert tone arm: assembly clamp; then tighten screw just enough to hold assembly together.

Drop lift pin (I) into place.

Push control button to "REJ." and rotate turn table clockwise by hand until tone arm drops to record level with one record on turn table. Hold clamp and sweep lever assembly (F) against stop lever (K) and rotate tone arm to proper drop point for 10 inch record and tighten clamp. A maximum of .010 inch end play should be allowed in tone arm pivot shaft (G).

Change Cycle starts Early or Late.
Remove button at left hand side of tone arm and with small screw driver rotate slotted stud slightly. Rotate counter-clockwise to delay change.

Positive trip lever (Q) should strike vertical tail on latch lever (E) without interference from control lever (H) or sweep lever (R).

CHANGER STALLED:
First—Rotate turn table backwards 1/8 turn and release. Do not use force.
Second—Remove turn table by releasing two screws on pinion (B) and lifting turn table. See that motor runs and rubber idler wheel is free and in good condition. Lubricate turn table with light grease (high pressure automobile grease) and re-assemble. Set and lock pinion (B) with top of teeth even with top of teeth in main cam (A).

Third—Check condition of levers described in "General" and clear any jam.

CHANGER DOES NOT TRIP:
Check starting dog (D) and latch lever (E) for bind and see that springs are in place. Check pawl (S) and sweep lever (R) for free action. Check horseshoe spring (T).

CHANGER REPEATS CYCLE:
Check latch lever (E) and spring. See that control lever (H) clears latch lever (E) when control button is in "Auto" position.

IMPROPER RECORD FEED:
Check records for warp, dish or poor edge condition. Check and level platforms (Y). Use flat record and adjust platforms (Y) by tightening or loosening mounting screws.

Check selector (Z) tip elevation. This should be 1/16 (.062") inches. Adjust whole selector (Z) blade. Do not bend tip.

Check timing of selector (Z) tips to edge of 12" record. They should be approximately 1/4" from the edge of 12" record and should be equally distant from the pinion (AA) and swing selector (Z) tip away from record. Set to correct position while approaching record and lock clamp screw.

"WOW".
Remove turntable as described in "Changer Stalled" (2) and see that rubber idler wheel is not worn or oily. If idler is oily, clean with carbon tetrachloride. Re-lubricate turn table spindle (C) and re-assemble.

MODEL 201

This mechanism consists of a rim driven turntable (not shown) running on a fixed bearing (1), which supports the record spindle (2). The spindle is equipped with a rotatable cap (3) to provide for holding records in automatic operation, when in one position, and removing records or playing manually, when in the other position.

The outer edge of the record is held by record supports (4) and (5), adjustable for 10- and 12 inch, and is fixed by a rubber tipped, spring loaded finger (6).

Control of operation is by a single control button (7) having four positions "Off", "Man", "Aut" and "Ref". Automatic operation starts when rubber tired drive wheel (8) is moved into contact with turntable rim by tone arm movement or control button.

All change functions are controlled by main cam (9) which is driven by drive wheel (8) thru a friction (10) and gear (11) train.

The main cam assembly consists of main cam (9) and automatic trip cam (12). The latter disengages the drive wheel (8) at the end of the change cycle.

The upper side of the main cam (9) controls tone arm swing by engagement with pin in sweep lever (13) attached to tone arm by means of clamp (14), around tone arm pivot sleeve (15). Tone arm lift is controlled by vertical section of main cam (9) operating tone arm lift pin (16) inside of sleeve. A boss projecting from the upper side of the main cam (9) displaces the stop lever (17) at the end of the change cycle to permit the tone arm to proceed across the record.

The lower side of the main cam (9) moves the feed lever (18) by means of a roller (19). This movement charges the feed spring (20) and at the proper time permits discharge of the spring causing the feed lever (18) to thrust the feed finger (21), (in top view), forward to feed the record. Connection between feed lever (18) and feed finger (21) is thru feed intermediate lever (22) pivoted in record support post (23). (In top view.)

The stop lever (17), normally held out of engagement by the boss on the main cam (9), swings into position at the start of the change cycle. Its selection of stop points for 10- or 12 inch records is controlled by dog (24) on the record selector shaft running up front of record support post (23) and actuated by swinging record support (4).

The drive wheel (8) is mounted on the carrier lever assembly (25) which is pivoted about the intermediate drive (11). This assembly consists of the carrier lever (26) carries a pin (27) engaging the automatic trip cam (12); a pawl (28) to engage the serrated edge of sweep lever (13); a positive trip screw (29) to interfere with sweep lever (13). Engagement of pin (27) with automatic trip cam (12) pulls drive wheel (8) out of engagement with turn table at end of change cycle. Reversal of the tone arm movement rotates pawl (28) to release trip lever (E). Thrust of sweep lever (13), when tone arm approaches spindle (2), against positive trip screw (29) releases trip lever (26). The control lever (31) operated by the control button (7), a-t-turns switch on and off -b- prevents carrier lever assembly (25) from swinging when in manual

position -c- permits carrier lever assembly (25) movement to engage drive wheel (8) with turntable, when in automatic position -d- displaces trip lever (26) causing drive wheel (8) engagement with turntable, when pushed to Reject. Function (a) is accomplished by pin which engages dog of toggle switch. Functions (b) and (c) are controlled by shape of rear edge of control lever (31) and a fixed stud (32) in the carrier lever. Function (d) is accomplished by stud (33) in control lever (31) striking edge of trip lever (26) and unlatching pin (27) in same from automatic trip cam (12).

Bearings are separated and center distances maintained by aligning bracket (34) which also carries bearing for record feed lever (18).

ADJUSTMENTS

Positive Trip

The tripping point is adjusted by turning positive trip screw (29) counterclockwise to trip earlier in playing cycle and clockwise to delay tripping.

Tone Arm

The drop point is adjusted by loosening the screw in clamp (14) slightly to permit repositioning of tone arm in relation to sweep lever (13). Care must be exercised to see that tightening the screw does not cause bind in tone arm swing.

The rise and drop of tone arm is adjusted by bending short arm of lift pin (16) slightly. Long arm must not be distorted or it will bind in pivot sleeve (15).

Record Feed

The feed finger (21) should strike only the bottom record of the stack. Record supports (4) and (5) should be adjusted up or down to obtain this result. Adjustments must be checked for both 10- and 12 inch records as one of the buttons is used in both cases.

Fixed record support (5) can be adjusted for engagement with record by removing hold down finger assembly (6) and loosening two screws under feed finger (21).

Friction drive

The rubber wheel (10) engaging with the intermediate drive assembly (11) should be compressed just enough to prevent slipping or skidding at any portion of the change cycle. Compression is controlled by the nut and locknut, below the rubber wheel.

General

Mechanism should be checked for damaged or missing parts. Carrier lever assembly (25) must be perfectly free on its shaft and trip lever (26) must be perfectly free on the carrier lever. All moving parts should be lubricated with oil.

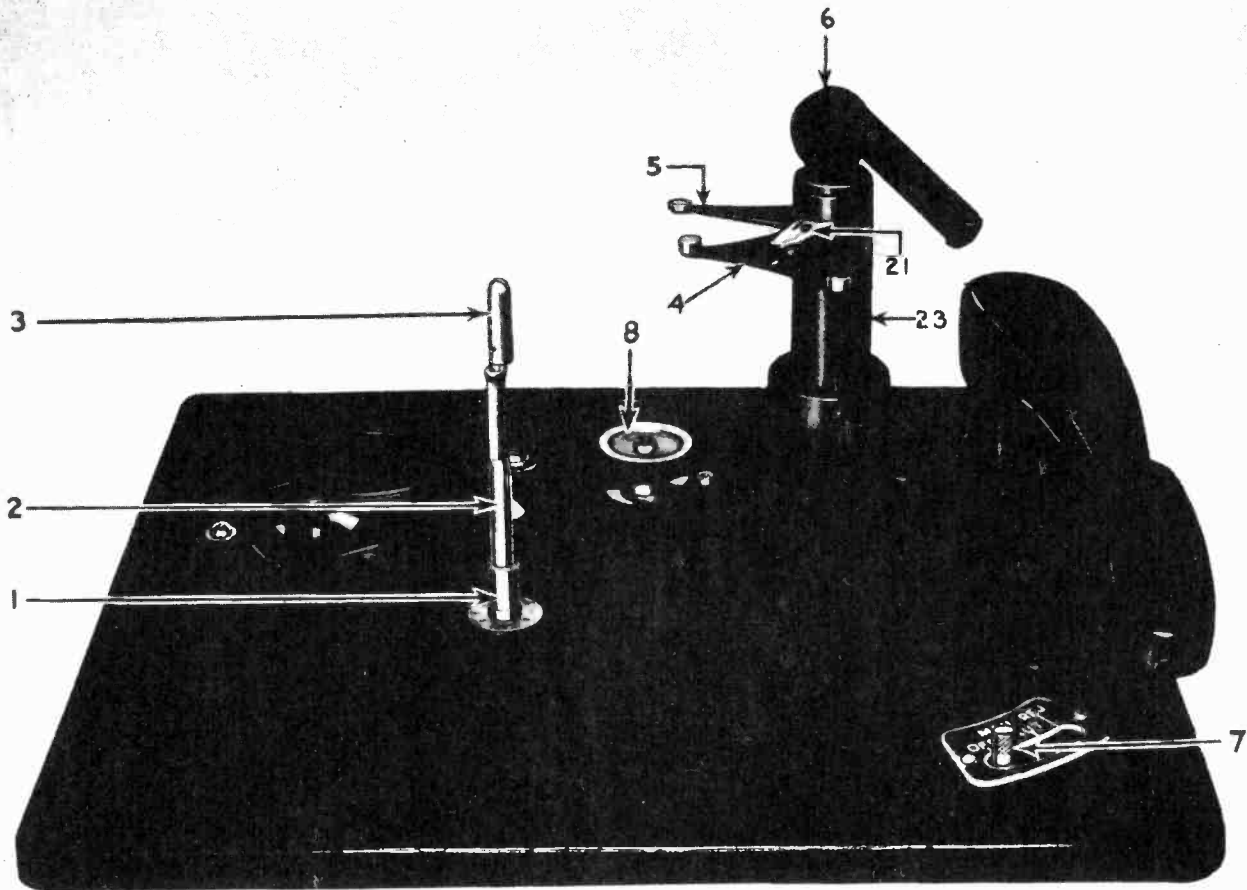
Rubber drive wheels under the turntable and the rim of the turntable must be free of grease or dirt.

Turntable thrust bearing can be lubricated with heavy oil or light grease and radial bearing with light oil.

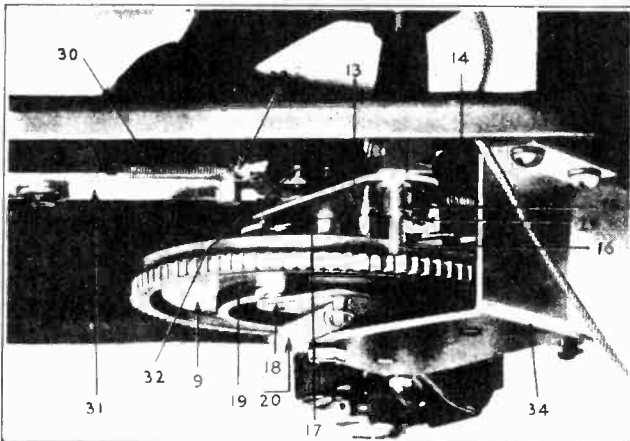
Pickup lead from tone arm must have slack to permit free movement of arm.

GENERAL INSTRUMENT CORP.

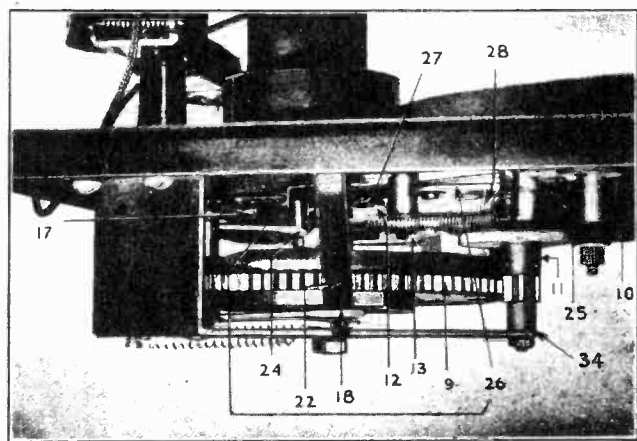
MODELS 201,
202,
203



TOP VIEW - TURNTABLE REMOVED



VIEW LOOKING AT RIGHT SIDE



VIEW LOOKING AT BACK

MODELS 201,
202,
203

GENERAL INSTRUMENT CORP.

SETTING UP

When received the changer will be screwed down securely in the cabinet and the *turntable* and bearing will be packed separately.

Loosen two hold down screws, at front and rear of motorboard, a few turns until changer floats on springs and screws turn hard. Remove packing material.

Drop ball bearing over center spindle.

Place *turntable* carefully straight down until it rests on bearing. Push rubber tired wheels in as turntable is lowered.

CONTROLS AND MOVING MECHANISM

CONTROL BUTTON:

The *control button* is located near the right front corner of the Record Changer with its index plate marked for four positions—

OFF. - MAN. - AUT. - REJ.

When you desire to change records manually, this button should be set in the "Man" (Manual) position.

To play a series of records, the button should be set at "AUTO". (automatic) position.

To reject a record being played, or to start the record changing cycle, simply push the button to the "REJ." (Reject) position and release. The *tone arm* will raise and swing out and the next record will drop.

To start the *turntable* set the button to "MAN" or "AUTO." position.

To stop the *turntable* set the button to "Off" position.

MANUAL OPERATION:

1. Insert needle in *tone arm* and clamp securely with screw protruding from front. (This applies only to record changer not equipped with permanent needle.)
2. Rotate *spindle cap* to line up with spindle and rotate *record support* to right. (Shown in dotted lines.)
3. Place record to be played on *turntable*.
4. Advance *control button* to "MAN."
5. Place needle on edge of record and push *tone arm* gently toward center to start needle in groove.
6. When playing is completed lift *tone arm* slightly to clear record and replace same on *rest*.
7. Return *control button* to "Off" position.

AUTOMATIC OPERATION:

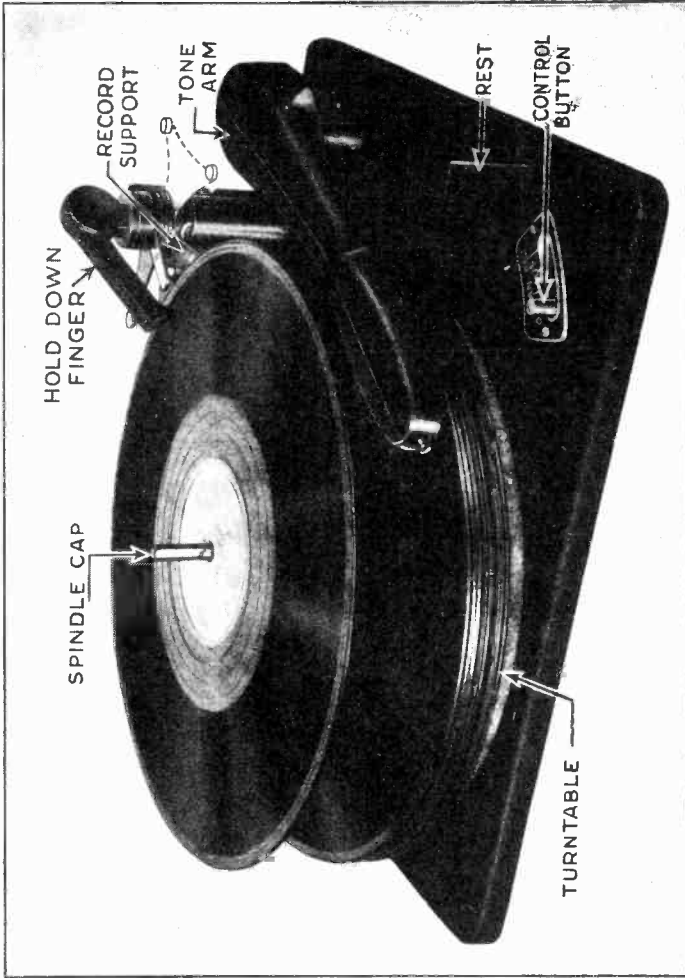
1. Insert long playing needle in *tone arm* and clamp securely with screw protruding from front. (This applies only to record changer not equipped with permanent needle.) Return arm to *rest*.
2. Rotate *spindle cap* OUT OF LINE with spindle.
3. Set *record support* for size record to be played. (Extreme left for 10 inch records or extreme right for 12 inch records.)
4. Place records to be played over *spindle cap* and on *record support*. Swing *hold down finger* to left and place on records.
5. Push *control button* to "Rej." position and release. The first record will then drop and play thru followed by the balance of the records.
6. After the last record has been played, allow the *tone arm* to reset on record. Return arm to *rest* and push *control button* to "Off".
7. Rotate *spindle cap* in line with spindle and swing *hold down finger* to right.
8. Remove records carefully from turntable. (Tilt records slightly when lifting to clear record support.)

GENERAL INSTRUMENT CORP.

MODELS 201,
202,
203

REPLACEMENT PARTS

REFERENCE NUMBER	NAME	PART NO.
1-2-3	Spindle Assembly	19-70495
6	Feeder Cap Assembly	21-70555
11	Intermediate Drive Assembly	26-70718
—	Thrust Bearing Assembly	30-70673
9	Main Cam Assembly	43-70517
18	Record Feed Lever Assembly	55-70508
21	Feed Finger Assembly	55-70514
17	Stop Lever Assembly	55-70521
13	Sweep Lever Assembly	55-70524
31	Operators Lever Assembly	55-70528
25	Drive Wheel Carrier Lever Assembly	55-70722
—	Switch and Bracket Assembly	58-70177
5	Stationary Record Support Assembly	62-70533
4	Swinging Record Support Assembly	62-70536
—	Turn Table Assembly	66-70491
16	Lift Pin	12-70569
20	Record Feed Spring	33-70754
—	Stop Lever Spring	33-70570
—	Tone Arm Pull In Spring	33-70599
—	Record Support Friction Spring	35-70564
—	Drive Wheel Tire	37-70580
19	Feed Lever Roller	65-70566
—	Intermediate Gear Spacer	65-70572
—	Spacer for Motor Mounting	65-70706



Top View of Automatic Record Changer

This record changer plays automatically a series of 10 or 12 inch records of the type generally available today or records of any size up to 12 inches changed manually. Records of the last few years with standard eccentric or spiral finishing grooves will operate the automatic mechanism.

10	Rubber Drive Wheel	65-70715
—	Motor 60 cy. - 110V	56-70574
—	Motor 25 cy. - 110V	56-70575

For Pickup Cartridge or Tone Arm replacement specify model number of your radio.

RECORD-CHANGER PARTS LIST

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

PART NUMBER	DESCRIPTION	LIST PRICE	R-54	DESCRIPTION	PRICE
117188	Motor-60 cycle	7.50	R-54	Cam stop lever	.20
151289	Crystal cartridge for pickup	5.00	R-57	Index plate	.16
R-2	Post	.27	R-58	Bushing	.08
R-3	Washer	.02	R-59	Control button	.08
R-4	Nut	.05	R-60	Reject link	.08
R-5	Pickup Rest	.04	R-61	Manual link	.10
R-6	Spring clip	.05	R-62	Pickup crank	.60
R-7	Cam Gear	1.50	R-67	Roller	.20
R-8	Start Pawl	.20	R-73	Rivet	.02
R-9	Rivet	.02	R-75	Escutcheon plate	.13
R-10	Cam Pawl Spring	.02	R-76	Lower changer blade	.60
R-11	Pawl Latch	.20	R-77	Upper changer blade	.70
R-12	Idler Bracket	.40	R-78	Changer blade pin	.02
R-14	Crank Screw #10-24 x 1/2 and lockwasher	.02	R-79	Changer shaft button	.08
R-15	Latch adjusting screw 3/16-24 x 3/4 special knurl	.04	R-81	Lift pin	.04
R-16	Cam latch spring	.02	R-82	Control button lockwasher	.01
R-18	Eccentric	.30	R-83	Pickup arm	.60
R-19	Cam extension	.36	R-85	(Order Part #117814) Motor spacer tube	.04
R-20	Cam extension spring	.01	R-101	Sub Frame Mtg. Screw #10-24 x 3/8 B.H.M.S. & lockwasher	.02
R-21	Eccentric arm	.60	R-104	Control button screw #4 x 3/8	.01
R-23	Eccentric arm spring	.30	R-107	Cartridge screw #4-36 x 1/4 Fil. Hd.	.01
R-24	Crank	.02	R-108	Lift adjusting screw #8-32 x 1/4 H.H.C.S.	.03
R-25	Motor screw #8-32 x 1/2 Fil. head	.01	R-109	Pickup arm adjusting screw spring	.01
R-26	Rivet (long)	.02	R-112	Washer	.04
R-27	Tie bar	.10	R-113	Nut	.06
R-28	Rivet (short)	.02	R-115	Pickup cord	.60
R-29	Long changer shaft	.16	R-116	Spring	.01
R-31	Changer shaft washer	.01	R-117	Wire	.20
R-32	Short changer shaft	.14	R-118	Changer shaft screw #10-24 x 3/8 Phillips Owl.Hd.	.02
R-33	Motor mounting grommets	.02	R-119	Oilwick	.01
R-34	(Order Part #117806) Idler Wheel	.60	R-125	Turntable 10"	1.78
R-35	Rivet	.02	R-126	Motor mtg. washer 3/16 x 1/2 x .030	.01
R-37	Idler bracket spring	.02	R-129	Motor pulley - 60 cycle	.40
R-38	Sub frame	2.00	R-130	(Order Part #117808) idler retaining clip	.02
R-40	Long bearing support	.01	R-131	Idler wheel washer	.01
R-41	Short bearing support	.02	R-132	Idler spring anchor	.02
R-43	Turntable shaft	1.50	R-133	Pickup crank spring	.02
R-46	Pinion	.30	R-136	Bearing support lockwasher	.01
R-47	Pinion pin	.03	R-137	Pickup hinge takeup spring	.03
R-48	Fibre washer 9/16 x 3/8 x 1/32	.01	R-143	Name plate	.02
R-50	Sub frame cam stop spring	.02	R-144-1	(Order Part #117085) Needle screw	.16
			R-191	Pickup crank clamp screw #8-32 x 9/16 & lockwasher	.02

FOR OPERATION AND SERVICE NOTES
SEE (ERWOOD) NEW PRODUCTS 220 SERIES

302R, 302RT LATE...

G.I. RECORDER R-70.

302RA LATE... G.I. R-70 RECORDER,
RCA RP-145 OR RCA 139A R/C.

HOWARD RADIO CO.

568R G.I. R-70 RECORDER.

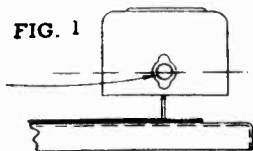
568RA G.I. R-70 RECORDER,

RCA RP-139A OR RCA RP-145.

GENERAL ADJUSTMENTS
ON
RECORDER MECHANISM.

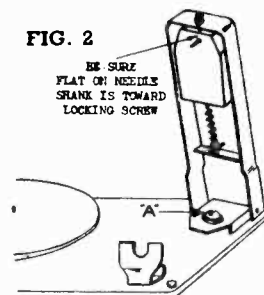
CUTTING HEAD POSITIONING ADJUSTMENT

FIG. 1



The cutting head position has been adjusted properly at the factory, using HOWARD Home Recording Blanks. However, check this adjustment by noticing if the Cutting Needle Locking Screw will locate itself in the Vertical Center of the clearance slot (See Fig. 1), when the record is being cut.

FIG. 2



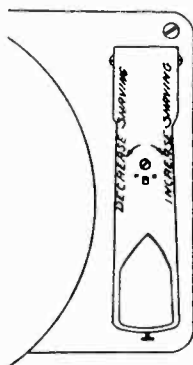
BE SURE
FLAT ON NEEDLE
SHANK IS TOWARD
LOCKING SCREW

When necessary to change the position of this screw in the slot, loosen locking nut (See Fig. 2) and turn screw "A" to RIGHT to raise needle locking screw; or turn to LEFT to lower.

After any adjustment is completed, be sure to tighten locking nut.

CUTTING NEEDLE PRESSURE ADJUSTMENT

FIG. 3



For quality recordings, it is of vital importance that the right amount of pressure is obtained with the cutting needle. Observe the character of the shaving as the record is being cut. The size of the shaving should be about the size of a human hair (approx. .003"). If it is too heavy, the groove in the record may be too close to the adjacent groove which would cause distortion. If the shaving appears to be too fine and "kinky", an insufficient pattern will be cut with distortion as a result.

Before making any change in the amount of pressure, FIRST BE SURE THE CUTTING NEEDLE ITSELF IS NOT DEFECTIVE, LOOSE OR MOUNTED WRONG, since the conditions as mentioned above due to improper pressure can also be caused by a defective needle. Check needle first.

When necessary to INCREASE thickness of shaving thread (See Fig. 3) TURN CUTTING PRESSURE adjustment "B" to the right. TO DECREASE thickness of shaving thread, turn adjustment to the left.

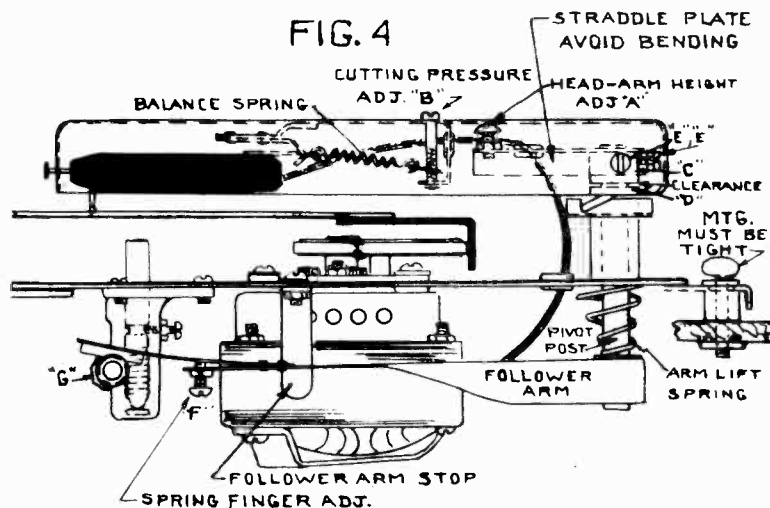
THE CORRECT HEIGHT OF FOLLOWER ARM IN RELATION TO THE CUTTER ARM is obtained by seeing that the pivot post (which is a fixed part of the follower arm) is flush with the bushing on the top side of the arm platform. See Fig. 4. Also see that there is a small clearance between the pivot post bushings "C" and "D" when the cutting arm is lowered to the cutting position. The two hex. head screws "E" - "E" permits both this adjustment and at the same time the very important FOLLOWER ARM ADJUSTMENT IN RELATION TO THE SWING OF THE CUTTER ARM as follows: When the follower arm touches the follower arm stop, the cutting stylus should be just outside the edge of the paper label on the Howard Record blanks.

THE BRONZE SPRING ADJUSTMENT ON THE FOLLOWER ARM. When the cutting arm is in cutting position, the bronze spring tongue should seat firmly into the bottom of the spiral groove of the lateral feed screw. This pressure should be great enough so that there will be no tendency of the knife edge tongue to climb out of the thread causing uneven grooves and distortion. However, too much pressure is to be avoided.

The screw "F" controls this tension, and if the spring lifts itself away from the tip of this screw in the cutting position, it indicates too much pressure. This may also be caused by the follower arm being too low or bent downward for some reason.

END PLAY ADJUSTMENT OF LATERAL FEED SCREW. Loosen locking nut for screw "G"; turn screw slowly to right until the end play cannot be felt; reverse screw slightly to left to allow running clearance, and tighten lock nut.

FIG. 4



STRADDLE PLATE
AVOID BENDING

CUTTING PRESSURE
ADJ. "B"

HEAD-ARM HEIGHT
ADJ. "A"

BALANCE SPRING

"E" "E"

"C" "D"

CLEARANCE

"D"

MTG. MUST BE TIGHT

"G"

FOLLOWER ARM

ARM LIFT SPRING

PIVOT POST

FOLLOWER ARM STOP

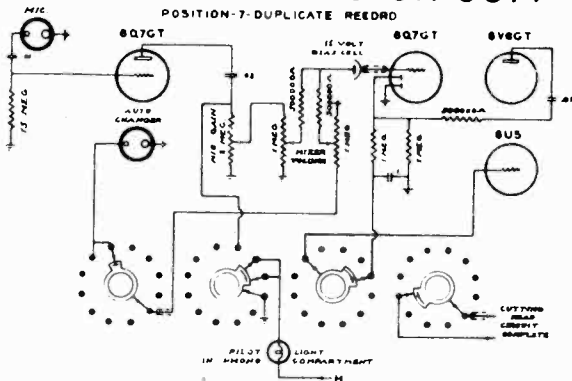
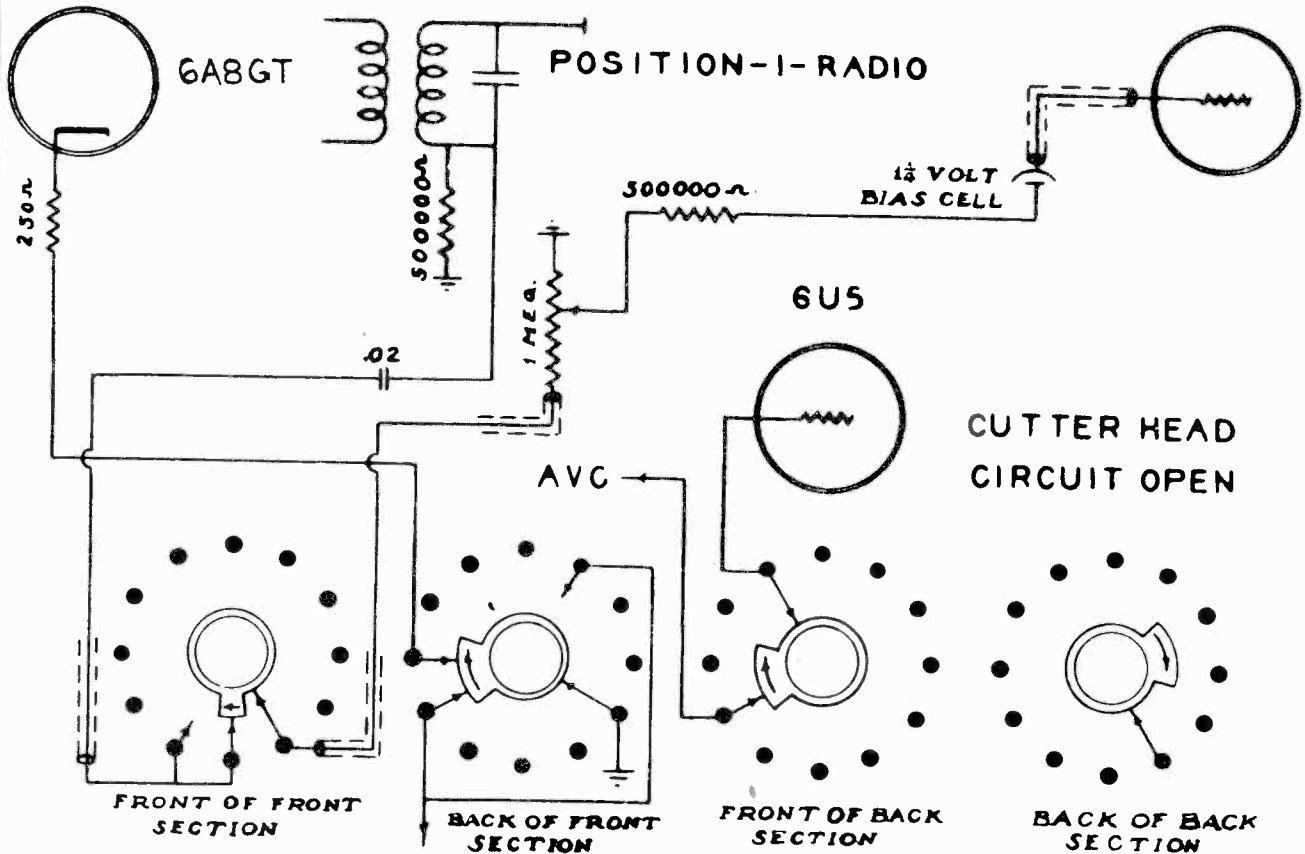
SPRING FINGER ADJ.

302R, 302RT LATE...
 G.I. RECORDER R-70.
 302RA LATE... C.I. R-70 RECORDER,
 RCA RP-145 OR RCA 139A R/C..

HOWARD RADIO CO

568R G.I. R-70 RECORDER.
 568RA G.I. R-70 RECORDER,
 RCA RP-139A OR RCA RP-145

6Q7GT

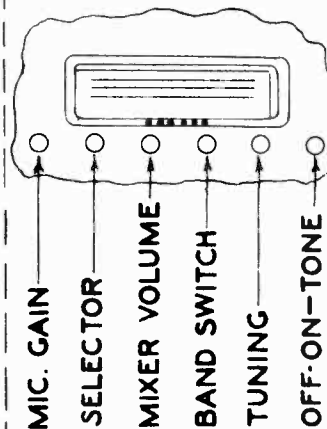


In the "Duplicate Record" position, the tuning-eye is again in the circuit, for indication of proper cutting level, the cutting head circuit is complete, and the duplication is made from the original blank in position on the automatic turntable. The microphone is in use for another superimposed registration if desired.

With our automatic record changer models when duplicating from a small 6 1/2" record, due to the fact that this record, having a small surface, is liable to slip on the turntable, we have provided a spring finger that slips over the spindle that locks this record in place.

All chassis models have the input socket for the automatic changer pick-up, or if the model is not equipped with the automatic changer, a conventional turntable and crystal pick-up may be plugged into this socket and the duplication of the record can be accomplished.

CONTROL LAYOUT FOR 568R [RA] SERIES



THE MASTER SWITCH with which these features are selected, has seven positions as follows:

1. Radio
2. Record Radio & Microphone
3. Record Mic.
4. Microphone for P.A. System
5. Play-back
6. Automatic Phono
7. Duplicate Record

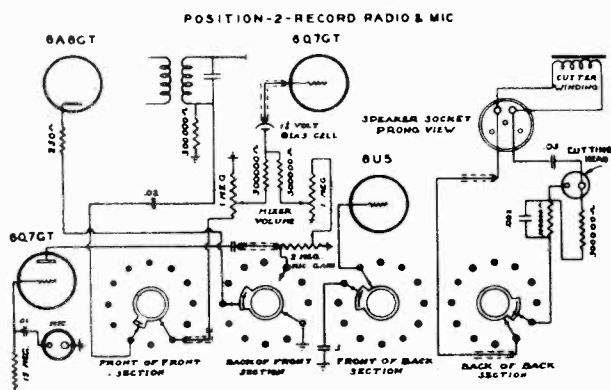
AUTOMATIC RECORD CHANGER WITH RA SERIES: USE ALSO FOR PLAYING RECORDS WHILE THEY ARE BEING DUPLICATED BY CUTTING ARM

302R, 302RT LATE...
G.I. RECORDER R-70.

HOWARD RADIO CO.

302RA LATE... G.I. R-70 RECORDER,
RCA RP-145 OR RCA 139A R/C.

568R G.I. R-70 RECORDER
568RA G.I. R-70 RECORDER
RCA RP-139A OR RCA RP-145



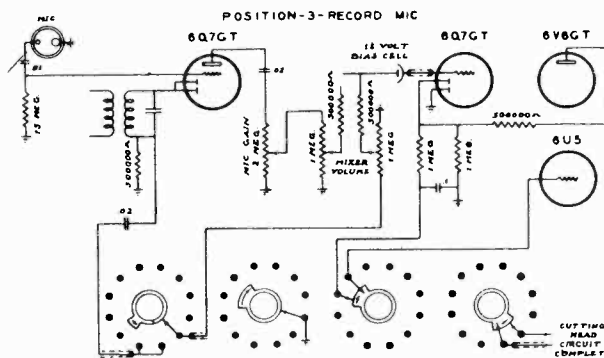
In the "Record-Radio & Mic." position, the radio circuit remains the same as in "Radio" position. The microphone circuit becomes effective as the short is removed from the Mic. Gain Control. The percentage of radio and/or microphone is then controlled with the dual control feeding the 6Q7GT Audio and the Mic. Gain Control.

The 6U5 now becomes the visual amplitude indicator of the recording voltage. The voltage is taken from the output plate (6V6), rectified and applied to the grid of the 6U5.

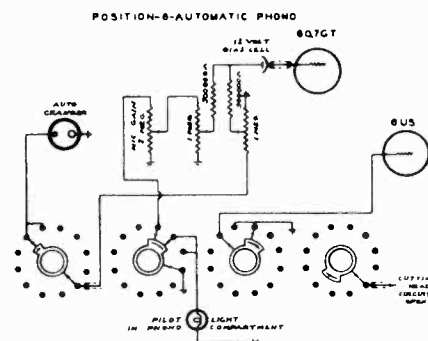
The cutter head circuit is completed.

THE PROPER VOLTAGE LEVEL FOR THE CUTTING OPERATION IS VERY IMPORTANT. TOO HIGH A LEVEL AS INDICATED BY THE CONTINUOUSLY OVERLAPPING OF THE TUNING-EYE RESULTS NOT ONLY IN FEED-BACK, BUT ACTUAL OVERCUTTING OF THE RECORD, RESULTING IN DISTORTION. HOWEVER, IT SEEMS THAT THE GENERAL PRACTICE IS FOR THE OPERATOR TO MORE OFTEN "UNDERCUT" THE RECORDING BY NOT PROVIDING SUFFICIENT CUTTING VOLTAGE. THIS RESULTS IN A HIGH BACKGROUND LEVEL AND POOR QUALITY.

The series condenser (.002) in one side of the cutting head circuit is a controlling compensator for high response when recording. Increasing the value of this condenser will increase the high frequency effect in recording.

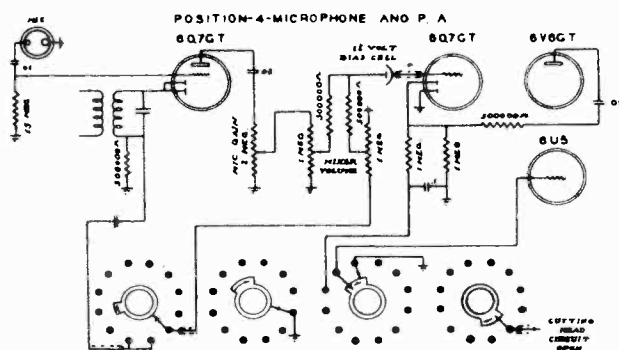


In the "Record Mic." position, the radio diode circuit is opened, the bias circuit is opened at the mixer tube, cutting out the radio, and cutting head circuit is closed.



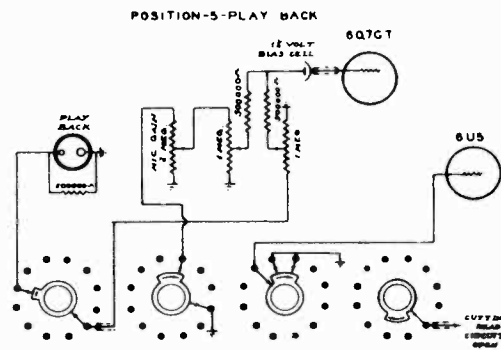
With the Howard "RA" Series, the automatic changer is included. With the switch in this position the audio system remains the same as in "Play-Back" position, except the pick-up arm of the changer is in use.

A pilot light is switched on over the changer unit when switch is in this position.



In the "Mic. P.A." position, only the microphone is in the circuit. An additional microphone extension is usually used with the microphone at a remote point, using the receiver as a public address system.

As shown in the above diagram, the tuning-eye becomes inactive.



In the "Play-Back" position the pick-up connects to one section of the dual volume control from which the audio output is regulated in the conventional manner.

The resistor directly in shunt with the play-back or pick-up circuit is a compensator controlling the low frequency response at "Play-Back" position. Decreasing this value will decrease the low response.

MODELS RC-4, RC-5,
RC-6, RC-8
Series

THE MAGNAVOX CO. INC.

MODELS RC-50, 50C, 50X,
RC-51, 51C, 51X

LUBRICATION

The motor should always be well lubricated as noise will develop if the bearings are allowed to run dry. All bearings are of the oil-retaining type and with average use, will require lubrication about once every three months. All oiling holes are accessible when the turntable is lifted from the motor spindle and are indicated on Fig. 1.

The pickup pivot is fitted with ball bearings and should be oiled only if it shows signs of sluggishness in moving into the playing grooves after it has lowered to the record. A few drops of very thin oil will be sufficient.

THE AUTOMATIC TRIP

The automatic trip plays an important part in the operation of the record changer, and upon the certainty of the automatic trip coming into action, depends the whole operation of the record changer. The automatic trip mechanism will operate on all makes of records having a "run-off" groove, either eccentric or spiral.

OPERATION OF THE AUTOMATIC TRIP

The trip lever "A" Fig. 1, is connected to the pickup arm through a series of levers and is moved forward towards the main spindle, a distance proportional to the advance made by the pickup. The striker arm "B" Fig. 1, is fitted on the main spindle in order to push back the trip lever, preventing the automatic stop from functioning while the record is being played. When the pickup reaches the end of the playing grooves and is carried into the "run-off" grooves, the movement transmitted to the trip lever is too great to allow it being pushed back by the striker arm. The striker arm then contacts the metal trip lever which in turn operates the changing mechanism.

If the automatic switch does not operate at the end of the last record, make certain that all of the levers are free and that all the springs are in place. Also make certain that the turntable spindle is free in the main spindle -- it should move about 1/8" when depressed and should rise the same distance when released. This test should be made while the changer is in the playing position. Switch tripping adjustment can be obtained by means of a small quadrant adjustment on the top of the spindle operated by lever "P" Fig. 2.

STRIKER ADJUSTMENT

The correct functioning of the trip mechanism depends on the rubber bushing "H" Fig. 1, on the trip lever arm "G". When the bushing becomes badly worn, a tapping sound will become apparent, and the trip lever may operate before the end of a record. This condition may be corrected by turning the rubber bushing on the spindle in order to present a new surface to the striker arm "B".

FRICITION ADJUSTMENT

If the changer fails to operate at the end of a record, the record spindle should be removed, the turntable lifted from the motor shaft so that the friction adjusting screw "E" Fig. 1, may be readjusted. Before adjusting this screw it is advisable to make certain that the operating trip lever "A" is not rubbing on the base plate, setting up additional friction.

To adjust the friction, give the friction adjusting screw "E" a small turn in a counter clockwise direction to increase the friction. If the changer trips before the pickup has reached the end of the playing grooves, or if a bumping noise is heard in the speakers, the friction adjusting screw should be turned in a clockwise direction to decrease the friction. This adjustment is very sensitive and the screw should be turned not more than a quarter of a turn at one time.

THE MAGNAVOX CO. INC.

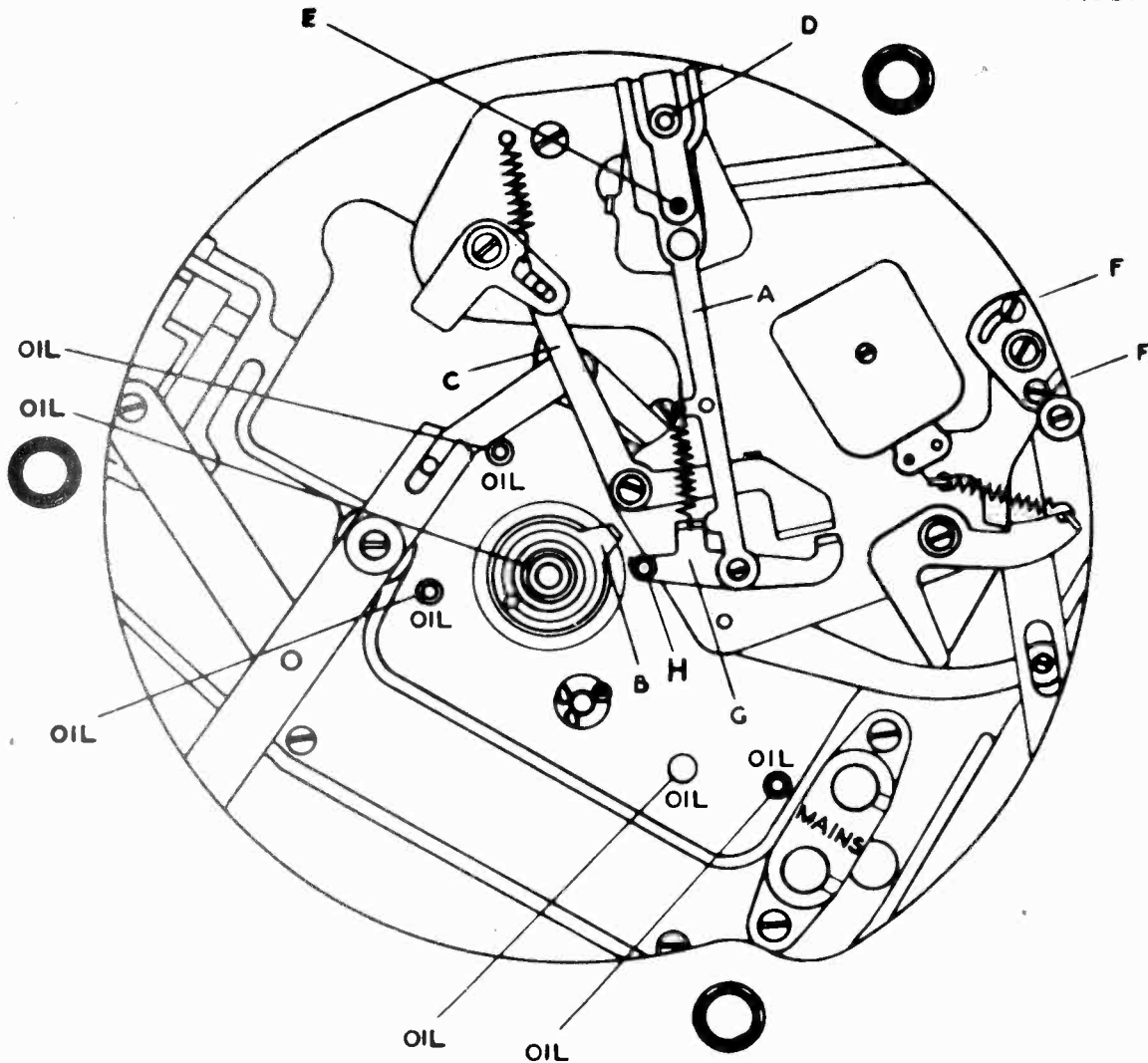
MODELS RC-4, RC-5,
RC-6, RC-8
Series

FIG. 1

FOR OTHER DATA
SEE GARRARD RC-4 SERIES

PICKUP ARM ADJUSTMENT

On some records, the playing groove may start farther from the center than on standard records, and in these exceptional instances, the needle would contact the record a few grooves in, and not on the smooth surface. If the pickup arm was set for these exceptional records, the pickup would not be lowered on to the edge of normal-sized records.

Should the lowering position of the needle require adjustment, the turntable should first be turned by hand to bring the pickup from the loading position to the point where the needle has dropped to within $1/16$ " of the record. The screw "N" Fig. 3, which is accessible through a hole in the motorboard should be turned either to the right or to the left according to the requirements -- a quarter turn in either direction will give the maximum adjustment obtainable. The adjustment should then be checked by operating the changer and noting the lowering position of the pickup.

When making any adjustments to the pickup arm, it should never be forced into position and when the turntable is turned by hand, it should never be turned other than in a clockwise direction.

MODELS RC-4, RC-5,
RC-6, RC-8
Series

THE MAGNAVOX CO. INC.

If the pickup is lowered so that the needle contacts the smooth surface of the record and does not run into the playing grooves, check to make certain that the motorboard is level. Then check the lead to the pickup, making certain that it is not twisted in any way to prevent free movement of the arm. Also check levers "Q" and "R" Fig. 3, to see that they are free, and that the pin at the end of lever "Q" is not rubbing on the bottom of the cam grooves.

If required, the pickup height can be adjusted by loosening the set screw in the pickup arm counter-balance weight "M" Fig. 2, and turning the weight while holding the spindle.

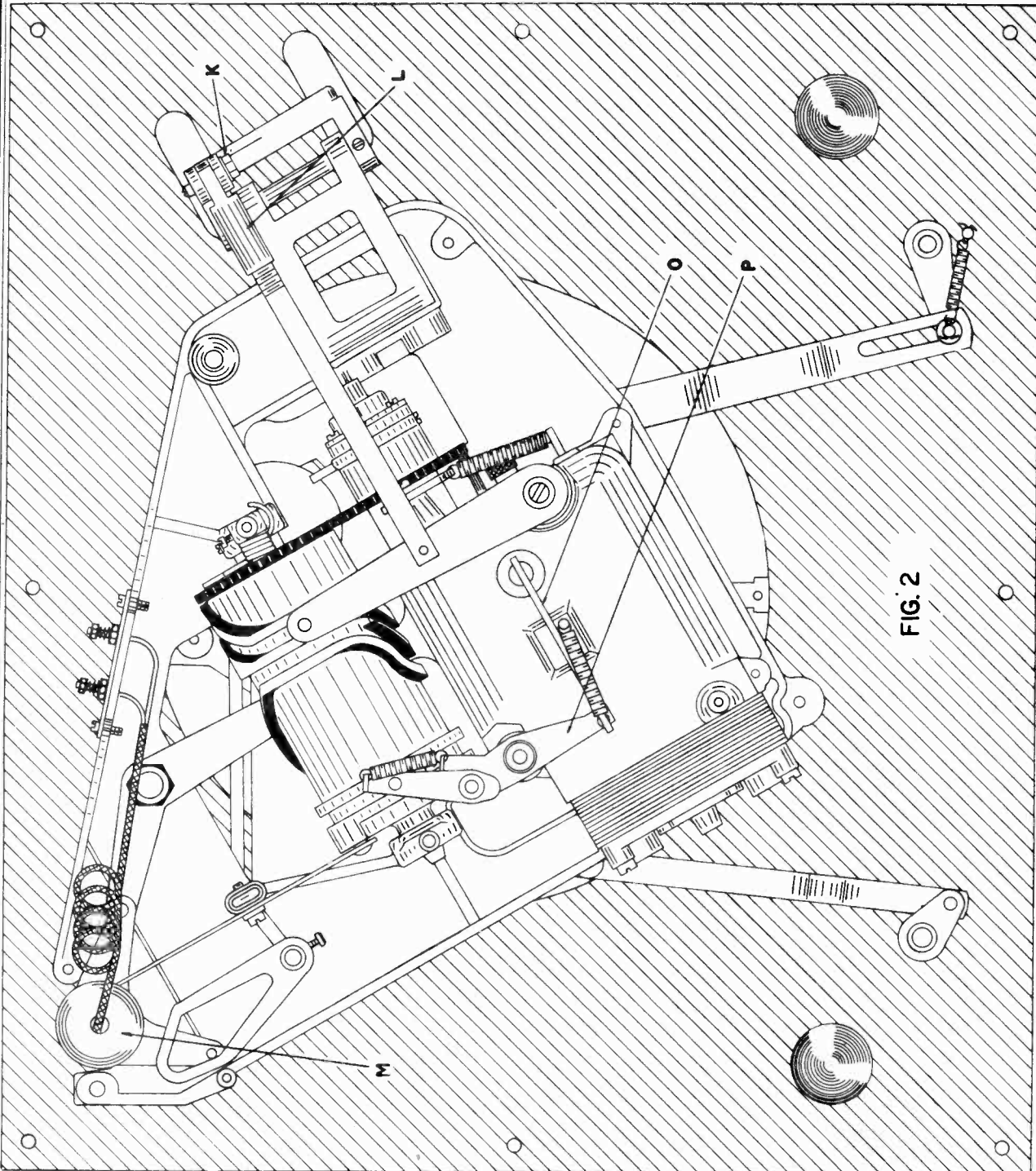


FIG. 2

THE MAGNAVOX CO. INC.

MODELS RC-4, RC-5,
RC-6, RC-8
Series

OPERATING INSTRUCTIONS

This record changer plays eight twelve-inch records or eight ten-inch records (not intermixed) automatically, and the changer stops operating after the playing of the last record. A record may be rejected before playing the entire selection, by turning the right-hand knob on the motorboard, to the REJECT position.

To operate the changer, first turn the left-hand knob on the motorboard so that the indicator is pointing to the 10-inch or the 12-inch designation, depending on the size of the records to be played. With the record spindle in position -- angling section toward the record platform -- place from one to eight records of either the ten or twelve-inch type on the record spindle. Rotate the right-hand knob on the motorboard to the START position, placing the changer in operation.

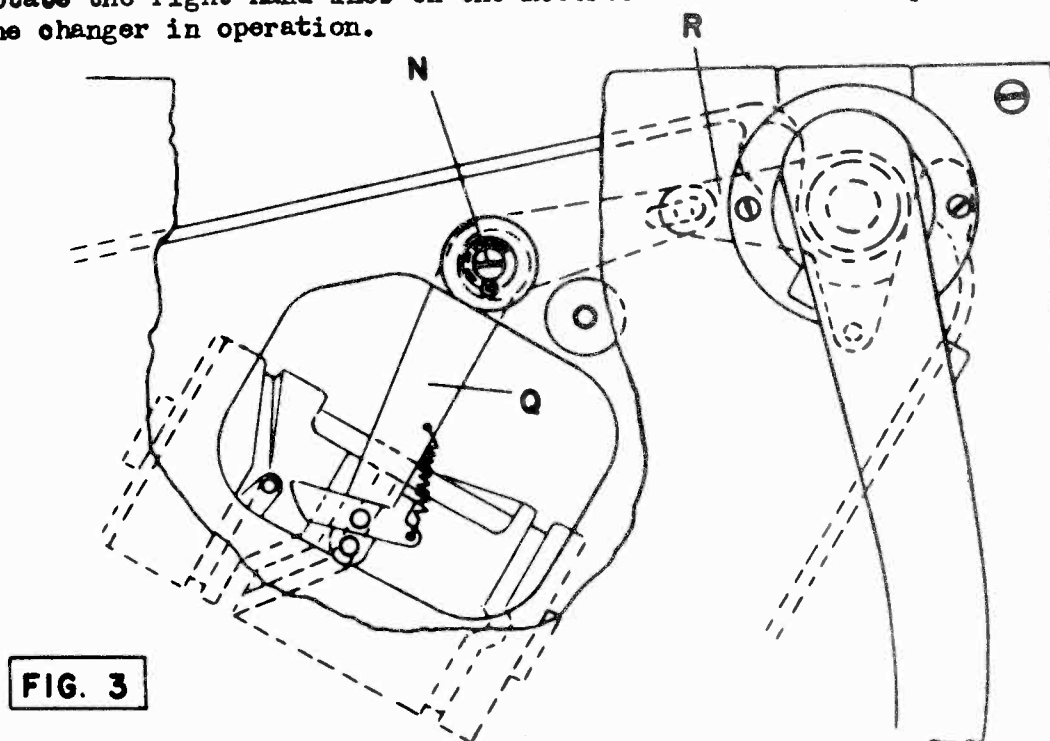


FIG. 3

SPEED ADJUSTMENT

Due to the differences of line voltages in various localities, a slight adjustment of the speed indicator lever (that projects from the edge of the turntable) may be necessary. To make this adjustment, first set the motor speed to 78 R.P.M. using the stroboscope disc (on A.C. models) furnished with the unit, in making this adjustment. To set the speed on the AC-DC unit, operating on DC current, place a piece of paper under a record on the turntable and count the revolutions in a period of 30 seconds. If there are more or less than 39 revolutions, the speed adjustment lever should be moved a slight amount in the required direction, and the process repeated.

After the motor has been set at 78 R.P.M., the turntable should be removed and the quadrant screw (near the spindle on the speed-control lever) should be loosened very carefully and the lever moved until the pointer is in position on "78" on the indicator plate, holding the quadrant stationary while making this adjustment. Now tighten the quadrant screw and replace the turntable.

MODELS RC-4, RC-5,
RC-6, RC-8
Series

THE MAGNAVOX CO. INC.

If it is correct the record edge should rest on the platform just clear of the studs when the changer is in the playing position.

RECORD DROPPING

If the first record does not drop when the changer is switched "ON", this is due to the leather brake pad becoming worn and not breaking the turntable sufficiently when the previous record was completed. To adjust this pad, loosen the two screws "F" Fig. 1, and turn the brake lever slightly to bring the leather pad nearer to the turntable rim. Tighten the screws and check to see that the switch breaks contact before the leather brake pad touches the turntable rim.

Occasionally a record may stick to the spindle and not drop to the turntable as it should. The record may be excessively thick and must be removed from the stack. The reason for the "thick" record sticking is that the slot at the angle in the spindle is not sufficiently wide to let the record slide into place. Never attempt to file this groove as it will then be possible for two "Thin" records to drop to the turntable at one time.

If the spindle should be bent, it will either cause records to stick or more than one record to feed to the turntable at one time, depending on the direction of the bend. Extreme care should be used in bending the spindle back into position, should this become necessary, as it may be broken very easily.

IRREGULAR SPEED

If an occasional "slowing up" is noticed in the reproduction, the trouble is most likely due to the record slipping, due to its being warped. If a record slips while it is being played, examine the center hole for burrs, left in the record manufacture. These burrs should be carefully removed with a pen-knife. Warped records may be flattened by subjecting them to a warm temperature and pressing them.

TO REPLACE THE TONE ARM BASE

If the bakelite tone arm base should need replacement, it can be removed by following the instructions outlined below:

1. Loosen the small set screw "4" Fig. 4 and punch the pivot pin "5" from the tone arm using a small punch and hammer.
2. Lift the tone arm from the base "6" and pull the pickup lead up from the bottom, after the plug has been unsoldered from the lead.
3. Remove the two mounting screws that secure the tone arm base to the motorboard, and rotate the base until the large hole in the rear of the base is directly over a screw in the casting beneath the motorboard.
4. Remove the screw from the casting and rotate the base 180 degrees exposing another screw which should be removed from the casting.
5. Slide the assembly to the rear of the board, removing the lever pins from their guide slots.
6. Remove the counter-balance weight "7" by first removing the set-screw "8" and then turning the weight in a counter-clockwise direction until it drops from the shaft.
7. Now loosen the set screws in the bushing "8" and remove the lever arm from the shaft holding the assembly over a small box so that the ball bearings will not be lost.
8. Slip the casting from beneath the base, off the shaft and replace the bakelite base. There are fifteen bearings above and fifteen bearings below the base, that should be replaced before the assembly is reassembled.
9. Reassembly of the unit is not difficult, however the counter-balance "7" will require adjustment to allow proper lowering of the tone arm to the record.

AUTOMATIC SWITCH

The record changer automatically stops after the last record has been played due to the fact that there is no longer any weight on the turntable spindle. The weight of a record on this spindle moves lever "O" Fig. 2, which interrupts the movement of the switch lever "P" Fig. 2, from the cam, so preventing the switch from operating. When the record is removed from the center spindle, the spindle raises and allows lever "O" to move so that it does not interrupt the switch lever "P", thereby allowing the switch to operate.

If the automatic switch does not operate at the end of the last record, make certain that all of the levers are free and that all the springs are in place. Also make certain that the turntable spindle is free in the main spindle — it should move about $1/8$ " when depressed and should rise the same distance when released. This test should be made while the changer is in the playing position. Switch tripping adjustment can be obtained by means of a small quadrant adjustment on the top of the spindle operated by the switch lever "P" Fig. 2.

UNIVERSAL MOTOR

The lubrication and speed adjustment is the same for the Universal motor as for the AC motor. If the brushes are allowed to become dirty and worn, brush noise will develop. The brushes may be removed by unscrewing the bakelite caps on the motor body and pulling out the brushes by means of the springs. The brushes can be cleaned by sanding them with a fine grade of sand paper or crocus cloth and cleaning the dust from the surface before replacing them. It is important that the brushes be replaced in the same holder and in the same way in which they were originally installed. The brushes when new, are $9/16$ " long under the springs; when they have worn down to $3/32$ ", they should be replaced.

TO REMOVE MOTOR

If for any reason, the motor must be removed from the mechanism, the following instructions should be observed. Disconnect the motor leads from the switch and terminals. On the AC-DC model, the leads must also be removed from the bakelite resistance block. Next, unscrew the platform operating lever from the bottom of the motor casting. Now hold the motor with one hand, remove the three motor mounting screws, and withdraw the motor. When reassembling the motor, the mark on the two large gears must coincide for correct timing.

PICKUP

If the quality of reproduction is distorted, or if the volume of the signal is unusually low, it may be due to a defective crystal pickup. If no signal is heard when the pickup is used and the amplifier is operating properly with the radio receiver, it is probable that the pickup lead is broken or shorted in the pickup arm.

To remove the pickup cartridge assembly, remove screw "1" Fig. 4, and pull the cartridge from the arm, examining the connections to the bakelite terminal block. To remove the cartridge from the assembly, remove the two retainer plates "2" and "3" Fig. 4, and unsolder the pigtail connections from the bakelite block.

OVERSIZE RECORDS

The record platform, opposite the pickup arm on the motorboard is normally adjusted to the correct position for all average records, however if a very large or small record is encountered, it may be necessary to make a slight adjustment to the platform position to accommodate these records. This is accomplished by removing the nut, washer and screw "X" Fig. 2, and turning the bushing "1" clockwise to accommodate larger records, and counterclockwise for smaller records. Replace the screw, washer and nut and check the platform position by placing a record on the spindle.

THE MAGNAVOX CO. INC.

MODELS RC-4, RC-5,
RC-6, RC-8
Series

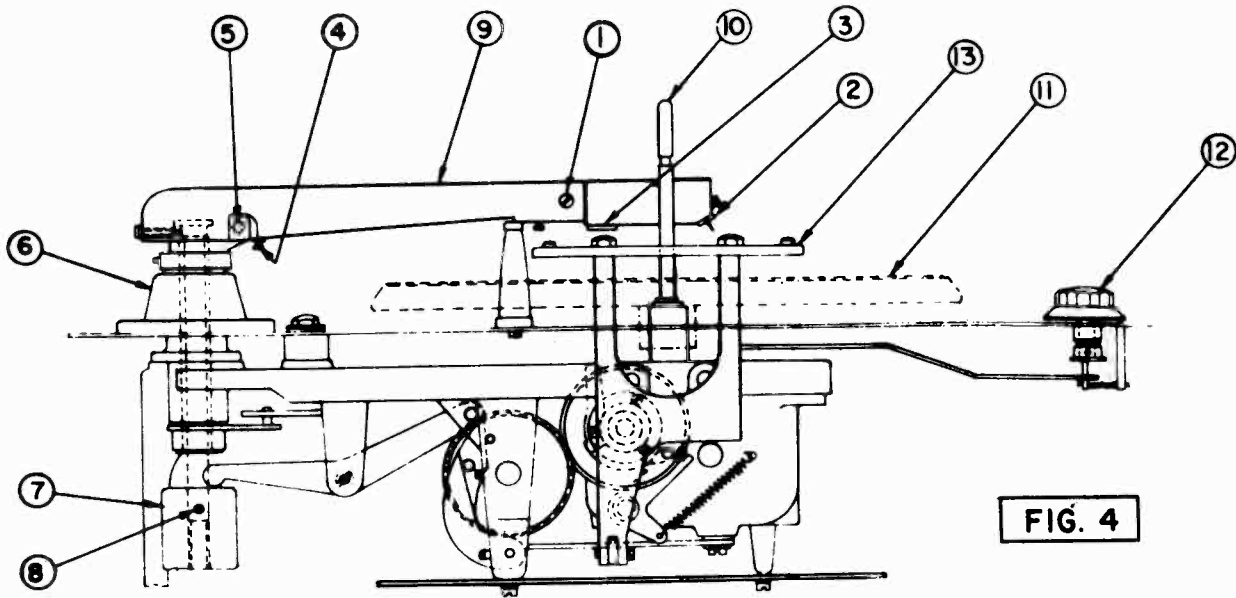


FIG. 4

PARTS PRICE LIST

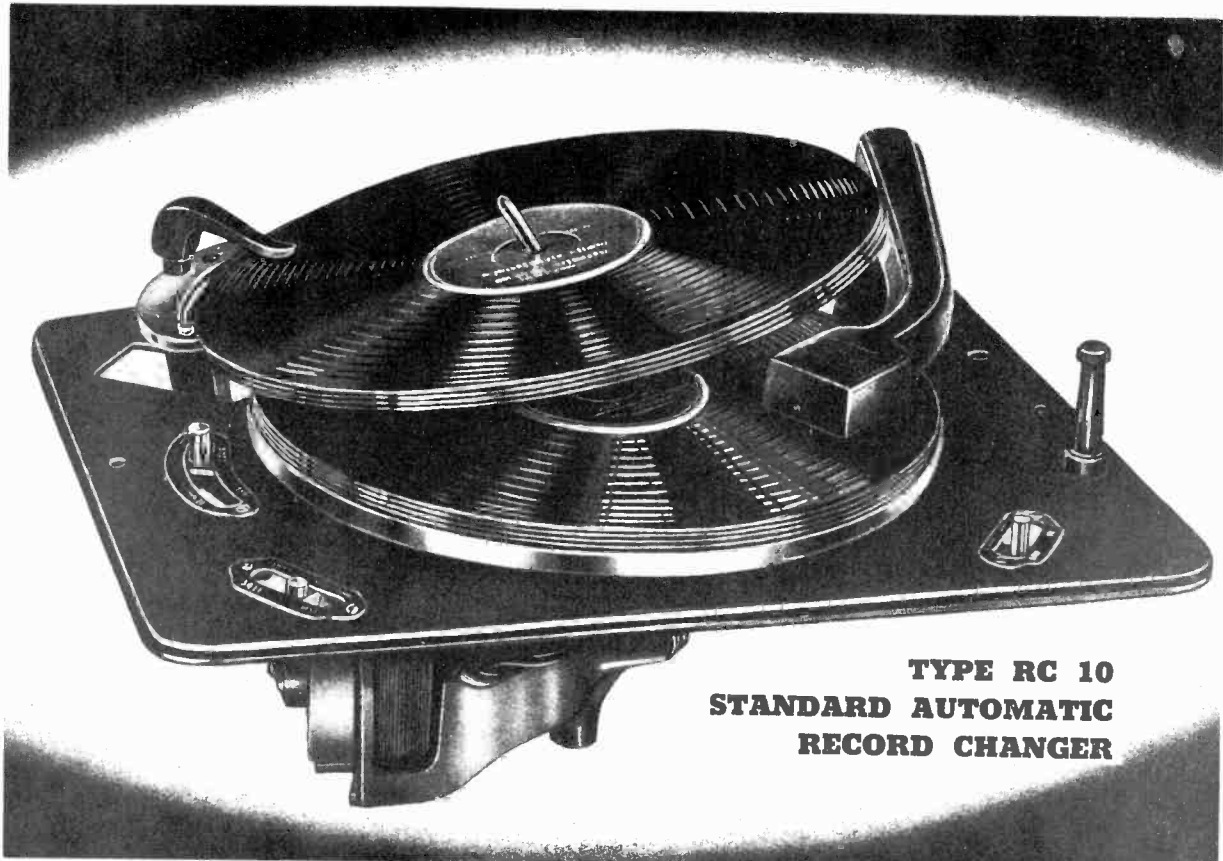
<u>Illus. No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Price</u>
2.	150017	Cartridge retainer plate	.05
5.	101468	Tone arm pivot pin	.05
6.	630015	Bakelite tone arm base	.55
9.	630099	Tone arm only	2.30
10.	630016	Record spindle	1.75
11.	630042	Turntable only	3.00
12.	140002	Bakelite control knob	.40
13.	630098	Record platform	1.75
	101192	Needle cup	.20
	630014	Striker assembly	.65
	467690	Shielded pickup cable	per ft. .05
	500013	Field coils for A.C. changer	pair 3.00
	500014	Field coils for AC-DC changer	pair 5.25
	569659	Crystal cartridge only	5.00
		Cartridge exchange price	2.00
	102644	Needle screw	.10
	101469	1/8" ball bearings -- per set of 30	.40

FOR ADDITIONAL PARTS
SEE GARRARD

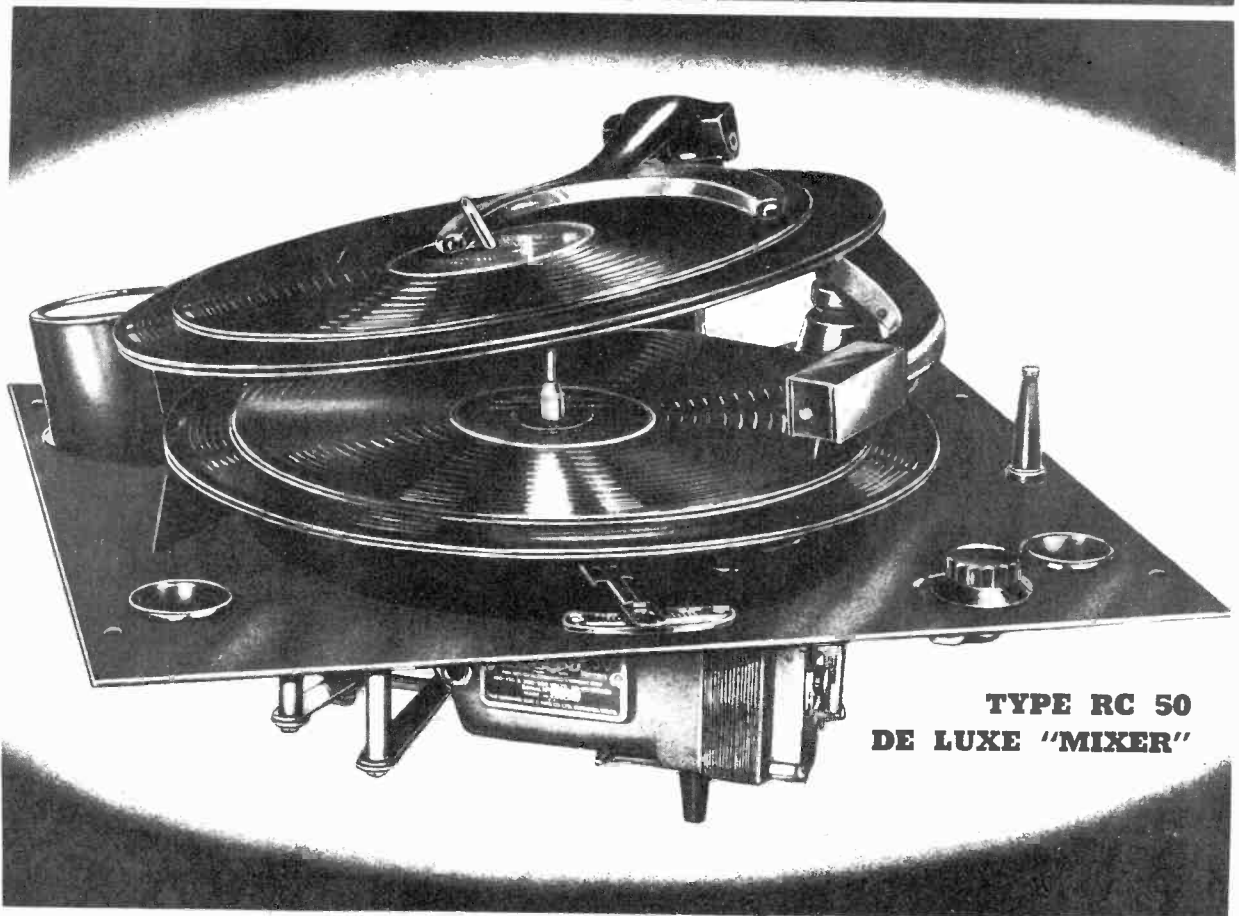
ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODEL RC-10
MODEL RC-50

THE MAGNAVOX CO., INC.



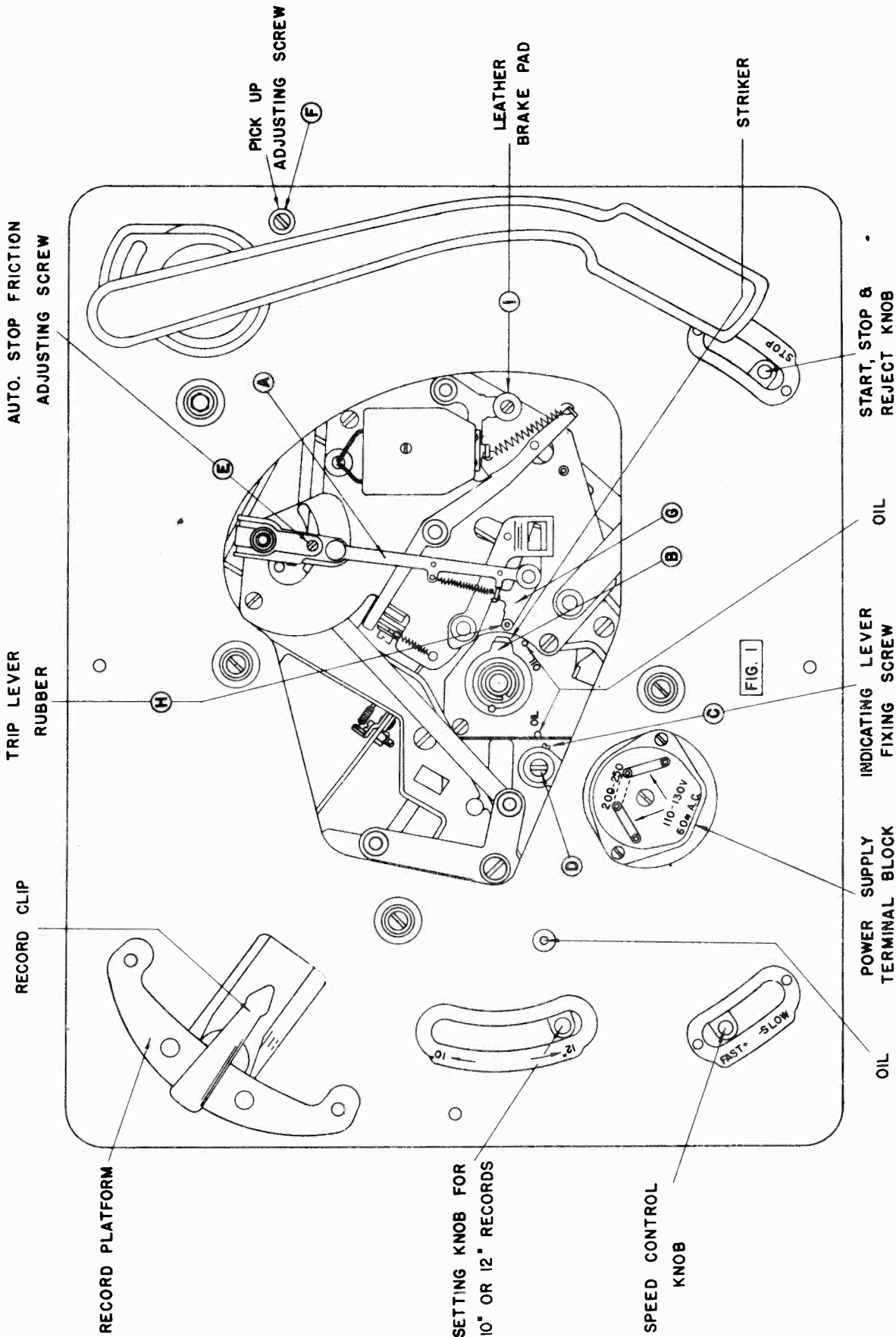
**TYPE RC 10
STANDARD AUTOMATIC
RECORD CHANGER**



**TYPE RC 50
DE LUXE "MIXER"**

THE MAGNAVOX CO. INC.

MODELS RC-10, RC-11



MODELS RC-10, RC-11

THE MAGNAVOX CO. INC.

FOR OTHER DATA
SEE GARRARD RC-10 SERIES

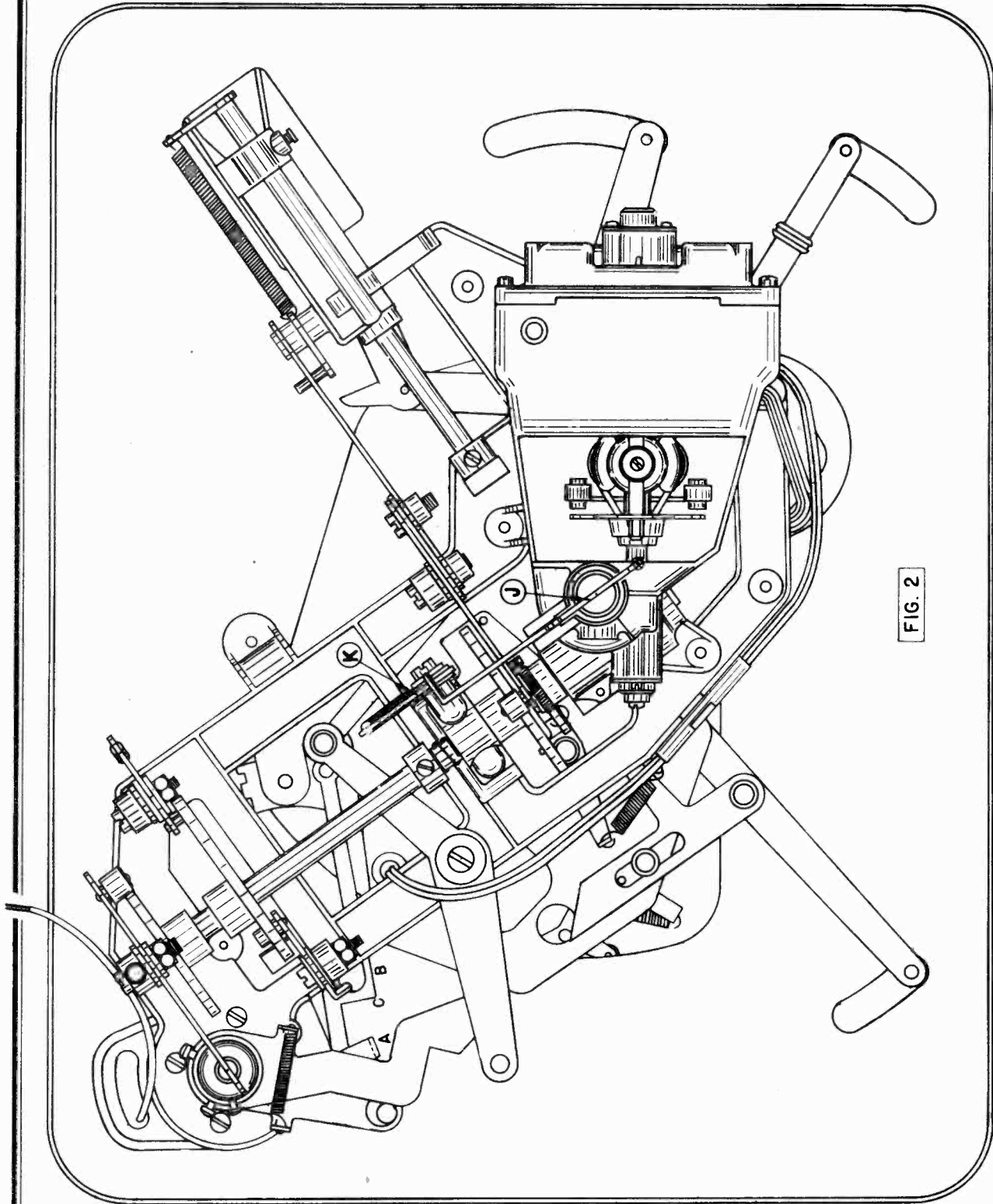


FIG. 2

THE MAGNAVOX CO. INC.

MODELS RC-10, RC-11

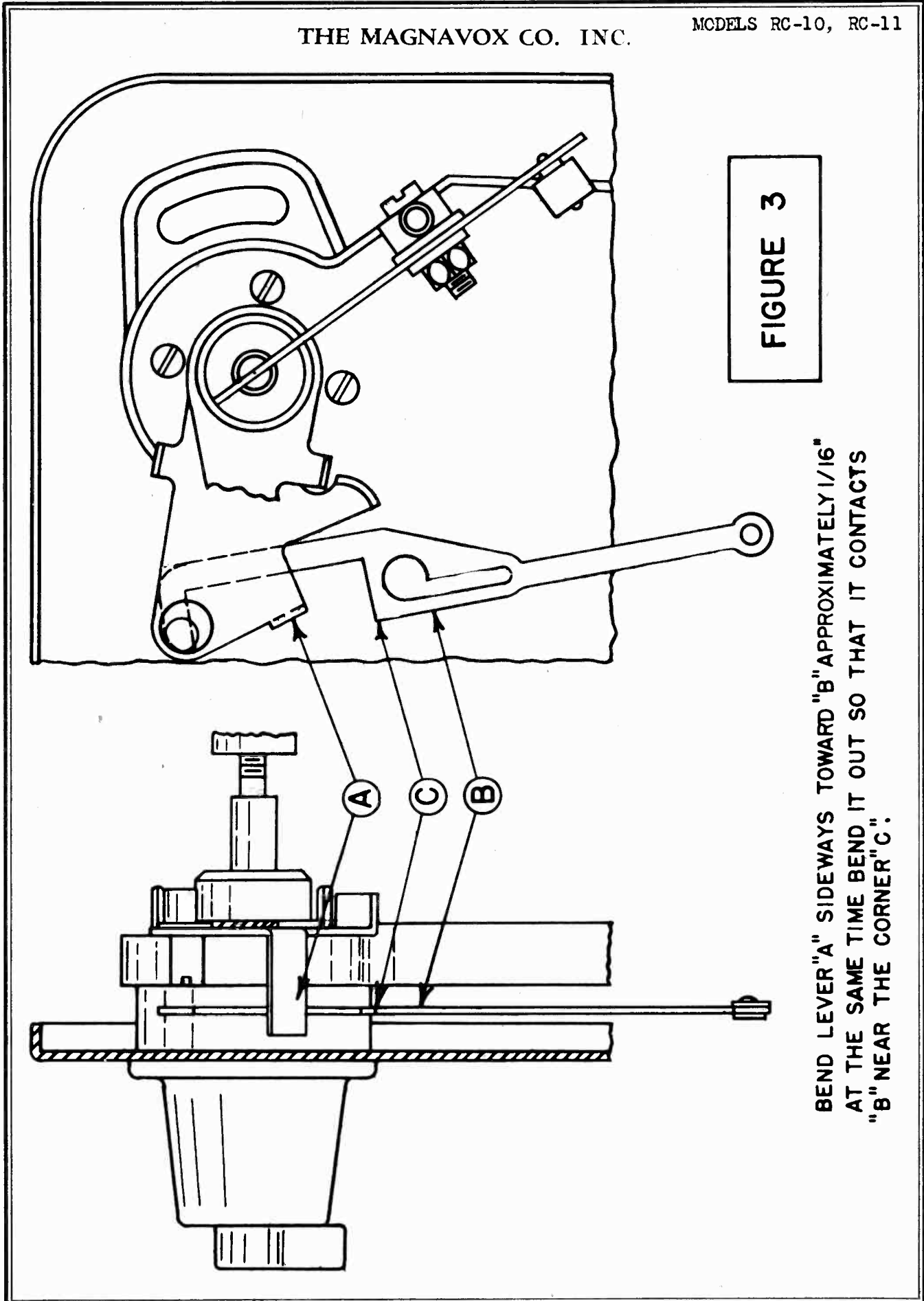


FIGURE 3

BEND LEVER "A" SIDEWAYS TOWARD "B" APPROXIMATELY 1/16"
AT THE SAME TIME BEND IT OUT SO THAT IT CONTACTS
"B" NEAR THE CORNER "C".

OPERATING INSTRUCTIONS

This record changer plays eight twelve-inch records or eight ten-inch records (not intermixed) automatically, and the changer stops operating after the playing of the last record. A record may be rejected before playing the entire selection, by moving the right-hand lever on the motorboard to the REJECT position.

To operate the changer, first move the left-hand lever on the motorboard so that the indicator is pointing to the 10-inch or the 12-inch designation, depending on the size of the records to be played. With the record spindle in position -- angling section toward the record platform -- place from one to eight records of either the ten or twelve-inch type on the record spindle. Move the right-hand lever on the motorboard to the START position, placing the changer in operation.

THE AUTOMATIC TRIP

The automatic trip plays an important part in the operation of the record changer, and upon the certainty of the automatic trip coming into action depends the whole operation of the record changer. The automatic trip mechanism will operate on all makes of records having a "run-off" groove, either eccentric or spiral.

OPERATION OF THE AUTOMATIC TRIP

The trip lever "A" Fig. 1, is connected to the pickup arm through a series of levers and is moved forward towards the main spindle a distance proportional to the advance made by the pickup. The striker arm "B" Fig. 1, is fitted on the main spindle in order to push back the trip lever, preventing the automatic trip from functioning while the record is being played. When the pickup reaches the end of the playing grooves and is carried into the "run-off" grooves, the movement transmitted to the trip lever is too great to allow its being pushed back by the striker arm. The striker arm then contacts the metal trip lever which in turn operates the changing mechanism.

If the trip mechanism does not operate at the end of some records, projection "A" should be bent towards point "C" on lever "B" Fig. 3 so that when the mechanism is in the playing position (and the changer stopped), the tone arm may be moved inwardly to a point where the needle is 1 1/8-inches from the edge of the motor spindle.

PARTS PRICE LIST

Part No.	Description	Price
520014	Record clip	.85
520026	Cartridge retainer plate	.30
630218	Bakelite tone arm only	2.25
520015	Record spindle	1.50
630202	Turntable only	3.00
167690	Shielded pickup cable	per ft. .05
500048	Field coils for AC changer	per pr. 3.00
500019	Field coils for AC-DC changer	per pr. 5.25
560008	Crystal cartridge	5.00
101526	Needle screw	.10
520017	Tone arm rest	.50

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

FOR ADDITIONAL PARTS
SEE GARTARD

PICKUP ARM ADJUSTMENT

On some records, the playing groove may start farther from the center than on standard records, and in these exceptional instances, the needle would contact the record a few grooves in, and not on the smooth surface. If the pickup arm was set for these exceptional records, the pickup would not be lowered on the edge of normal-sized records.

Should the lowering position of the needle require adjustment, the turntable should first be turned by hand, after the STOP-START lever has been set to the START position, to bring the pickup from the loading position to the point where the needle has descended to within 1/16-inch of the record. If it is seen that the lowering position must be shifted either to the left or to the right, the tone arm should be returned to the "rest" position by hand, at which time, screw "F" Fig. 1, which is accessible through a hole in the motorboard near the tone arm base, should be turned either to the right or to the left according to the requirements -- a quarter turn in either direction will give the maximum adjustment obtainable. The adjustment should then be checked by operating the changer and noting the lowering position of the pickup.

When making any adjustments to the pickup arm, it should never be forced into position and when the turntable is turned by hand, it should never be turned other than in a clockwise direction.

If the pickup is lowered so that the needle contacts the smooth surface of the record and does not run into the playing grooves, check to make certain that the motorboard is level or tilted slightly to the left as adjusted at the factory. Then check the lead to the pickup, making certain that it is not twisted in any way to prevent free movement of the tone arm.

If the needle scrapes across the surface of the last record at the completion of the playing of that record, the pickup height requires adjustment. Loosen the set-screw in the collar at the bottom of the pickup arm, lift the spindle and turn the collar while holding the spindle. A few turns in a counter-clockwise direction should be sufficient. Tighten the collar set screw, completing the adjustment.

If the tone arm lowers to the record and then immediately returns to the rest, it is possibly due to the fact that the STOP-START lever at the right side of the motorboard is rubbing on the under side of the motorboard preventing the clutch from disengaging. Bend the lever downward so that it operates freely.

AUTOMATIC STOP

The record changer automatically stops after the playing of the last record, due to the fact that there is no longer any weight on the turntable spindle. The weight of a record on this spindle moves lever "J" Fig. 2, which interrupts the movement of the switch lever "K" Fig. 2, from the cam, so preventing the switch from operating. When the record is removed from the center spindle, the spindle raises and allows lever "J" to move so that it does not interrupt the switch lever "K", thereby allowing the switch to operate.

THE MAGNAVOX CO., INC.

MODELS RC-10, RC-11,
RC-30, RC-31,
RC-40, RC-41

FOR MODELS RC-30, RC-31, RC-40, RC-41 ONLY

OPERATING INSTRUCTIONS

This record changer plays eight 10 and 12-inch records, intermixed in any order automatically, and the changer stops operating after the playing of the last record. A record may be rejected before playing the entire selection by turning the motorboard knob to the REJECT position.

To operate the changer, raise the forked arm and place any number of records -- not exceeding eight -- on the record spindle and lower the forked arm until it rests on the top record. Turn the pickup head one-half turn in a counter clockwise direction and insert a phonograph needle, returning the pickup to its normal position. The needle should be inserted only when the arm is located on the rest as movement of the arm when it is in any other position may affect the mechanism.

Turn the motorboard knob to the START position, setting the changer in operation. Be sure to hold the knob in this position until the motor has started and becomes engaged with the changer mechanism. Should the changer be stopped for any reason during the record changing, it may be necessary to give it help in restarting by turning the turntable by hand due to the excessive load imposed on the motor when it is stopped in such a position. If it is desired to stop the motor at any time, it may be done by rotating the motorboard knob to the STOP position.

BINDING

If the mechanism should bind during operation, it may be possible to free it by depressing the pushing pawl "p" Figure 1, and allowing the pickup to come to the rest position. Turn off the motor and note the set-screws "q" in the stop lever. Loosen the set-screws and move the stop forward a slight amount. Tighten the set-screws and check the adjustment. If the mechanism still binds, the stop lever should be advanced a little more. This position is quite critical and the lever should not be moved more than 1/32-inch during each adjustment.

FOR MODELS RC-10, RC-11, RC-30, RC-31, RC-40, RC-41

THE AUTOMATIC TRIP

The automatic trip plays an important part in the operation of the record changer, and upon the certainty of the automatic trip coming into action, depends the whole operation of the record changer. The automatic trip mechanism will operate on all makes of records having a "run-off" groove, either eccentric or spiral.

OPERATION OF THE AUTOMATIC TRIP

The trip lever "A" Fig. 1, is connected to the pickup arm through a series of levers and is moved forward towards the main spindle, a distance proportional to the advance made by the pickup. The striker arm "B" Fig. 1, is fitted on the main spindle in order to push back the trip lever, preventing the automatic stop from functioning while the record is being played. When the pickup reaches the end of the playing grooves and is carried into the "run-off" grooves, the movement transmitted to the trip lever is too great to allow it being pushed back by the striker arm. The striker arm then contacts the metal trip lever which in turn operates the changing mechanism.

FRICTION ADJUSTMENT

If the changer fails to operate at the end of a record, the record spindle should be removed, the turntable lifted from the motor shaft so that the friction adjusting screw "E" Fig. 1, may be readjusted. Before adjusting this screw, it is advisable to make certain that the operating trip lever "A" is not rubbing on the base plate, setting up additional friction.

To adjust the friction, give the friction adjusting screw "E" a small turn in a counter-clockwise direction to increase the friction. If the changer trips before the pickup has reached the end of the playing grooves, or if a bumping noise is heard in the speakers, the friction adjusting screw should be turned in a clockwise direction to decrease the friction. This adjustment is very sensitive and the screw should be turned not more than a quarter of a turn at one time.

SPEED ADJUSTMENT

Due to the differences of the line voltages in various localities, a slight adjustment of the speed indicator lever (located on the left side of the motorboard) may be necessary. To make this adjustment, first set the motor speed to 78 r.p.m. using the stroboscope disc (on AC models) furnished with the instrument in making the adjustment. To set the speed on the AC-DC combination operating on direct current, place a piece of paper under a record on the turntable and count the revolutions in a period of 30 seconds. If there are more or less than 39 revolutions, the speed adjustment lever should be moved a slight amount in the required direction as indicated on the excutocheon plate, and the process repeated to check the adjustment.

After the motor speed has been set at 78 r.p.m., the turntable should be removed and screw "C" Fig. 1, should be loosened very carefully and the speed control lever moved until the knob is in position on the center mark of the excutocheon. Now tighten screw "C". Be sure that the screw stud "D" does not move during this adjustment.

CHANGE OF SPEED

If an occasional "slowing-up" is noticed in the reproduction, the trouble is most likely due to the fact that the record is slipping resulting from warpage. If a record slips while it is being played, examine the center hole for burrs. These burrs should be carefully removed with a penknife. Warped records may be flattened by subjecting them to a warm temperature and pressing them.

LUBRICATION

A. C. MOTOR

The motor should always be well lubricated as noise will develop if the bearings are allowed to run dry. All bearings are of the oil retaining type and with average use, will require lubrication about once every three months. All oiling holes are accessible when the turntable is lifted from the motor spindle and are indicated on Fig. 1.

UNIVERSAL MOTOR

The lubrication and speed adjustment for the universal (AC-DC) motor is the same as for the AC motor. If the brushes are allowed to become dirty and worn, brush noise will develop. The brushes may be removed by unscrewing the bakelite caps on the motor body and pulling out the brushes by means of the springs. The brushes can be cleaned by sanding them with a fine grade of sandpaper or crocus cloth and cleaning the dust from the surface before replacing them.

It is important that the brushes be replaced in the same way in which they were originally installed. The brushes when new, are 9/16-inch long under the springs -- when they have worn down to 3/32-inch, they should be replaced.

A drop of PARAFFIN OIL on one of the brushes will eliminate a "brush-squeak" that may develop due to a dry commutator. Be sure to use only paraffin oil for this purpose and nothing else or trouble will result.

RECORD DROPPING

If the first record does not drop when the changer is switched ON, this is due to the leather brake pad becoming worn and not braking the turntable sufficiently when the previous record was completed. To adjust this pad, loosen the screw "I" Fig. 1 and turn the brake pad slightly to present a new surface to the turntable rim. Now tighten the screw "I" and check the adjustment.

If the records do not drop properly, it is possible that the forked arm is

MODELS RC-10, RC-11
MODELS RC-30, RC-31,
RC-40, RC-41

THE MAGNAVOX CO. INC.

changer should be tilted slightly to the left so that the needle will slide into the first groove of the record easily.

PICKUP ARM ADJUSTMENT

On some records, the playing groove may start farther from the center than on standard records, and in these exceptional instances, the needle would contact the record a few grooves in, and not on the smooth surface. If the pickup arm was set for these exceptional records, the pickup would not be lowered on the edge of normal-sized records.

Should the lowering position of the needle require adjustment, the turntable should first be turned by hand, after the STOP-START lever has been set to the START position, to bring the pickup from the loading position to the point where the needle has descended to within 1/16-inch of the record. If it is seen that the lowering position must be shifted either to the left or to the right, the tone arm should be returned to the "rest" position by hand, at which time, screw "F" Fig. 1, which is accessible through a hole in the motor-board near the tone arm base, should be turned either to the right or the left according to the requirements -- a half turn in either direction will give the maximum adjustment obtainable. The adjustment should then be checked by operating the changer and noting the lowering position of the pickup.

When making any adjustments to the pickup arm, it should never be forced into position and when the turntable is turned by hand, it should never be turned other than in a clockwise direction.

If the pickup is lowered so that the needle contacts the smooth surface of the record and does not run into the playing grooves, check to make certain that the motorboard is level or tilted slightly to the left as adjusted at the factory. Then check the lead to the pickup, making certain that it is not twisted in any way to prevent free movement of the tone arm.

PICKUP HEIGHT ADJUSTMENT

If the needle scrapes across the surface of the last record at the completion of the playing of that record, the pickup height requires adjustment. Loosen the set-screw in the collar at the bottom of the pickup arm, lift the spindle and turn the collar while holding the spindle. A few turns in a counterclockwise direction should be sufficient. Tighten the collar set-screw, completing the adjustment.

If the tone arm fails to leave the rest after the lever has been set to the START position, the tone arm height probably requires adjustment and is accomplished in the manner described in the foregoing paragraph.

AUTOMATIC STOP

The record changer automatically stops after the last record has been played due to the fact that the overarm has depressed the pin controlling the automatic stop lever, completely on the record stack so that the automatic stop may function.

If the automatic stop does not function after the last record has been played and the overarm is lowered in the normal position, check to see that spring "M" Fig. 2 is in position and it may be necessary to bend the arm of the lever controlled by this spring, toward the motorboard.

FOR OTHER DATA SEE GARRARD

sprung to the right, preventing the pushing pawl "P" Fig. 1, from pushing the records from the platform. To correct this condition, spring the forced arm to the left a slight degree and check to make certain that the bottom record contacts the smooth surface of the record platform. The vertical motion of the record platform may be controlled by loosening screws "L" Fig. 2, and slipping them in the same holes to increase the length of the arm. Tighten the screws and check the adjustment.

It is also possible that the horizontal motion of the record platform is not sufficient to allow the records to feed from the spindle properly. To increase the distance of motion, the screws "R" Fig. 2 should be loosened and slipped in the same holes to increase the length of this arm. Tighten the screws and check the adjustment.

Occasionally a record may stick to the spindle and not drop to the turntable as it should. The record may be excessively thick and must be removed from the stack. The reason for the "thick" record sticking is that the slot at the angle in the spindle is not sufficiently wide to let the record slide in to place. Never attempt to file this groove as it will then be possible for two "thin" records to drop to the turntable at one time.

If the spindle should be bent, it will either cause records to stick or more than one record to feed to the turntable at one time, depending on the direction of the bend. Extreme care should be used in bending the spindle back into position, should this become necessary, as it may be broken very easily.

STRIKER ADJUSTMENT

The correct functioning of the trip mechanism depends on the rubber bushing "H" Fig. 1, on the trip lever arm "G". When the bushing becomes badly worn, a tapping sound will become apparent, and the trip lever may operate before the end of the record. This condition may be corrected by turning the rubber bushing on the spindle in order to present a new surface to the striker arm "B".

PICKUP

If the quality of reproduction is distorted, or if the volume of the signal is unusually low, it may be due to a defective crystal pickup. If no signal is heard when the pickup is used and the radio is operating properly, it is probable that the pickup lead is broken or shorted on the pickup arm.

To remove the pickup cartridge assembly, remove the four screws securing the cartridge retainer plates and pull the cartridge from the arm, examining the connections to the bakelite terminal block. Pull the plugs from the bakelite block to free the cartridge from the arm.

TO REMOVE THE CHANGER FROM THE CABINET

When removing the record changer unit from the cabinet, first remove the two connecting cords from the radio chassis by withdrawing their plugs from the sockets.

The metal motorboard of the changer has been "floated" in the cabinet and it is necessary to remove the nuts and springs from the mounting screws and lift the changer from the cabinet.

When replacing the mechanism, be sure that the springs are replaced in EXACTLY the same way that they were removed as the springs are intermixed -- some of the heavier springs are used above the mounting cleats and some below. The

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MODELS RC-30, RC-31,
MODELS RC-40, RC-41FOR ADDITIONAL PARTS
SEE GARRARD

PARTS PRICE LIST

Illus. No.	Part No.	Description	Price
1.	560022	Crystal cartridge	\$ 3.90
2.	630409	Cartridge retainer plate	.05
3.	101527	Screw for cartridge retainer plate	.01
4.	101687	Composition spacer	.05
5.	630398	Cartridge retainer bracket	.10
6.	520029	Cartridge housing with plates	2.65
7.	520163	Tone arm only - less cartridge housing & base	2.30
8.	520052	Bakelite pickup receptacle	.10
9.	101571	Pickup receptacle screw	.05
10.	520157	Pivot bearing screw	.10
11.	520158	Set screw for 520157 screw	.05
12.	520166	Tone arm bracket and spindle	1.00
13.	660007	Tone arm counterbalance	.35
14.	100654	Screw for counterbalance	.05
15.	520161	lifting tube spring	.25
	520165	Ball bearing for tone arm pivot	
16.	520030	Lifting tube	.50
17.	101639	Phillips-head needle screw	.05
	101648	Knurled-head needle screw	.10
18.	520167	Lifting tube weight	.50

MISCELLANOUS PARTS

520155	Record spindle	1.75
620202	Turntable	3.00
101192	Needle cup	.20
630014	Striker assembly	.65
460051	Shielded pickup cable	per ft. .05
500048	Field coils for AC changer	per pr. 3.00
500049	Field coils for AC-DC changer	" " 5.25
101511	Cotter pin terminals	" " .05
520168	Overarm assembly	1.75
520036	Rubber bumper for overarm	.02
520016	Tone arm rest	.50
520037	Rubber bumper for tone arm rest	.02
520023	Rubber bumper for trip lever	.05
520033	Turntable shaft and gear	2.00
500108	A.C. motor only	28.50
103731	#10-32 x 3-inch motorboard mounting screws	.05
109134	Light mounting springs	.05
109135	Heavy mounting springs	.05
520051	Screw for pushing pawl angle bracket	.05
520027	Pushing pawl	.25
520028	Screw for pushing pawl	.05

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODELS RC-30, RC-31
 MODELS RC-40, RC-41

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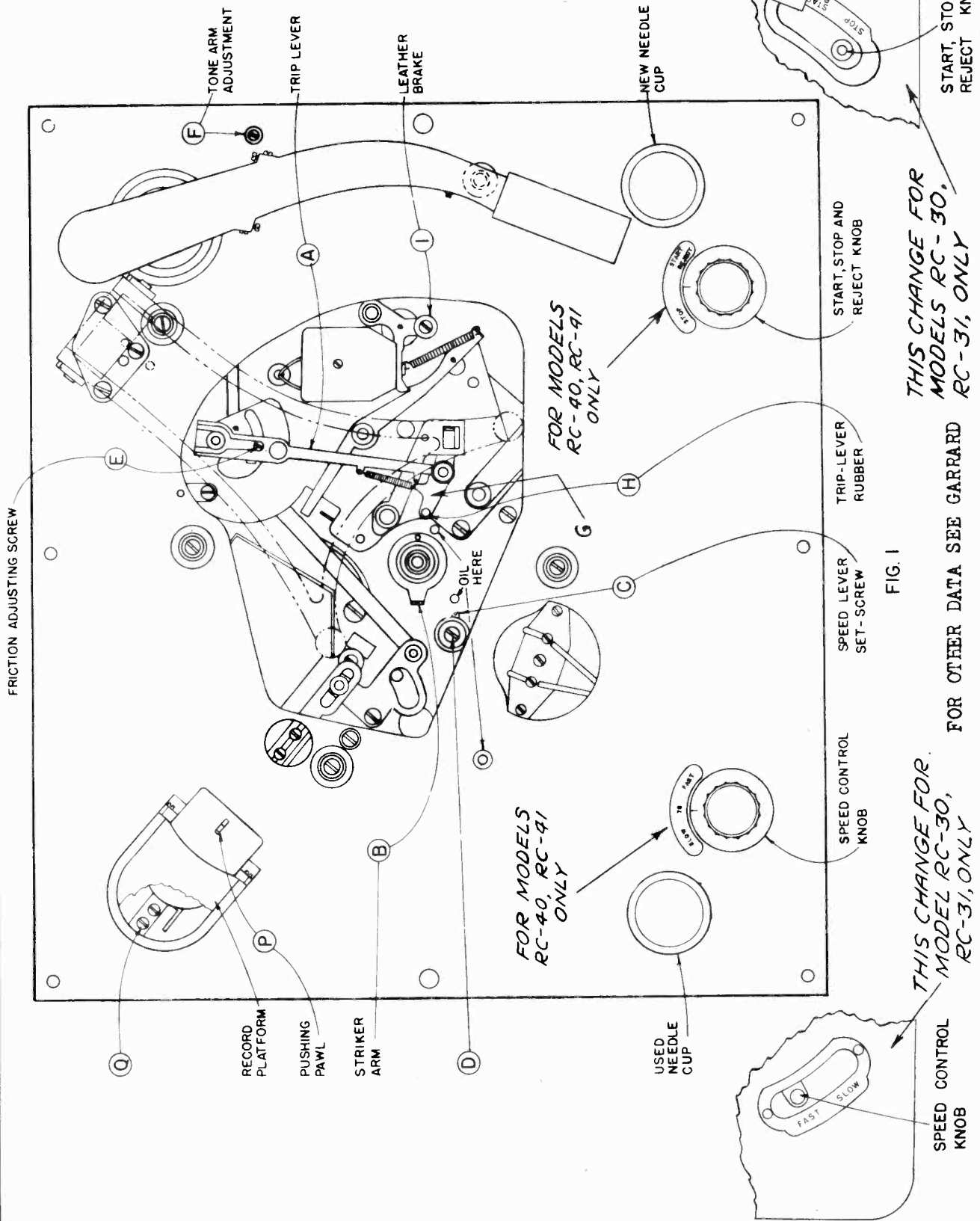
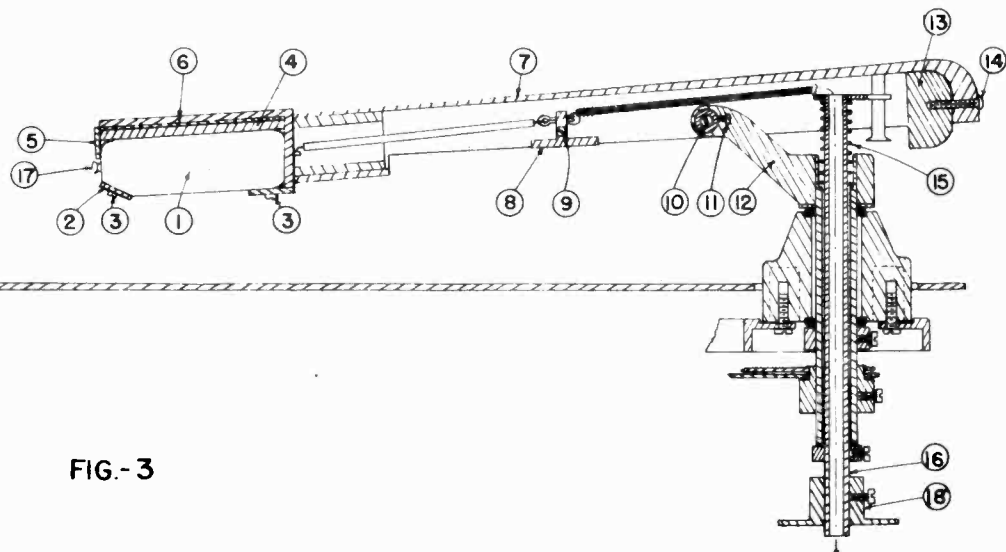
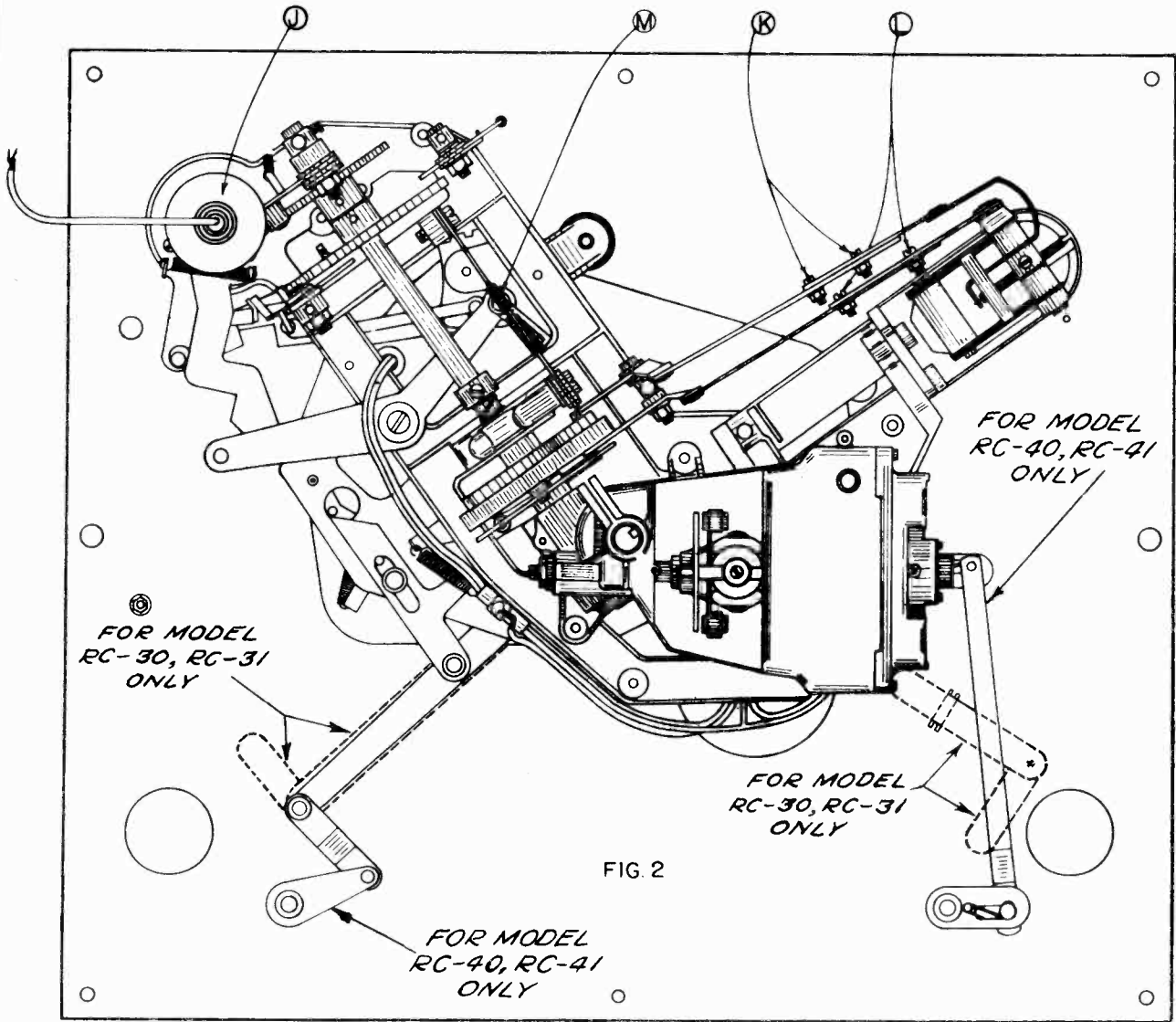


FIG. 1

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MODELS RC-30, RC-31
MODELS RC-40, RC-41



MODELS M-40, M-60, M-70

PARTS LIST

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MAGNAVOX MODEL M-40

FOR OTHER DATA SEE GENERAL INDUSTRIES MODEL C-120

PARTS LIST

520127	Spring	Pressure spring holding trip rod against ratchet
520128	Gear	Fibre gear only as used in motor
520129	Spindle	Record spindle complete with fibre gear
500099	Motor	Motor for M-25 record changer
560022	Cartridge	Crystal cartridge only
520130	Pulley	Rubber idler pulley
520131	Rod	Tone arm lifting rod
520132	Washers	Spring clip washers used in mechanism
520133	Spring	Small spring used above motorboard
520134	Spring	Medium spring used above motorboard
520135	Spring	Large spring used above motorboard
520136	Finger	Trip finger for trip rod
520137	Turntable	Turntable for M-25 changer

MAGNAVOX MODEL M-60, M-70

PARTS PRICE LIST

FOR OTHER DATA SEE WEBSTER-MODEL 40

<u>Part No.</u>	<u>Description</u>	<u>Price</u>
500096	Motor, 117 Volt, 60 cycle	\$11.75
500097	Motor, 117 Volt, 50 cycle	13.00
520101	Rubber motor coupling	.75
520102	Tone arm lift pin	.15
520103	Complete clutch assembly	2.15
520104	Top cork for clutch	.05
520105	Middle cork for clutch	.05
520106	Bottom cork for clutch	.05
520107	Turntable only	3.25
520108	"C" washers for mechanism	.01
520109	Record separator knife	.60
101639	Phillips-head needle screw	.05
101648	Standard needle screw	.05
800013	Wrench for Phillips-head needle screw	.15
800017	Allen wrench 3/32" for mechanism	no charge
800016	Allen wrench 5/64" for mechanism	no charge
560023	Crystal cartridge only	3.50
520111	Return lever and bracket assembly	.45
520112	Recording head tension spring	.15
520113	Recorder arm for Model M-70	1.70
520117	Push button "START-REJECT" knob	.10
520118	"MANUAL-AUTOMATIC" pointer knob	.40
520119	Record spindle and gear assembly	4.00
520120	Complete switch assembly	2.60
520121	Tone arm "pull-in" spring	.05

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THE MAGNAVOX CO. INC.

MODELS RC-50, 50C, 50X,
RC-51, 51C, 51X**OPERATING INSTRUCTIONS**

This record changer plays eight 10 and 12-inch records, intermixed in any order automatically, and the changer stops operating after the playing of the last record. A record may be rejected before playing the entire selection by turning the motorboard knob to the REJECT position.

To operate the changer, raise the forked arm and place any number of records -- not exceeding eight -- on the record spindle and lower the forked arm until it rests on the top record. A permanent-point jeweled needle is installed in the pickup of the RC-50X and RC-50C changers (1 1/4 oz. type pickup) at the factory and may be used for playing several thousand records before replacement is required. UNDER NO CIRCUMSTANCES SHOULD THE NEEDLE BE REMOVED AFTER USE AND TURNED IN THE PICKUP AS THIS WILL RESULT IN SERIOUS DAMAGE TO THE RECORDS. In order that the needle may not be loosened or removed by anyone not familiar with the instrument, a special set-screw is used which requires a tool for turning it.

When a chromium needle is used in the RC-50 changer (3 oz. type pickup), turn the pickup head one-half turn in a counter clockwise direction and insert the phonograph needle, returning the pickup to its normal position. The needle should be inserted only when the arm is located on the rest as movement of the arm when it is in any other position may affect the mechanism.

Turn the motorboard knob to the START position, setting the changer in operation. Be sure to hold the knob in this position until the motor has started and becomes engaged with the changer mechanism. Should the changer be stopped for any reason during the record changing, it may be necessary to give it help in restarting by turning the turntable by hand due to the excessive load imposed on the motor when it is stopped in such a position. If it is desired to stop the motor at any time, it may be done by rotating the motorboard knob to the STOP position.

OVERSIZE RECORDS

The record platform, opposite the pickup arm on the motorboard is normally adjusted to the correct position for all average records, however if a very large or small record is encountered, it may be necessary to make a slight adjustment to the platform position to accommodate these records. This is accomplished by removing the nut, washer and screw "q" Fig. 2, and turning bushing "m" clockwise to accommodate larger records and counter clockwise for smaller records. Replace the screw, washer and nut, and check platform position by placing a record just clear of the pushing pawl "12" Fig. 4, when the changer is in the playing position.

PICKUP ARM SETDOWN ADJUSTMENT

On some records, the playing groove may start farther from the center than on standard records, and in these exceptional instances, the needle would contact the record a few grooves in, and not on the smooth surface. If the pickup arm was set for these exceptional records, the pickup would not be lowered on the edge of normal-sized records.

Should the lowering position of the needle require adjustment, the turntable should first be turned by hand to bring the pickup from the loading position to the point where the needle has descended to within 1/16" of the record. (To facilitate the turning of the turntable by hand, set the power switch on the radio panel to the OFF position and rotate the motorboard control knob to the START setting). The screw "r" Fig. 3, which is accessible through a hole

in the motorboard, should be turned either to the right or to the left, according to the requirements -- a quarter turn in either direction will give the maximum adjustment obtainable. The adjustment should then be checked by operating the changer and noting the lowering position of the pickup.

When making adjustments to the pickup arm, it should never be forced into position and when the turntable is turned by hand, it should never be turned other than in a clockwise direction. If the pickup is lowered so that the needle contacts the smooth surface of the record and does not run into the playing grooves, check to make certain that the motorboard is not tilted to the right -- if so, it should be leveled by adjustment of the tension on the mounting springs. Then check the lead to the pickup, making certain that it is not twisted in any way to prevent free movement of the tone arm. Also check lever: "S" and "T" Fig. 3, to see that they are free and that the pin at the end of lever "T" is not rubbing on the bottom of the cam grooves.

**PICKUP ARM HEIGHT ADJUSTMENT
RC-50 3 OZ. PICKUP**

If, after the playing of the last record (when eight are played), the needle scrapes across the surface on the top record as the tone arm moves to its rest position, the pickup height must be adjusted, and in the following manner. Loosen screw "8", shown in Figure 4 and rotate the counter-balance "7" a few turns in a clockwise direction. The adjustment should be such that at the completion of the last record, the pickup will move across the top record with the needle at least 1/2 inch above the surface of the top record. Tighten set-screw "8" completing the adjustment.

RC-50C, 50X 1 1/4 OZ. PICKUP

To adjust the height of the tone arm on the RC-50C changer in the event that the needle scrapes across the top record when eight records are on the turntable, the adjustment is made as follows:

Refer to Figure 6. Loosen the set screw in the bushing "22" and rotate it in a clockwise direction for one or two turns. Tighten the set screw and check the adjustment.

If the tone arm fails to lower sufficiently to properly "ride" the grooves of the first record on the turntable, the set screw in the collar bushing "13" should be loosened and the bushing rotated several turns in a counter clockwise direction. Tighten the set screw and check the adjustment. Where the tone arm drop adjustment is correct, the needle will just contact the surface of the turntable without a record.

AUTOMATIC STOP

The record changer automatically stops after the last record has been played, due to the fact that there is no longer any weight on the turntable spindle. The weight of a record on this spindle moves lever "o" Fig. 2, which interrupts the movement of the lever "p" Fig. 2, from the cam so preventing the switch from operating. When the record is removed from the center spindle, the spindle raises and allows lever "o" to move so that it does not interrupt the switch lever "p", thereby allowing the switch to operate.

Should the mechanism fail to stop at the completion of the last record, the lever arm at the bottom of the motor casting, is probably sprung to one side, preventing it from engaging the lever controlling the power switch. When the weight on the spindle has been removed, caused by the dropping of the last record to the turntable, the spindle should raise allowing the lever arm to engage the lever controlling the power switch.

MODELS RC-50, 50C, 50X,
RC-51, 51C, 51X

THE MAGNAVOX CO.

LUBRICATION A.C. MOTOR

The motor should always be well lubricated, as noise will develop if the bearings are allowed to run dry. All bearings are of the oil-retaining type, and with average use, will require lubrication about once every three months. All oiling holes are accessible when the turntable is lifted from the motor spindle and are indicated on Fig. 1.

The tone arm pivot is fitted with ball bearings and should be oiled only if it shows signs of sluggishness in moving into the playing grooves after it has lowered onto the record. A few drops of very thin oil will be sufficient. A few drops on the hinge pin and the tension spring of the forked arm will be helpful but should be necessary not oftener than once a year.

A.C.-D.C. MOTOR

The lubrication and speed adjustment is the same for the universal motor as for the AC motor. If the brushes are allowed to become dirty and worn, brush noise will develop. The brushes may be removed by unscrewing the bakelite caps on the motor body and pulling out the brushes by means of the springs. The brushes can be cleaned by sanding them with a fine grade of sandpaper or crocus cloth and cleaning the dust from the surface before replacing them. It is important that the brushes be replaced in the same way in which they were originally installed. The brushes when new, are 9/16-inch long under the springs -- when they have worn down to 3/32-inch, they should be replaced.

RECORD DROPPING AND SELECTING

If the first record does not drop when the changer is switched ON, this is due to the leather brake pad becoming worn and not breaking the turntable sufficiently when the previous record was completed. To adjust this pad, loosen the two screws "P" Fig. 1, and turn the brake lever slightly to bring the leather pad nearer to the turntable rim. Tighten the screws and check to see that the switch breaks contact before the leather brake pad touches the turntable rim.

If the records do not drop properly, it is possible that the forked arm is sprung to the right, preventing the pushing pawl "12" Fig. 4 from pushing the records from the platform. To correct this condition, spring the forked arm to the left a slight degree and check to make certain that the bottom record contacts the smooth surface of the record platform. The vertical motion of the record platform may be controlled by adjusting the bushing "L" Fig. 2, after the nut, screw and washer at "K" have been removed.

If the records do not feed properly from the spindle, it is possible that the horizontal motion of the record platform is not sufficient to push the lower record from the stack on the spindle, to the turntable. To increase the distance of motion, the lever arm with bushing "N" must be lengthened by removing the nut and screw "C", sliding the bushing "N" from the lever and rotating the bushing a few turns in a counter clockwise direction. Slide the bushing back to the lever and install the nut and screw "C" in place. Now, check the adjustment by operating the mechanism. If the motion of the platform is still not sufficient to push the records to the turntable, the bushing should be turned a few revolutions to further lengthen the lever arm, however, it is not probable that a second adjustment will be required.

Occasionally a record may stick to the spindle and not drop to the turntable as it should. The record may be excessively thick and must be removed from the stack. The reason for the "thick" record sticking, is that the slot at the angle in the spindle is not sufficiently wide to let the record slide in to place. Never attempt to file this groove as it will then be possible for two "thin" records to drop to the turntable at one time.

If the spindle should be bent, it will either cause records to stick, or more than one record to feed to the turntable at one time, depending on the direction of the bend. Extreme care should be used in bending the spindle back into position, should this become necessary, as it may be broken very easily.

BINDING

If the mechanism should bind during operation, it may be possible to free it by depressing the pushing pawl "12" Figure 4, and allowing the pickup to come to the rest position. Turn off the motor, slide the nameplate that covers the mechanism in the record platform, from its holder, exposing a small set-screw in a stop lever. Loosen the set-screw and move the stop forward a slight amount. Tighten the set-screw and check the adjustment. If the mechanism still binds, the stop lever should be advanced a little more. This position is quite critical and lever should not be moved more than 1/32-inch during each adjustment.

If the mechanism should bind as a result of the turntable being rotated manually, it is probably caused by the fact that the motor end-bearing has been forced from its correct position in the end of the motor frame, allowing the motor governor set-screws to strike the main gear of the motor.

To correct this condition, loosen the small set-screw that holds the motor end-bearing in place -- located adjacent to the name-plate on the motor frame -- press the bearing in as far as it will go, and tighten the set-screw. This adjustment should permit the motor to operate properly, however if it still binds, it may be necessary to loosen this set-screw again, rotate the end-bearing a fraction of a turn and tighten the set screw. This adjustment may be necessary to keep the spacing around the armature equal at all points.

PICKUP

If the quality of reproduction is distorted, or if the volume of the signal is unusually low, it may be due to a defective crystal pickup. If no signal is heard when the pickup is used and the radio is operating properly, it is probable that the pickup lead is broken or shorted in the pickup arm.

To remove the pickup cartridge assembly, remove screw "1" Fig. 4, and pull the cartridge from the arm, examining the connections to the bakelite terminal block. To remove the cartridge from the assembly, remove the two retainer plates "2" and "3" Fig. 4, and slide the cartridge from the housing.

TO REMOVE THE CHANGER FROM CABINET

When removing the record changer unit from the cabinet, first remove the two connecting cords from the radio chassis by withdrawing their plugs from the sockets. Remove the nuts and springs from the four mounting screws and lift the unit from the cabinet. When replacing the mechanism, be sure that the heavier springs are used on the top of the mounting cleats and the lighter springs on the bottom, being careful to mount the unit so that the motorboard is tilted, very slightly to the left.

THE MAGNAVOX CO. INC.

MODELS RC-50, 50C, 50X,
RC-51, 51C, 51X

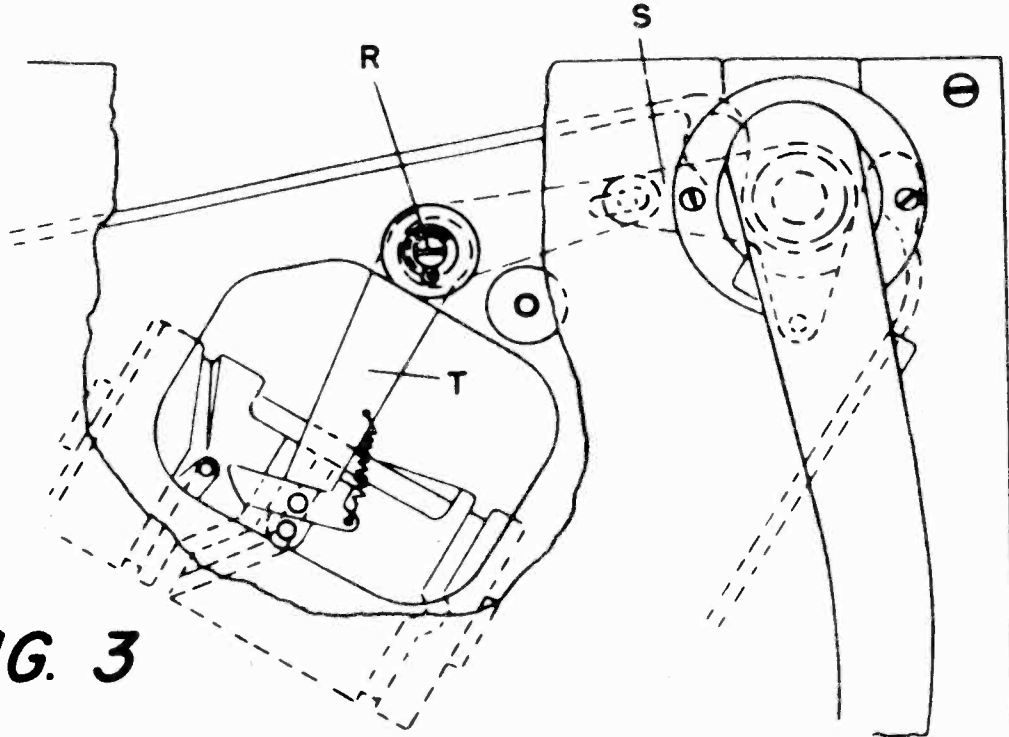


FIG. 3

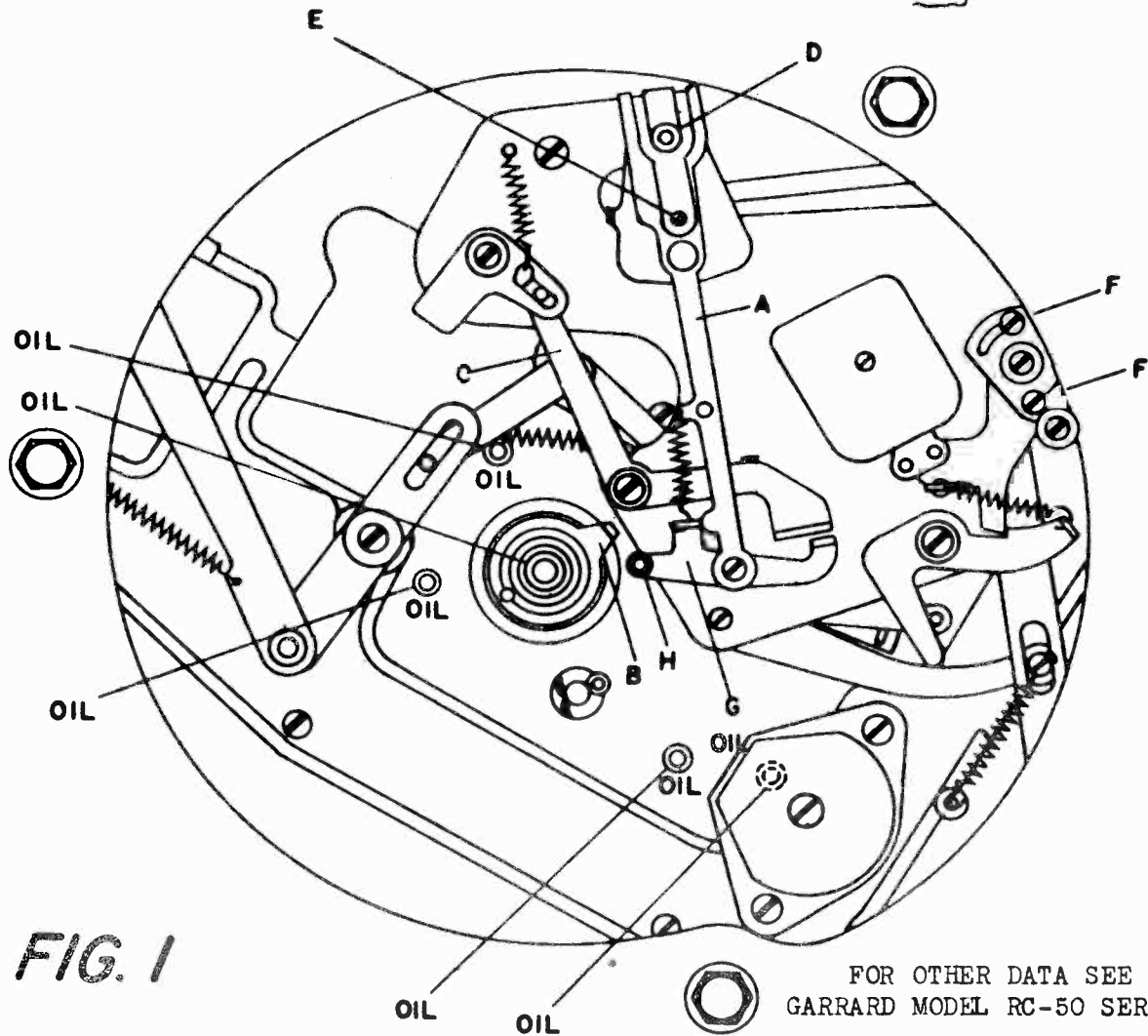


FIG. 1

FOR OTHER DATA SEE
GARRARD MODEL RC-50 SERIES

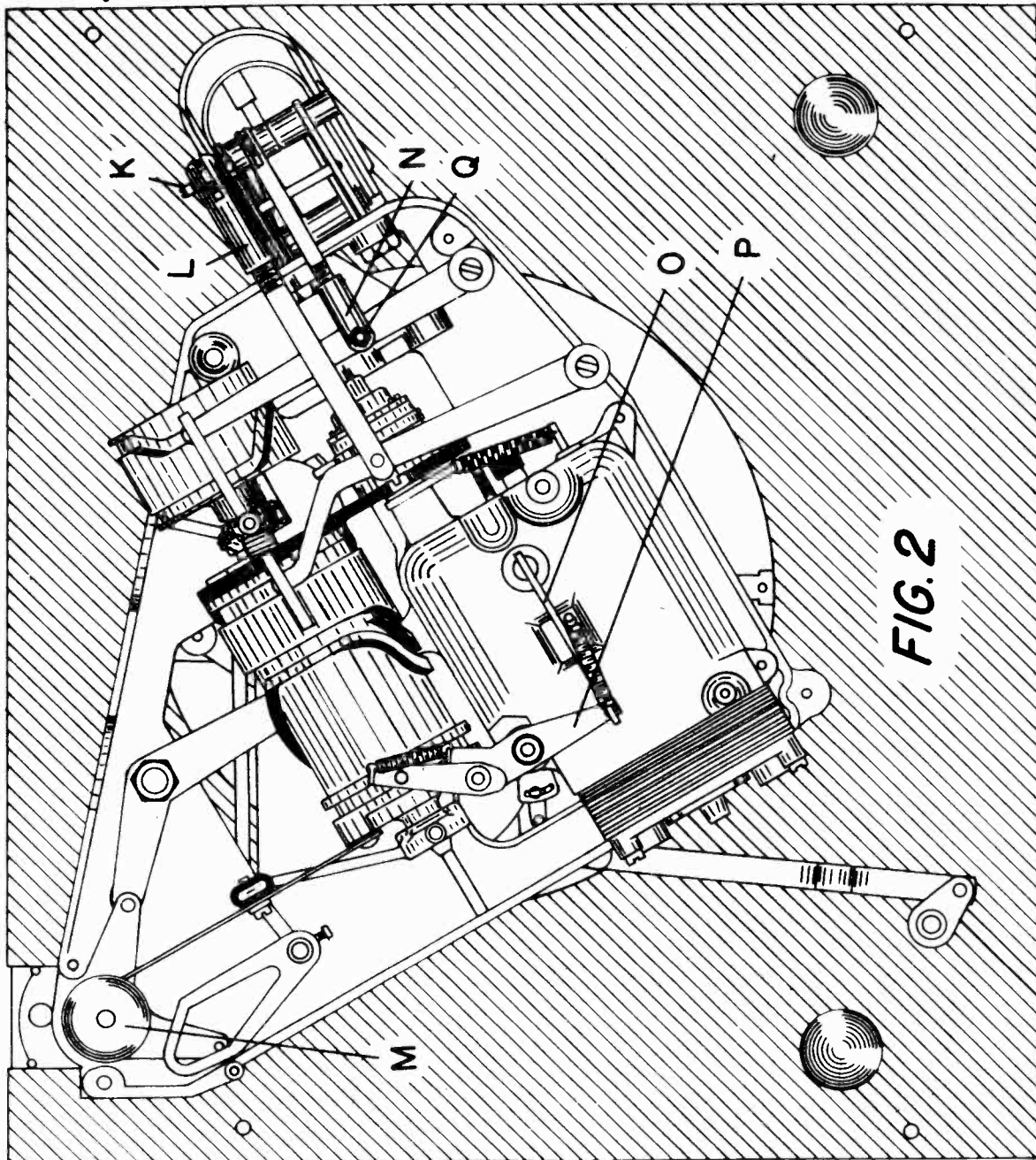
MODELS RC-50, 50C, 50X,
RC-51, 51C, 51X

THE MAGNAVOX CO. INC.

SPEED ADJUSTMENT

Due to the differences of line voltages in various localities, a slight adjustment of the speed indicator lever (that projects from the edge of the turntable) may be necessary. To make this adjustment, first set the motor speed to 78 r.p.m. using the stroboscope disc (on AC models) furnished with the unit, in making this adjustment. To set the speed on the AC-DC unit, operating on direct current, place a piece of paper under a record on the turntable and count the revolutions in a period of 30 seconds. If there are more or less than 39 revolutions, the speed adjustment lever should be moved a slight amount in the required direction, and the process repeated.

After the motor has been set at 78 r.p.m., the turntable should be removed and the quadrant screw (under the spindle on the speed-control lever) should be loosened very carefully and the lever moved until the pointer is in position on "78" on the indicator plate, holding the quadrant stationary while making this adjustment. Now tighten the quadrant screw and replace the turntable.



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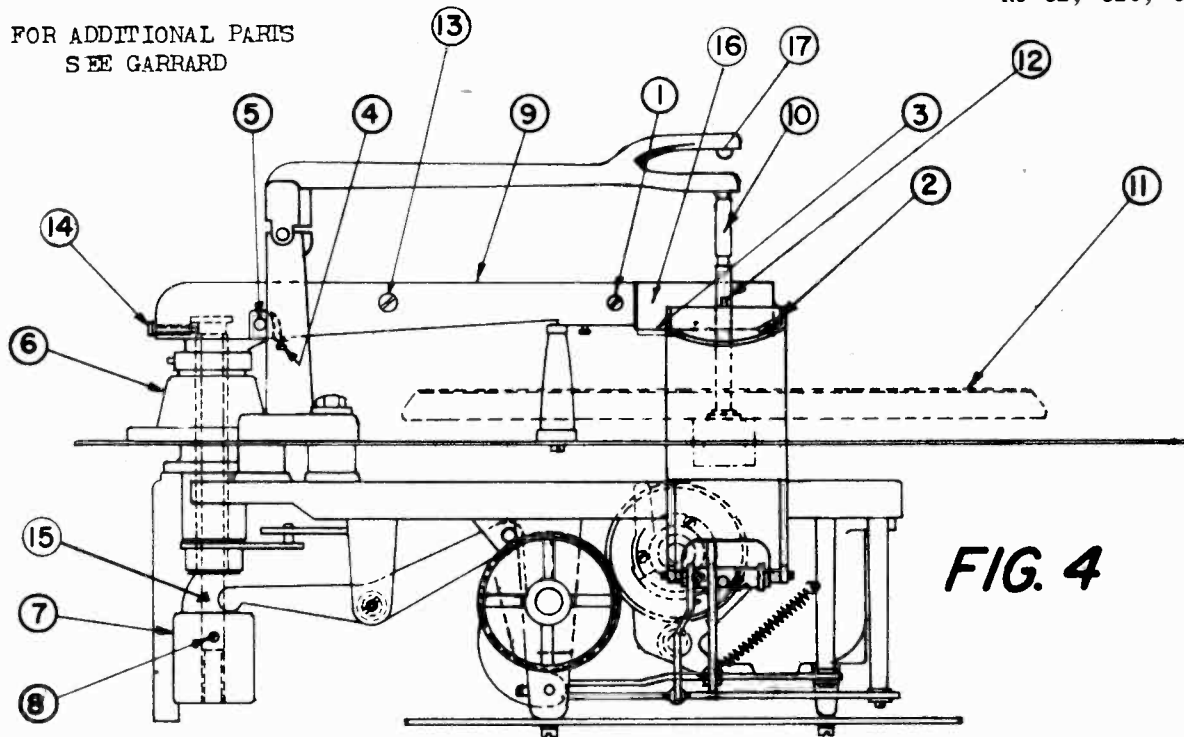
MODELS RC-50, 50C, 50X,
RC-51, 51C, 51XFOR ADDITIONAL PARTS
SEE GARRARD

FIG. 4

RC-50, 50C, 50X PARTS LIST

Illus. No.	Part No.	Description	Price
1.	101526	Tone arm screw	.05
10.	520008	Record spindle	1.75
11.	630202	Turntable	2.25
12.	140002	Bakelite control knob	.25
13.	101571	Screw for bakelite receptacle	.01
17.	520036	Rubber bumper for overarm	.02
	101192	Needle cup	.20
B*	630014	Striker assembly	.65
	460051	Shielded pickup cable	per ft. .05
	500048	Field coils for AC changer	per pr. 1.50
	500041	Field coils for AC/DC changer	per pr. 2.85
	520016	Tone arm rest	.25
	101511	Cotterp in terminals	.01
	460032	Braided shielding	per ft. .05
	520010	Overarm assembly	2.00
	101527	Screw for cartridge retainer plate	.01
H*	520023	Rubber bushing for trip arm	.05
	520037	Rubber bumper for tone arm rest	.01
	520031	Turntable shaft and gear	1.90
	500063	Replacement AC motor	28.95
	103731	Fancy-head mounting bolts	.05
	109134	Light mounting springs	.01
	109135	Heavy mounting springs	.01

RC-50 PARTS LIST

2.	630017	Cartridge retainer plate	.40
9.	630099	Tone arm only	2.70
14.	101570	Tone arm screw	.01
15.	520030	Lifting tube	.75
16.	520029	Cartridge housing with plates	2.65
	560008	Crystal cartridge	5.00
	102644	Needle screw	.05

*See Fig. 1

MODEL M-4
 MODELS RC-50X, RC-51X

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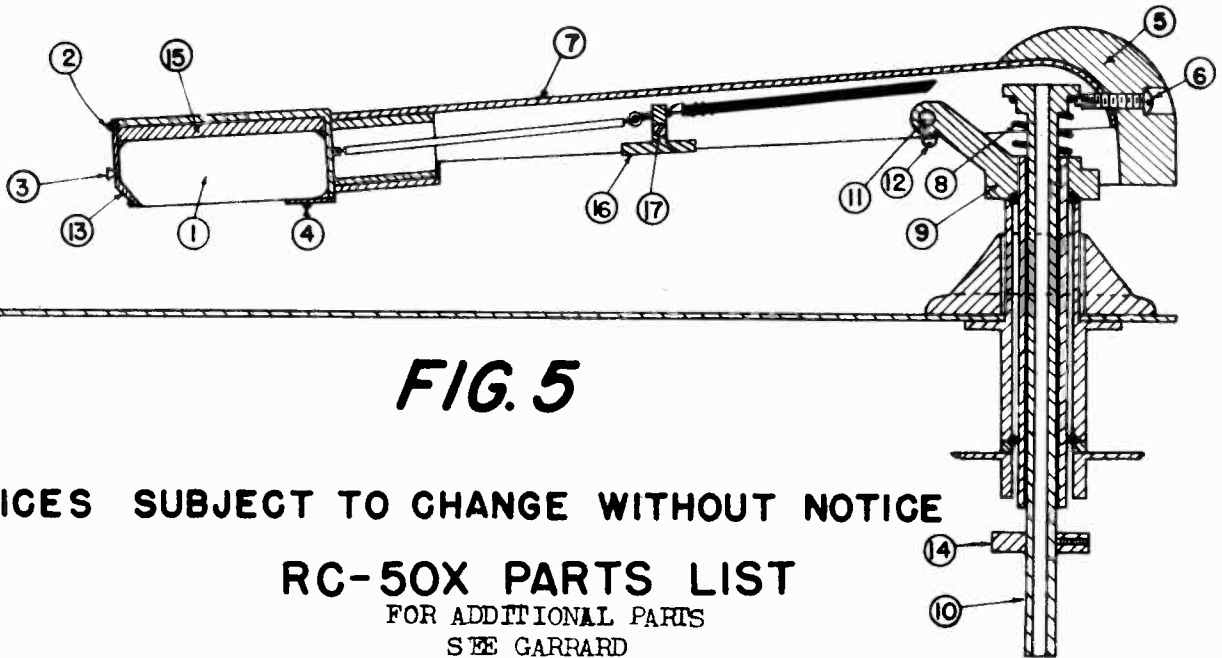


FIG. 5

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

RC-50X PARTS LIST

FOR ADDITIONAL PARTS
 SEE GARRARD

Illus. No.	Part No.	Description	Price
1.	560022	Crystal cartridge	3.90
2.	101651	Retainer plate screw	.01
3.	101639	Phillips needle screw	.05
4.	101527	Retainer plate screw	.01
5.	660006	Tone arm weight	.40
6.	101659	Tone arm weight screw	.05
7.	630099	Tone arm only	2.70
8.	101660	Lifting tube spring	.05
9.	520047	Tone arm bracket and spindle	.70
10.	520030	Lifting tube	.75
11.	101468	Tone arm pivot pin	.05
12.	520053	Screw for pivot pin	.02
13.	630331	Retainer plate	.10
14.	630339	Lifting tube weight	.20
15.	101652	Composition spacer	.02
16.	520052	Pickup receptacle	.15
17.	101571	Pickup receptacle screw	.01

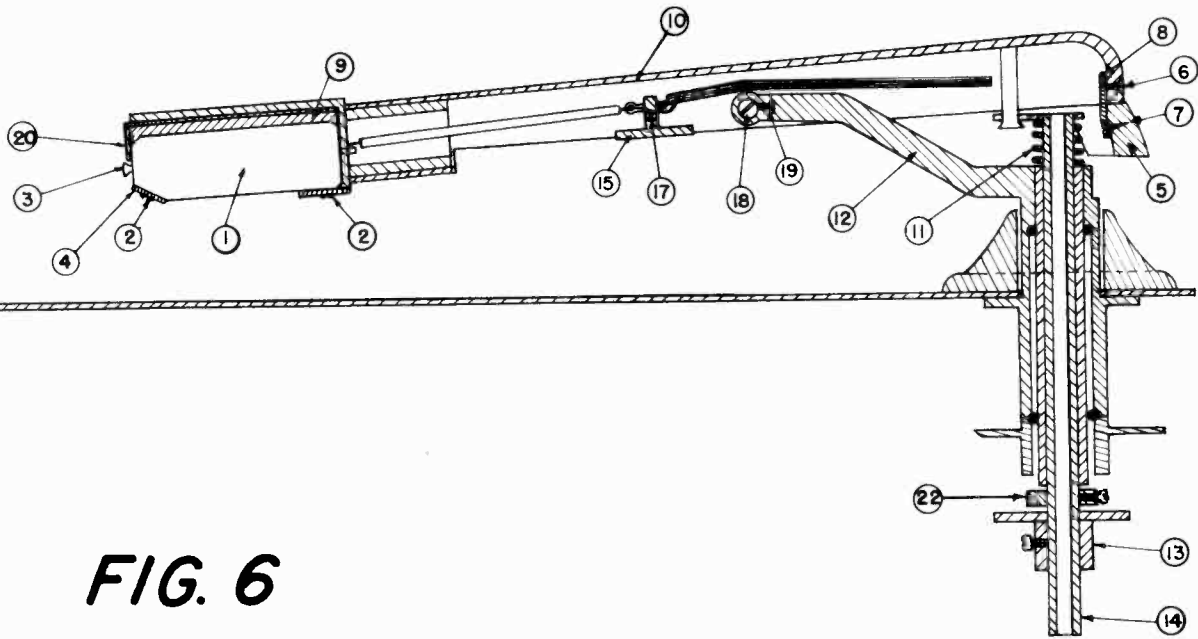
MODEL M-4, FOR OTHER DATA SEE RCA RP-139A

PART PRICE LIST

MODEL M-4

560012	Crystal cartridge only	5.95
101539	Needle screw only	.15
520011	Motor switch	.40
630217	Turntable only	2.80
520012	Springs, complete set for mechanism	.60
500047	Motor and spindle, 110V. 78 r.p.m. 60 cycle	18.50
467690	Shielded pickup cable	per ft. .05
520013	Large "C" washer for mechanism	
520019	Small "C" washer for mechanism	

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MODELS RC-50C,
RC-51C**FIG. 6****RC-50C PARTS LIST**

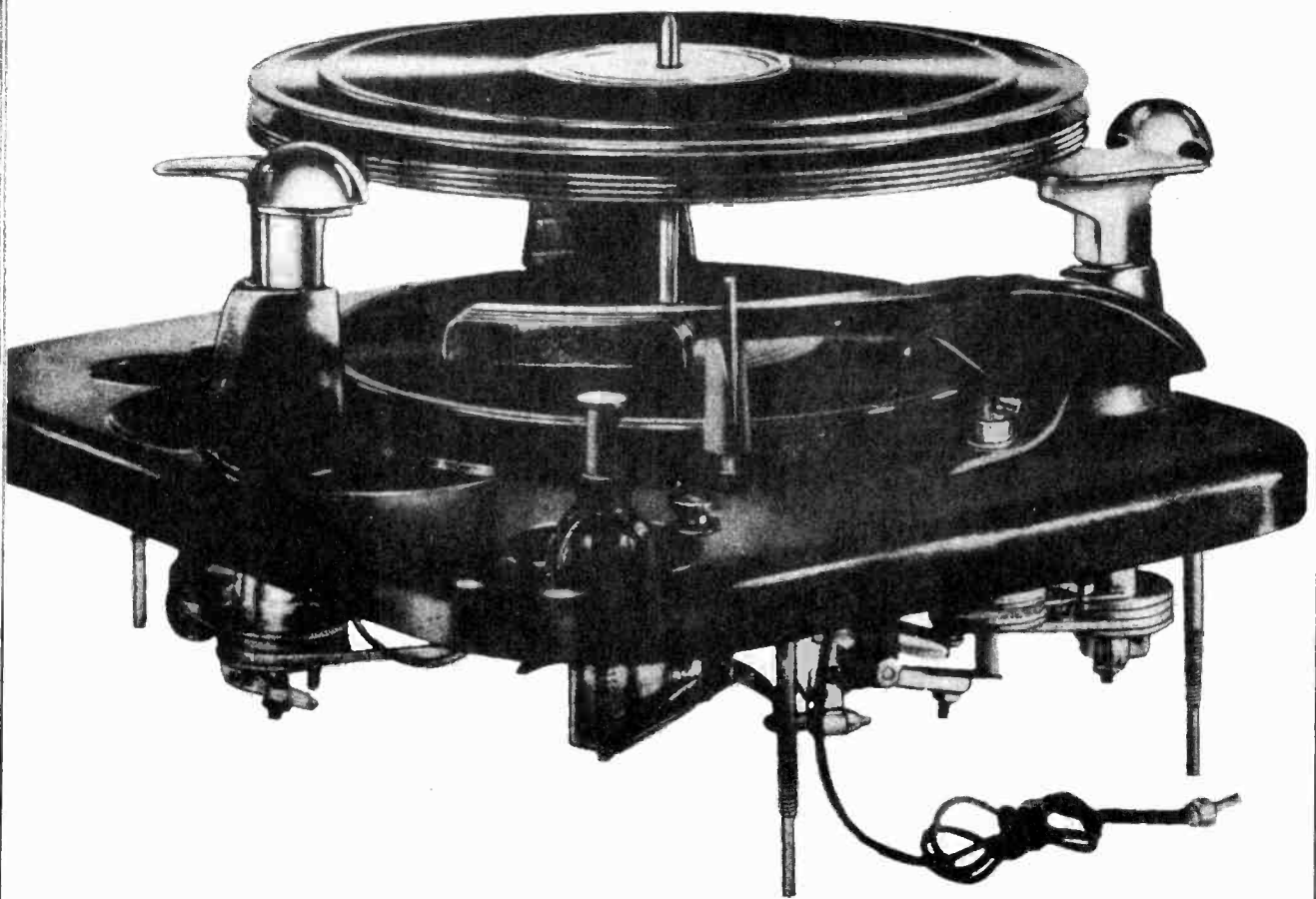
1.	560022	Crystal cartridge	3.90
2.	101527	Retainer plate screws	.01
3.	101639	Phillips needle screw	.05
	101648	Knurled needle screw	.05
4.	630409	Cartridge retainer plate	.20
5.	660010	Tone arm weight	.30
6.	101254	Tone arm weight screw	.05
7.	100991	Tone arm weight screw	.05
8.	630390	Mounting bracket	.10
9.	101687	Composition spacer	.02
10.	520162	Tone arm only	2.75
11.	520161	Lifting tube spring	.05
12.	520160	Tone arm bracket and spindle	.75
13.	520159	Lifting tube weight	.20
14.	520030	Lifting tube	.75
15.	520052	Bakelite pickup receptacle	.15
17.	101571	Pickup receptacle screw	.01
18.	520157	Pivot bearing screw	.05
19.	520158	Set screw for pivot bearing screw	.05
20.	630398	Cartridge retainer bracket	.10
	520165	Ball bearing for tone arm pivot	per pr. 01

FOR ADDITIONAL PARTS
SEE GARRARD

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

MODELS M-61, M-71

THE MAGNAVOX CO.



OPERATING INSTRUCTIONS

This changer is equipped with a constant-speed self-starting motor. Under all normal conditions, it starts automatically and runs at correct speed.

Each changer is designed to operate only a specific voltage and frequency (cycles). Be sure to look at your serial plate -- at the rear of the cabinet -- to make certain that the instrument conforms to the power supply, before plugging in the supply cord.

This mechanism automatically plays up to sixteen ten-inch records or twelve twelve-inch records, or fourteen ten and twelve-inch records intermixed.

AUTOMATIC OPERATION

1. Place records on shelf plates which should be in a horizontal position.
2. Set pointer to A.
3. Push down red START-REJECT button.
4. To reject a record not desired, press the red START-REJECT button when the record starts to play.
5. The changer will stop automatically after the last record has been played.
6. DO NOT HANDLE THE TONE ARM.
7. The changer may be turned off at any time, by depressing the STOP button on the motorboard.

THE MAGNAVOX CO.

MODELS M-61, M-71

REMOVING PLAYED RECORDS

First see that the motor has been switched off. Then grasp the played records and lift them from the turntable. It is not necessary to raise the shelf plates before removing the records as the shelf plates will be tilted so that only the edge of the stack of records come in contact with a special runner on the bottom of each shelf. The changer may then be loaded with a new stack of records.

MANUAL OPERATION

1. Set pointer to M.
2. Raise the shelf plates to place record on turntable.
3. Press red START-REJECT button to start the motor.
4. Lower the tone arm to the first groove of the record.
5. When record is completed, place the tone arm on its rest and press STOP button to turn off the changer motor.

LUBRICATION

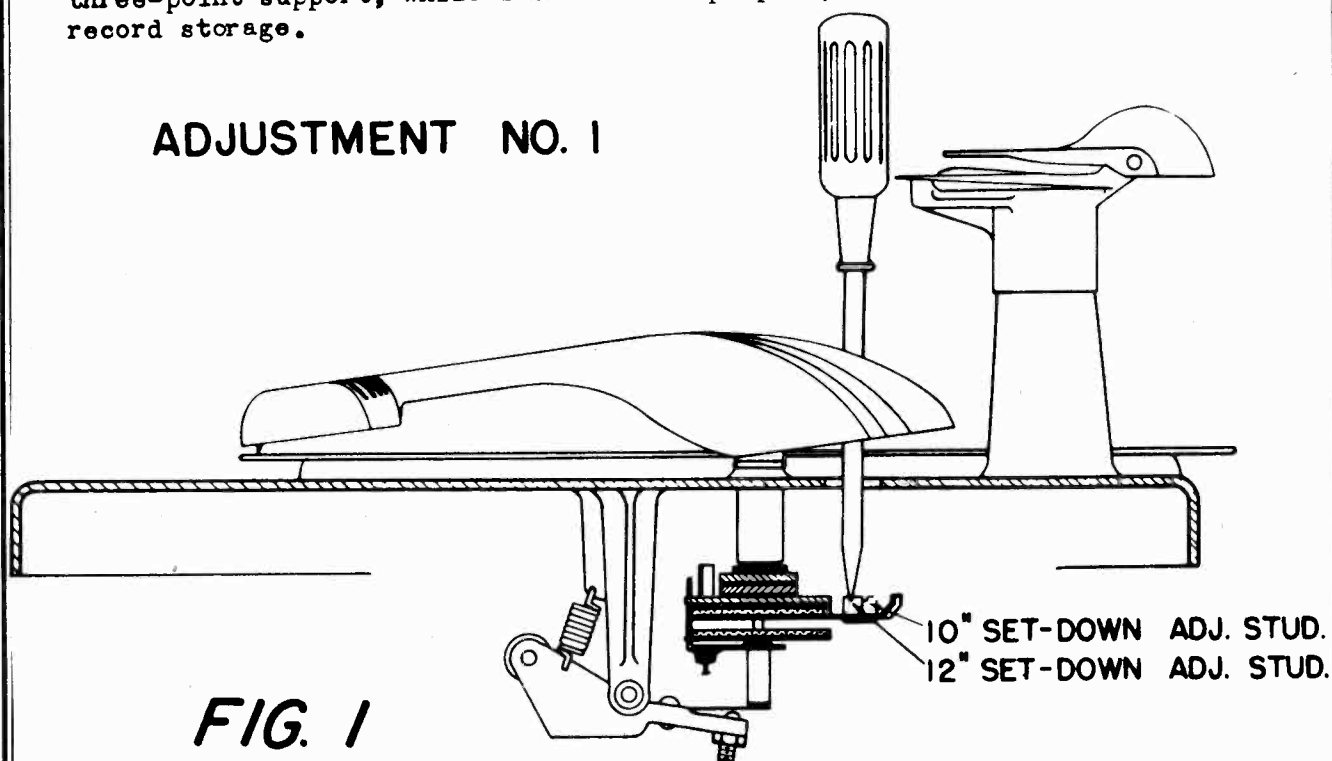
The changer should be lubricated once a year with a few drops of a good grade of light machine oil at each of the following points: Oil holes in motor gear housing, turntable spindle bearings, and all other bearing points.

Also apply a generous amount of lubricant to the idler gear at regular intervals. NEVER OIL THE CORKY FRICTION CLUTCH OR IDLER PULLEY WHEELS AT ANY TIME, AS IT WILL CAUSE SLIPPAGE.

CARE OF RECORDS

Records may safely be left stacked directly upon each other on the turntable, but should never be left resting on the shelf plates of the changer. This three-point support, while best for its purpose, is not at all suitable for record storage.

ADJUSTMENT NO. 1



MODELS M-61, M-71

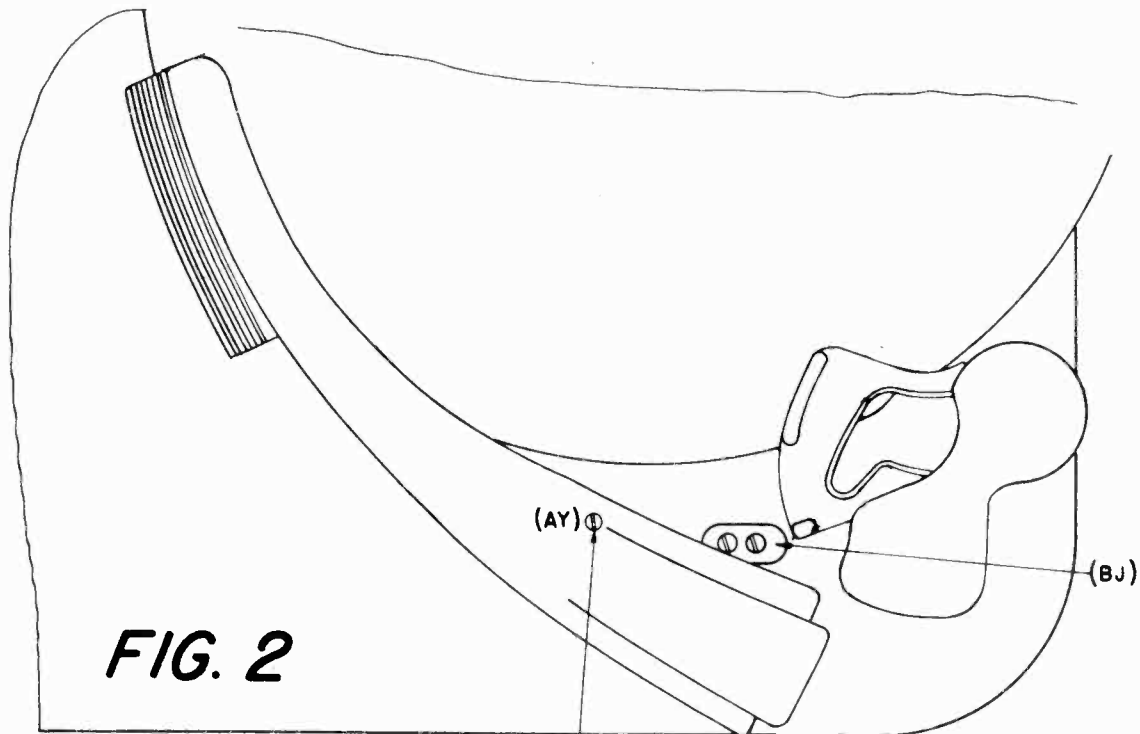
THE MAGNAVOX CO.

Adjustments Nos. 1, 2 and 3 can be made from above the motorboard and it is not necessary to remove the changer from the cabinet.

ADJUSTMENT NO. 1 -- ADJUSTING LANDING POSITION OF NEEDLE ON RECORD

The position at which the needle lowers to the record can be adjusted by inserting a screw driver through the hole (BJ) located just to the rear of the tone arm (shown in Figure 2). For adjusting the 10-inch set-down, insert the screw driver into the inside eccentric adjusting stud. For adjusting the 12-inch set-down, insert the screw driver into the outside slotted stud (see Figure 1). Turn very slightly clockwise or counterclockwise to move the needle landing in or out.

ADJUSTMENT NO. 2



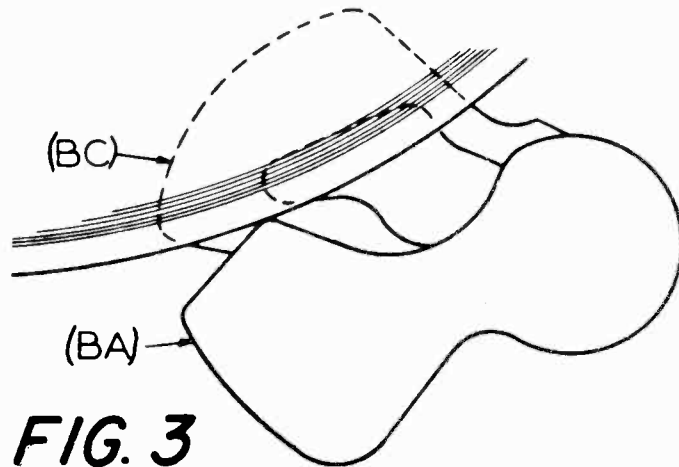
TONE ARM HEIGHT ADJ. STUD.

ADJUSTMENT NO. 2 -- TONE ARM HEIGHT ADJUSTMENT

To adjust the height of the tone arm, insert a screw driver into the stud (AY) on Figure 2. The stud should be turned in a clockwise direction to lower the arm and in a counterclockwise direction to raise it. The tone arm elevating pin presses against this adjusting stud which should be adjusted so that the distance between the point of the needle in the pickup and the turntable surface is $1 \frac{3}{8}$ to $1 \frac{1}{2}$ inches which is the equivalent of approximately sixteen ten-inch records.

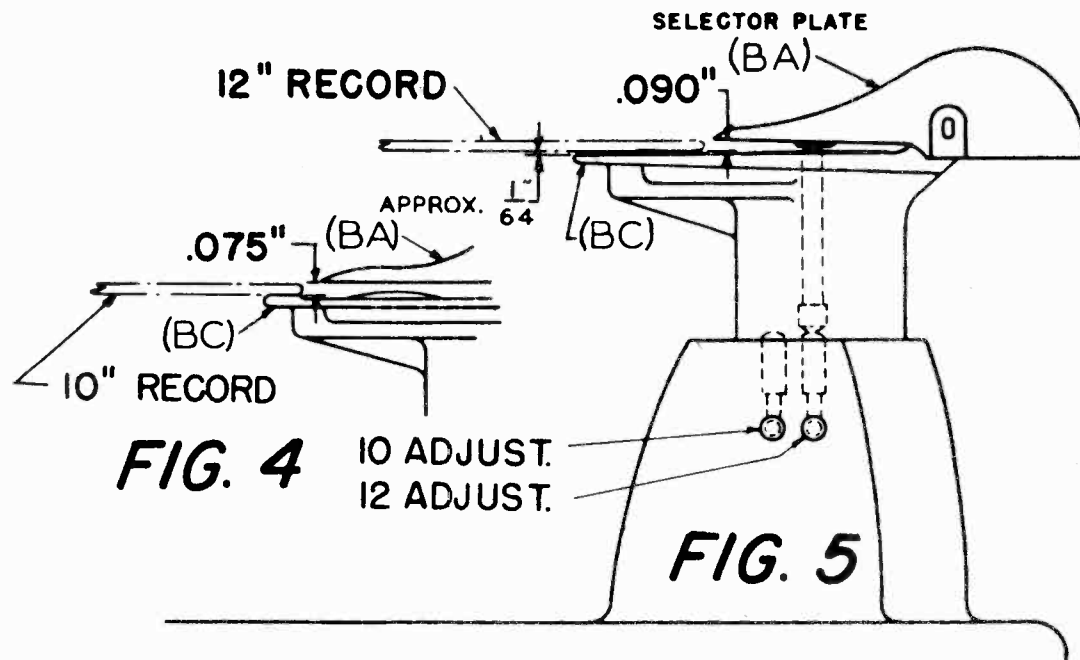
THE MAGNAVOX CO.

MODELS M-61, M-71



ADJUSTMENT NO. 3

FIG. 3



ADJUSTMENT NO. 3 -- ADJUSTMENT FOR CHANGER PLATES

To adjust the distance between the selector plate (BA) and the shelf plate (BC) for 10-inch records, first select a flat 10-inch record that is approximately .075" thick. Then position it on the changer and start a change cycle to revolve the changer plates. Stop the turntable by hand just as the selector plate (BA) is about to touch the record, and shut off the motor (see Figure 4). Then slowly revolve the turntable by hand, allowing the selector plates to contact the edge of the record so that it just slides over the record, touching the surface lightly. Check all three selector plates and if adjustment is necessary, it can be done by inserting a No. 10 Allen wrench (Magnavox Part No. 800017) in the set screw holes located in the sides of the changer posts. Turn the set screw slightly clockwise to raise the selector plate and counter-clockwise to lower it. The set screw for adjusting the 10-inch record setting, and the one for 12-inch record setting are shown above in Figure 5. To adjust for 12-inch records, select a flat 12-inch record that is approximately .090" thick; then follow the same procedure as for adjusting for 10-inch records. After the correct adjustments have been made tighten the locking callers securely.

ADJUSTMENT NO. 4

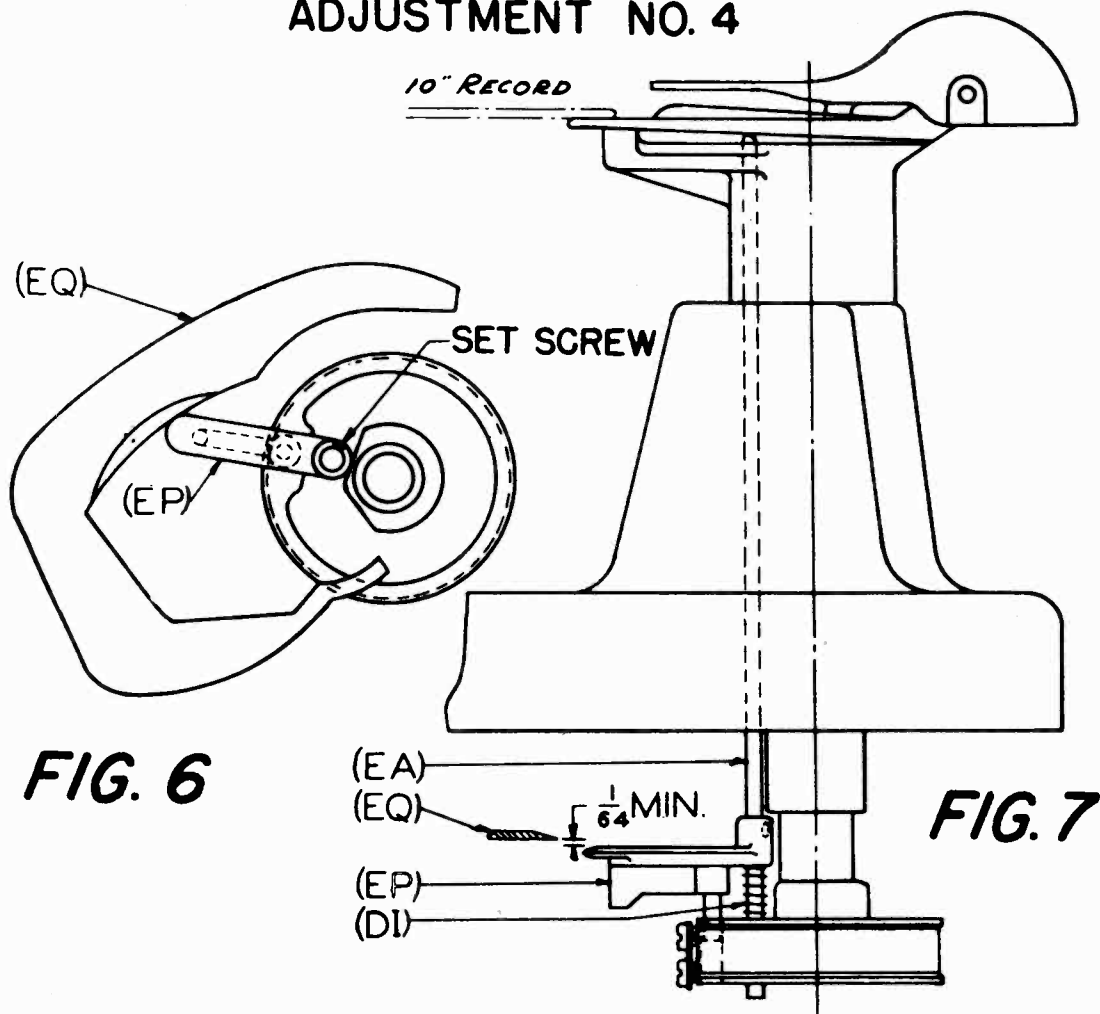


FIG. 6

FIG. 7

The following adjustments cannot be made from above the motorboard, and therefore it may be necessary due to position of the changer to remove it from the cabinet.

ADJUSTMENT NO. 4 -- NO-RECORD SELECTING LEVER ADJUSTMENT

Note: This adjustment is on "Master-post" only -- one nearest tone arm.

First be sure that the spring tension on spring (DI) is strong enough to lift the center blade raising pin (EA) properly and fully, but not so strong that one 10-inch record will not fully depress pin and lever (see Figure 7). Then with the set-screw loose in the no-record selecting lever (EP), see Figure 6, and pin held down by the weight of one 10-inch record, slide the no-record selecting lever (EP) into position so that it will just clear under the lower edge of the lower cam setting lever (EQ) by approximately 1/64-inch clearance (see Figure 7). Then tighten the set screw and check adjustment with and without a record -- also be sure that without a record, the fin on the no-record selecting lever (EP) swings above the cam setting lever (EQ) and portion of lever (EP), indicated by the arrow on Figure 7, sweeps the stop lever (EQ) on cam setting lever into position shown on Figure 6.

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MODELS M-61, M-71

ADJUSTMENT NOS. 5 AND 6

FIG. 8

SET TO $\frac{1}{64}$ "
WITH 12" RECORD
ON PLATES

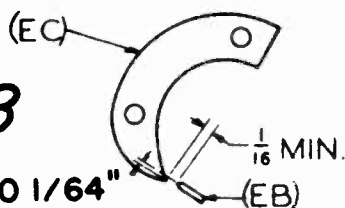


FIG. 9

WILL COME TO
 $\frac{1}{64}$ " MIN. WITH
10" RECORD UNDER
A 12" RECORD

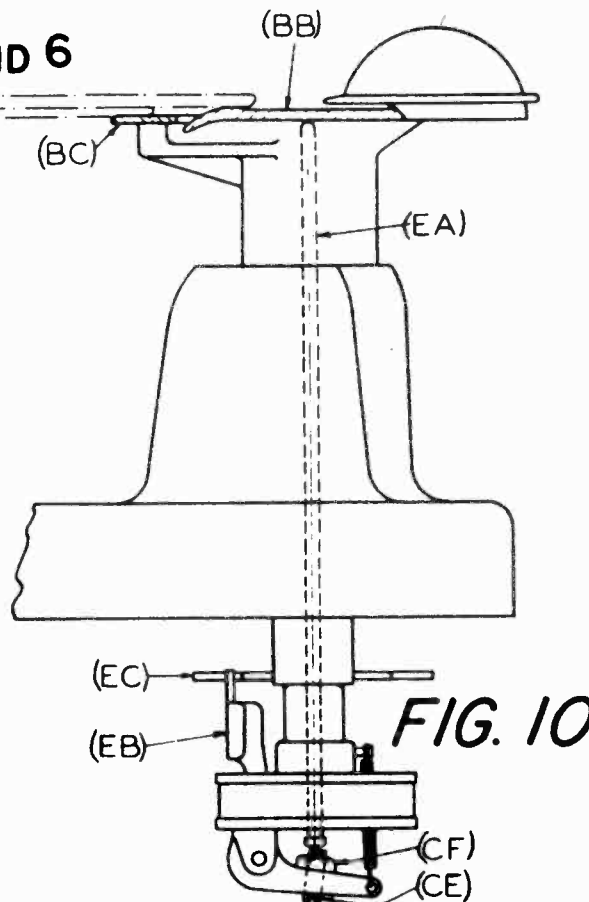
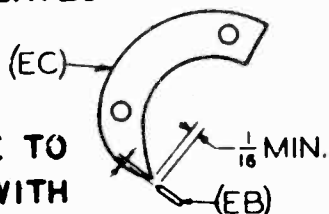


FIG. 10

ADJUSTMENT NO. 5 -- LIFTER LEVER DIFFERENTIAL ADJUSTMENT.

Note: This adjustment is made at all three posts.

Place a 12-inch record over the turntable spindle so that the record rests on the shelf plates. Then check the center plate lifter lever (EB) and see that point of this lever will just slide inside of the lifter cam (EC) as shown in Figure 8. Then place a 10-inch record under the 12-inch record so that the 10-inch record will rest on shelf plate (BC) and the 12-inch record will then touch center plate (BB). The lever (EB) should then follow the outside of the lifter cam (EC) as shown in Figure 9. If it is necessary to readjust this can be done by means of the adjusting screw (CE) and lock nut (CF).

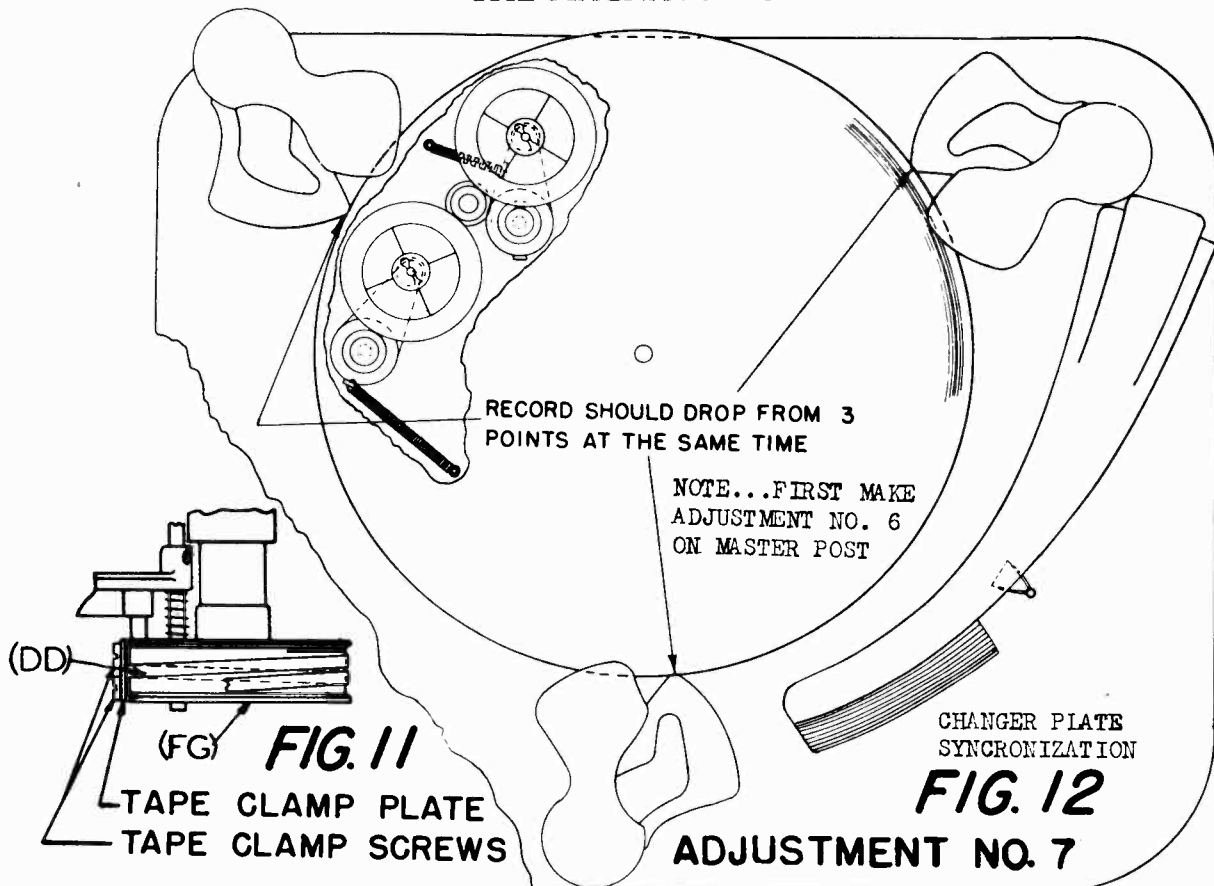
ADJUSTMENT NO. 6 -- LIFTER LEVER CLEARANCE ADJUSTMENT.

Note: Make this adjustment on Master Post and then follow adjustment No. 7 for synchronizing the other two posts.

Check the distance between the leading edges of the center plate lifter lever (EB) and lifter cam (EC) with a 12-inch record resting on the shelf plates. It should be a minimum of $\frac{1}{16}$ -inch. See Figure 8. It should not be necessary to check this adjustment unless the tape clamp screws on the pulley (FG) have been loosened. See Figure 11. To readjust after the screws have been loosened, first set the pulley so that when the slack in the tape line is taken up in the direction of forward motion, there will be the necessary $\frac{1}{16}$ -inch clearance as mentioned above.

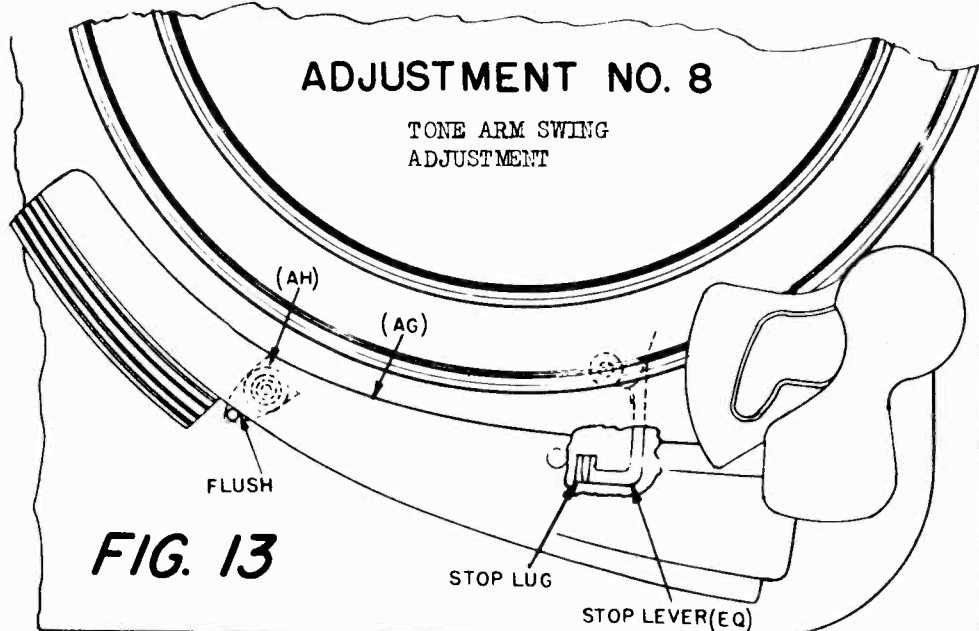
MODELS M-61, M-71

THE MAGNAVOX CO.



First slightly loosen clamp screw on tone arm pivot assembly see Figure 14. Then start a change cycle shut off the power supply to motor when the tone arm (AG) is being held in stop position above tone arm rest (AH) and stop lever on the setting cam assembly is contacting a stop lug on locator plate. see Figure 13. Align the tone arm (AG) flush with tone arm rest (AH) as shown in Figure 13 and tighten clamp screw. Check action of the tone arm in a change cycle and make adjustment #1 if the needle landing is incorrect.

Place one ten-inch record on the record shelves and start the change cycle, allowing it to continue until the blades are just about ready to drop the record. Using the master post as a standard, synchronize the remaining two posts so that the record will drop evenly. This is done by loosening the screws on the tape clamps (see Figure 11). Adjust the changer plates to synchronize with that of the master post so that the record will drop evenly. The tape line should have a very slight amount of slack. Check by grasping the tape line with the thumb and index finger moving it in and out approximately 5/8-inch with a moderate pressure.



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MODELS M-61, M-71

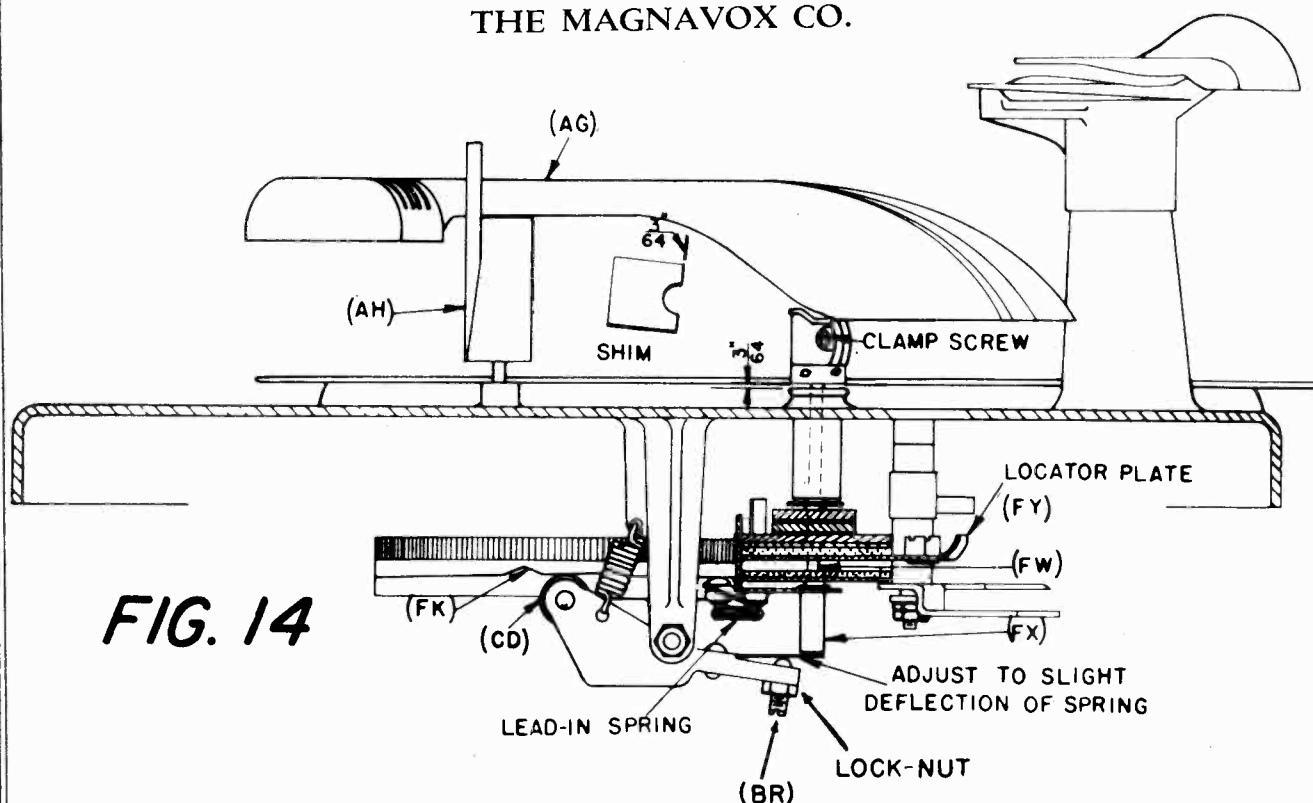


FIG. 14

ADJUSTMENT NO. 9 -- RAISING LEVER PRESSURE ADJUSTMENT

To make this adjustment, first put the mechanism into a change cycle and stop it when roller (CD) -- see Figure 14 -- is at the highest point on cam (FK); then loosen the lock nut and turn adjusting screw (BR) under the flat lifter spring clockwise until the tone arm elevating pin (FW) and tone arm shaft (FX) are completely raised, holding the clutch assembly firmly in the "high" position and only slightly deflecting the flat spring. Then tighten the lock nut and check the operation.

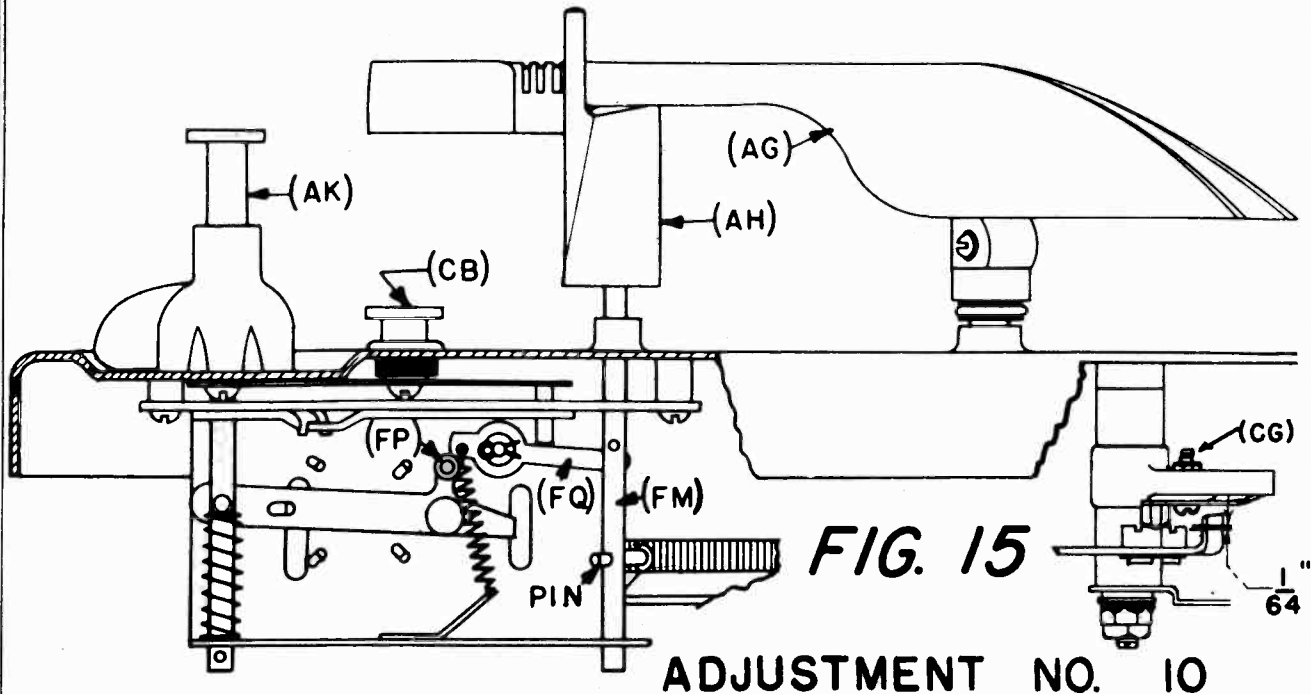
CAUTION: Never attempt to loosen the two Allen-head set screws in the tone arm collar except when it is necessary to disassemble the clutch for the replacement of parts. Be sure that there is a vertical clearance of $3/64$ -inch as shown on Figure 14. This is accomplished by inserting a $3/64$ " shim (Magnavox No. 800036) between the shaft collar and bearing washer. Then with the clutch assembly in the "high" position, as mentioned above, tighten the set-screws in the collar to the shaft and remove the shim. Use $5/64$ -inch Allen wrench (Magnavox No. 800016) for making this adjustment.

ADJUSTMENT No. 10 -- SETTING CAM ADJUSTMENT

Start a change cycle and release a 10-inch record to the turntable -- shut off the power by depressing STOP button (CB) when the stop lever contacts the stud as shown in Figure 15. By means of the adjusting screw (CG) set the stop lever so that there will be at least $1/64$ -inch overlap on the eccentric studs. If there is not sufficient overlap, the stop lever will slide off instead of holding on the eccentric studs while measuring the tone arm lowering position. If there is too much overlap, the stop lever will not release the tone arm and allow it to track in on the record after the change cycle is completed.

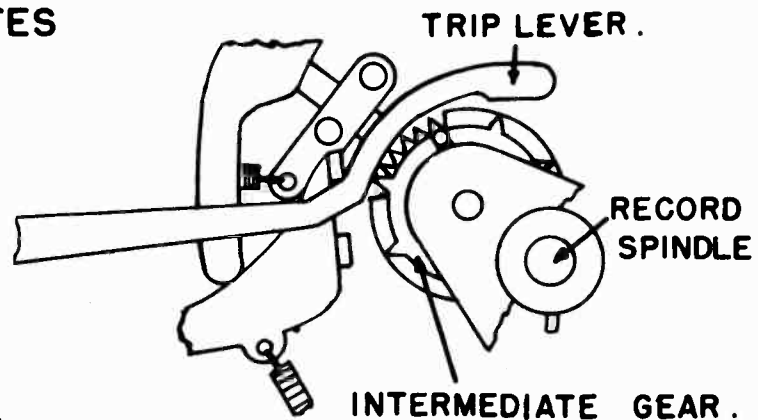
MODELS M-61, M-71

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MISCELLANEOUS NOTES

- A. If the changer continues to cycle without playing the record, set the switch knob to the "M" position as for manual operation. Then set the switch knob back to the "A" position for automatic operation. If this does not correct the trouble, the hook on the trip lever shown in the sketch should be bent nearer the intermediate gear.
- B. If the motor continues to operate after the last record has been played it is probable that the mercury switch is out of level. Either the cabinet is not setting on a level floor or the mounting springs for the changer require adjustment to level the motor-board.
- C. Whenever the turntable is removed from the changer and replaced it is necessary to rotate the turntable by hand for a few revolutions so that the idler pulleys can properly contact the inside rim of the turntable.
- D. If the turntable is slow during operation, it is probable that it is being driven by only one of the idler pulleys. Remove the turntable and slide each of the idler pulley assemblies -- see Figure 12 -- to make certain that they do not bind at any place. Be sure that the tension springs are in place and do not hinder the free movement of the idler pulleys.

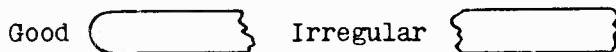


THE MAGNAVOX CO.

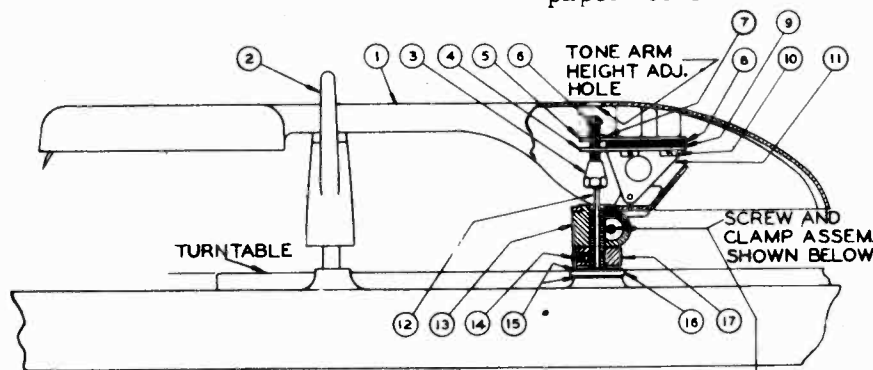
MODELS M-61, M-71

E. If records jam the mechanism when being dropped to the turntable and the blade adjustment No. 3 has been properly made, the cause is most likely to be off-size or defective records. Properly manufactured records have a

uniform semi-circular edge which can be successfully handled by the changer even though the records vary in thickness. Records that prove troublesome in the selecting process can usually be corrected by using a piece of fine sand paper to round up the edges.

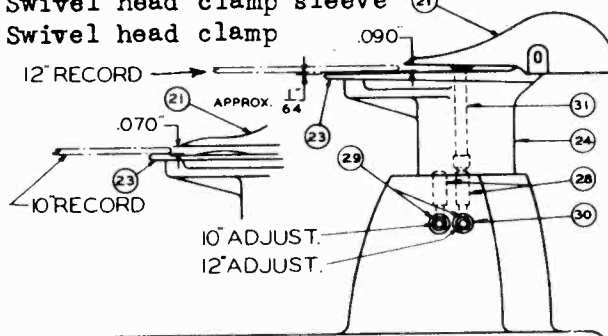
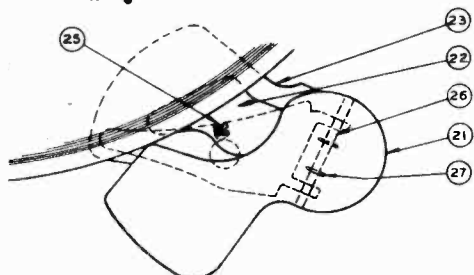


Cross section of record edge showing a perfect record and three imperfect edges.



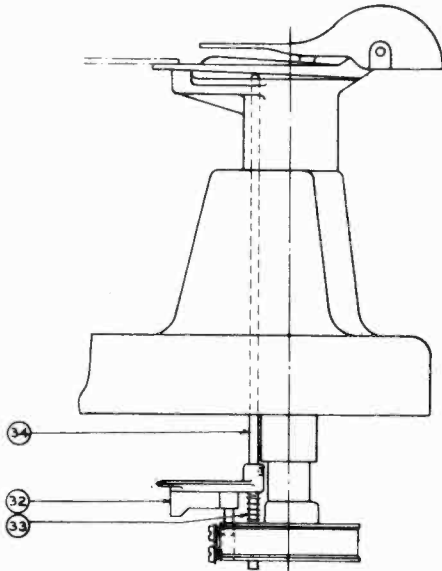
PARTS LIST

Illus. No.	Part No.	Description
1.	520401	Tone arm assembly
2.	520402	Tone arm rest
3.	520403	Tone arm adj. screw nut
4.	520404	Tone arm blank
5.	520405	Tone arm blank
6.	520406	Adjusting screw
7.	520407	Tone arm spring
8.	520408	Tone arm spacer
9.	520409	Tone arm spacer
10.	520410	Screw
11.	520411	Tone arm bracket
12.	520412	Tone arm elevating pin
13.	520413	Tone arm pivot assembly
14.	520414	8-32x .218 Headless set screw
15.	520415	Bearing race washer
16.	520416	Bearing assembly
17.	520417	Tone arm shaft collar assembly
18.	100029	6-32x1/2" R.H.M.S.
19.	520418	Swivel head clamp sleeve
20.	520419	Swivel head clamp



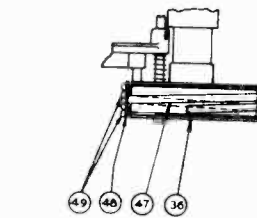
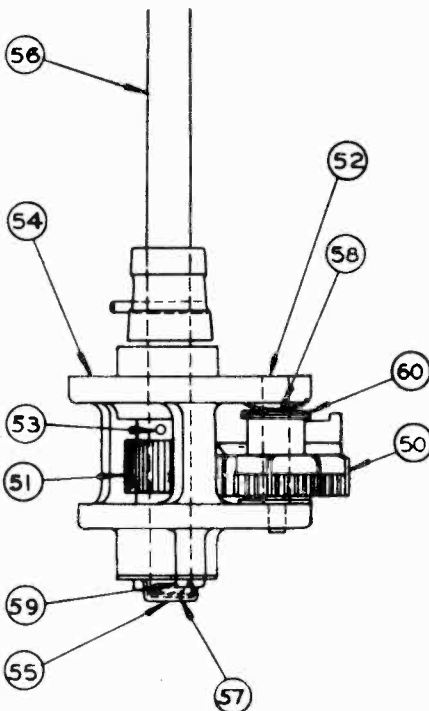
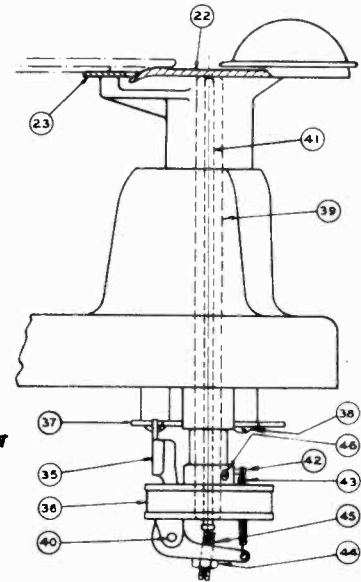
MODELS M-61, M-71

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- 21. 520420 Upper changer plate
- 22. 520421 Center changer plate
- 23. 520422 Lower changer plate
- 24. 520423 Changer plate bracket
- 26. 520424 Plate hinge pin
- 27. 520191 Spring clip
- 28. 520183 Adjusting pin
- 29. 520425 Adjusting set screw
- 30. 520426 Adjustment set-screw lock nut
- 31. 520427 Lifter pin
- 32. 520199 No-record selecting lever
- 33. 520428 Selecting lever spring
- 34. 520429 No-record raising pin

- 35. 520195 Center blade lifter assembly
- 36. 520430 Post pulley
- 37. 520431 Center blade lifter cam
- 39. 520432 Blade post stem
- 40. 520433 Blade pivot pin
- 41. 520434 Center blade raising pin
- 42. 520435 Lifter spring pin
- 43. 520436 Center blade lifter spring
- 46. 520437 8-32 x 1/4 cone point Allen set screw
- 520438 8-32 x 1/4 cup point Allen set screw

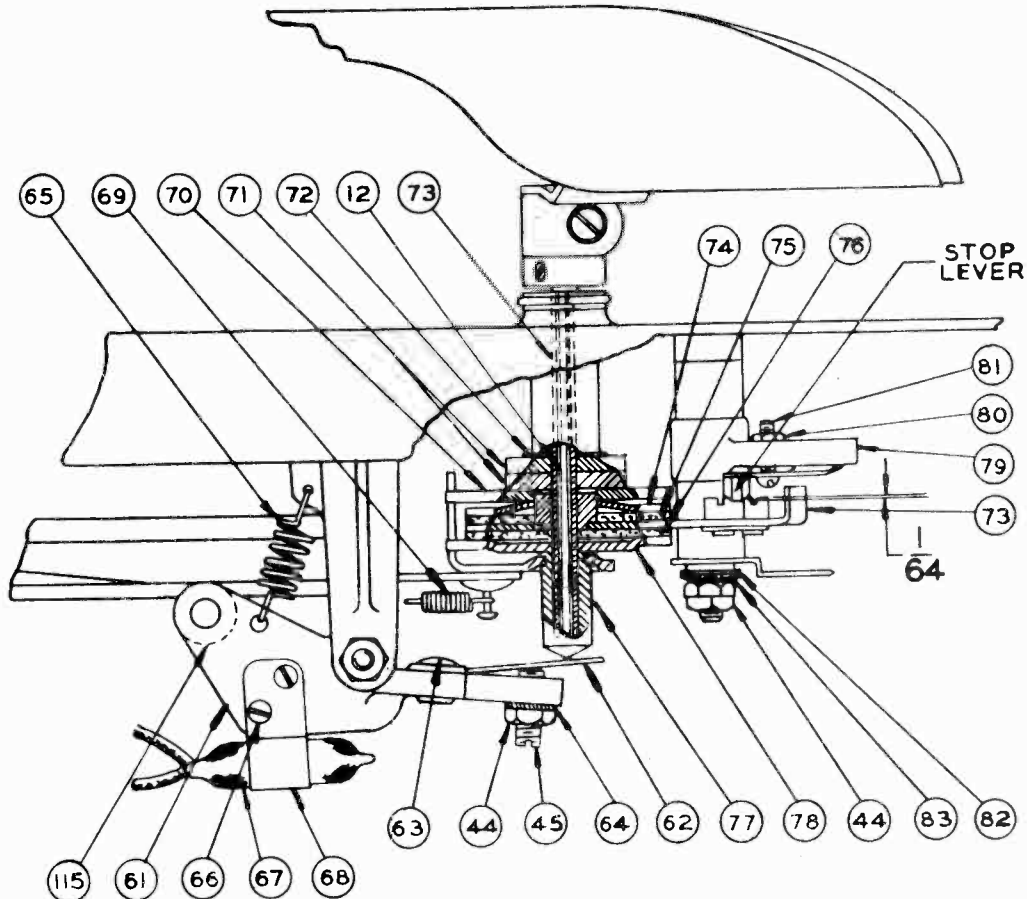


- 47. 520308 Tape
- 48. 520439 Tape clamp
- 49. 520440 Tape clamp screws

- 50. 520441 Turntable spindle & housing assbly.
- 51. 520442 Intermediate gear
- 52. 520443 Drive pinion gear
- 53. 520444 Idler gear shaft
- 54. 520445 Drive pinion pin
- 55. 520446 Turntable spindle housing
- 56. 520447 Spindle housing end cap
- 57. 520448 Turntable spindle and cone assbly.
- 58. 520449 Thrust disc
- 59. 520450 Intermediate gear thrust washer
- 60. 520451 Fish paper washer

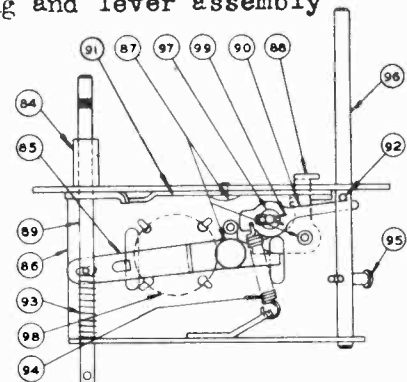
THE MAGNAVOX CO.

MODELS M-61, M-71



61.	520452	Raising lever and bushing assembly
62.	520455	Raising lever flat spring
65.	520457	Raising lever spring
67.	520458	Mercury switch
68.	520459	Mercury switch bracket
69.	520121	Lead-in spring
70.	520460	Tone arm top friction disc
71.	520461	Clutch washer
72.	520462	Trip lever
73.	520464	Tone arm shaft assembly
74.	520465	Trip and replace lever
75.	520106	Cork friction disc (large)
76.	520104	Cork friction disc (small)
77.	520466	Swing lever assembly
78.	520467	Tone arm bottom friction cup
79.	520468	Setting cam bushing and lever assembly
82.	520469	Washer
83.	520470	Spring washer
115.	520453	Cam roller
	520454	Cam roller stud

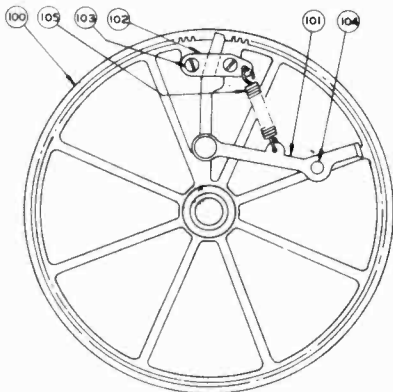
84.	520471	Manual arm assembly
85.	520472	Switch lever assembly
86.	520473	Switch base & spring bkt. assbly.
88.	520474	Trip kick lever
89.	520475	Push button stem
90.	520476	Switch latch
91.	520477	Manual latch
92.	520478	Cam pin



MODELS M-61, M-71

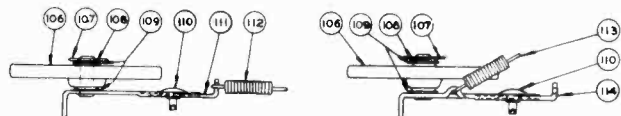
THE MAGNAVOX CO.

PRINCIPAL TROUBLE SYMPTOMS		CHECK ADJUSTMENT
a.	Changer fails to trip after playing record while set on "A" automatic position.	Nos. 4, 8.
b.	Trips too soon or before record has finished playing.	See Miscel. Notes.
c.	Tone arm lifts immediately without playing record or continues cycling.	See Miscel. Notes.
d.	Tone arm lifts but does not swing out properly.	Nos. 8, 9.
e.	Tone arm falls off record or misses record completely.	No. 1.
f.	Tone arm fails to pull into first groove on record properly.	No. 10
g.	Tone arm lands too far out or in on record.	No. 1.
h.	Tone arm lands in middle of record.	No. 10
i.	Tone arm fails to clear stack of 16 10" records.	No. 2.
j.	Tone arm lands for 10" record even on a 12" record.	Nos. 5, 6.
k.	Records jam.	Nos. 3, 5. Miscel. Notes.
l.	12" record is not dropped by one of shelves.	No. 5.
m.	One or more shelves drop 2 records at a time.	No. 3.
n.	Changer fails to turn off automatically after playing last record.	Nos. 4, 9.
o.	Records drop unevenly from shelf plates to turntable.	No. 7.
p.	Motor speed is not constant.	See Miscel. Notes.
q.	Motor continues to operate after last record has been played.	See Miscel. Notes.



520399 Stop button
 520117 Start-Reject button
 520118 Metal switch knob
 520397 Turntable
 520398 Mounting studs
 500118 60 cycle motor
 580023 Crystal cartridge

93. 520479 Push button stem spring
 94. 520480 Spring
 95. 520481 Switch cam roller
 520482 Switch cam roller pin
 96. 520483 Tone arm rest shaft
 97. 520484 Trigger spacer
 98. 520485 A.C. switch
 99. 520486 Spring clip
 100. 520487 Cam gear and bushing assembly
 101. 520488 Cam latch and trigger assembly
 102. 520489 Latch plate
 103. 520490 Latch plate screw
 104. 520491 Swivel pin
 105. 520492 Spring
 106. 520493 Idler wheel assembly
 107. 520494 Spring clip
 108. 520495 Felt washer
 109. 520496 Fish paper washer
 110. 520497 Shoulder rivet
 111. 520498 Idler wheel link & stud assbly.
 112. 520499 Spring
 113. 520500 Spring
 114. 520400 Idler wheel link & stud assbly.



ATTACHING THE RECORD-MAKER TO THE RADIO

The Airline Record-Maker may be used with a number of Airline radios and radio-phonograph combinations in which the radio chassis has been suitably wired and has the necessary sockets for proper cable connections.

First, mount the Junction Box. This is generally mounted at the back edge of the cabinet near the radio chassis. Several locations are shown in Fig. 1. In some models a wood block will be seen at the back of the cabinet on which the Junction Box may be mounted. In other models there is room on the chassis shelf for the Junction Box. In cabinets with a side and top rail at the back, mount the Junction Box to the rail even though only two screws, one on each flange, can be used. If

there is a built-in loop aerial, keep it as far away from this aerial as possible.

After the Junction Box is secured to the cabinet with the wood screws provided, complete the cable connections between the radio and the Junction Box as shown in Fig. 6. If there is a record player with the radio, the pickup lead should be connected as shown.

The Record-Maker may be placed on a table, stand, or on top of the radio, whichever is most convenient. The cable to the Junction Box is connected as illustrated in Fig. 6. The cover of the Record-Maker may be removed by tipping it back and lifting up.

The Record-Maker may be dis-

connected after being used by withdrawing the plugs on the end of the recorder cable from the Junction Box (See Fig. 6) and pushing the switch below to "out" position.

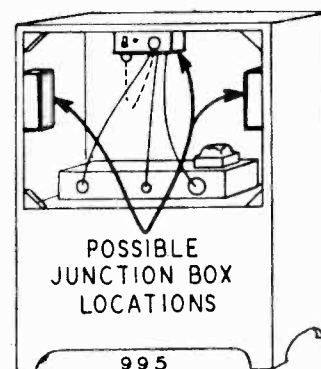


Fig. 1. Junction Box Locations

1. TO MAKE A RECORD FROM A RADIO PROGRAM

A—Recorder arm in rest position—See Fig. 3.

B—Tone arm in rest position—See Fig. 2.

C—Microphone Volume Control in OFF position—See Fig. 2.

D—P.A.—Record Switch in RECORD position.

E—Phono-Radio Knob (On radio panel) in RADIO position.

F—Tune in the desired radio program carefully to room volume.

G—Place a blank record disc on the turntable with the small pin in the turntable extending through the hole in the disc.

H—The Tone Control on the radio panel should, for most recordings, be in the TREBLE position.

I—Lift up the cutting end of the recorder arm, see that the cutting needle is properly in place (See article "Recording Needles," page 4), move this arm over to the intermediate position and set it down gently

—See Fig. 3. The volume of the radio program will be reduced. Bring the volume up with the Radio Volume Control until the red indicator light just flashes on loud passages. Then back the volume down a slight amount so that the red indicator light does not flicker.

J—Push the Motor Switch Knob to the ON position (Fig. 2) and allow the turntable to come up to full speed.

K—Lift up the recorder arm and carefully let it down with the needle point about $\frac{1}{4}$ inch from the outside edge of the blank record.

L—Watch the volume indicator light as the recording is being made. It is not necessary to continuously adjust the position of the Radio Volume Control—merely make sure that the red light does not flicker. A slight flicker on very loud passages only will not be harmful.

M—The thread which forms at the cutting needle may be pushed gently toward the center with a soft brush while the record is being cut. Considerable care must be taken that the operator does not tangle this thread around the cutting needle or that he does not slow up the turntable by touching it with his hands, as either condition will cause poor recordings. After the recording is completed, remove the thread from the record.

N—The record can be cut until the cutting needle is about $1\frac{1}{2}$ inches from the center of the record or until a short distance before the paper label is reached. Shortly before the needle reaches its final position, reduce the volume to zero with the Radio Volume Control (without turning the knob to the OFF position on those models which have a combined Switch and Volume Control) and cut 3 to 5 blank grooves on the record. Then lift off the recorder arm and return it to the rest position. Push the Motor Switch Knob to the OFF position.

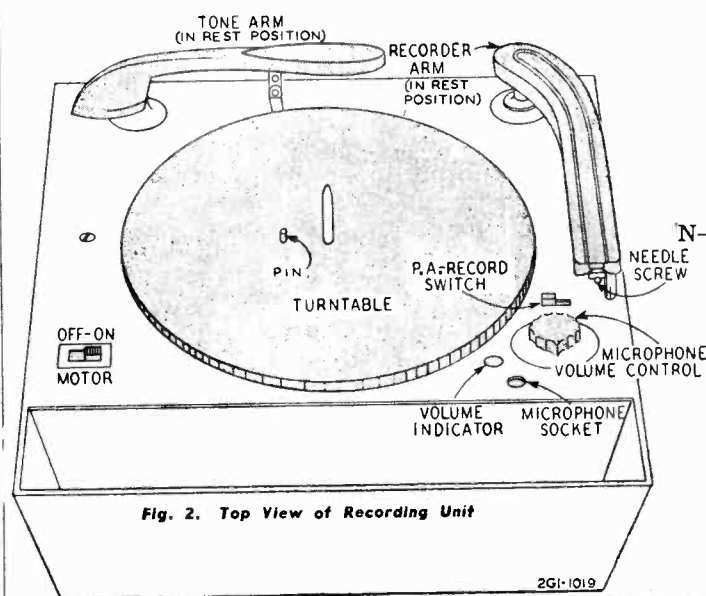


Fig. 2. Top View of Recording Unit

2. TO MAKE A RECORD USING THE MICROPHONE

Voice or music that can be picked up by the microphone with sufficient volume can be recorded. Keep the room quiet, as all extraneous noises picked up by the microphone will be on the record.

- A—Recorder arm in rest position—See Fig. 3.
 B—Tone arm in rest position—See Fig. 2.
 C—Microphone Volume Control in OFF position—See Fig. 2.
 D—P.A.-Record Switch in RECORD position.
 E—Phono-Radio Knob (On radio panel) in PHONO position.
 F—Insert the plug on the end of the microphone cord in the microphone socket (Fig. 2) on the motor panel and push this plug all the way down.
 G—Turn the radio On-Off Switch (On the radio panel) to the ON position.
 H—Place a blank record disc on the turntable with the small pin in the turntable extending through the hole in the disc.
 I—The Tone Control on the radio panel should, for most recordings, be in the TREBLE position.
 J—Keep the microphone at least one yard away from the radio loudspeaker at all times. If the recording is to be speech, keep the lips about 6 inches (or cutting) away from the microphone. If the recording is to be music or other sound, place the microphone near the sound source, moving it closer or farther away as the volume requires.
 K—Lift up the cutting end of the recorder arm, see that the cutting needle is properly in place (See article "Recording Needles," page 4), move this arm over to the intermediate position and set it down gently—See Fig. 3.
 Turn the Microphone Volume Control past the point at which the speaker silencing switch is felt to operate. This switch is at about the halfway mark on the control. Speak or start the music or sound into the microphone.
 After the Microphone Volume Control knob has been

turned past the point at which the switch is thrown, the sound can no longer be heard through the radio speaker but the sound intensity will be shown by the red indicator light. Turn the Microphone Volume Control until the speech or sound picked up by the microphone causes the red indicator light to flicker. Then turn the Microphone Volume Control down slowly until the red light just disappears.

If in reducing the microphone volume, the knob is turned below the point at which the switch is felt to operate, the sound will again be heard through the radio speaker. The recording continues and no harm will result if the microphone is kept at least one yard from the radio speaker. If brought closer, a howl may occur.

- L—Push the Motor Switch Knob to the ON position (Fig. 2) and allow the turntable to come up to full speed.
 M—Lift up the recorder arm and carefully let it down with the needle point about $\frac{1}{4}$ inch from the outside edge of the blank record.
 N—After 1 or 2 blank grooves have been cut in the record, start the speech, music, or sound into the microphone. Watch the volume indicator light as the recording is being made. It is not necessary to continuously adjust the position of the Microphone Volume Control—merely make sure that the red light does not flicker. A slight flicker on very loud passages only, will not be harmful.
 O—Remove thread as explained in Article 1, Step M.
 P—The record can be cut until the cutting needle is about $1\frac{1}{2}$ inches from the center of the record or until a short distance before the paper label is reached. Shortly before the needle reaches its final position, reduce the volume to zero with the Microphone Volume Control and cut 3 to 5 blank grooves on the record. Then lift off the recorder arm and return it to the rest position. Push the Motor Switch Knob to the OFF position.

3. TO PLAY BACK THE HOME RECORDING; TO PLAY ORDINARY PHONOGRAPH RECORDS

The record made in Articles 1 and 2 may be played back immediately.

Also, ordinary commercial records may be played in the following manner:

- A—Recorder arm in rest position—See Fig. 3.
 B—Turn Phono-Radio Knob on radio panel to PHONO position.
 C—Push Motor Switch Knob to ON position.
 D—Lift tone arm, see that the needle is in place, and set arm down gently with needle in outside groove of record. See article on Home Recording and Ordinary Phonograph Needles.
 E—Adjust volume by means of Radio Volume Control to desired intensity.
 F—Adjust tone by means of Radio Tone Control to desired quality.
 G—Lift up tone arm at end of recording, set it in its rest position, and push Motor Switch Knob to OFF position.

TO PLAY 12 INCH COMMERCIAL RECORDS, lift tone arm off rest and bend the tone arm rest over to a horizontal position.

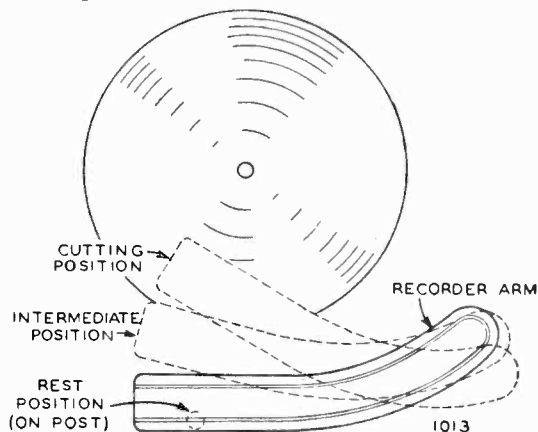


Fig. 3—Positions of Recorder Arm

4. TO USE MICROPHONE AND RADIO AS A PUBLIC ADDRESS SYSTEM

- A—Recorder arm in rest position—See Fig. 3.
- B—Tone arm in rest position—See Fig. 2.
- C—Microphone Volume Control in OFF position—See Fig. 2.
- D—P.A.-Record Switch in P.A. position.
- E—Phono-Radio Knob (On radio panel) in PHONO position.
- F—Insert the plug on the end of the microphone cord in the microphone socket (Fig. 2) on the motor panel and push this plug all the way down.
- G—Turn the Radio On-Off Switch (On the radio panel) to the ON position.
- H—Turn the Microphone Volume Control to about

the half-way mark. The speaker silencing switch at about the mid-point of the Microphone Volume Control is not effective when the recorder arm is in the rest position.

Keep the microphone at least one yard away from the radio speaker at all times. The lips should be about 2 inches (for public address) away from the microphone.

- I—Speak into the microphone and adjust the volume by means of the Microphone Volume Control to the proper intensity. If this control is turned too high, a howl may result. Should this happen, turn down the microphone volume slightly, move the lips closer to the microphone, and move the microphone farther away from the radio speaker.

5. TO USE THE MICROPHONE FOR MAKING ANNOUNCEMENTS WHEN PLAYING RADIO OR PHONOGRAPH

Follow all of the steps as given in Article 4 except that for radio reception the Phono-Radio Knob is in RADIO position.

Reduce the radio or phonograph volume by means of the Radio Volume Control when making an announcement.

6. TO USE THE MICROPHONE FOR SUPERIMPOSING AN ANNOUNCEMENT OR ACCOMPANYING THE PROGRAM WHEN MAKING A RECORD OF A RADIO PROGRAM

The microphone can be used for superimposing an announcement on the record at any time when making a record of a radio program.

A musical instrument or a singing voice may be used to accompany a radio program while recording it.

A—Instructions for cutting the record are given in Article 1. Be sure P.A.-Record Switch is in RECORD position.

B—Insert the plug on the end of the microphone cord in the microphone socket (Fig. 2) on the motor panel and push this plug all the way down.

C—Keep the microphone at least one yard away from the radio speaker at all times. The lips should be about 6 inches away from the microphone.

D—If an announcement or title is to be inserted, reduce the volume of the radio program with the Radio Volume Control to any desired level, just before the announcement is to be made or the title is to be put in.

If a musical instrument or singing voice is to be used to accompany the radio program, the latter may be reduced with the Radio Volume Control or may be left at normal volume.

E—Turn the Microphone Volume Control up to just below the point at which the speaker silencing switch is felt to operate. This switch is at about the half-way mark on the control. (Continuing to turn this knob in a clockwise direction would throw the switch, and the sound could no longer be heard through the radio speaker but the recording would continue.)

F—Speak, or start the sound into the microphone and observe the indicator light. To increase volume, speak louder and get closer to the microphone. To decrease volume, of course, reverse these procedures and turn down the Microphone Volume Control. Keep volume just below point at which red indicator light flickers.

G—When the announcement or accompaniment is completed, turn the Microphone Volume Control to the OFF position and if additional radio program recording is wanted, turn up the Radio Volume Control to just below the point at which the red indicator light flickers.

7. TO MAKE A RECORD FROM ANOTHER RECORD WITH A RADIO-PHONOGRAPH COMBINATION

If you have a radio-phono combination, play the record to be copied on the phonograph.

Follow all of the instructions as given in Article 1 except that the Radio-Phono Switch on the radio should be in the PHONO position.

WITH A SEPARATE ELECTRIC PHONOGRAPH

If you have or can borrow a small phonograph of the electric type, play the record to be copied on this phonograph. Place the recorder microphone about 12 inches away, then proceed to make the new record in the usual manner with the microphone—See Article 2.

MODEL 14WG-499

MONTGOMERY WARD & CO.

ADJUSTING THICKNESS OF THREAD (PRESSURE ADJUSTMENT)

The pressure on the cutting needle can be varied by the adjusting nut shown in Fig. 4. This pressure determines the thickness of the thread cut from the blank record.

All recorders are adjusted at the factory to cut grooves approximately .0015 inches deep. When cut at this depth, the thread will be approximately as thick as a human hair.

You can get a fairly good idea of the depth of the cut by examining the record with a magnifying glass. The width of the groove should be about equal to the space between grooves if the cutting needle is sharp and the cutting head is correctly adjusted.

The thickness of the thread is increased by rotating the pressure adjusting nut in a counterclockwise direction. Turning this nut clockwise will decrease the thickness of the thread. Before making any pressure adjustment, be sure that a good cutting needle is used and that it is properly inserted.

ADJUSTING HEIGHT OF RECORDER ARM

In Fig. 4 is shown the screw and locking nut for adjusting the height of the recorder arm above the turntable. This height is adjusted at the factory and ordinarily does not require readjustment.

To check for proper height, grasp the needle screw and lift it until

the cartridge assembly is felt to touch the recorder arm. The needle point will then be approximately 1/8 inch above the record surface.

If, due to variations in recording needle length, the height must be adjusted, loosen the locking nut, adjust the screw to the proper height and retighten the nut.

HOME RECORDING NEEDLES—ORDINARY PHONOGRAPH RECORD NEEDLES

Fifty tone arm needles are supplied with this recorder unit. These may be used both to play back home recordings and to play ordinary commercial records on the recorder unit.

Needles which are used on home recordings may be used for ordinary commercial records, but those used on commercial records cannot be used for home recordings, as the latter would be ruined.

OILING

Oil the two bearings, one at either end of the worm shaft, fibre gear bearing, recorder arm hinge pivot and recorder arm shaft once a year.

CAUTION: Never oil the friction clutch or the felt washers on the rubber idler wheels. (The purpose of the felt washers is to silence the operation of the idler wheels and not to lubricate.)

HIGH PITCH ON PLAY BACK

If the pitch when a home recording is played back appears to be

too high, it may be due to excessive depth of cut. This causes too great a load on the motor, slowing it down. The remedy, of course, is to reduce cutting needle pressure.

SAPPHIRE NEEDLE

If a sapphire cutting needle is used in place of a steel cutting needle, the needle pressure must be increased to maintain .0015" depth of cut.

CUTTER CARTRIDGE VERTICAL STOP

With the cutting needle resting on a record, raise the cutting arm slowly. There should be from 1/8" to 3/16" of motion of the cutting arm before the cutting needle lifts from the record. This will allow free vertical movement of the cutter cartridge and compensate for any slight wobble of the turntable or record. To get slightly more or less movement, bend stop lug on male pivot which bears against cutting arm, down or up—see Fig. 4.

TIMING YOUR RECORDS

The following is the approximate maximum time for each record:

- 6" size..Each side 1 1/2 min.
- 8" size..Each side 3 min.
- 10" size..Each side 4 1/2 min.

REPLACEMENT PARTS LIST

PRE-AMPLIFIER UNIT PARTS MISCELLANEOUS

Part No.	Description	Selling Price
7A119	Neon Lamp for Red Volume Indicator.....	.28
15X175	Red Celluloid Indicator Doz.....	.12
3A303	Tube Sockets—Octal (8 Prong).....	.06
3A305	Microphone Socket—Single Pin Tip.....	.06
3A308	Cutter Socket.....	.06
2A175	P.A.—Record Switch.....	.10
2A213	Record Cutter Changeover Switch.....	.30
37X194	Trip Arm and Hub Assembly for Changeover Switch.....	.16
29X141	Stop Collar on Changeover Switch.....	.16
51X101	Record Cutter Transformer.....	.76
10A314	Knob for Microphone Volume Control.....	.06
CONDENSERS		
D66104	C1,C5 1 mf. 400 V. Tubular.....	\$0.10
B66402	C2 .004 mf. 200 V. Tubular.....	.06
45X287	(C3A 10 mf. 400 V.) Dry.....	
45X316	(C3B 20 mf. 25 V.) Electrolytic.....	.38
	(C4 4 mf. 25 V.) Dry.....	
	(C5 20 mf. 25 V.) Electrolytic.....	.22
D66503	C6 .05 mf. 400 V. Tubular.....	.06

RESISTORS	
B95205	R1 2 Megohm 0.5 W. Carbon.....
B94105	R2 1 Megohm 0.5 W. Carbon.....
B94505	R3 5 Megohm 0.5 W. Carbon.....
36X292	R4 Microphone Volume Control and Switch.....
B93254	R5 250,000 Ohm 0.5 W. Carbon.....
B93504	R6 500,000 Ohm 0.5 W. Carbon.....
D94502	R7 5000 Ohm 2.0 W. Carbon.....
B95300	R8 30 Ohm 0.5 W. Carbon.....
B95502	R9 5,000 Ohm 0.5 W. Carbon.....
B94404	R10 400,000 Ohm 0.5 W. Carbon.....
B95104	R11 100,000 Ohm 0.5 W. Carbon.....
B94102	R12 1000 Ohm 0.5 W. Carbon.....
B94104	R13 100,000 Ohm 0.5 W. Carbon.....
43X118	R14 1.5 Ohm Wire Wound.....

JUNCTION BOX PARTS	
3A303	Speaker or Recorder Cable Sockets—Octal (8 Prong).....
3A305	Phone Sockets—Single Pin Tip.....
2A175	Junction Box Switch.....

W-28A74 RECORDER UNIT PARTS	
26A333	Recorder Arm Swivel Head Clamp, Sleeve and Screw Assembly.....
26A334	Recorder Arm Height Adjusting Screw and Nut Assembly.....

W-21A048	Cartridge Spring.....	Doz.	.28
W-21A050	Cutter Cartridge (Crystal Type X-26).....	12.00	
W-21A078	Recorder Arm Only.....	1.02	
W-21A032	Recorder Arm Post Gear.....		
W-21A028	Cork Friction Washer for above Gear.....	Doz.	.10
W-25A072	Felt Washer for above Gear.....		
W-26A177	Needle Screw for Recorder Arm or Tone Arm.....		.10
W-15B054	Motor 60 cycle—115 Volt.....	7.80	
W-17B182	Turntable.....	2.86	
W-17A1769	Rubber Idler Wheel.....	.40	
W-17A1363	Spring Clip for Above.....	Doz.	.10
W-25A030	Felt Washer for above.....	Doz.	.08
W-25A048	Fish Paper Washer for above.....	Doz.	.04
W-21A076	Pick-Up Arm Only.....	1.30	
W-21A158	Crystal Cartridge for Tone Arm L 40.....	4.36	
W-32A016	AC Switch.....	.24	

MICROPHONE AND CABLES

28A75	Recording Microphone complete with stand and cable.....	\$5.10
13X440	Recorder Cable with Molded Octal Plug and Single Pin Tip Jack.....	6.04
13X442	Phone Cable with Single Pin Tip Jack.....	.46
13X443	Pre-Amplifier Cable complete with 2 Prong Plug.....	.54
13X441	Speaker Socket Cable complete with Octal Plug.....	.40

Prices Subject to Change Without Notice.

MONTGOMERY WARD & CO.

MODEL 14WG-499

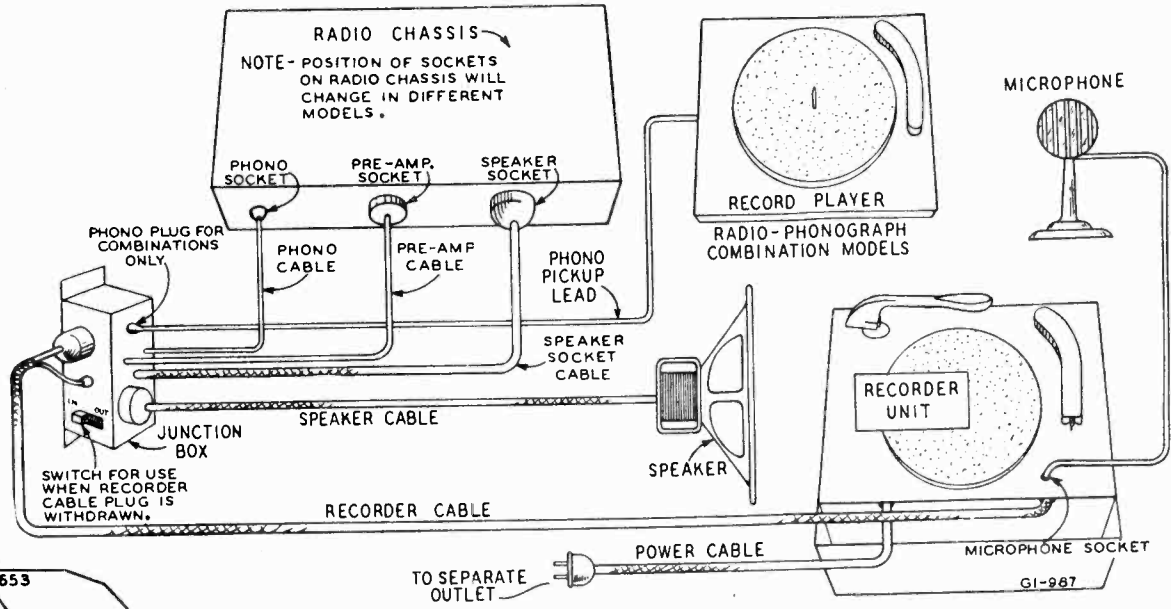


Fig. 6 - Cable Connections

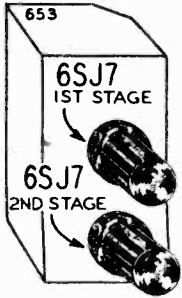


Fig. 5 - Pre-Amplifier Unit Tube Arrangement

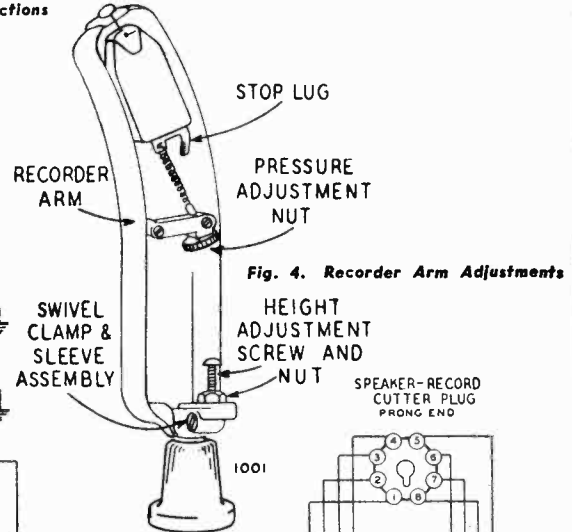


Fig. 4 - Recorder Arm Adjustments

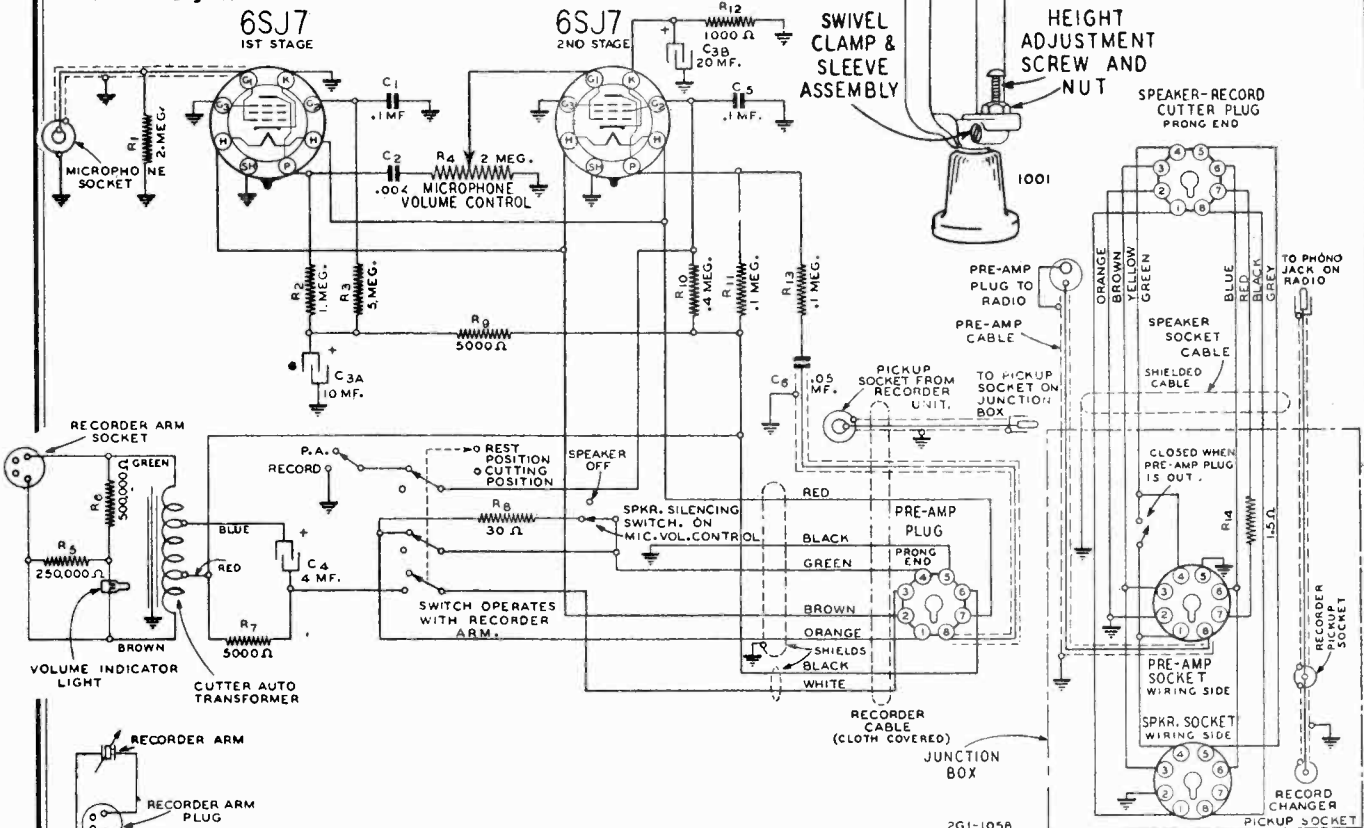


Fig. 7 - Schematic Circuit Diagram

WG&C SERIES 2G1-1

7-41

MODELS 220, 221, 223,
320, 321, 323

NEW PRODUCTS CORP.

Alphabetically arranged index letters are used in the illustrations and in the description to facilitate locating of parts in the illustrations. Parts with the prefix letter "A" will be found in the illustration of the top of the record changer. Parts with the prefix letter "B" and "C" will be found in the illustration of the bottom of the changer. Parts with the prefix letter "D" will be found in the illustration of the main cam gear assembly.

SUMMARY OF MECHANISM OPERATION:

The capacity of the instrument is ten 12" or twelve 10" records.

To load, turn the two large lower blades AM (in top view) towards the center of the turntable, as shown. Then place the records over the turntable shaft allowing them to rest on the blades. To start operation, trip Reject button AP. To unload after playing, grasp under lower blade, lift slightly, and turn 180 degrees allowing them to fall into the notches provided. There will then be no obstruction in taking the records off.

Set middle button AQ to 10" or 12" in accordance with size of records. All records must be of same size for each loading.

To change record anytime when needle is on the record, merely trip Reject button AP.

To play records one by one, turn changer blades back away from center of table, and set Manual-Automatic button AR for Manual operation.

DESCRIPTION OF CHANGE CYCLE:

Push Reject button AP which releases latch CF (through reject link BG) that holds pawl CH. When CH is in starting (or neutral) position it is under sub-frame BJ and upon being released from latch CF engages with lugs on pinion DG which is rotating. This turns main cam gear DQ sufficiently to engage first tooth shown at CHA and continues to rotate it for one complete revolution, which constitutes one cycle of the changer. Pinion DG is driven through the train from motor pulley AD through the idler pulley AC which drives on the rim of turntable AB keyed to turntable shaft DA.

The pickup arm movement is controlled laterally by the pickup crank CB, the end of which rides in the cam track DPA of cam gear DQ.

As the cam rim DPB slides on the head of lift pin CC raising pickup arm AJ, the roller on pickup crank CB, rolling in track DPA it forces outward (carrying outward with it pickup arm AJ) into the concentric portion of track DPA.

While the pickup arm is swung out in the raised position and the cam gear continues, the eccentric CE actuates the changer blades through eccentric arm CG, changer shafts CN and BC, and tie bar BF.

ADJUSTMENTS AND SYNCHRONIZING:

1. To set changer blades, AM and AN, loosen screws on CM, BD, and CP, and place blade in position shown in top view with top blades about 1/16" from the edge of a 12" record and cam gear in neutral or playing position. The tie bar BF should then be pivoted over to within 1/16" of sub-frame BJ with driving crank BD pointing straight out to left (machine in position shown in bottom view). Then screw clamps CM, BD, and CP tight.

2. To adjust the lift of the pickup arm, should it hit under the lower blade AM or not clear over 10-12" records, merely tighten or loosen (by small degrees) the hex head screw on the under side of the pickup arm near the pivot end.

The lateral swing is controlled by crank CB riding in groove DPA.

To adjust the swing of pickup arm loosen the screw on the hub of CB, place a record (preferably a 12" one) on the turntable, trip reject button and turn turntable by hand until pickup arm AJ lowers to record. Just before the needle touches, stop turning and push the arm sideways until the needle is about 3/32" from the edge of the record then continue to turn turntable to see if it lands that distance from the edge. Then tighten up the clamping screw on pickup crank CB.

The tripping adjustment or latch adjusting screw CM controls the point at which the mechanism picks up the pickup arm AJ and removes it to allow the next record to be dropped. Should records not finish playing it is merely necessary to unscrew this screw until it completes records properly, or should machine fail to trip at end of record, turn screw in so that it will trip sooner.

REPLACING MOTOR:

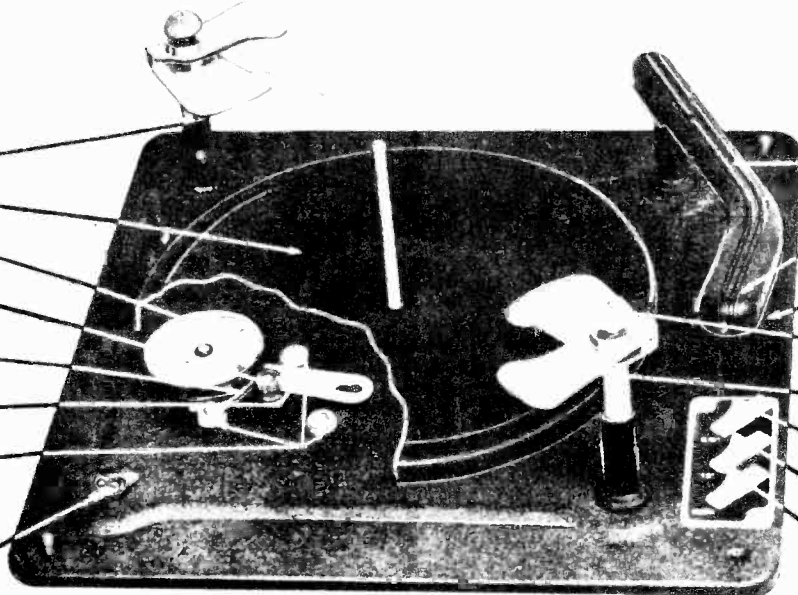
Remove idler wheel AC and the three motor mounting screws AG. Be sure to save metal bushing spacers, which slip inside of rubber grommets. These prevent rubber from being squeezed out of shape which would prevent proper cushioning of motor. Place motor of proper rating in same position as present motor and replace spacers, washers and screws as before.

AUGUST 14, 1940

NEW PRODUCTS CORP.

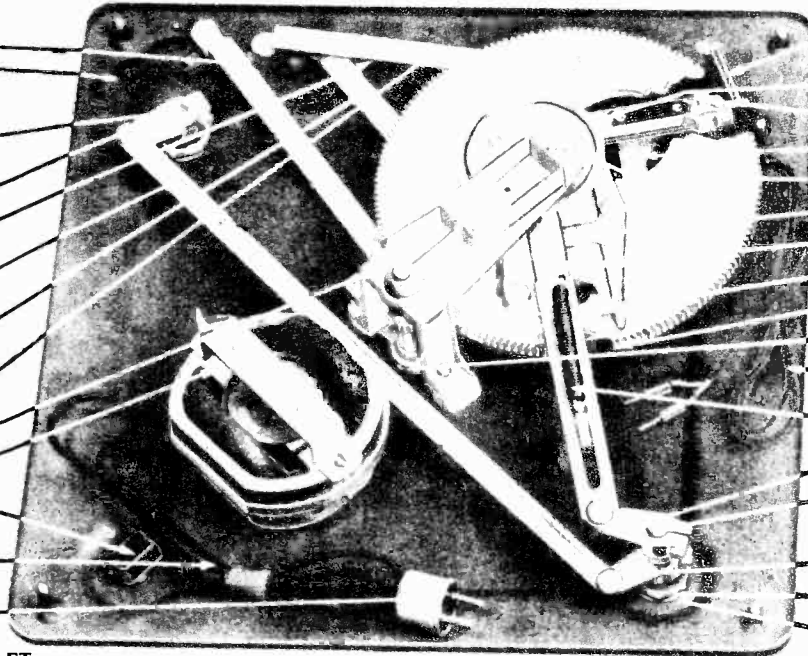
MODELS 220, 221, 223,
320, 321, 323

- R-2 CHANGER POSTS AA
- R-125 TURNTABLE AB
- R-34 IDLER WHEEL AC
- R-129 MOTOR PULLEY AD
- R-37 IDLER SPRING AE
- R-12 IDLER BRACKET AF
- R-23 MOTOR MOUNTING SCREWS AG
- R-111 ON-OFF SWITCH AH



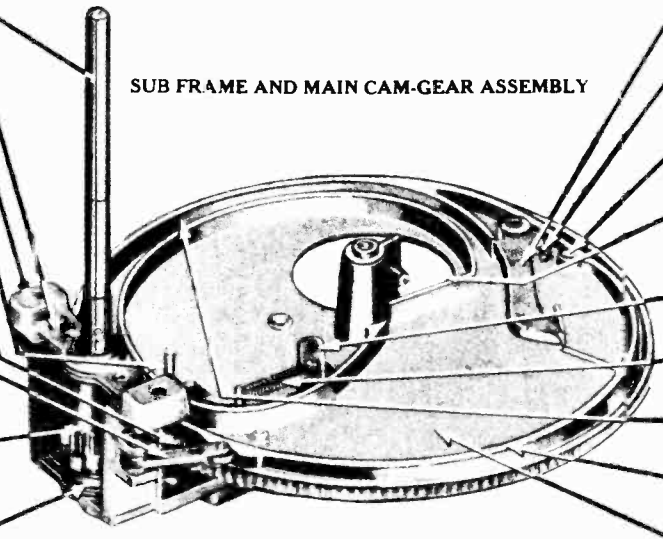
- AJ PICKUP ARM R-83
- AK PICKUP CARTRIDGE (IN PICKUP ARM)
- AL PICKUP REST R-5
- AM LOWER BLADE R-76
- AN UPPER BLADE R-77
- AP REJECT BUTTON R-60
- AQ 10" & 12" BUTTON R-60
- AR MANUAL BUTTON R-60

- R-63 MANUAL LINK BA
- R-6 SPRING CLIP BB
- R-32 SHORT CHANGER SHAFT BC
- R-24 DRIVING CRANK BD
- R-62 REJECT RETURN SPRING BE
- R-27 TIE BAR BF
- R-61 REJECT LINK BG
- R-58 INDEX LINK BH
- R-38 SUB FRAME BJ
- MOTOR (SPECIFY RATING) BK
- R-111 ON-OFF SWITCH BL
- R-117 MOTOR CORD BM
- R-123 MOTOR PLUG BN



- CA PICKUP CRANK SPRING R-133
- CB PICKUP CRANK R-66
- CC LIFT PIN R-81
- CD INDEX PLATE R-57
- CE ECCENTRIC R-18
- CF PAWL LATCH R-11
- CG ECCENTRIC ARM R-21
- CH STARTING PAWL R-8
- CHA
- CJ PAWL SPRING R-10
- CK PICKUP CORD & CLIPS R-115
- CL ECCENTRIC SLIDE SPRING R-23
- CM DRIVING CRANK R-24
- CN LONG CHANGER SHAFT R-29
- CP DRIVING CRANK R-24
- CQ POST NUTS R-4
- CR POST WASHERS R-3

- R-43 TURN TABLE SHAFT DA
- R-40 LONG BEARING SUPPORT DB
- R-38 SUB FRAME DC
- R-8 STARTING PAWL DD
- R-50 CAM STOP SPRING DE
- R-54 CAM STOP LEVER DF
- R-46 PINION DG
- R-41 SHORT BEARING SUPPORT DH

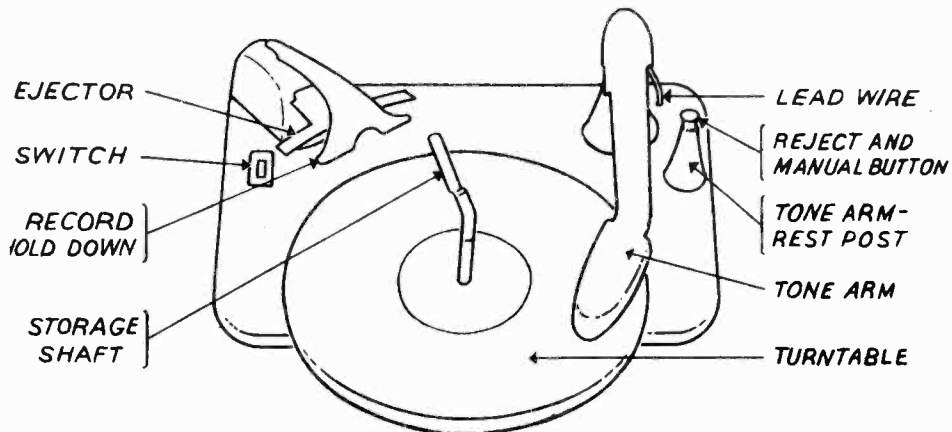
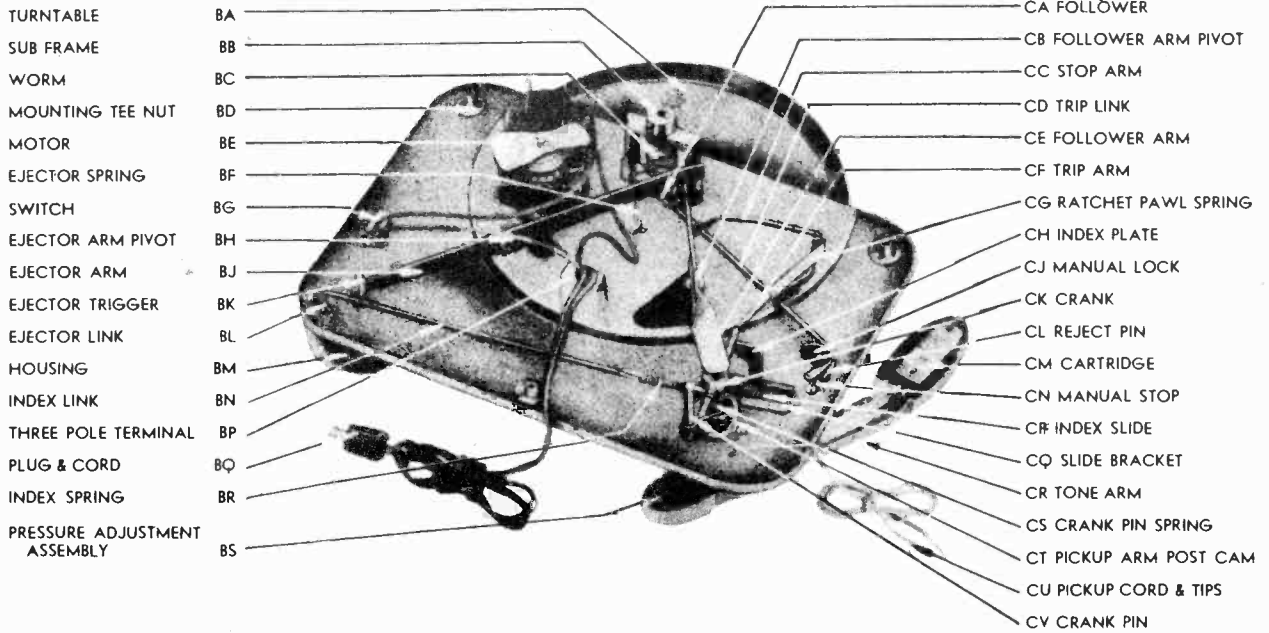
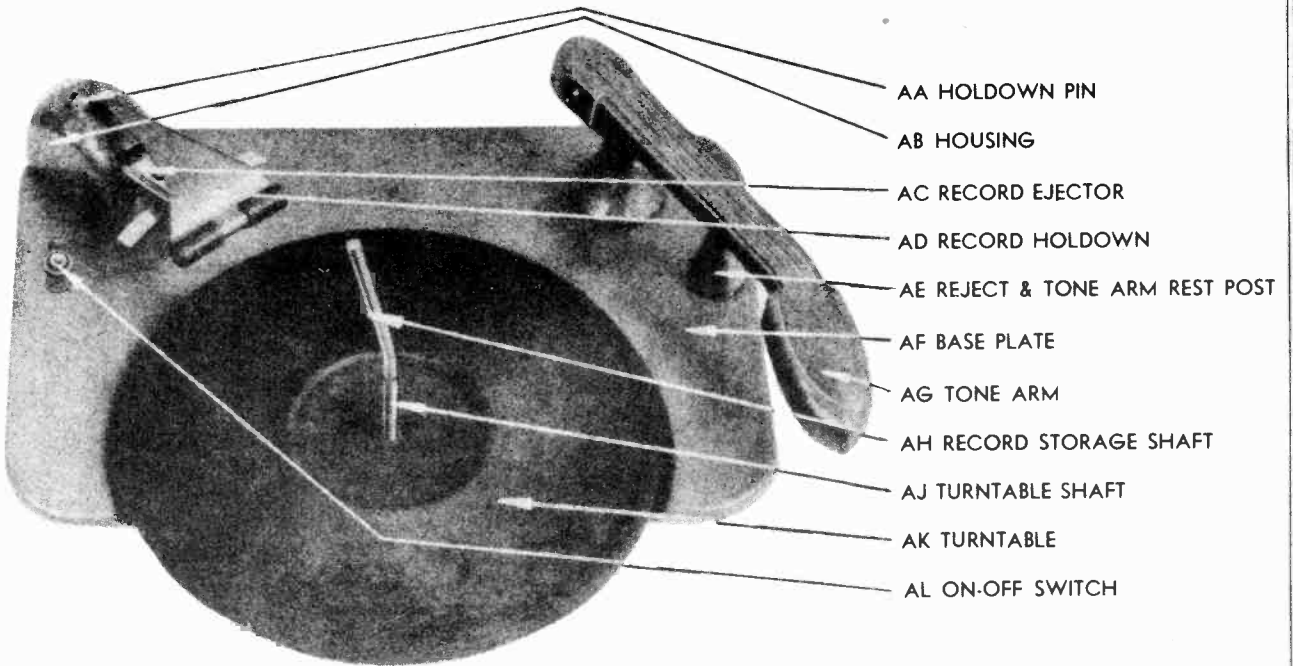


SUB FRAME AND MAIN CAM-GEAR ASSEMBLY

- DJ CAM EXTENSION R-19
- DK CAM EXTENSION SPRING R-20
- DL FELT OIL WICK R-119
- DM LATCH ADJUSTING SCREW R-15
- DN PAWL LATCH R-11
- DP LATCH SPRING R-16
- DPA CAM GROOVE
- DPB CAM RIM
- DQ MAIN CAM GEAR R-7

MODELS 300 Series, 301

NEW PRODUCTS CORP.



NEW PRODUCTS CORP.

LUBRICATION

When follower CA engages in worm BC, lever CE is pivoted at CB lifting crank CK which raises tone arm AC. Crank CK is fastened to the lift pin. As this rises and strikes the incline at the upper end of the pickup arm post cam CT, it causes a rotation of the crank CK which in turn swings tone arm AC inward until it strikes index plate CH.

The set down position for 10" or 12" records is automatically controlled when the ejector AC is positioned so that the edge of the 10" or 12" records rest on the support bracket.

The record ejector AC can be set in the 10" or 12" position by merely slightly lifting it and pulling or pushing it in or out until the 10" or 12" numbers show at the edge of the opening in the housing.

ADJUSTMENTS

To adjust the set down position of the tone arm, trip the reject button, turn the turntable AK by hand until the crank CK strikes the index plate CH, loosen slightly the clamp screw, move the tone arm over until it is directly above the first groove in a record of the size indicated on the ejector slide AC. Then retighten the clamp screw, and carry the mechanism through the remainder of the cycle.

REPLACING MOTOR

Remove idler wheel and the three motor mounting screws. Be sure to save metal bushing spacers, which slip inside of rubber grommets. These prevent rubber from being squeezed out of shape which would prevent proper cushioning of motor. Place motor of proper rating in same position as present motor and replace spacers, washers and screws as before.

Index letters are alphabetically arranged to facilitate rapid locating of parts. Prefix letters are in illustration as follows: A in photo of top of record changer, B & C in photo of the bottom.

The capacity of the instrument is ten 12" or twelve 10" records.

To load, turn the center spindle so that the bent portion points towards the front of the instrument. Then slip a selected stack of records onto the spindle, turn the spindle to point to the rear, and allow the pack of records to rest on the notch in the spindle and also on the ejector.

To start the instrument, turn on the switch AL, which will rotate the turntable. Then press down on the tone arm momentarily and release at once. This depresses the reject button on top of the tone arm rest post AE, and starts the cycle, which will automatically repeat until the entire stack of records has been played.

To change records anytime while the record is playing, merely press down on the reject button on top of the tone arm rest post.

To play records one by one, remove center spindle by lifting straight up. Then turn the button on top of the tone arm rest post to the right. This locks the cycling mechanism during manual operation. To return to automatic operation, merely turn the button to the left (counter clockwise) approximately one-quarter turn.

DESCRIPTION OF CYCLE

To start the cycle on models with a switch on the base plate or on the radio control panel, turn on the switch and press down on the tone arm AC. This depresses the reject button on top of the rest post AE, which in turn through link CD engages the follower CA, starting the cycle.

No lubrication should be necessary. However, in case of squeaks or stiffness of operation a drop of any good light machine oil on each of the bearings on the spindle worm and at other pivot points should be applied. Also, a light application of grease to the worm itself might help.

MANUAL OPERATION APPLIES TO ONLY THOSE MACHINES EQUIPPED WITH THIS FEATURE AND INDICATED BY COLORED ARROW ON TOP OF REJECT BUTTON.

MODEL 300
REPLACEMENT PARTS LIST

PART NO.	PART NAME	PRICE	ASSEMBLY NO.	ASSEMBLY NAME	PRICE
R-48	Fibre Thrust Washer	\$.02			
R-62	Slide Spring	.08	R-738	Trigger Assembly	\$.60
R-84	Rivet	.02	R-739	Ejector Assembly	1.50
R-127	Motor Cord Clamp	.02	R-741	Sub Frame Assembly	5.00
R-195	Index Link Spring	.06		R-677, R-680, R-689, R-724	
R-589	Pickup Wire Clip	.04		R-707, R-742 (704, 679)	
R-631	No. 8 Self Topping Screw	.04			
R-667	Follower Arm	.30			
R-669	Ejector Arm	.20			
R-681	Pickup Post	1.00	R-743	Storage Shaft	2.00
R-683	Follower	.60	R-744	Trip Assembly	.90
R-685	Follower Arm Spr.	.10			
R-686	Crank Spring	.10			
R-688	Ejector Spring	.10	R-745	Reject Post	1.40
R-694	Index Link	.20		R-682, R-607, R-696, R-717	
R-697	Trigger Pin	.08	R-748	Shaft Clamp & Pin Assembly	.60
R-705	Shoulder Rivet	.08		R-700, R-668, R-711, R-712	
R-706	Lock Ring	.02			
R-709	No. 6 Type Z Screw	.02	R-749	Crank Assembly	1.00
R-710	No. 8 Lock Wash. External	.02		R-678, R-691, R-699, R-728	
R-711	10/32" x 1/4" Bolt	.02			
R-712	10/32" Nut	.02	R-754	Lightweight Pickup & R-751	2.00
R-713	Type Z Screw	.02		R-751, (647 & 560) R-611B,	
R-555	Crystal P. U. Cord	1.20		R-746, (674, 688) R-167, R-168	
R-560	Crystal P. U. Cord	1.20		R-189) R-701, R-713, R-352	
R-647	Type NI-5 Cartridges	6.80			
R-648	L-40 Cartridges	6.80	R-760	Housing Assembly	4.80
R-649	99-182-Type Cartridges	6.80		R-684, R-739, (670, 672)	
R-642	60 cy. Pulley & set screw	.40		R-695, R-738, (671, 697)	
R-640	Motor, Pulley, and Screw	\$.80		R-703, R-726, R-737, R-768	

PRICES SUBJECT TO CHANGE
WITHOUT NOTICE

MODELS 320, 321, 323

NEW PRODUCTS CORP.

R-205 RATCHET PAWL EA

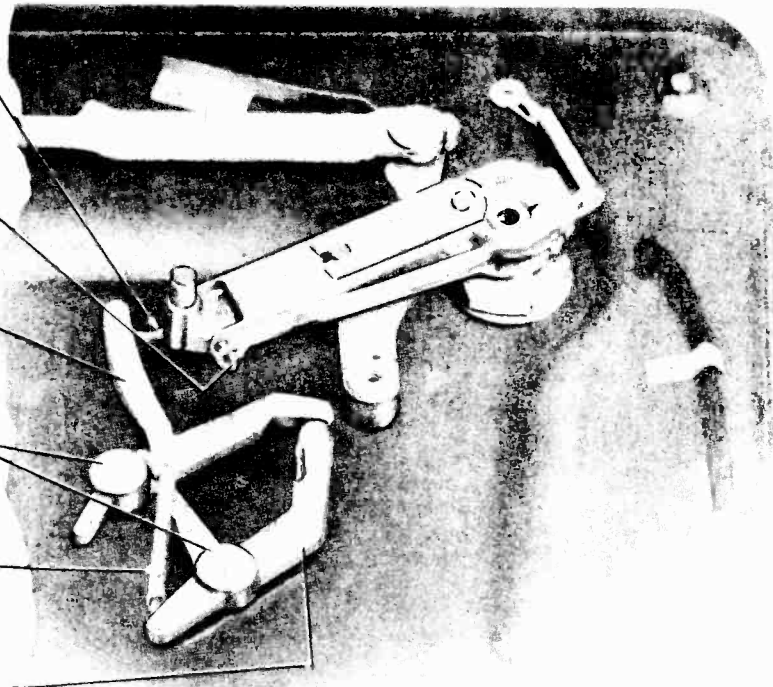
R-207 RATCHET PAWL
SPRING EB

R-88 RATCHET LATCH EC

R-26 RIVETS ED

R-195 RATCHET SPRING EE

R-87 RATCHET TRIP EF



RATCHET TRIP MECHANISM

Figure 3

This modification consists of a ratchet mechanism that trips the mechanism for the next record. It does this regardless of the distance from the eccentric groove to the center of the record. The positive stop mechanism *220 series* is dependent for its operation upon the distance between the center of the record and the eccentric groove, and accordingly will not work with records that do not have the standard distance between eccentric groove and center.

OILING

Normally, this mechanism should require no additional lubrication. However, a drop of any good machine oil on all friction surfaces, and to the oil wicks on both ends of the motor shaft, may be applied about once a year, or more often if used extensively.

RATCHET TRIP MODELS

No. 320 This model is equipped with a ratchet mechanism that serves the purpose of tripping the machine for the next record when records occur that end in an eccentric groove too far from the center to allow the positive stop to trip.

The Pickup arm crank CB as it swings inward with the pickup arm during the playing of a record drags the Ratchet Pawl EA across the serrations in the arm of Ratchet latch EC. The Pawl EA, which pivots about its center, tends to maintain a position

pointing straight out from the end of the crank CB through the action of Ratchet Pawl Spring EB. Thus, a reversal of the direction of travel of the crank caused by the pickup arm following the eccentric groove at the end of a record, will cause the pawl EA to catch in the serrations in latch EC pivoting it about one of the rivets ED allowing the ratchet trip EF to pivot about the other Rivet ED through the spring action of Ratchet spring EE. The vertical protrusion on Ratchet Trip EF then trips the latch DN which starts the cycle for dropping the next record.

No. 221 & No. 321 Same as 220 and 320 except that the power supply for these models is 50 cycle 110V.

No. 223 & No. 323 Same as 220 and 320 except that power supply is 25 cycle 110V.

SUPPLEMENT # 1

OCTOBER 18, 1940

OAK MFG. CO.

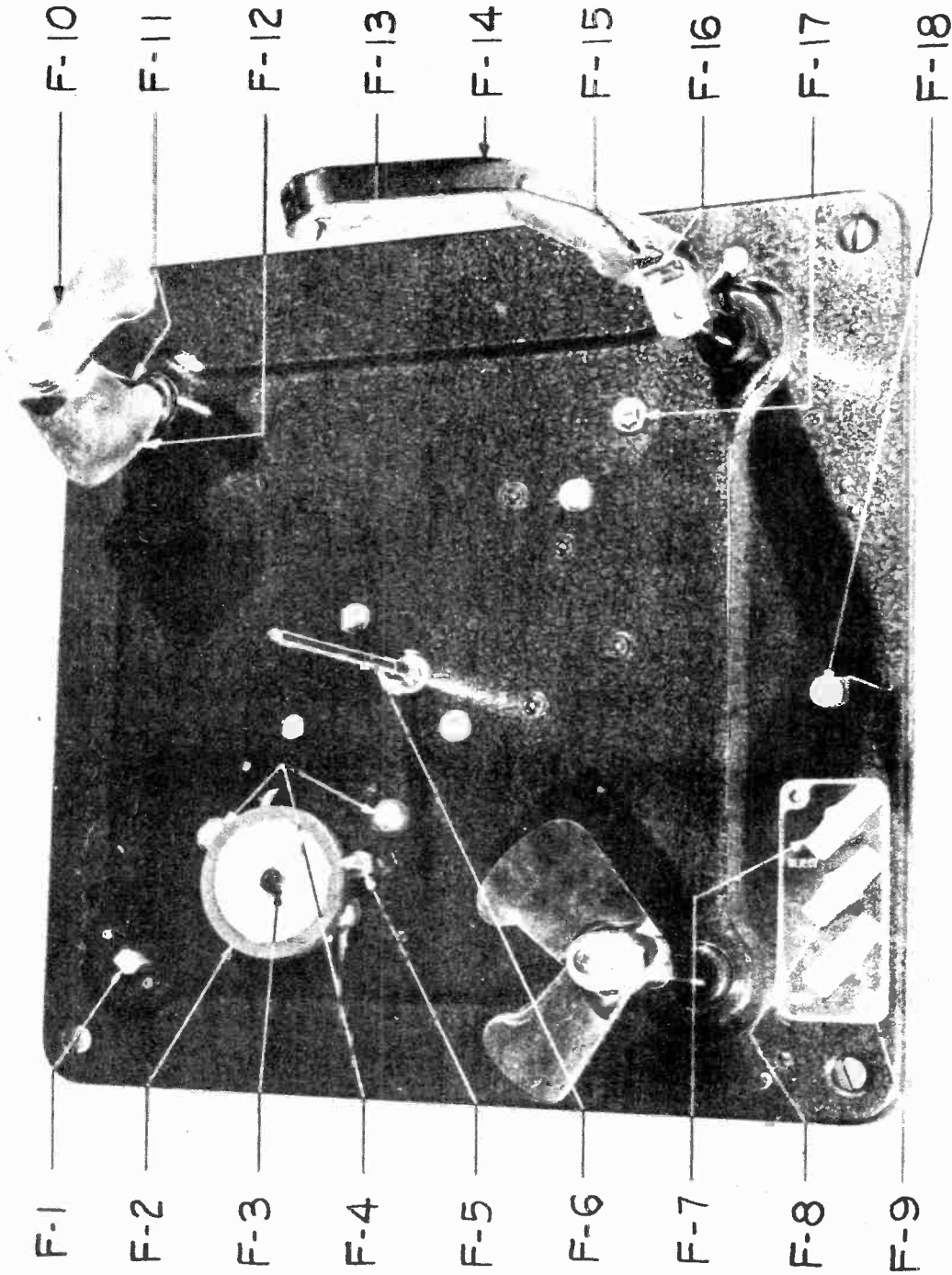


FIG-1 (TOP VIEW)

OAK MFG. CO.

SETTING FOR RECORD SIZE

This mechanism plays up to twelve 10-inch or ten 12-inch records at one set-up. All records must be of the same size for each set-up. To set for record size, it is necessary to move the 10-12 button so that it will indicate correct size record, and the Auto-Manual button to indicate Automatic....See illustration.

LOADING

See that both lower shelf plates are turned toward center of turntable. If they are not, grasp the post just below the shelf plate and rotate post until it falls into proper position with both shelf plates correctly turned toward center of turntable. Place the stack of records over center pin so they will rest on the two shelf plates.

TO TURN THE PHONOGRAPH ON

Turn the radio On-Off switch knob to the "On" position...

tration. A click will be heard and the dial will light. Wait 30 seconds for the tubes to heat.

Turn the Phonograph-Radio knob to the Phonograph (P) position.

Push the Motor Switch to the "On" position. Motor will then start.

Push the button marked "Reject". This will release the first record and start the record changing mechanism.

REJECTING A RECORD

Push the button marked "Reject." This can be done any time after the needle has come in contact with the record. The mechanism will immediately start the change cycle.

TO TURN THE PHONOGRAPH OFF

Push Motor Switch to "Off" position.

Lift pickup arm; place it on the pickup rest.

ALWAYS BE SURE TO TURN OFF WHILE NEEDLE IS RESTING UPON A RECORD, OTHERWISE PICKUP CANNOT BE RETURNED TO ITS REST DUE TO UNIT BEING IN A CHANGE CYCLE.

Turn the radio "On-Off" switch knob to the "Off" position.

REMOVING PLAYED RECORDS

First switch off motor. Then take hold of both posts, just below the shelf plates, lift and turn them out of the way. Place pickup in position on arm rest. Lift the played records from the turntable. Taking hold of posts as before, move plates until post again falls into playing position. The changer may then be loaded with a new stack of records. See directions on previous page for loading.

OAK MFG. CO.

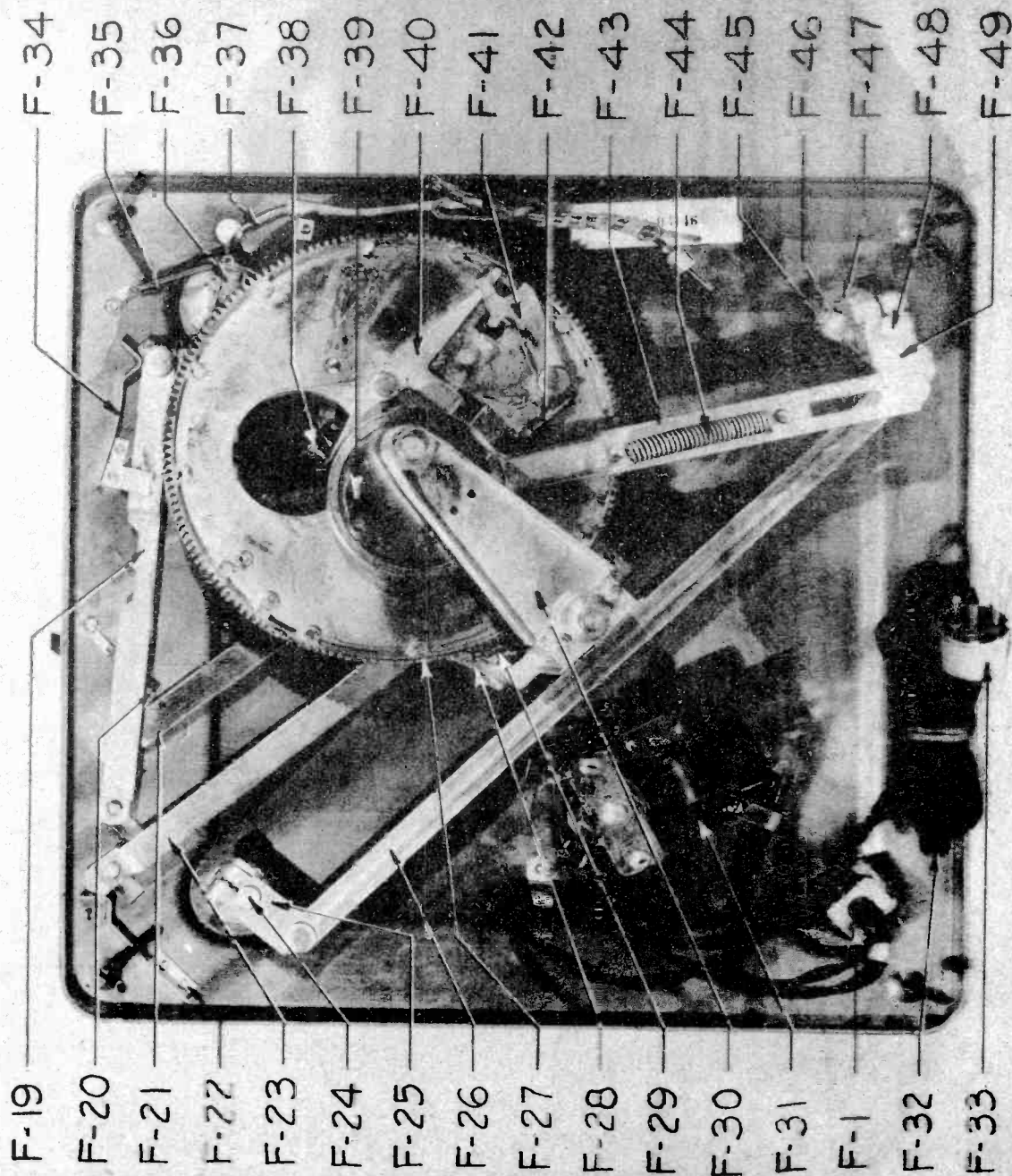


FIG-2 (BOTTOM VIEW OF MECHANISM)

OAK MFG. CO.

tone arm - automatic operation

CAUTION: To avoid damage to the mechanism, the Tone Arm should not be handled while the Auto-Manual button is in the "Automatic" position. If it is desired to remove the Tone Arm from a record, push this button to the "Manual" position. To return the pickup arm to its "Rest" position from Automatic operation, follow the instructions under "To Turn the Phonograph Off."

IF CHANGER IS LEFT RUNNING

No damage will be done if you forget to turn off Changer after it has played its entire load of records. It will simply repeat the last record until stopped or reloaded.

MANUAL OPERATION

To play records one at a time as in an ordinary phonograph:
(1) Remove any records remaining on the turntable.
(2) Leave plates turned outward as for removing played records.
DO NOT turn them back toward center of turntable.

Push Auto-Manual button to "Manual" position. Then place a record on turntable, switch on motor, and lift pickup into position.

tone and volume control

The volume and tone controls are used in the same manner for phonograph reproduction as they are for radio reception.

THIS PHONOGRAPH IS EQUIPPED WITH A PERMANENT POINT NEEDLE

This phonograph is equipped with a permanent point needle good for 2,000 record plays. Tighten the needle screw with a Phillips Head screwdriver every 500 plays.

CAUTION: Never change the position of the needle. If it should become bent or broken, remove the old needle by first loosening the needle screw. If a flat is provided on the shank of the new needle, place the needle all the way in with the flat portion of the shank facing the needle screw.

OILING

Normally, this mechanism should require no additional lubrication. However, a drop of any good machine oil on all friction surfaces, and to the oil wicks on both ends of the motor shaft, may be applied about once a year, or more often if used extensively.

OAK MFG. CO.

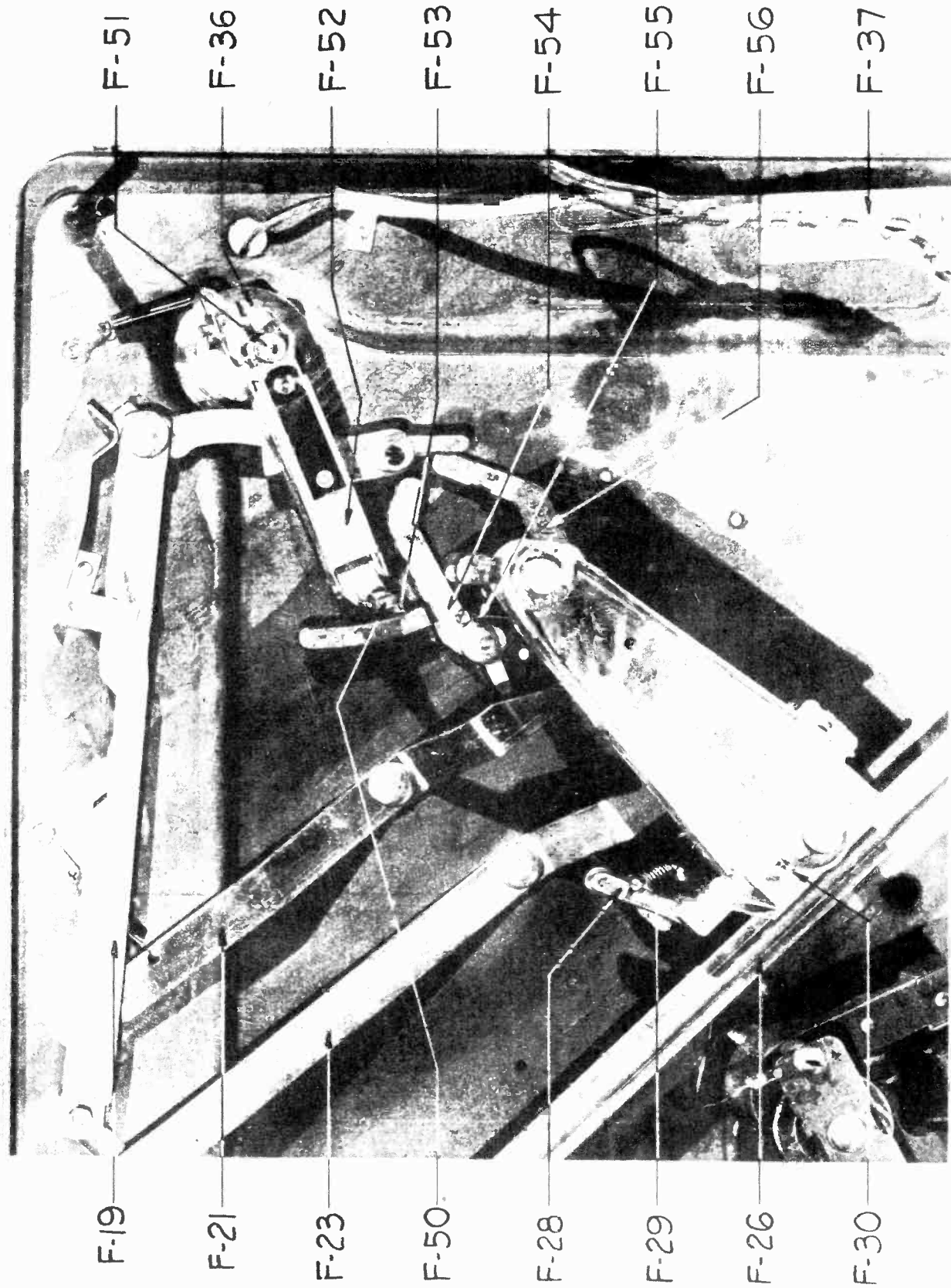


FIG-3

OAK MFG. CO.

RECORD CHANGER SERVICE INSTRUCTIONS

GENERAL

Figure reference or F numbers are numbered in order from Figure 1, except where a part has been numbered in a previous figure. Each part carries the same reference number through all the figures.

Figure 1 is an angle top view of the record changer with the turntable removed and the tone arm raised. This view shows all the parts above the base.

Figure 2 is an angle bottom view of the record changer, with the mechanism about three fourths of the way through a change cycle.

Figure 3 is an angle section bottom view of the record changer with the large gear removed, showing the trip mechanism, including the ratchet trip in detail.

Figure 4 is a top view of the large gear and sub frame, including the turntable shaft. This assembly is shown in the neutral position which is the actual position except during a changing cycle. In the neutral position, the gears are not in mesh.

OILING

All the main moving parts of this record changer have oilless type bearings which have sufficient lubrication for an average lifetime. A few drops of high grade machine oil on the main shaft bearings, idler wheel bearing, and motor bearings at long intervals however, will do no harm, but this is not necessary. (Notes from operating instructions if desired).

DESCRIPTION OF CHANGE CYCLE

Pushing reject button F-7 moves pawl latch F-40 through reject link F-21 and releases starting pawl F-41 which is moved by starting pawl spring F-42. The starting pawl F-41 engages with lugs on pinion F-58 and rotates the large gear for approximately one revolution until the stop lever F-28 rolls into the stop depression of the large gear. This entire movement is one complete turn of the large gear and is one complete change cycle of the record changer. When the large gear turns, the eccentric F-39 pushes the eccentric arm F-43 through the eccentric arm spring F-44. This moves the driving crank F-49 and turns the blades F-10 and F-12. The other set of blades are turned simultaneously through driving crank F-47, tie bar F-26, and driving crank F-25.

PICKUP ARM

The lateral movement of the pickup arm is controlled during a change cycle by the pickup crank roller F-50 on the pickup crank F-36, following the cam groove F-57 in the large gear. (See Figure 4).

The vertical movement of the pickup arm during a change cycle is controlled by the pickup lift pin F-51 riding on the cam rim F-62 on top of the large gear.

On records which do not have a starting groove, the needle is pushed into the first groove by pickup crank spring F-36. The tension of this spring may be adjusted by bending the lug to which it is attached on the base.

POSITION TRIP

When the needle travels to within 1-3/4 inches from the center post, the pickup crank F-36 moves the position trip screw F-38 which is fastened to the pawl latch F-40, and releases the starting pawl F-41.

OSCILLATING TRIP

When the needle travels into an eccentric groove on the inside of a record, the ratchet pawl F-53 on the pickup crank F-36 moves the ratchet latch F-54, and releases the ratchet trip F-56 which is moved by the ratchet spring F-55. The ratchet trip F-56 moves the pawl latch F-40 which releases the starting pawl F-41.

The ratchet pawl F-53 has a spring F-52 which tends to hold the ratchet pawl F-53 straight out from the end of the pickup crank F-36.

ADJUSTMENTS

NEEDLE DROP POINT

With the 10⁰-12⁰ button in the 10⁰ position, the needle should contact the record 4-5/8 inches from the turntable shaft or about 3/16 inch from the edge of the record. This dropping point is adjusted by the adjustment screw F-17 on top of the record changer. (See Figure 1) Turning this screw clockwise causes the needle to drop farther from the turntable shaft, while turning this screw counter clockwise causes the needle to drop nearer the turntable shaft. Turn screw only a fraction of a turn at one time, as about one-fourth turn of this adjustment screw changes the drop point of the needle almost one-fourth of an inch. The overall range of this adjustment is secured in one turn of the adjustment screw.

PICKUP ARM LIFT

The lift of the pickup arm is adjusted by the adjustment nut F-15 underneath the pickup arm. The top of the pickup arm F-14 should rise to within about one-fourth inch from the under side of the lower blade. To lower the raise of the pickup arm, turn the nut clockwise, while to raise, turn the nut counter clockwise.

POSITION TRIP

The position trip is adjusted by turning the position trip screw F-38. The trip should operate when the needle is moved to 1-3/4 inches from the center post. To trip earlier or farther from the center post, turn the screw clockwise, while to trip later or nearer the center post, turn the screw counter clockwise.

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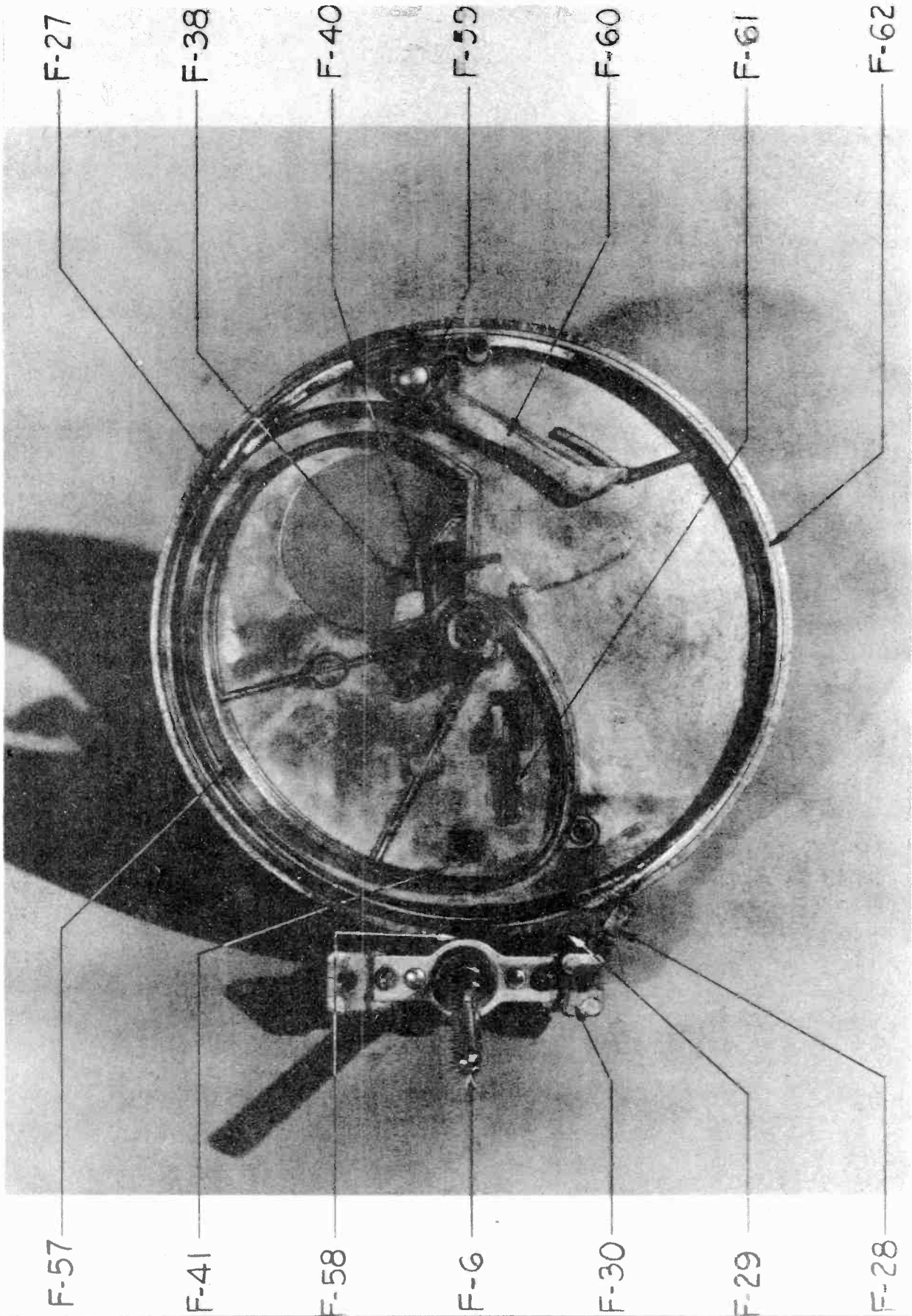


FIG-4

OAK MFG. CO.

ELECTRICAL CHARACTERISTICS

Speed, no load on turntable, 81 R. P. M. (Max.)

Speed, needle in outside groove of 12 inch record, 76.6 R.P.M. (Min.)

The above are the maximum and minimum speeds of the turntable. The number of records on the turntable makes practically no difference in the revolutions per minute.

The following table lists the output level from the outside groove (1000 cycles) of an Audiotone 78-1 record or Webster PE 50, using an average length of pickup cord (200 mmf.) terminated in a 500,000 ohm load.

Zero Level = 1.0 Volts

CARTRIDGE	NEEDLE	PRESSURE OZ.	OUTPUT DB.	1000 Cycles
				Signal Level Table Rumble
Webster N1, N1-5	Steel	1.5	-7.5	20 db. min.
	AJ1	1.5	-9.0	" " "
	Floating Point	1.5	-9.5	" " "
	Pfanstiel	1.5	-10.0	" " "
Webster N1-7, N1-8	Steel	1.5	-4.5	20 db. min.
	AJ1	1.5	-6.5	" " "
	Floating Point	1.5	-7.0	" " "
	Pfanstiel	1.5	-7.5	" " "
Astatic LP-6	Sapphire	1.25	-1.5	20 db. min.
Astatic L-26	Steel	2.75	+1.5	20 db. min.
	AJ1	2.75	-4.0	" " "
	Floating Point	2.75	-6.5	" " "
	Pfanstiel	2.75	-6.0	" " "
Astatic L-40	Steel	1.5	-4.5	20 db. min.
	AJ1	1.5	-7.0	" " "
	Floating Point	1.5	-8.0	" " "
	Pfanstiel	1.5	-8.5	" " "
Shure 99-182S	Steel	1.5	+1.5	20 db. min.
	AJ1	1.5	-2.0	" " "
	Floating Point	1.5	-2.5	" " "
	Pfanstiel	1.5	-3.0	" " "

OAK CO. MFG. CO.

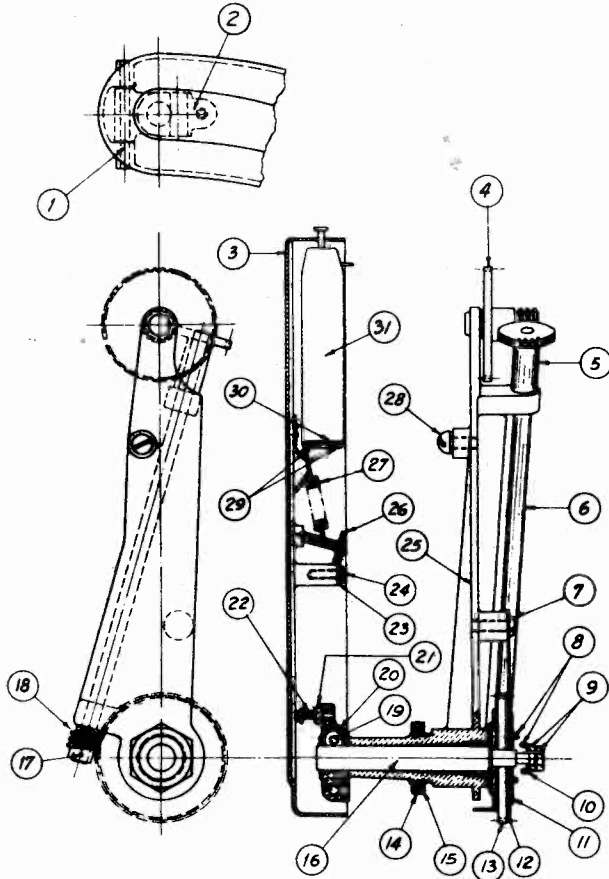
PART NO.	FIGURE REFERENCE NO.	DESCRIPTION		
3231	F-1	Power Switch		F-1 On-Off Switch
4234	F-2	Idler Wheel		F-2 Idler Wheel
4318	F-3	Spring Clip		F-3 Spring Clip
4324		Idler Tension Spring		F-4 Motor Mounting Grommets
4325		Idler Plate Retainer	FIGURE 1	F-5 Motor Pulley
4326		Idler Plate and Stud	(LEFT SIDE)	F-6 Turntable Shaft
4322		Idler Plate Lock Nut		F-7 Reject Button
4317		Idler Thrust Washer		F-8 10"-12" Button
4233	F-4	Motor Mounting Grommet		F-9 Automatic-Manual Button
4329		Motor Mounting Screw		F-10 Upper Blade
4341		Motor Mounting Sleeve		F-11 Changer Post
4225		Motor Mounting Washer	(RIGHT SIDE)	F-12 Lower Blade
4323		Motor Mounting Nut		F-13 Pickup Cartridge
4320	F-5	Motor Pulley		F-14 Pickup Arm
4321		Motor Pulley Set Screw		F-15 Adjustment Nut
4243	F-6	Turntable Shaft		F-16 Pickup Arm Spring
4319		Turntable		F-17 Needle Drop Adjustment
4260	F-7	Reject Button		F-18 Pickup Rest
4260	F-8	10"-12" Button		F-19 Index Link
4250	F-9	Auto-Manual Button		F-20 Reject Return Spring
4202	F-11	Changer Post		F-21 Reject Link
4203		Changer Post Washer	FIGURE 2	F-22 Control Spring
4423		Upper and Lower	(LEFT SIDE)	F-23 Manual Link
4242-1	F-13	Shelf Blade Assembly		F-24 Short Changer Shaft
4242-5	F-13	Pickup Cartridge		F-25 Driving Crank
4440		Pickup Cartridge		F-26 Tie Bar
4245	F-15	Pickup Arm Assembly		F-27 Large Gear
4214		Pickup Lift Adjusting Screw		F-28 Cam Stop Lever
		Pickup Lift Adjusting Spring		F-29 Cam Stop Spring
4307	F-16	Pickup Arm Spring		F-30 Sub Frame
4282	F-17	Index Bushing Stud		F-31 Motor
4259		Index Bushing		F-1 On-Off Switch
4294		Spring Washer		F-32 Motor Cord
4273		Adjustment Lock Nut		F-33 Motor Plug
4257		Indexing Plate		F-34 Control Spring
4292		Rubber Pickup Rest Bumper		F-35 Pickup Crank Spring
4258	F-19	Index Link		F-36 Pickup Crank
4262	F-20	Reject Return Spring		F-37 Pickup Shielded Lead
4261	F-21	Reject Link		F-38 Position Trip Screw
4407	F-22	Control Spring		F-39 Eccentric
4263	F-23	Manual Link	(RIGHT SIDE)	F-40 Pawl Latch
4232	F-24	Short Changer Blade Shaft		F-41 Starting Pawl
4434		Tie Bar Assembly		F-42 Starting Pawl Spring
4436		Large Gear Assembly		F-43 Eccentric Arm
4254	F-28	Cam Stop Lever		F-44 Eccentric Arm Spring
4250	F-29	Cam Stop Spring		F-45 Post Washer
4249		Cam Stop Pin		F-46 Post Nut
4255		Cam Stop Roller		F-47 Driving Crank
4256		Cam Stop Roller Pin		F-48 Long Changer Shaft
4439		Sub Frame Assembly		F-49 Driving Crank
4316	F-31	Motor		F-19 Index Link
4410	F-32	Line Cord and Plug		F-21 Reject Link
4414	F-32	Line Cord and Plug		F-23 Manual Link
4416	F-32	Line Cord and Plug	FIGURE 3	F-23 Manual Link
4407	F-34	Control Spring	(LEFT SIDE)	F-50 Pickup Crank Pin
4286	F-35	Pickup Crank Spring		F-28 Cam Stop Lever
4437		Pickup Crank Assembly		F-29 Cam Stop Spring
4408	F-37	Pickup Cord		F-26 Tie Bar
4413	F-37	Pickup Cord		F-30 Sub Frame
4415	F-37	Pickup Cord		F-51 Lift Pin
4290-10	F-38	Position Trip Screw		F-36 Pickup Crank
4211	F-40	Pawl Latch		F-52 Ratchet Pawl Spring
4208	F-41	Starting Pawl		F-53 Ratchet Pawl
4210	F-42	Starting Pawl Spring	(RIGHT SIDE)	F-54 Ratchet Latch
4438		Eccentric Arm Assembly		F-55 Ratchet Spring
4203	F-45	Post Washer		F-56 Ratchet Trip
4204	F-46	Post Nut		F-37 Pickup Shielded Lead
4229	F-48	Long Changer Shaft		F-57 Cam Groove
4267	F-50	Pickup Crank Roller		F-41 Starting Pawl
4268		Pickup Crank Roller Pin		F-58 Pinion
4281	F-51	Pickup Lift Pin	FIGURE 4	F-6 Turntable Shaft
4311	F-52	Ratchet Pawl Spring	(LEFT SIDE)	F-30 Sub Frame
4309	F-53	Ratchet Pawl		F-29 Cam Stop Spring
4310		Ratchet Pawl Pivot Pin		F-28 Cam Stop Lever
4288	F-54	Ratchet Latch		F-28 Cam Stop Lever
4339	F-55	Ratchet Spring		
4287	F-56	Ratchet Trip		
4246	F-58	Pinion		
4220	F-59	Cam Extension Spring		
4219	F-60	Cam Extension	(RIGHT SIDE)	
4216	F-61	Pawl Latch Spring		
4239		Turntable Bearing		
4241		Bearing Support (lower)		
4435		Upper Bearing Assembly	F-27	Large Gear
4279		Change Shaft Cap (Temite)	F-38	Position Trip Screw
4215-37		Change Shaft Cap Screw (Chrome)	F-40	Pawl Latch
4424		Needle Set Screw	F-59	Cam Extension Spring
4441		Index Link Assembly	F-60	Cam Extension
			F-61	Pawl Latch Spring
			F-62	Cam Rim

MODEL HR-1

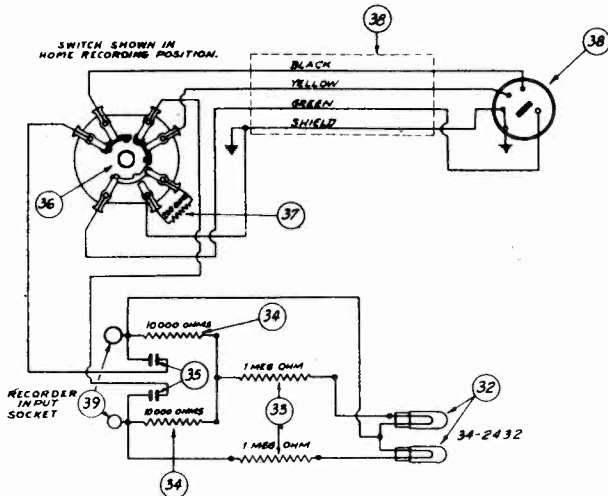
PHILCO RADIO & TELEV. CORP.

Model HR-1 Home Recording Unit is designed for use on Philco Record Changers equipped for home recording. The instructions for installing the unit on these changers are supplied with each unit. The information listed in this bulletin covers the replacement parts and procedure for making better home recordings.

REPLACEMENT PARTS
Model HR-1 — Recorder Assembly



PART LOCATIONS — HR-1 UNIT



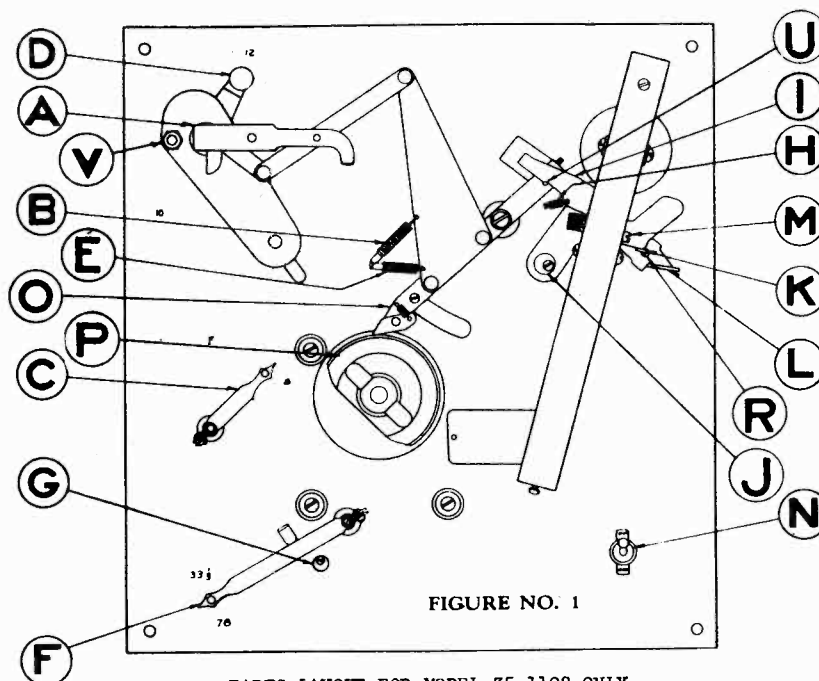
HR-1 CONTROL SCHEMATIC DIAGRAM
DECEMBER, 1940

SCH. No.	DESCRIPTION	PART No.
1	Cutting Arm Hinge Pin	35-2246
	Spring Washer	35-2247
2	Cutting Arm Hinge	35-2248
3	Cutting Arm (less crystal)	35-2359
4	Worm and Vertical Shaft Gear Assembly	35-2242
5	Gear Shaft Spacer	35-2250
6	Shaft and Helix Gear Assembly	35-2244
7	Screw	W-91
8	Friction Clutch Spring	35-2235
9	Nut	W-617
10	Washer	
11	Stationary Friction Plate	35-2240
12	Friction Washer (large)	35-2239
	Friction Washer (small)	35-2238
13	Recorder Arm Post Gear	35-2237
14	Recorder Base Nut	35-2465
15	Recorder Base Washer	35-2466
16	Shaft and Friction Plate Assembly	35-2245
17	Gear Shaft Drive Pin	35-2236
18	Gear Shaft Worm	35-2243
19	Screw	W-147
20	Swivel Head Clamp Sleeve	35-2252
21	Nut	W-661
22	Screw	W-2158
23	Adjusting Screw Support	35-2253
24	Self Tapping Screw	97-0070
25	Recorder Base and Bush Assembly	35-2234
26	Adjusting Screw	35-2241
27	Cartridge Spring	35-2388
28	Screw	W-412
29	Screw	W-2222
30	Male Pivot	35-2249
31	Crystal	35-2232
32	Recording Lamps	34-2432
33	Resistors (1 megohm)	33-510339
34	Resistor (10,000 ohms, 2 watts)	33-310539
35	Condensers (.1 mfd., 400 volts)	30-4455
36	Switch	76-1141
37	Resistor (200 ohms)	33-120439
38	Cable and Plug	41-3589
39	Socket (two prong)	27-6154
	Clamp	56-1956

MISCELLANEOUS

Cutting Needle (Package of 5 Needles)	45-2824
Escutcheon (control)	R-2578
Screws	W-2054FA9
Grommet (cable)	2675
Insulator (lamps)	27-9760
Complete Drive Assembly (less Tone Arm & Crystal)	35-2254
Arm Rest	35-3052
Microphone	35-4077
Pick-up Cable and Plug Assembly	41-3565

PHILCO RADIO & TELEV. CORP. MODELS HR-1, 35-1108



PARTS LAYOUT FOR MODEL 35-1108 ONLY

MAKING BETTER HOME RECORDINGS

When making home recordings, it is essential that the speed at which the record is cut, be kept at or near 78 RPM. The load imposed on the motor when cutting a record is much greater than when playing back the recording and, when the difference in speed between recording and playing is in excess of four RPM, it becomes quite objectionable. Increased satisfaction with home recordings will result when the following conditions are observed and adjustments are made for the most suitable operation.

1—Allow the phonograph motor to become thoroughly warmed up before attempting to make a home recording. Play six records or more so that the grease in the gears becomes thoroughly loosened.

2—The fiber gear on the home recording gear train that engages the spindle should mesh loosely with the spindle gear in order to avoid binding. It may be necessary to enlarge the mounting hole in the record changer base in order to obtain this condition.

3—The cutting arm height adjusting screw should be set so that the cutting arm is just $\frac{1}{4}$ " above the record. Put the cutting needle in the crystal and place it on the record near the spindle. Check the cutting arm height— $\frac{1}{4}$ " above the record.

4—The needle pressure is very critical. Philco Scale, Part No. 45-2851, should be used, so that needle pressure can be adjusted accurately to $1\frac{1}{4}$ ounces with the cutting needle placed near the spindle. The needle pressure must be checked just as the needle is raised from the record.

5—The crystal "low level" stop should be adjusted, if necessary, to obtain $\frac{1}{2}$ " of free movement of the crystal in the cutting arm. With the needle resting on a record, raise the cutting arm slowly. There should be from $\frac{3}{16}$ " to $\frac{1}{4}$ " of motion of the cutting arm before the cutting needle lifts from the record. This will allow a free vertical movement of the crystal, compensating for any slight wobble in the turntable or record.

6—At the first sign of fuzzy or poor tone when making home recordings, change the cutting needle, replacing it with a new Philco cutting needle. A cutting needle should make between ten and twenty good clear recordings before it becomes necessary to replace it.

Two types of needles have been furnished in the past. The first recording needle was of the type normally known as a plow type needle. The cutting face of this needle is curved so that it actually digs into the surface of the record. This type has been replaced very readily from the plow type because the cutting face of the needle is flat and is parallel to the axis of the needle. The plow type needle can be used to make 6" home recordings satisfactorily, but it should not be used to make 10" home recordings, since it cuts too deeply into the record and will slow up the phono motor while cutting the outer edge of the record. The new flat face needle will be satisfactory when making the 10" recordings.

FOR OTHER DATA ON HR-1, SEE INDEX

MODEL 35-1108

PHILCO RADIO & TELEV. CORP.

OPERATING INSTRUCTIONS

The Model "L" Record Changer plays seven 12" or eight 10" Records automatically. The last record remains on the turntable and repeats as long as the Record Changer is in operation.

Records may be repeated as often as desired by raising the record removing arm at A Fig. 1 to the upright position.

To reject a record and play the next record below it, pull the latch lever at L Fig. 1 forward.

To adjust the record removing arm to handle 10" records set the record removing arm change lever at D Fig. 1 opposite the number 10 stamped on the base plate. For 12" records set the lever opposite the number 12.

To adjust the pickup to play 10" records, push the pickup stop at K Fig. 1 back. (Away from the pickup needle) For 12" records pull the stop forward (toward the needle) as far as it will go.

Some units are equipped with two speed motors, and others with 78 RPM motors. When the two speed motor is used change from one speed to the other by simply moving lever at F Fig. 1 to position desired.

To start motor, throw switch (supplied on some models) at N Fig. 1 on the "on" position.

MOTOR LUBRICATION

The motor installed in the Record Changer is governor controlled, with all gearing enclosed, and leaves the factory lubricated for proper operation. For maximum satisfaction, lubricate the motor at regular intervals with SAE No. 10 oil. Please do not use any other grade of oil.

The governor disc engages with a ring of hard felt. This felt is impregnated with a lubricating solution sufficient for proper operation for approximately a year under normal conditions. It may be necessary, however, if the motor shows a tendency to chatter or waiver, to apply a drop or two of oil to this felt ring.

MOTOR SPEED

The motor speed is adjusted by means of a lever at C Fig. 1 which is mounted under the turntable. The direction of swing to fast or slow is indicated by the legends F and S on the base plate.

33-1/3 RPM — 78 RPM SHIFT

(Two-speed motors only)

Move the speed change lever at F Fig. 1 as far as it will go in the direction of swing indicated by the legends 33-1/3 and 78 on the base plate.

If adjustment of the speed change lever is required for any reason, proceed as follows: First loosen the screw which clamps the lever to the motor shaft. This shaft is provided with a screw-driver slot in the end. Next, using a screw driver, turn this shaft in a clockwise direction until you feel it strike the stop. The motor is now in the 33-1/3 RPM position. Now set the lever against the lug provided in the base plate and opposite the legend 33-1/3 and tighten the clamp screw. This places the lever in the correct position on the motor shaft. The final step is the adjustment of the eccentric bushing at G Fig. 1 which limits the throw of the lever. First loosen the screw which holds the eccentric bushing. Next, throw the speed change lever to its farthest 78 RPM position, (using care that the lever does not slip on the motor shaft). Then turn the eccentric bushing around until it touches the side of the lever, and tighten it in place with the screw provided.

TRIP MECHANISM

The trip mechanism is the trigger that sets the Record Changer in motion. This is done by allowing the latch bar at O Fig. 1 to drop in front of, and be actuated by the cam at P Fig. 1. This cam is driven by the motor and is in motion as long as the motor is running. If this mechanism does not operate smoothly, the precautions outlined in succeeding paragraphs should be observed.

First of all, make sure that the square pin in the latch lever at U Fig. 1 latches properly in the notch in the lift lever at I Fig. 1. When latched, the notch should be engaged approximately one-half of its depth. The depth of engagement is adjusted by means of the eccentric washer and locking screw at J Fig. 1. Now run the Record Changer through its cycle. If the square pin fails to engage the notch in the lift lever, first check the tension of the latch spring at H Fig. 1 to insure that the notch can engage the pin. Next check the tension of the reset spring at E Fig. 1. This reset spring should not be under tension when the latch bar is latched but should have enough tension when the latch bar drops back off of the cam to cause the square pin to over travel the notch in the lift lever.

IMPORTANT — Before attempting to change the tension of any spring, be sure that the parts involved work freely without any tendency to bind, as of course any binding condition would preclude proper operation.

The Record Changer is adjusted at the factory to trip on a spiral trip groove record when the phonograph needle is 1/4" from the edge of the hole in the center of the record.

PHILCO RADIO & TELEV. CORP.

When eccentric or oscillating trip groove records are used, tripping is effected by means of the hardened steel pin in the end of tone arm lift crank at S Fig. 2 engaging the serrated block on the trip lever at T Fig. 2. There must be a minimum of $1/32$ "

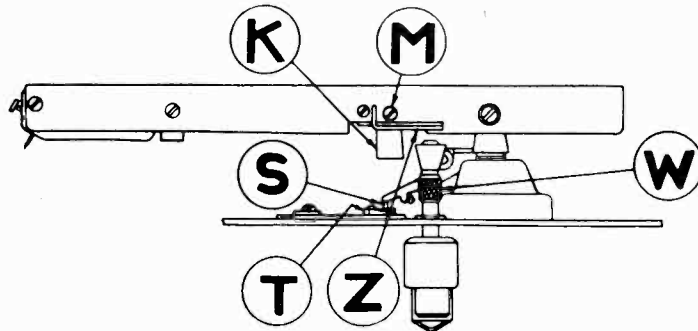


FIG. NO. 2

ing out of a worn record trip groove. Next make certain that all parts of the mechanism work freely and smoothly. If it is found that the latch bar at O Fig. 1 is not dropping in far enough to engage the cam at P Fig. 1, then check the tension of the trip spring at B Fig. 1.

play between the end of the pin and the block, when, with a short needle, ($5/8$ " Minimum Length) the pickup is resting on one record on the turntable. If the pressure of the pin on the block is not sufficient to insure operation, then check the pressure spring which is located up under the pickup.

The oval head pivot screw at R Fig. 1 serves as a pivot for the lift lever at I Fig. 1. This screw should allow the lift lever to be raised by the latch bar to its maximum height without binding but also without any additional play.

If the Record Changer fails to trip, see if the phonograph needle is jump-

RECORD REMOVING MECHANISM

The Record Changer is adjusted so that it will always leave one record on the turntable. This is done to prevent the phonograph needle from damaging the covering on the turntable.

In case the Record Removing Mechanism fails to operate smoothly, proceed as follows: First

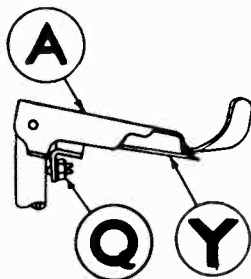


FIG. NO. 3

make certain that all parts work freely with no binding in pivots or bearings, and that the record removing arm assembly rests on the stop screw at Q Fig. 3. Next stop the motor in such a position that the latch bar at O Fig. 1 can swing by and clear the cam at P Fig. 1. Place just one record on the turntable and measure from the top of this record down to the base plate. This distance should be one inch. Now by pulling the reject lever at L Fig. 1 first, it will be found possible to swing the record removing finger at Y Fig. 3 over to where it just touches the edge of the record. If the adjustment is correct, the record removing finger should just barely rise over the edge of the first record. If adjustment is required it can be made by means of the stop screw at Q Fig. 3. In the event the record removing arm raises the record from the turntable and drops it back in place without removing it, check the lift adjustment at V Fig. 1. This adjustment consists of an eccentric stud which is provided with a lock nut, and is made by loosening the lock nut and turning the eccentric stud. The lift adjustment should be set so that the hole in the center of the record just clears turntable spindle when the Record Changer is in operation.

PICKUP LOWERING MECHANISM

The pickup lowering mechanism has two functions. First, it lowers the phonograph needle gently to the surface of the record. Second, it feeds the needle toward the center of the record so that it will enter the playing groove.

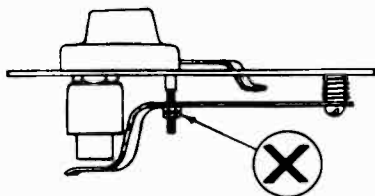


FIG. NO. 4

If the pickup descends too fast or too slow, adjust the speed of descent by turning the knurled thumb nut on the dashpot sleeve at W Fig. 2.

The unit is adjusted at the factory so that the needle will be set down approximately $3/32$ " in from the edge of the record. An adjusting screw is provided on the side of the pickup at M Fig. 2. If the needle is being lowered onto the playing surface of the record, and the adjusting screw at M Fig. 2 fails to correct the condition proceed as follows: First stop the record changer, with the pickup in the maximum raised position and check the clearance between the underside of the pickup shelf at Z Fig. 2 and the tip of the dashpot.

This clearance should be very small as otherwise the pickup will tend to bounce as it is lowered. There must be sufficient clearance however to prevent the pickup shelf from rubbing on the tip of the dash pot, or the pickup will not swing out far enough to allow the adjustable stop at K Fig. 2 to come to rest against the dashpot. Check this clearance in both 10" and 12" record positions. If adjustment is required, the height of the dashpot may be regulated by loosening the nuts on the bottom of the lift lever stud at X Fig. 4 and changing their position on the stud. To raise the dashpot turn the nuts clockwise, to lower the dashpot turn the nuts counter-clockwise. Be sure to lock the nuts tightly together after the adjustment is made.

**MODEL 35-1169 Automatic
Record Changer**
PHILCO RADIO & TELEV. CORP.

Automatic record changer Part No. 35-1169 plays eight 10" records automatically or eight 12" records manually. The last record remains on the turntable and repeats as long as the record changer is in operation either in the manual or automatic position.

OPERATION
AUTOMATIC POSITION:

To load the mechanism lift the record removing arm at (A) Fig. 1 to the upright position. To adjust the pickup to play 10" records, automatically, push the pickup stop at (K) Fig. 1 back away from the pickup. To play 12" records manually, pull the stop forward toward the needle as far as it will go. Place records on turntable. Throw switch at (N) Fig. 1 to the "On" position. Mechanism will now operate and reject each record after it has been played through. To reject a record and play the next record below it, pull the latch lever at (L) Fig. 1 forward.

MANUAL POSITION:

To operate the mechanism in the manual position, lift the record removing arm at (A) Fig. 1 to the upright position. 10 or 12" records can then be played by the position of the pickup stop at (K) Fig. 1. To play 10" records manually, push the pickup stop at (K) Fig. 1 back away from the pickup needle. For 12" records, pull the stop forward toward the needle as far as it will go.

MOTOR LUBRICATION

The motor installed in this Record Changer is governor controlled, with all gearing enclosed and leaves the factory lubricated for proper operation. For best results, lubricate the motor at regular intervals with a pure mineral oil as light as obtainable. Under no circumstances use any oil heavier than an SAE #10 nor any oil containing mixtures of animal or vegetable oils.

The governor disc engages with a felt brake. This felt is impregnated with a lubricating solution sufficient for proper operation for approximately six months under normal conditions. An oil hole is provided in the top of the governor housing for re-lubricating the brake felt.

MOTOR SPEED

The motor speed is adjusted by means of a slotted post (C) 3 Fig. 1 which is located under the turntable. To change motor speed rotate this post slightly by means of a screw driver.

TRIP MECHANISM

The trip mechanism is the trigger that sets the Record Changer in motion. This is done by allowing the latch bar at (O) Fig. 1 to drop in front of, and be actuated by the cam at (P) Fig. 1. This cam is driven by the motor and is in motion as long as the motor is running. If this mechanism does not operate smoothly, the precautions outlined in succeeding paragraphs should be observed.

First of all, make sure that the square pin in the latch lever at (U) Fig. 1 latches properly in the notch in the lift lever at (1) Fig. 1. When latched, the notch should be engaged approximately one-half of its depth. The depth of engagement is adjusted by means of the eccentric washer and locking screw at (J) Fig. 1. Now run the record changer through its cycle. If the square pin fails to engage the notch in the lift lever, first check the tension of the latch spring at (H) Fig. 1 to insure that the notch can engage the pin. Next check the tension of the reset spring at (E) Fig. 1. This reset spring should not be under tension when the latch bar is latched but should have enough tension when the latch bar drops back off of the cam to cause the square pin to over travel the notch in the lift lever.

IMPORTANT --- Before attempting to change the tension of any spring, be sure that the parts involved work freely without any tendency to bind, as of course any binding condition would preclude proper operation.

The Record Changer is adjusted at the factory to trip on a spiral trip groove record when the phonograph needle is 1-3/4" from the edge of the hole in the center of the record.

When eccentric or oscillating trip groove records are used, tripping is effected by means of the

hardened steel pin in the end of tone arm lift crank at (S) Fig. 2 engaging the serrated block on the trip lever at (T) Fig. 2. There must be a minimum of 1/32" play between the end of the pin and the block, when, with a short needle, (5/8" Minimum Length) the pickup is resting on one record on the turntable. If the pressure of the pin on the block is not sufficient to insure operation, then check the pressure spring which is located up under the pickup.

The oval head pivot screw at (R) Fig. 1 serves as a pivot for the lift lever at (1) Fig. 1. This screw should allow the lift lever to be raised by the latch bar to its maximum height without binding but also without any additional play.

If the Record Changer fails to trip, see if the phonograph needle is jumping out of a worn record trip groove. Next make certain that all parts of the mechanism work freely and smoothly. If it is found that the latch bar at (O) Fig. 1 is not dropping in far enough to engage the cam at (P) Fig. 1 then check the tension of the trip spring at (B) Fig. 1.

RECORD REMOVING MECHANISM

The record Changer is adjusted so that it will always leave one record on the turntable. This is done to prevent the phonograph needle from damaging the covering on the turntable.

In case the Record Removing Mechanism fails to operate smoothly, proceed as follows: First make certain that all parts work freely with no binding in pivots or bearings, and that the record removing arm assembly rests on the stop screw at (Q) Fig. 3. Next stop the motor in such a position that the latch bar at (O) Fig. 1 can swing by and clear the cam at (P) Fig. 1. Place just one record on the turntable and measure from the top of this record down to the base plate. This distance should be one inch. Now by pulling the reject lever at (L) Fig. 1 first, it will be found possible to swing the record removing finger at (Y) Fig. 3 over to where it just touches the edge of the record. If the adjustment is correct, the record removing finger should just barely rise over the edge of the first record. If adjustment is required it can be made by means of the stop screw at (Q) Fig. 3. In the event the record removing arm raises the record from the turntable and drops it back in place without removing it, check the lift adjustment at (V) Fig. 1. This adjustment consists of an eccentric stud which is provided with a lock nut, and is made by loosening the lock nut and turning the eccentric stud. The lift adjustment should be set so that the hole in the center of the record just clears turntable spindle when the Record Changer is in operation.

PICKUP LOWERING MECHANISM

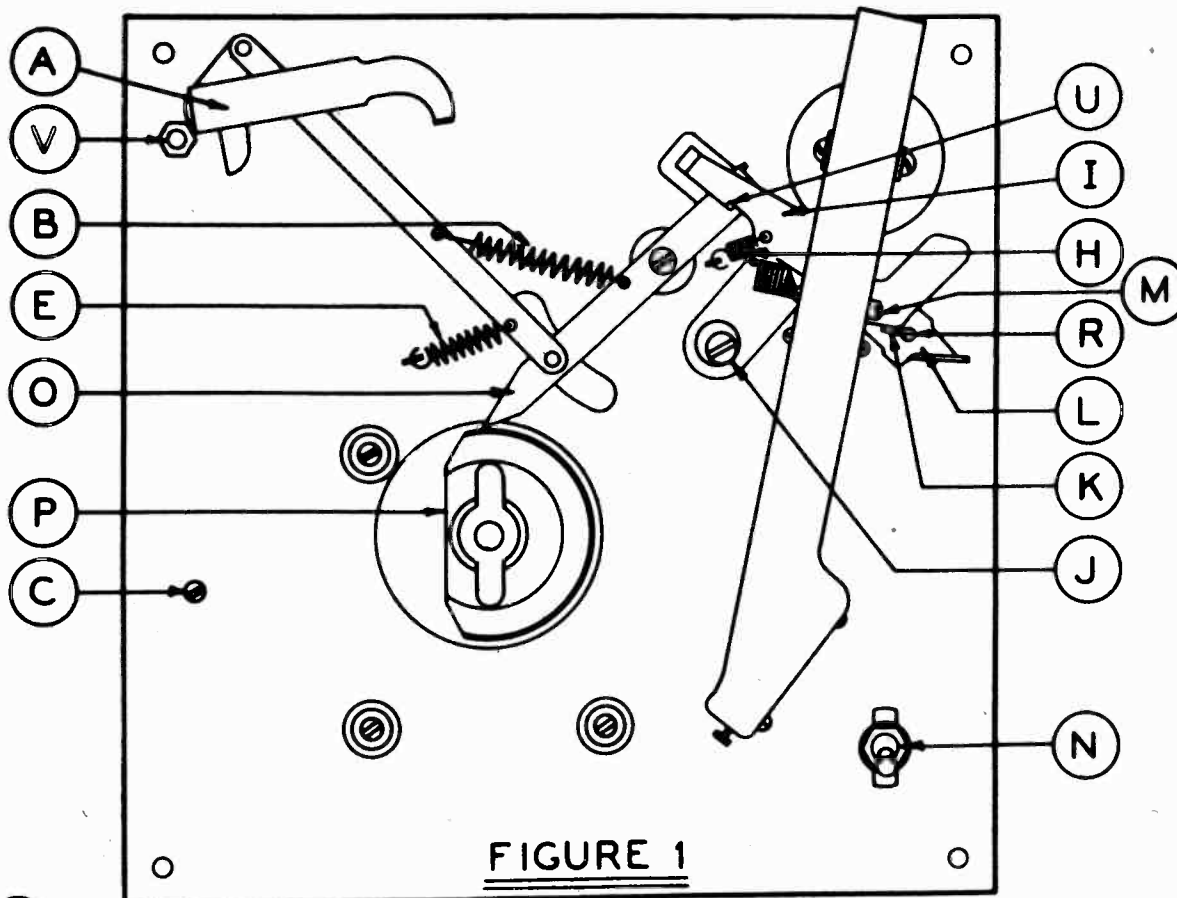
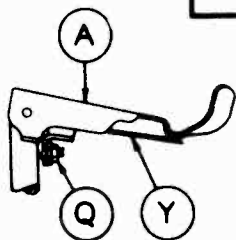
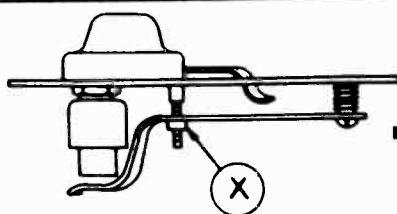
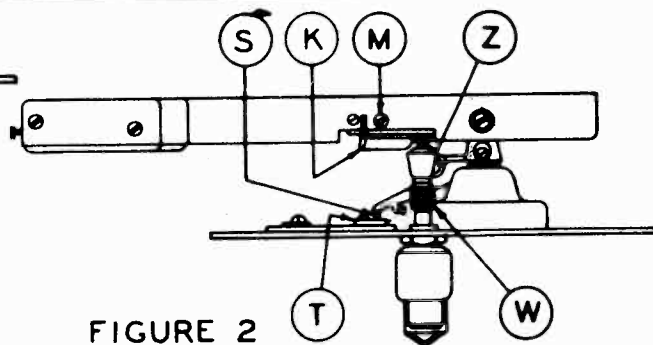
The pickup lowering mechanism has two functions. First, it lowers the phonograph needle gently to the surface of the record. Second, it feeds the needle toward the center of the record so that it will enter the playing groove.

If the pickup descends too fast or too slow, adjust the speed of descent by turning the knurled thumb nut on the dashpot sleeve at (W) Fig. 2.

The unit is adjusted at the factory so that the needle will be set down approximately 3/32" in from the edge of the record. An adjusting screw is provided on the side of the pickup at (M) Fig. 2. If the needle is being lowered onto the playing surface of the record, and the adjusting screw at (M) Fig. 2 fails to correct the condition proceed as follows: First stop the record changer, with the pickup in the maximum raised position and check the clearance between the underside of the pickup shelf at (Z) Fig. 2 and the tip of the dashpot. This clearance should be very small as otherwise the pickup will tend to bounce as it is lowered. There must be sufficient clearance however to prevent the pickup shelf from rubbing on the tip of the dash pot, or the pickup will not swing out far enough to allow the adjustable stop at (K) Fig. 2 to come to rest against the dashpot. Check this clearance in both 10" and 12" record positions. If adjustment is required, the height of the dashpot may be regulated by loosening the nuts on the bottom of the lift lever stud at (X) Fig. 4 and changing their position on the stud. To raise the dashpot turn the nuts clockwise, to lower the dashpot turn the nuts counter-clockwise. Be sure to lock the nuts tightly together after the adjustment is made.

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**FIGURE 1****FIGURE 3****FIGURE 4****FIGURE 2**

A. Record Removing Mechanism Assy. Complete

Parts of Above Assembly

- | | | |
|---------------------------------------|----|---------------------------------------|
| Record Removing Arm Assembly | L. | Reject Lever |
| Record Removing Sleeve & Link Assy. | M. | Pickup Positioning Adjusting Screw |
| Record Removing Sleeve Link Mtg. Stud | N. | Power Switch |
| Record Removing Sleeve Screw | O. | Latch Bar Assembly Complete |
| Record Removing Link Screw | | Screw (Latch Bar Mtg.) |
| Record Removing Link Spring | | Washer (Latch Bar Mtg. Screw) |
| Record Removing Finger Pin | | Stud Nut (Latch Bar & Bumper) |
| Record Removing Finger | | Stop (Latch Bar) |
| Record Removing Finger Spring | | Cam (Latch Bar Stop) |
| Record Removing Arm Adjusting Nut | P. | Record Removing Arm Adjusting Screw |
| Record Removing Arm Adjusting Screw | Q. | Nut (Record Removing Arm) |
| Record Removing Arm Pin | | Lift Lever Pivot Screw |
| (Arm to Sleeve & Link Assy.) | | Tone Arm Lift Crank |
| B. | | Trip Lever Serrated Block (Part of L) |
| Tripp Spring | R. | Pin (Part of Latch Bar (O)) |
| C. | | Record Removing Arm Adjusting Stud |
| Motor Speed Adjusting Post | S. | Dash Pot Complete |
| E. | | Dash Pot Lift Lever |
| Record Removing Link Spring | T. | Record Removing Finger |
| H. | | Pickup Lift Shelf |
| Latch Spring | U. | |
| I. | | Dash Pot |
| Lift Lever Assembly | V. | Nut (Dash Pot) |
| Lift Spring | W. | Adjusting Cap (Dash Pot) |
| Lift Crank Washer | X. | Gland (Dash Pot) |
| Lift Lever Screw | Y. | Plunger Assembly (Dash Pot) |
| J. | | Lever Spring (Dash Pot) |
| Eccentric Washer & Locking Screw | Z. | Weight (Dash Pot) |
| K. | | Lever Spacer (Dash Pot) |
| Adjustable Stop | | Felt Washer (Dash Pot) |
| | | Leather (Dash Pot) |
| | | Washer Large (Dash Pot) |
| | | Washer Small (Dash Pot) |

MODEL 35-1176

PHILCO RADIO & TELEV. CORP.

SPECIFICATIONS

PHILCO INTER-MIX RECORD CHANGER, Part No. 35-1176 plays and automatically changes with one loading—14 ten-inch and twelve-inch records mixed together in any order. This record changer will also separately play 15 ten-inch records or 13-twelve inch records. In addition, the mechanism is designed to operate with slightly warped records.

Service information contained in this bulletin covers operation, care, and adjustments that may be necessary if the mechanism ceases to function properly.

When ordering parts, refer to the part number of the entire mechanism in addition to the number and name of parts shown in the figures of this bulletin.

PHILCO RECORD PLAYER NEEDLES

To obtain brilliant life-like tone quality, PHILCO Record Player Needles are recommended. These needles are especially designed to give high fidelity tone reproduction—less record wear and less surface noise. One needle plays 15 to 20 records. The use of inferior needles in the pick-up of this mechanism will greatly affect the tone reproduction performance.

AUTOMATIC AND MANUAL POSITIONS

A control knob (1) Fig. 2 is provided for placing the mechanism in the automatic or manual operating position.

When changing from manual to automatic or automatic to manual positions, the mechanism should be turned off and allowed to complete its cycle. The knob can then be set for the position desired as follows:

To operate the mechanism manually, press knob (1) Fig. 2 marked "Press-Turn" down and turn to the right (clockwise) until record support arm assembly (16) Fig. 1 is in the extreme clockwise position.

For the automatic operating position, control knob (1) Fig. 2 is turned to the left (counter-clockwise) until knob snaps up.

PICK-UP DOES NOT INDEX PROPERLY ON OUTER EDGE OF 10" AND 12" RECORDS

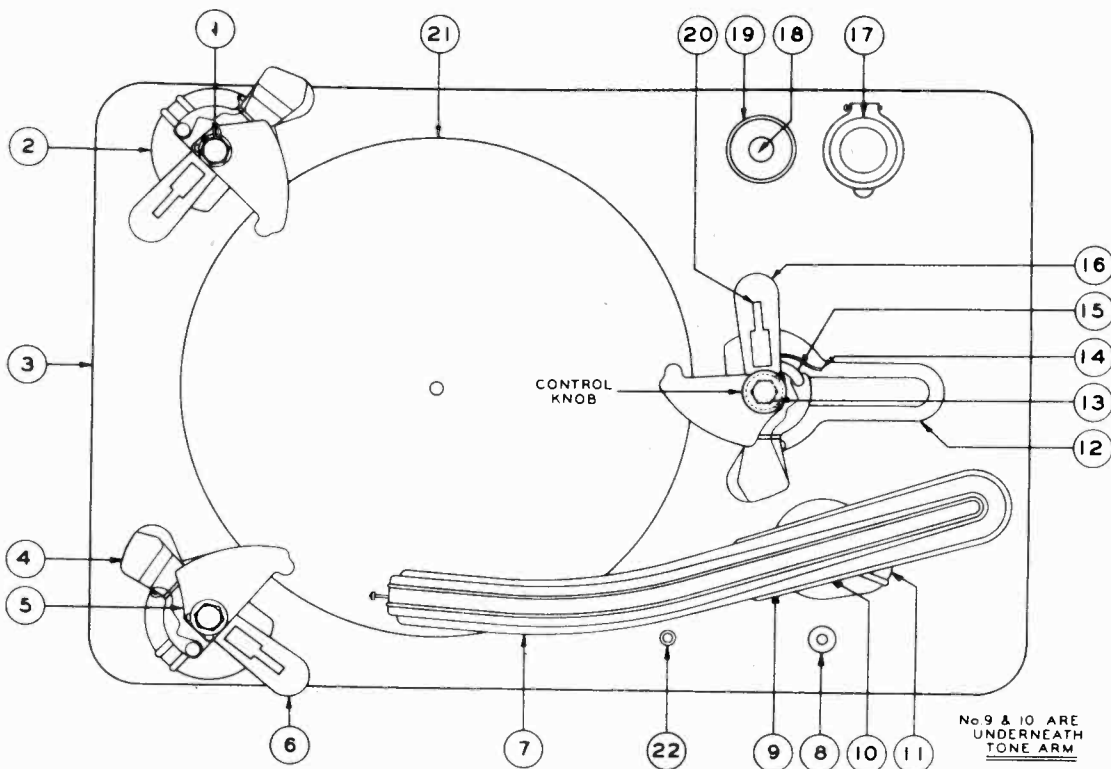
The pick-up is set for 12" records by the trip cam (15) Fig. 1 that is pivotally mounted under the selector blade on main record support post (12) Fig. 1. This trip cam is operated by the edge of a 12" record compressing the cam when the record support arm moves in a clockwise direction. This cam moves trip lever blade (14) Fig. 1 and toggle bar and spring (38) Fig. 3 which pushes set lever blade (5) Fig. 3 into position to hold the tone arm locator (36) Fig. 3 in the 12" position.

After playing a record or the mechanism has been rejected, the set lever (5) Fig. 3 is reset for the 10" position by the control cam bracket lever (35) Fig. 3 mounted on the set lever shaft. The control cam bracket (35) Fig. 3 engages the control shaft cam pin (31) Fig. 3 at the start of rotation.

Adjustment of the tone arm when placing the needle in the first groove of 10" and 12" records is controlled by tone arm locator (36) Fig. 3. When 10" or 12" adjustments are made, the 12" adjustment should be made first. If 10" adjustment alone is necessary, the 12" adjustment should be re-checked. Adjustment of the locator lever is as follows:

12-inch Record Adjustment

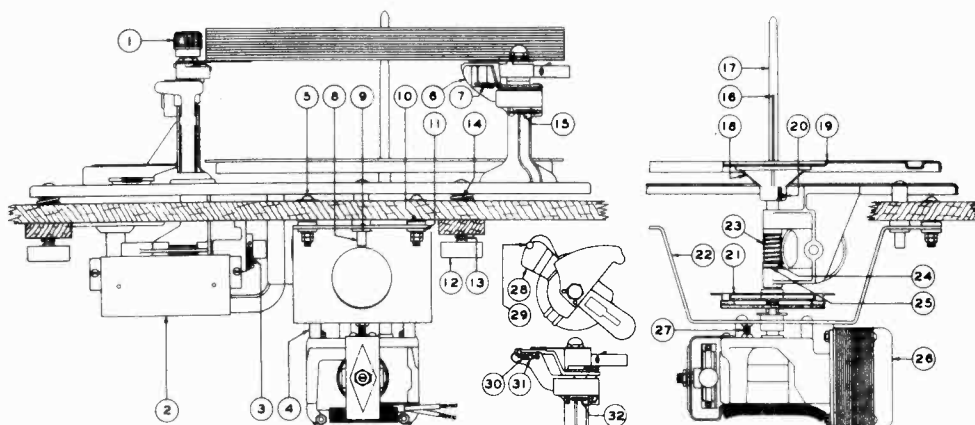
1. Turn control knob (1) Fig. 2 to "manual" position.
2. Place a 12" record on the turntable.
3. Start mechanism and allow pick-up to position itself on the outer edge of the record. If the needle has not been placed in the center of the smooth outer rim of the record, adjust stop (2) Fig. 3 by loosening set screw. Move the stop in the direction necessary to center the needle on the smooth outer rim of the record.



TOP VIEW OF RECORD CHANGER PART No. 35-1176

FIGURE 1

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SIDE VIEW OF RECORD CHANGER PART No. 35-1176 & MOTOR PART No. 35-1177
FIGURE 2

10-inch Record Adjustment

1. Set control knob (1) Fig. 2 to "automatic" position.
2. Load the mechanism with several 10" records.
3. Allow mechanism to set a record on turntable and place the pick-up on the smooth outer rim of the record.
4. If the pick-up does not come down in the center of the smooth outer edge of the record, adjust the following:
5. Loosen 10" record stop (1) Fig. 3.
6. Move the stop slightly toward or away from the stop pin as the case may be to center the pick-up needle on the outer edge of the record.

If, after making the above adjustments, it is found that the pick-up will not move into the first groove after the needle is centered on the outer edge of the record, examine the following parts:

1. Spring (2) Fig. 3 on 12" adjustment stop may be weak.
2. Tone arm lever or swivel shaft may be binding; examine and lubricate.

TONE ARM ELECTRIC REJECT SWITCH WILL NOT OPERATE

(When no record is on turntable)

The tone arm electric reject switch operates when the mechanism is first loaded and no records are on the turntable or no records are on the record support arms. This switch closes when the pick-up needle drops into a groove provided in the turntable; allowing the tone arm to go to a lower level and causing switch contact to close. Adjustment of this switch is as follows:

1. Adjust screw (9) Fig. 1 located in the tone arm directly above the end of the tone arm shaft. Turn this screw in the direction necessary to obtain a clearance of $\frac{1}{16}$ " between the bottom of the groove in the turntable and the bottom end of the needle.
2. With a record on the turntable and the needle resting on the record, a clearance of $\frac{1}{16}$ " between the top and bottom contacts of the tone arm electric reject switch should be obtained. Bend the moving contacts spring upward or downward to obtain the necessary clearance.
3. Also check the electric magnet (19) Fig. 3 and associated wiring for open circuits.
4. Check the small metal rod connecting the trip trigger (13) Fig. 3 and lever of electric magnet.

MECHANISM WILL NOT REJECT AT THE END OF RECORDS

The tone arm is designed to reject records with an oscillating or spiral reject groove. To make the adjustments for either type of records, proceed as follows:

1. See that the screw (10) Fig. 1 which clamps the tone arm swivel bracket is tight. Make sure that the set screws holding the tone arm lever (12) Fig. 3 to the tone arm shaft are tight.

2. Oscillating Groove Records

Records with an oscillating reject groove are rejected by the trip dog located on the end of the tone arm lever (12) Fig. 3 engaging the saw teeth of the trip trigger (13) Fig. 3. When the mechanism will not reject an oscillating groove record, either the screws mentioned in paragraph 1 are loose or the trip dog trip trigger (13) Fig. 3 or springs (15) Fig. 3 are at fault. When it is found that these parts have become worn or weak, they should be replaced.

3. Spiral Groove Records

Records with spiral reject grooves are rejected by the trip shoe (14) Fig. 3 located on the end of the tone arm lever (12) Fig. 3. This trip shoe (14) Fig. 3 hits the pin on the trip trigger (13) Fig. 3 releasing the clutch throwout bracket (29) Fig. 3. This should occur when the pick-up needle has traveled to within a distance of $1\frac{1}{8}$ " from the center of the turntable spindle. Adjust the mechanism to properly reject this type of record as follows: If the pick-up does not reject the mechanism after traveling to within $1\frac{1}{8}$ " from the center of the turntable spindle (or $1\frac{1}{8}$ " from the edge of spindle), loosen the knurled nut holding trip shoe (14) Fig. 3 to the tone arm lever (12) Fig. 3. Move trip shoe toward or away from the pin on the trip trigger (13) Fig. 3 until the trip shoe operates the mechanism properly. When this point is found, the knurled nut should be well tightened.

TEN AND TWELVE INCH RECORDS DO NOT SEPARATE PROPERLY IN A MIXED LOADING

Ten and twelve inch records in a mixed loading are separated by lifter cams (20) Fig. 1 located on the record support arms (6) (16) Fig. 1. These cams operate when the next record to be selected by the mechanism is 10" and are designed to lift a 12" record when one is located directly above the 10" record. This allows the selector blades (5) Fig. 1 and guide arms (4) Fig. 1 to slide under the 12" record so that a 10" record can be placed on the turntable. The lifter cams (20) Fig. 1 are caused to operate by the 10" record hitting the end of the cam. Check the following parts when mechanism does not separate records properly:

1. The lifter cam link (20) Fig. 1 should be approximately $\frac{3}{32}$ " above the surface of the record support arms (6) (16) Fig. 1 when no records are on support arms (6) (16) Fig. 1. This link is held in this position by the small return spring found under (20) Fig. 1 underneath the support arms (6) (16) Fig. 1. If link is not above the surface of support arms (6) (16) Fig. 1, check for loose spring; replace spring if necessary.
2. The selector blades (5) Fig. 1 should have a slight downward pressure on the top surface of the guide arms (4) Fig. 1 when in their return position ready for next selection.
3. In their full return position after a record has been placed on the turntable the selector blades should also pass the guide arm link pin (22) Fig. 1 so that the selector blades will carry the guide arm toward the edge of a record when making the next selection. If any one of the blades do not return enough to clear the guide arm link pin (22) Fig. 1, the blade should be adjusted as given in paragraph "RECORD SELECTORS DO NOT OPERATE IN SYNCHRONISM".

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4. There should also be sufficient tension between the guide arm link pin (22) Fig. 1 and the end of the selector blade (5) Fig. 1 so that the guide arms (4) Fig. 1 will be pulled forward against the record when the selector blade (5) Fig. 1 moves to select the next record. Tension between guide arms and selector blades should be sufficient so that sloop on guide should lift a full load of records to proper height for selector blades to select bottom record. If guide arm pin (22) Fig. 1 does not have enough tension against end of selector blades (5) Fig. 1, check the springs holding the pin in position, also, for worn surface on side of pin.

5. Action of the selector guide arm (4) Fig. 1. The guide arm is designed to guide the selector blade (5) Fig. 1 and lift the record to the proper height necessary to separate the records. The top of the guide arm (4) Fig. 1 has two inclined surfaces. The outer surface for 10" records and the inner surface for 12" records. After the selector blades (5) Fig. 1 have entered between the records, the guide arm (4) Fig. 1 is released and returned to its normal position. If it does not return to its normal position, check for a weak spring on the guide arms (4) Fig. 1 or binding between guide arm and record support post (2) Fig. 1. These springs are attached to record support posts (2) (12) Fig. 1 and a pin at the swivel of the guide arm.

6. In case of a warped 10" record with its concave face down, resting on a warped 12" record with the concave face upward, there is a tendency for the selector blades to jam against the edge of the 10" record instead of going in under it. In order to prevent this condition the blades must be bent down sufficiently to slide along the top surface of the 12" record.

SELECTOR BLADE (5) FIG. 1 FAILS TO SEPARATE BOTTOM RECORD FROM STACK

This is due either to a badly warped condition of the record, or to its being of a thickness considerably different from those now in standard use. The design of both selector blade and record support arms is such as to accommodate a maximum variation in thickness and flatness of records, but certain records may be found which are so far out as to be unfit for use in the automatic changer.

RECORD SELECTORS DO NOT OPERATE IN SYNCHRONISM

If the record selector blades (5) Fig. 1 do not operate in synchronism proceed as follows:

1. Set the control knob (1) Fig. 2 to "automatic" position. See page 1 "Automatic and Manual Positions". (Turn knob to the left until it snaps up). Place one 10" record on selector blades. After record has been dropped to record supports, pull lower plug and rotate turntable by hand until the selector blades are close to the edge of record. At this point all selector blades should be as nearly as possible the same distance from spindle. If the selector blades are not the same distance from the spindle due to replacement of gears, etc., the blades are resynchronized as follows:

2. With the mechanism in the same condition as outlined in paragraph 1, remove the "C" washer from segment arms (23) or (27) Fig. 3 depending on which of these selector blades are out of time. Pull segment arm down so that gears are disengaged, then move selector blade (5) Fig. 1 in direction necessary to align it with other blades. When this position is found, mesh gears and replace "C" washer.

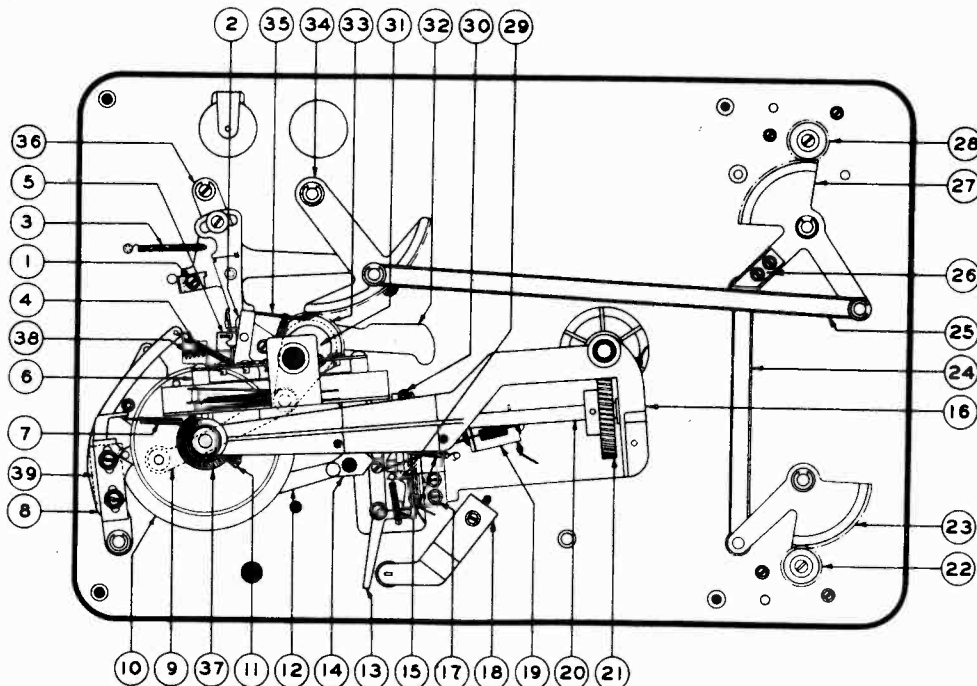
MECHANISM DOES NOT RETURN SELECTOR BLADES TO LOADING POSITION

If the selector blades will not return to the loading position (pointed toward spindle) after a record has been placed on the turntable:

1. Look for trouble in the parallel cam switch (6) Fig. 3. The contact of this switch should be in a closed position, at the time a record is being played.

2. When the selector blades are in the proper loading position cam (37) Fig. 3 should open parallel switch (6) Fig. 3. To place the mechanism in the loading position, turn changer switch (8) Fig. 1 off. After the switch is off the changer should continue to operate until the next record is selected and dropped on the turntable. When the record is dropped on the turntable, cam (37) Fig. 3 should open parallel switch (6) Fig. 3. When the turntable stops rotating the selector blades should be pointed toward spindle.

3. To adjust cam (37) Fig. 3 loosen the two set screws and rotate cam on the shaft until proper position is obtained. Retighten set screws.



BOTTOM VIEW OF RECORD CHANGER PART No. 35-1176

FIGURE 3

NO REPRODUCTION WHEN NEEDLE IS OPERATING ON RECORD

A muting switch (177 Fig. 3, the purpose of which is to short the pick-up during the change cycle. This switch is mounted on the transmission frame, and is operated from the clutch throw-out (29) Fig. 3. When a record is on the turntable and the needle is in playing position, the contact of this switch should be in the open position.

AUTOMATIC CLUTCH DOES NOT COMPLETELY DISENGAGE AT THE END OF THE CYCLE

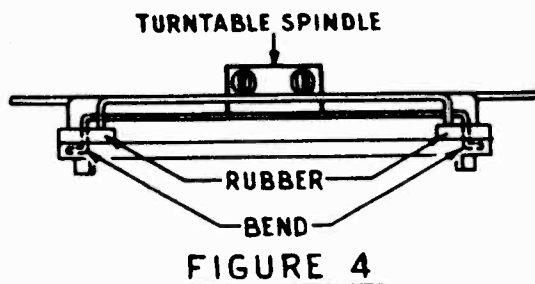
This trouble is identified by a steady thumping or clicking sound when the pick-up is in the playing position and is caused by the clutch not properly disengaging at the end of the automatic cycle. In most cases, this trouble is due to the clutch clearance adjusting plate not being in the proper position on the tone arm brake (8) Fig. 3. To eliminate this trouble, make the following adjustments:

1. Loosen the two screws that hold the clutch clearance adjusting plate to the tone arm brake lever (8) Fig. 3. Advance the adjusting plate until the clutch pawl [found in clutch housing (30) Fig. 3] clears the clutch sprocket.
2. If the clutch disengages before the pin on the drive drum (10) Fig. 3 reaches the inclined surface of the adjusting plate, the plate should then be retarded until the drive drum pin passes over the humps and slides down inclined surface.

FAILURE OF UNIVERSAL DRIVE COUPLING

The Universal drive coupling consists of four strips of rubber held together by a frame having ears projecting into slots in the rubber.

If excessive strain is placed on the coupling, the projecting ears may slip out of the slots in the rubber, thus disconnecting the drive. In order to hold the coupling together more firmly, the outer end of these ears projecting through the rubber may be bent outward at right angles to form a hook which will hold the rubber firmly in place. Do not make bend any more than $\frac{1}{4}$ " from end of ear. See Fig. 4.



REMOVING MOTOR TRANSMISSION

In removing the motor transmission, the following parts should be disassembled first:

1. Remove turntable shaft. (See paragraph — Removing Turntable Shaft Assembly.)
2. Unsolder pick-up wires.
3. Loosen the two set screws which hold the tone arm lever and the tone arm shaft and remove tone arm and shaft.
4. Remove the mounting screws which hold the tone arm post to the panel. Unsolder electric tone arm reject switch wire from the terminal strip and remove tone arm post.
5. Remove "C" washer from the drive link pin — this will allow the drive link to be removed from the transmission and then remove the six mounting screws holding the transmission to the panel and take out the transmission.

TOP RECORD SLIPS WHEN PICK-UP IS IN THE PLAYING POSITION

If the top record slips in the playing position, check the following parts:

1. Check for excessively warped records. Records warped too badly should be replaced and not used in the changes.

2. Check for worn grooves in record, particularly old records. After the grooves of the records lose their gloss, the pick-up does not glide through the groove. This condition has a tendency to cause pick-up needle to drag resulting in the top record slipping.

3. Check record friction spring (16) Fig. 2 for tension. This spring should protrude far enough from the shaft to hold the top record from slipping when in the playing position. This spring when adjusted properly to hold a record, should also allow a 10" record to fall freely onto the turntable.

If the spring is in need of adjustment, see heading "Removing Turntable Shaft Assembly", Paragraph 4.

OILING AND GREASING MOTOR AND MECHANISM

The motor and mechanism should be oiled and greased every six months with a good grade of S. A. E. 10 oil.

Parts to Lubricate:

1. All bearings of the mechanism.
2. All sliding surfaces such as, cams, etc., should be lubricated with a very light grease.
3. Motor bearings and governor felt.

TURNTABLE SPEED ADJUSTMENT

If motor runs too fast or slow, the governor adjustment screw (27) Fig. 2 on the top side of the governor should be screwed in or out slightly as required. To do this, loosen the lock nut and turn screw, then retighten lock nut.

REMOVING TURNTABLE SHAFT ASSEMBLY

To remove the turntable shaft assembly, proceed as follows:

1. Loosen the two set screws holding the motor coupling (21) Fig. 2 to the turntable shaft.
2. Loosen the two screws holding the turntable drive worm (23) Fig. 2 to the turntable shaft, then lift out turntable and shaft.
3. To remove the turntable from the shaft, remove the three screws and nuts which hold it to the hub.
4. The record friction spring (16) Fig. 2 on the turntable shaft can be removed by pushing the hub downward toward the heavy end of the shaft — the spring can then be removed. If it is desired to increase the record friction on spring, bend upward the lower section of the spring which contacts with the bottom surface of the hub. To decrease the record friction against the spring, bend the spring downward.

The motor is removed as follows:

1. Remove the three $10\frac{3}{32}$ " machine screws which hold the motor to the motor mounting bracket. Three $\frac{1}{2}$ " spacers will also be found which space the motor from the mounting plate.
2. There are two motor bracket locating pins on the underside of the changer base panel which pass through rubber grommets located in the motor mounting bracket. These are provided to keep the mounting panel and motor bracket in proper alignment.

MECHANISM AND CHASSIS MOUNTING

The mechanism is mounted in the cabinet as follows: 4 mounting studs are located in the bottom surface of the panel each threaded to take $\frac{1}{4}$ " No. 20 machine screws. The mounting panel rests on four tapered coil springs. The small end of each spring is pressed over a mounting stud and the large end of each spring fits into a screw in the top surface of the mounting shaft in the cabinet. Four spacing blocks $\frac{1}{2}$ " thick and with a $\frac{3}{16}$ " hole are fastened to the lower side of the cabinet motor board. The $\frac{3}{16}$ " hole in each block is centered with the $\frac{1}{16}$ " screw clearance hole. These are provided and located on the lower side of the cabinet motor board into which each of the lower mounting springs are to fit. The $\frac{1}{4}$ " No. 20 machine screws are turned through the four wing nuts until the head of each screw is against the head of the bottom side of each wing nut. The four lower springs are of smaller diameter than the upper springs. These lower springs are slipped over the nuts to each of the $\frac{1}{4}$ " No. 20 machine screws with the smaller end toward the head and resting on the wing nuts.

The $\frac{1}{4}$ " No. 20 machine screws are pushed through the $\frac{1}{16}$ " clearance hole and tightly screwed into the mounting studs. Wing nuts should be backed down on head of $\frac{1}{4}$ " No. 20 bolt to place changer in operation.

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REPLACEMENT PARTS

Several Parts were changed on the Mechanism in later production. The major change was made in the "Selector Blade Guide Arm and Link Assembly". This change is shown in Fig. 1, Page 119, Parts 1, 4, 6, 13, 16, and Fig. 2, Page 120, Parts 6, 16, 27, 28, 29, 30, 31, 32. Other changes are indicated in the list below.

FIGURE 1, PAGE 119

TOP VIEW OF RECORD CHANGER, PART NO. 35-1176

Item No.	Description	Part No.	No. used per Instrument	Item No.	Description	Part No.	No. used per Instrument
1	Nut, Selector Blade Post (Early Production)	W-2092	2	9	Tone Arm Adjusting Screw	W-2100	1
	(Later Production)	35-2140	2		Contact Spring Blade	56-1663	1
	Spring Washer (Selector Post)	35-2141	2	10	Tone Arm Swivel Bracket	35-2182	1
	Rubber Bumpers	27-4926	3	11	Tone Arm Post	35-2183	1
2	Record Support Post	35-2147	2	12	Main Record Support Post	35-2148	1
3	Panel Assembly		1	13	Nut, Control Knob Selector Post (Early Production)	W-2091 (Hex)	1
4	Selector Blade Guide Arm and Link Assem. (Early Production)	35-2105	3		(Later Production)	35-2139	1
	Selector Blade Guide Arm and Link Assem. (Later Production)	35-2135	3	14	Trip Lever		1
5	Selector Blade	315-1022	3	15	Trip Cam	35-2104	1
6	Record Support Arm Assembly (Early Production)	35-2075	3	16	Main Record Support (Early Production)	35-2107	1
	(Later Production)	35-2136	3		(Later Production)	35-2137	1
7	Spring (Record Support Arm)		1	17	New Needle Cup	45-6091	1
	Tone Arm Assembly	35-2067	1	18	Used Needle Cup Cover	45-6093	1
	Crystal Pickup	35-2030	1	19	Used Needle Cup	45-6092	1
8	Needle Screw	45-2788	1	20	Lifter Cam	35-2149	1
	Screw (Mounting Crystal)	W-1377	1	21	Springs for Lifter Cams	35-2150	3
				22	Turntable Assembly	35-3039	1
					Reject Button	35-2184	1

FIGURE 2, PAGE 120

SIDE VIEW OF RECORD CHANGER, PART NO. 35-1176, AND MOTOR, PART NO. 35-1177

Item No.	Description	Part No.	No. used per Instrument	Item No.	Description	Part No.	No. used per Instrument
1	Control Knob	35-2083	1	20	Spindle Lock Pin	35-2187	1
2	Spring (Control Knob)	35-2164	1	21	Coupling Assembly (Motor Turntable Spindle)	45-6098	1
3	Parallel Switch Cover		1	22	Motor Bracket	35-2100	1
4	Clutch Pawl Spring	35-2102	1	23	Worm Gear	35-2179	1
5	Motor Spacer	35-2097	3	24	Ball Bearing Retainer Assembly	35-2177	1
6	1 1/2" x 3/8" - 24 Bolt		4	25	Worm Thrust Washer	35-2178	2
	Selector Blade Guide Arm and Link Assembly (See Note "A" below) (Later Production)	35-2135	3	26	Motor (110 volts, 60 cycle)	35-1177	1
7	Guide Arm Link Spring	35-2138	3		(110 volts, 25 cycle)	35-1201	1
8	Motor Guide Studs	35-2185	2		(110 volts, 50 cycle)	35-1186	1
9	Rubber Grommet	35-2186	2		(110-220 volts, 50 cycle)	35-1209	1
10	Spacer	35-2099	7		(110-220 volts, 60 cycle)	35-1210	1
11	Rubber Grommet	35-2098	7	27	Motor Adjusting Screw		1
12	Special Nut ("U" Shaped Spacer)	56-1670	4		Note "A"—The following parts from 28 to 32 were used on Early Production Changers.		
13	Spring (Small-Bottom Springs)	28-8961	4	28	Selector Blade Guide Arm and Link Assem. (Early Production)	35-2105	3
14	Spring (Large-Top Springs)	28-8962	4	29	Link Pins (Early Production)	35-2151	3
15	Mounting Bolts	W-369	4	30	Link Pin (Early Production)	35-2151	3
	Guide Arm Return Spring (Later Production)	28-8963	3	31	Link Pin Spr. (Early Production)	28-8966	3
16	Record Friction Spring	35-2088	1	32	Guide Arm Return Spring (Early Production)	28-8963	3
17	Turntable Spindle	35-2087	1				
18	Turntable Hub	45-6097	1				
19	Turntable	35-3039	1				

FIGURE 3, PAGE 121

BOTTOM VIEW OF RECORD CHANGER, PART NO. 35-1176

Item No.	Description	Part No.	No. used per Instrument	Item No.	Description	Part No.	No. used per Instrument
1	Tone Arm Locator Shoe (10 inch, Records)		1	22	Drive Pinion	35-2192	1
2	Tone Arm Locator Shoe (12 inch, Records)		1	23	Segment Arm Assembly	35-2120	1
3	Spring	35-2153	1	24	Connecting Link	35-2193	1
4	Spring	28-8964	1	25	Segment Connecting Link	35-2194	1
5	Set Lever Assembly	35-2188	1	26	Segment Stop Bracket	35-2195	1
6	Parallel Switch Assembly	42-1555	1	27	Drive Segment Assembly	35-2090	1
7	Spring	28-8965	1	28	"U" Washer	35-2106	1
8	Tone Arm Brake Lever Assembly (Early Production)	35-2133	1	29	Drive Pinion		1
	(Later Production)	35-2176	1		Clutch Throwout Bracket Assembly	35-2112	1
9	Drive Link Assembly	35-2189	1		Mounting Screws	W-2183	1
10	Drive Drum Assembly	35-2152	1	30	Clutch Housing Assembly (Clutch Assem. Complete with Housing)	35-2103	1
11	Revel Gear	35-2076	1		Clutch Housing	35-1218	1
12	Tone Arm and Lever Assembly	35-2167	1		Clutch Pawl	315-1039	1
13	Trip Trigger Assembly (Tone Arm Lever Assembly)		1	31	Control Shaft and Cam Assembly	35-2196	1
14	Tone Arm Trip Shoe	35-2085	1	32	Drive Crank Assembly	35-2197	1
15	Springs	35-2190	1	33	Main Drive Gear	35-2197	1
16	Transmission Frame	35-2154	2	34	Main Segment	35-2198	1
17	Muting Switch Assembly	35-2171	1	35	Control Cam Bracket Assembly	35-2163	1
18	Cancel Button Bracket	35-2084	1		Spring (Cam Bracket)	35-2170	1
19	Electro Magnet	42-1552	1	36	Tone Arm Locator Assembly	35-2145	1
20	Shaft	35-2077	1	37	Drive Drum Gear (Part of No. 10, Fig. 3)		1
	Pins for Drive Shaft (Large) Motor End	45-6100	1	38	Toggle Bar	35-2199	1
	(Small) Clutch End	46-6101	2	38	Toggle Bar Spring	35-2200	1
21	Worm Gear Assembly	45-2786	1	39	Bracket (Brake Lever Shoe)	35-2142	1
					Female Plug and Cable (2 prong)	41-3522	1

ASSEMBLY OF MOTOR TO BASE PLATE

The motor is attached to the base plate by three bolts, and mounted on rubber cushions.

The brace that is over the turntable spindle and bolted to the base plate serves as an excellent gauge for aligning the motor in the center.

When removing the two screws that hold the turntable locating plate over the turntable spindle, preparatory to operating the instrument, be sure that the locating plate lines up with the holes that the screws are just removed from.

If the motor has become shifted in transit there will be a tendency for the holes in the locating plate and base plate to not perfectly line up.

In this case it is necessary to slightly loosen the three bolts holding the motor to the base plate and shift the motor to such position that the holes in the brace and the base plate align perfectly, and while the brace is still in place, tighten the suspension bolts to hold the motor in that particular position. The brace must then be removed before the turntable is mounted on the shaft.

In placing the turntable on the shaft, be certain that the rubber driving washer is in proper place with clips over the spindle pin.

After the turntable is put on the shaft, force it down by hand to be sure that the rubber washer and turntable are making perfect contact.

To level the turntable, place a straight edge across the turntable and adjust the three suspension bolts holding the motor to the base plate until the same distance is obtained from the bottom edge of the straight edge to the base plate near the three points where the suspension bolts are located.

This measurement should be approximately $11/16''$. This adjustment must be made so that there is no free movement of the motor by either of the suspension bolts being too loose.

STONE ARM ADJUSTMENT FOR TEN INCH AND TWELVE INCH RECORDS

Pickup change lever No. 5509 is for changing the instrument from 10 inch to 12 inch record operation and vice versa.

The lever changes the position of the pickup return lever in such a manner that the needle is let down for the 10 inch or the 12 inch record, as desired.

To adjust for playing 10 inch records, loosen the forward lever stop No. 5526 and hold the lever in such a position that the needle will come down on a 10 inch record exactly $4-11/16''$ from the edge of the center pin. (A scale should be placed on the record with the end of the scale against the centering pin in such a position that the needle point will come down on the scale at the $4-11/16''$ inch position.)

When the proper location of lever No. 5509 is ascertained, then the front stop may be set snug against this lever and the screw tightened, which will allow the lever to always be thrown over to that exact position when desiring to play 10 inch records.

To adjust for playing 12 inch records, loosen the back lever stop No. 5527 and hold the lever in such position that the needle will come down exactly $5-11/16''$ from the edge of the centering pin. (A scale should be placed on the record with the end of the scale against the centering pin in such position that the needle point will come down on the scale at the $5-11/16''$ position.)

In the event you are unable to properly adjust for either 10 inch or 12 inch records by the above method, make the adjustment as nearly correct as possible then refer to instructions on Page 6 and check Tone Arm Bracket Lever adjustment making certain the adjustment is correct.

Then loosen the lock nut holding the adjustment screw on the tone arm return lever No. CA5687 and turn the adjusting screw either in or out, as the occasion requires, to bring the needle to the proper location for the size record you are unable to adjust for by the lever stop method. It will then be necessary to readjust the lever stop which was originally set in position for the other size record.

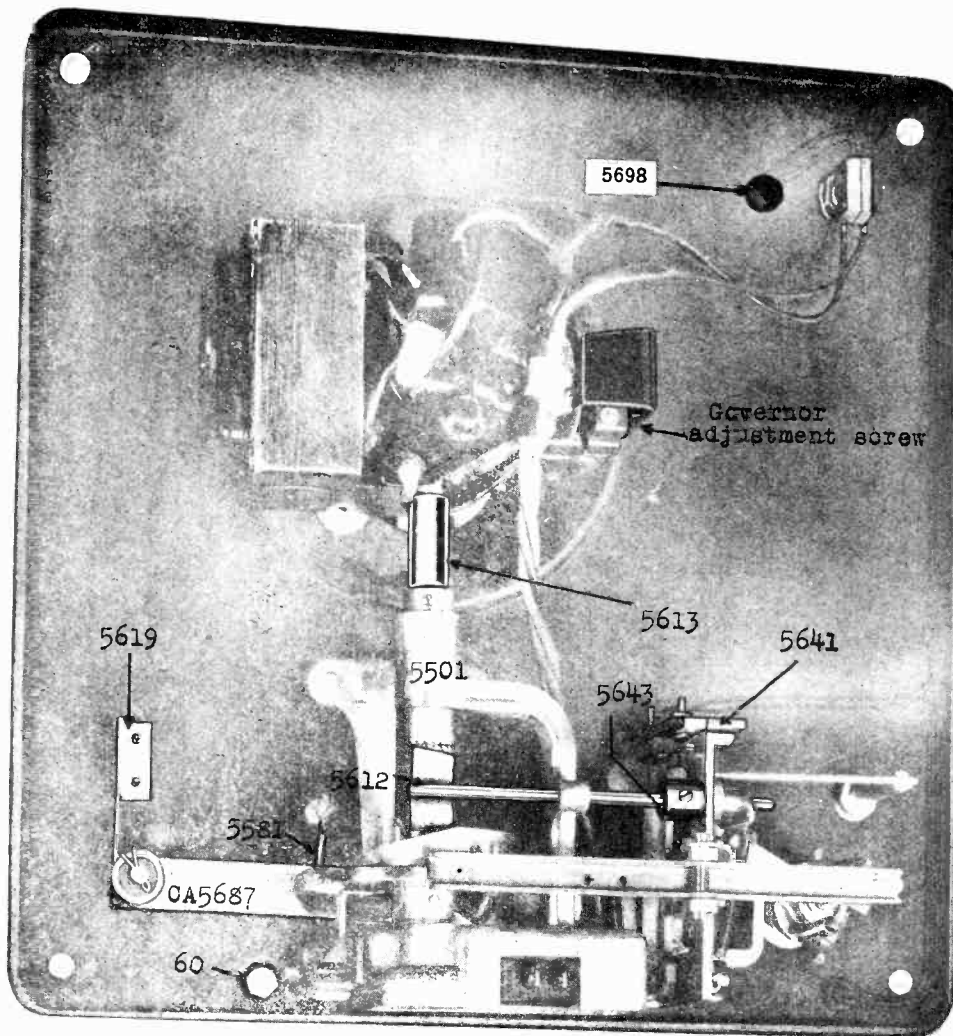
The lever stop screws must be set tight so the lever stops will not be jarred out of position as the lever is thrown from one position to the other.

ADJUSTMENT OF PICKUP WEIGHT

Make this adjustment while music is being played, and only one record is on the turntable. With a delicate pair of scales, having a range of 0 to 12 ounces, catch the needle screw and lift the pickup from the record until the audio quality breaks, at which time a reading of $5\frac{1}{2}$ to 6 ounces should be shown on the scales. Raising or lowering the spring support No. 5575 which is affixed to the tone arm lifting rod No. 5553 adjusts the weight of the pickup.

MODELS 4585, 4586
35-1178

PHILCO RADIO & TELEV. CORP.



60 ¼-20 Hex Head Screw.
5501 Drive Bracket.
5581 Link Spring-Lower.
5612 Trip Lever & Cam Assy.
5613 Drive Sleeve Assy.

5619 Eccentric Spring Assy.
5641 Short Circuit Switch Assy.
5643 Trip Lever Rod Collar Assy.
5698 Volume Control.
CA5687 Tone Arm Return Lever & Fork Assy.

GOVERNOR ADJUSTMENT

If the turntable speed cannot be regulated to 78 R. P. M. by the speed control lever located under the turntable, then loosen the set screw holding the governor to the governor shaft and move the governor either in or out, as the case may be, to increase or decrease the speed of the motor.

This adjustment must be made when the speed control lever under the turntable is in the center position.

To increase the speed of the turntable motor, move the governor out, and to decrease the speed of the turntable, move the governor in.

Do not, under any conditions, change the adjustment of the end thrust bearing screws.

An occasional drop of oil on the governor brake will assist in maintaining a constant speed.

ASSEMBLY AND ADJUSTMENT OF OSCILLATING AND SPIRAL TRIP LEVER AND PICKUP SILENCER

To time the automatic switch so the instrument will automatically trip and change records, proceed as follows:

First: Thoroughly acquaint yourself with the different part numbers.

Second: Study the photographs carefully and note the relative location of the various parts.

Third: Complete each of the following operations before going on to the next operation.

Operation No. 1.

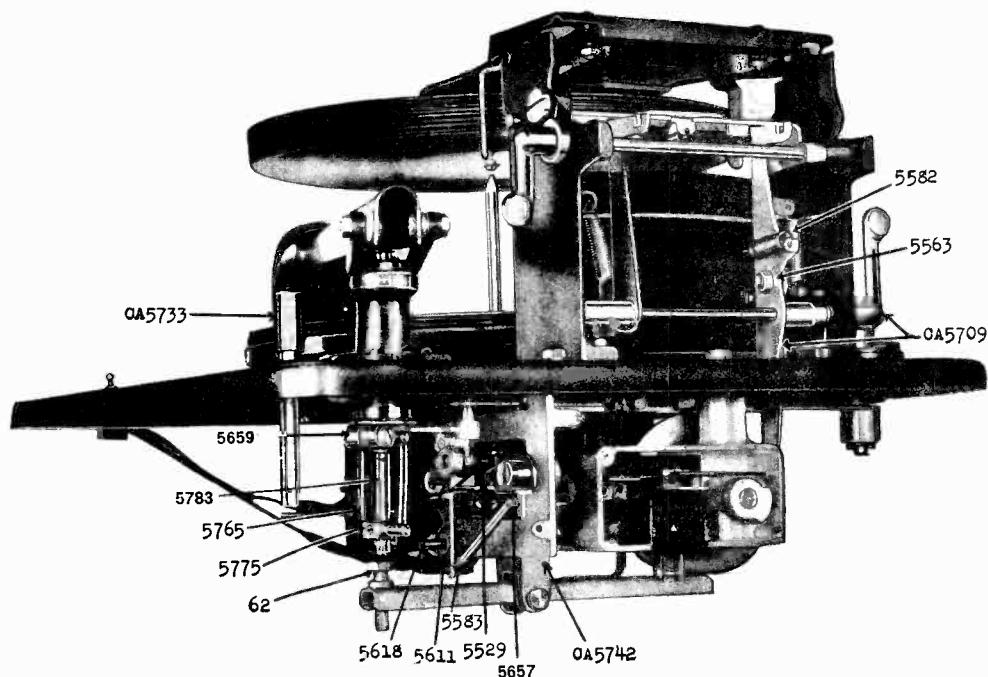
Turn the master cam No. 5504 until the large timing mark is exactly above the timing mark on the tone arm lifting lever No. 5761.

Operation No. 2.

Hold the switch lever and cam assembly No. 5612 against the driven clutch No. 5616, so the radius of the cam will center against the clutch. (Be sure that cam No. 5612 is directly under the driven clutch No. 5616.)

Operation No. 3.

Set the pickup silencer switch No. 5643 against the casting bearing so the shaft of cam No. 5612 cannot be moved further toward the automatic switch.



62 1/4-28 Hex Head Screw.
5529 Spiral Trip Cam.
5783 Tone Arm Lift Rod.
5554 Eccentric Pin.
5563 Slide Finger Eccentric.
5582 Link Spring-Upper.
5583 Trip Lever Spring.
5611 Trip Lever & Hub Assy.

5618 Oscillating Trip Dog Assy.
5659 Tone Arm Bracket Lever & Pin Assy.
5657 Oscillating Trip Lever Assy.
CA5709 Slide Finger & Shaft Assy.
CA5733 Reject Stud Assy.
CA5742 Switch Panel Assy.
5765 Tone Arm Weight Adj. Spring.
5775 Tone Arm Spring Hook.

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Operation No. 4.

Hold the tail of cam No. 5612 against the lug on the inside of the master cam No. 5504 and adjust the trip lever No. 5611 until it is 1/16" beyond the catch in the oscillating trip lever No. 5657. This adjustment is made while the tail of the cam No. 5612 is held against the outside of the lug inside the master cam No. 5504.)

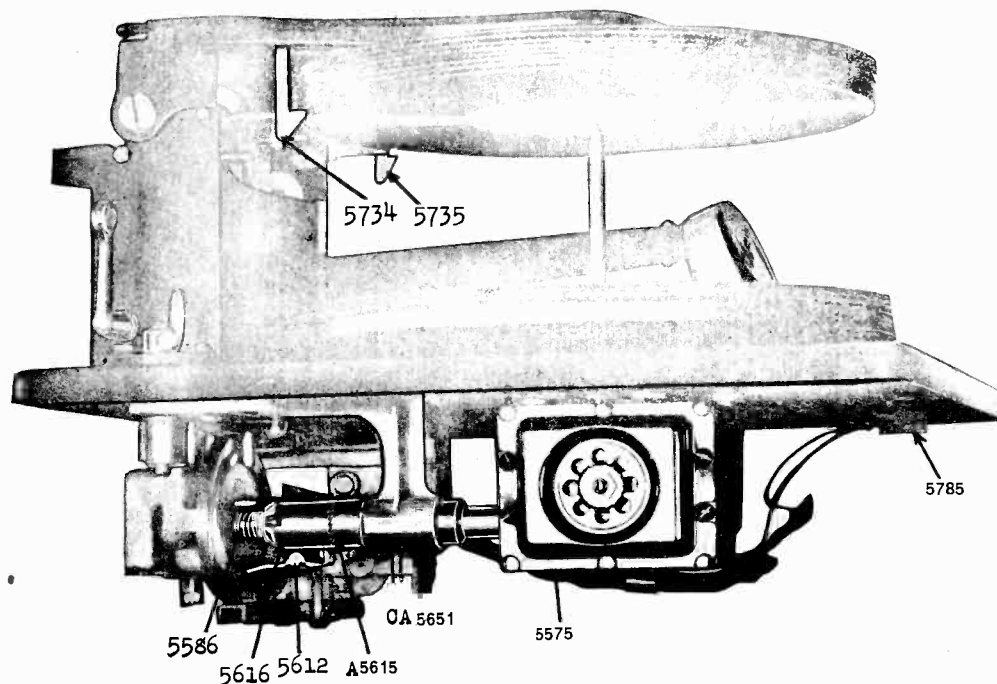
Operation No. 5.

Care must be exercised to have the end play of the oscillating trip shaft just free. This is taken care of in adjusting the pickup silencer switch No. 5643, so a good contact is made on the pickup short circuiting switch WHEN THE NEEDLE IS ON THE RECORD AND THE AUTOMATIC SWITCH HAS BEEN TRIPPED.

After the pickup silencer switch No. 5643 has been set according to the above instructions, the resetting of the automatic trip should allow the contacts on the pickup silencing switch to open.

If the above operations are followed out in detail, and adjustments properly made, the clutch will automatically disengage when the pin on the clutch No. 5616 has travelled approximately one-half of the distance of cam No. 5612.

At the time the pin has travelled one-half of the distance of the clutch release cam, the small timing mark on cam No. 5504 should be exactly above the timing mark on the tone arm lifting lever No. 5761.



5612 Trip Lever & Cam Assy.
A5615 Drive Shaft Assy.
5615 Drive Shaft Assy.
5616 Driven Ratchet & Pin Assy.
CA5651 Main Drive Assy.

5785 Switch Double Circuit H & H.
5586 Clutch Spring.
5575 Motor, give voltage and cycles.
5690 Governor Assy.
5734 Record Lock Lever & Hook Assy-Left.
5735 Record Lock Lever & Hook Assy-Right.

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ASSEMBLY OF RECORD MAGAZINE AND STANDARD TO BASE PLATE: AND ALIGNMENT OF TURNABLE SHAFT

Mount the magazine and standard on the base plate with four bolts, tightening the bolts only tight enough to hold the complete magazine assembly in position. The magazine assembly must be so adjusted by shifting the standard on the base plate to bring the offset at the bottom end of the magazine pin exactly over the center of the point of the turntable spindle.

This adjustment cannot be made until the motor has been aligned according to the instructions on page one.

Enough clearance is allowed in the four bolt holes to take care of this adjustment.

After the adjustment is made perfect, the bolts must be securely tightened with lock washers.

ASSEMBLY AND ADJUSTMENT OF RECORD SLIDE SHELF AND FINGER

First, set the master cam No. 5504 so the lug on the cam at the side of the large timing mark comes directly under the end of the record release finger No. CA 5709.

The eccentric stud No. 5563 affixed to the main record release finger controls the adjustment of record release finger. Turn the eccentric stud No. 5563 until the record slide shelf No. 5521 is 1/64" past the front edge of record support shelf No. 5520 at which time it should be possible to obtain a slight amount of clearance between the end of the record release finger and the point of the lug on the master cam without causing the safety spring, (which is a part of this lever assembly) to give.

The two points on the record slide shelf must come to the edge of the radius on the record support shelf at the same time.

RECORD WEIGHT ADJUSTMENT

The record weight No. 5759 must be so adjusted at the bearing pivot that the lower edge of the record weight does not touch the record slide shelf while in the 10 inch position, but comes low enough to hold one record in proper position for the slide plate to unload it on the turntable.

ASSEMBLY OF DRIVE BRACKET ASSEMBLY TO BASE PLATE AND MOTOR

The drive bracket No. 5651 must be bolted to the base plate in such a manner as to align the drive shaft with motor shaft, so the coupling is free. A flexible coupling No. 5613 takes care of any minor lack of alignment between the drive shaft and the motor shaft, because of the motor hanging on rubber cushions.

ASSEMBLY OF TONE ARM HOUSING TO BASE PLATE

The tone arm base is attached to the base plate with three screws. This can be mounted only in the proper position.

The two pivot screws holding the tone arm to tone arm bracket must be so adjusted that the pickup is free to come down on to the record by its own weight and still the points of bearing must be in good contact in such a manner that the tone arm cannot be twisted from side to side.

TO ADJUST FOR NEEDLE PLAYING POSITION

Turn the master cam until the small timing mark is exactly above the timing mark on the tone arm lifting lever No. 5761, at which time there will be no pickup weight on the tone arm lifting rod.

Then, without a record on the turntable, and the needle (of the length that is regularly going to be used with the instrument) properly inserted in the pickup, the "Y" shaped tone arm rest No. 5534 should be adjusted to allow the tone arm to lower to such a position that the needle just clears the highest point of the turntable surface. **THIS ADJUSTMENT PROPERLY MADE WILL ELIMINATE THE POSSIBILITY OF THE NEEDLE DAMAGING THE TURNABLE SURFACE.**

TO ADJUST THE RECORD SUPPORT HOOKS

First, throw lever No. 5509 to the 10 inch position, and place a 10 inch record on the magazine pin, bringing the magazine down to playing position.

The record support hooks are adjusted by bending to proper position. The record support hooks must be kept 1/16" from the edge of the record support shelf and must be adjusted far enough back to just clear the edge of a 10 inch record, as the record is released from the record support shelf.

The record support hooks must also be low enough to clear the bottom side of the record, as it is supported on the magazine shelf.

The record support hooks should operate freely in either 10 inch or 12 inch position.

TONE ARM LIFT LEVER AND ITS ADJUSTMENT

Turn the master cam to such position that the small timing mark is directly above the timing mark on the tone arm lifting lever No. 5761.

Without a record on the turntable, and the needle in playing position, adjust the tone arm lift lever screw No. 62 until a visiting card can be slid between the top of the lever screw No. 62 and the lower end of the tone arm lifting rod No. 5553.

It is important, in the adjustment of cam No. 5576, that 1/64" clearance be allowed between the back side of this cam and the bearing through which the shaft passes.

ADJUSTMENT OF THE SPIRAL TRIP CAM

To adjust the spiral trip cam, turn the master cam No. 5504 until the small timing mark is exactly above the timing mark on the tone arm lift lever No. 5761 at which time the automatic trip can be manually reset or tripped at will.

Lay a steel scale, graduated in 64ths, flat on the record under the pickup, with the end of the scale against the turntable spindle in such position that the needle rests on the scale. By sliding the needle toward the center of the record, the spiral cam should cause the automatic trip to operate when the point of the needle is 1-49/64" from the edge of the turntable spindle.

If the automatic trip operates before the needle has come to 1-49/64" position, then the spiral cam is set too far ahead and must be moved very slightly back, while, if the needle comes closer to the turntable spindle than 1-49/64", then the spiral cam is set too far back and must be set ahead to the proper position.

Failure to properly adjust the spiral trip cam so the automatic trip operates when the needle is 1-49/64" from the edge of the turntable spindle will cause the instrument to change records before the music is finished, or to not change records automatically.

To adjust the spiral trip cam No. 5529, slightly loosen the two screws holding the cam to automatic switch lever No. 5657 and pry the cam forward or back as required to obtain the proper setting.

To test the position of the spiral cam, it is necessary to carry the pickup back to the edge of the record each time to manually reset the automatic trip.

ASSEMBLY OF TRIP BRACKET TO BASE PLATE

The automatic trip bracket No. CA 5742 is mounted to the base plate by two nickel plated bolts and lock washers.

The end that the bakelite panel is mounted on is to be mounted toward the front of the base plate in such a manner that the bearing aligns perfectly with the bearing in the drive bracket. The final alignment can be made when the trip lever shaft No. 5612 is being installed and adjusted.

TONE ARM BRACKET LEVER ADJUSTMENT

Set lever No. 5509 to 10 inch record operating position, and slightly loosen the clamp screw holding the bracket lever No. 5704 to the bracket under the tone arm base, and turn the bracket lever to such position that the slot, where the bracket lever clamps together around the bracket, is exactly centered on each side of the aligning notch cut in the lower rim of the bracket.

Then lay a scale, graduated in 64ths, on the turntable, placing the end of the scale against the turntable spindle in such position that when the needle is automatically let down the point of the needle will come to exactly 4-11/16" from the edge of the turntable shaft.

If the needle does not automatically come down at the 4-11/16" position refer to page 2 and make final adjustment at lever stop on lever No. 5509.

Care should be exercised to lock the tone arm return bracket lever, allowing .015 inch clearance between the cork insert and the tone arm base.

After the adjustment is properly made, tighten the clamp holding the tone arm bracket lever No. 5704 in place, which should leave ample clearance between the cork insert and the tone arm housing to allow perfect freedom of the tone arm operation.

If needle fails to feed into music groove, lift tone arm bracket lever No. 5704 tightly against tone arm housing and manually move tone arm back and forth to relieve any unevenness that might occur on the face of the cork insert.

ASSEMBLY AND ADJUSTMENT OF RECORD MAGAZINE

The record magazine pin No. 5555 must be tightened in the elongated hole in the magazine top plate No. A5736 in such a manner that the offset at the bottom of the pin extends directly away from the record support shelf.

The magazine pin must also be adjusted to such a position that exactly 47/64" clearance is obtained between the back center of the offset at the bottom of the magazine pin, and the extreme right and left corners of the record support shelf. This adjustment is to be made when the record magazine is in 10 inch playing position.

TO ADJUST THE RECORD SUPPORT HOOKS

First, throw lever No. 5509 to the 10 inch position, and place a 10 inch record on the magazine pin, bringing the magazine down to playing position.

The record support hooks are adjusted by bending to proper position.

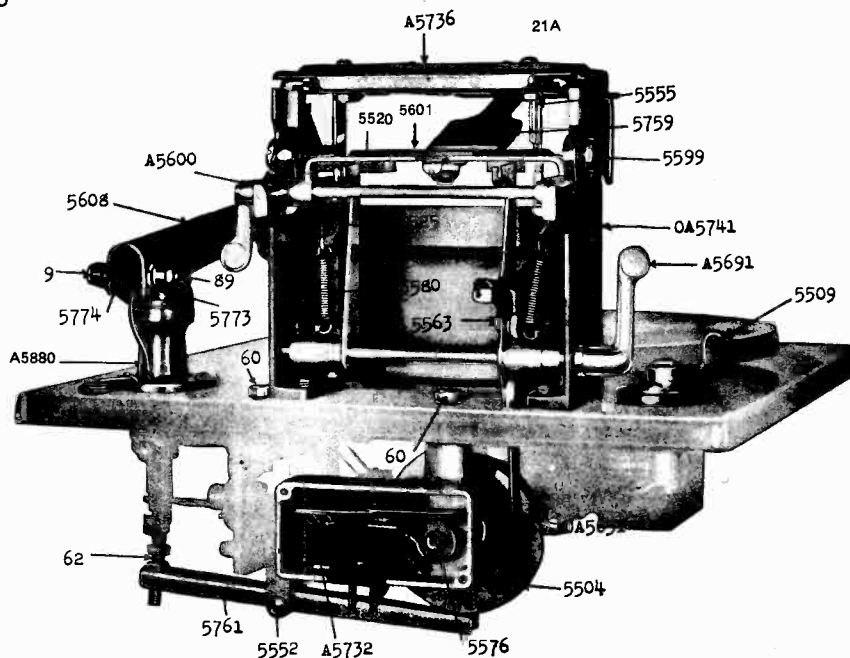
The record support hooks must be kept 1/16" from the edge of the record support shelf and must be adjusted far enough back to just clear the edge of a 10 inch record, as the record is released from the record support shelf.

The record support hooks must also be low enough to clear the bottom side of the record, as it is supported on the magazine shelf.

The record support hooks should operate freely in either 10 inch or 12 inch position.

MODELS 4585, 4586
35-1178

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9 10-32 Hex Head Screw.
21A Acorn Nut.
60 $\frac{1}{4}$ -20 Hex Head Screw.
62 $\frac{1}{4}$ -28 Hex Head Screw.
89 10-32 Headless Set Screw 60 Point.
5504 Master Cam.
5509 Eccentric Handle.
5520 Record Shelf.
5601 Record Slide.
5525 Spring Hook.

5552 Tone Arm Lift Lever Pin.
5555 Record Support Pin.
5563 Slide Finger Eccentric.
5576 Switch Finger Cam.
5580 Hook Spring.
5599 Record Support Plate Screw.
A5600 Record Shelf Shaft Assy.
5608 Tone Arm.
CA5651 Main Drive Assy.
CA5654 Tone Arm & Bracket Assy.

A5691 Record Unloading Lever.
A5732 Switch Panel Assy.
A5736 Record Support Plate Assy.
CA5741 Standard Assy.
5759 Record Weight & Felt Assy.
5761 Tone Arm Lift Lever Assy.
5773 Tone Arm Insulating Bushing.
5774 Tone Arm Pivot Bushing.
A5880 Tone Arm Bracket Assy.

After the above adjustment is made, check the instrument with one record on turntable, by shutting current switch off and see that instrument comes to an automatic stop position when the lug on the master cam No. 5504 has completely passed under the end of record release finger No. CA 5709. If the lug has not entirely passed under the end of the record release finger, then move cam No. 5576 to the left as little as possible to allow the lug to clear the cam when instrument stops automatically with one (1) record on turntable.

TONE ARM RETURN LEVER AND ITS ADJUSTMENT

The tone arm return lever No. CA5687 is mounted on an eccentric pin with the bushing extended downward, the tone arm change and adjusting lever No. 5509 is mounted on the same shaft and located on the top back left corner of the chassis.

The sharp point of the cam, which is a part of the eccentric pin is to be mounted toward the tension spring which is affixed to the base plate, so that when the lever is thrown to 10 inch or 12 inch position the spring will hold the cam in that particular position.

The coil spring No. 5585 is attached from the lug on the tone arm return lever to the lug on the automatic trip bracket in such a manner that the spring is held as far down as possible by the lugs.

NOTE: The adjustment screw found on the tone arm return lever is covered in the instructions on page 1, and after once being properly set, should need no further adjustment.

Care must be exercised to have clearance between the high point of the master cam No. 5504 and the tone arm return lever.

MOUNTING AND ADJUSTMENT OF REJECTOR

The reject button is located at the right of the tone arm and is for the purpose of discontinuing a record before it has finished playing. With the automatic trip set and the instrument playing music, there should be $\frac{1}{16}$ " clearance between the bottom of the reject pin and the lateral pin affixed to the automatic trip lever No. 5657.

If this distance is too great, one will not be able to reject a record. If this distance is too small the automatic trip will not properly reset. Adjustment can be made by CAREFULLY bending the lateral pin to its proper position with relation to the rejector pin.

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SPECIFICATIONS

PHILCO AUTOMATIC RECORD CHANGER Part No. 35 - 1180 automatically changes either twelve 10" or ten 12" records. The service information contained in this bulletin covers the operation, care, and adjustments that may be necessary if the mechanism ceases to function properly.

When ordering parts for this mechanism, refer to the part number of the entire mechanism in addition to the number and names of the parts shown in the figures of this bulletin.

PHILCO RECORD PLAYER NEEDLES

To obtain brilliant life-like tone quality, PHILCO needles are recommended. These needles are especially designed to give high fidelity tone reproduction—less record wear and less surface noise. One needle plays 15 to 20 records. The use of inferior needles in the pick-up of this mechanism will greatly affect the tone reproduction performance.

CHANGER OPERATION

Setting for Record Size

This changer plays up to twelve 10-inch records or ten 12-inch records at one loading.

On each post you will see two plates. The lower one, on which the records rest, is the shelf plate. The upper one is the selector blade which selects the next record to be played from the bottom of the stack.

To set for record size. (1) Clasp one of the posts just underneath the shelf plate, with thumb and finger of left hand. With right hand, lift knob and turn selector plate until the figure 10 or 12 (whichever size you want to play) is opposite the pointer. Do the same with the other post. Both selector plates must be in 10 or 12 position. (2) Push button marked 10 or 12, as required (see Figure 1).

Loading

See that both shelf plates are turned toward center of turntable. As shelf plates near correct position you will feel the shelf plates drop into their indexing slots. Make sure both posts have dropped into their slots, if one is not in the slot, records may be damaged. Place the stack of records over center pin so they will rest on the two shelf plates.

Starting the Mechanism

To start motor and turntable (1) turn the switch to "ON" position. (2) Then push button "R". This will release the first record and start the record-changing mechanism.

Rejecting a Record

To reject a record press the "R" button. This can be done any time after the needle has come into contact with that record.

Turning Off

Turn changer switch to "OFF" position. Lift pickup arm, place it on the pickup rest. (If you happen to turn off the changer switch while the mechanism is going through a "change cycle", you will notice that it does not stop until the cycle has been completed, and pickup is again in playing position, ready to be lifted over onto the pickup rest.)

To avoid warping of records, never leave records resting on the shelf plates.

Removing Played Records

To remove records make sure motor switch is off, then take hold of both posts, just below the shelf plates, and turn

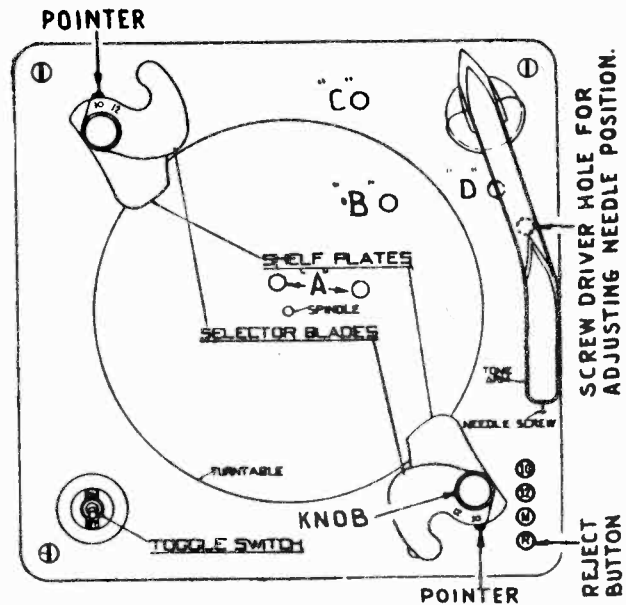


FIG. 1 SHOWS SELECTOR BLADES IN POSITION FOR 10-INCH RECORDS.

them out of the way. Lift the played records from the turntable. Taking hold of posts as before (below shelf plate) move plates until post again falls into indexed position as outlined under loading. The changer may then be loaded with a new stack of records.

Manual Operation

To play records one at a time as in an ordinary phonograph: (1) Remove any records remaining on the turntable, leave plates turned outward as for removing played records. Do not turn them back toward center of turntable. (2) Press button marked "M". Then place a record on the turntable, switch on motor and lift pickup into position.

LUBRICATION

The record changer will not need lubrication more than once a year and should be lubricated with a good light machine oil such as S.A.E. 10. There are 6 locations that will need oiling. These are shown in Figure 1. These lubricating holes can be reached from the top of the mechanism and are as follows:

1. The motor gear housing contains 3 lubricating wicks. These wicks are shown at "A" in Figure 1. Two of these wicks are reached through the hole directly in back of the turntable spindle and the other wick to the right of the turntable spindle.

2. A small quantity of oil should be dropped through hole marked "B" in Figure 1. Lubricating this point distributes oil to the various moving surfaces of the mechanism.

3. A felt wick directly below the hole marked "C" in Figure 1 should also be oiled.

4. Another felt wick marked "D" in Figure 1 should also be well oiled.

After long periods of use the oil becomes gummed in the above mentioned wicks. The wicks should be removed and cleaned with kerosene or carbon tetrachloride.

SQUEAKS OR OTHER NOISES DURING PLAYING OF RECORDS

If squeaks or various noises are heard from the mechanism during the playing of records or changing of records, the following items should be checked:

1. In the majority of the cases, these squeaks will be usually found to come from the friction between the stacked records and the turntable spindle. To check for this trouble, operate the mechanism with and without a load of records. To eliminate this condition, apply a very thin coat of light motor grease or vaseline to the turntable spindle.

2. Check the 5 wicks given under the paragraph on "Lubrication." Each wick should be thoroughly saturated with oil. All 3 motor wicks should be removed from the retaining holes with tweezers and examined to see if the oil has become gummy. In this case, the wicks should be thoroughly cleaned and relubricated with oil and replaced in their sockets.

3. Check all set screws to see that they are in place and tight.

4. Check motor windings. If coils have been jarred loose they should be tightened in place. The shading coils which encircle a portion of each laminated pole, the purpose of which is to make the motor self-starting, should be rigidly held in place by the retaining tape.

TURNTABLE SPEED VARIES

The turntable speed should be 78 R.P.M. + or - 2 R.P.M. when a record is being played, and the mechanism will operate satisfactorily. If the speed is below or above these limits, it indicates either trouble in the motor windings or bearings of the motor. Sometimes a few drops of oil on the bearings will increase the speed to normal. If upon investigation the normal speed cannot be obtained, replace the motor.

ADJUSTING LANDING POSITION OF NEEDLE ON RECORD

Adjustment of the landing position of the needle on records is controlled by the adjusting screw located in the hole shown in Figure 1. This adjustment is made with a screw driver from the top of the mechanism and does not require the removal of the changer from the cabinet. If the needle comes down too far from the edge of the record, playing of records will not start at their beginning. In this case, turn the needle positioning adjustment screw very slightly counter-clockwise. If the needle comes down too close to the edge of the record, the pickup may slip off the record. To adjust this condition turn the adjusting screw clock-wise. If adjustment screw is too far to rear and cannot be adjusted through hole in base plate, depress "Manual" push button, and push bracket —Forward.

NEEDLE FAILS TO MOVE INTO RECORD GROOVE AFTER LANDING ON RECORD

Generally when the needle will not pull into the groove after landing on the record, trouble may be found due to lead spring (97) being weak. Increasing the tension of this spring or replacing spring will generally eliminate the trouble.

If after adjusting the lead spring (97) it is found that the needle jumps across the record, it may be necessary to adjust the angle of the pickup in relation to the turntable spindle. This procedure is covered under paragraph "Mechanism Will Not Reject at the End of Records".

TONE ARM SLIDES INWARD ACROSS RECORD

This is caused by the guide arms stud (12) not releasing from the grooves in the upper side of the large cam gear (11). This may be due to friction at the shoulder screw (26) or the coil spring lifting the arm may be weak.

If the coil spring appears to be weak, it may be strengthened by shortening. If there is binding at the bearing, a little oil will help; also, a few movements by hand under considerable pressure will relieve the binding. If the binding is caused by the are being twisted out of line, the trouble can be sured by straightening up the parts.

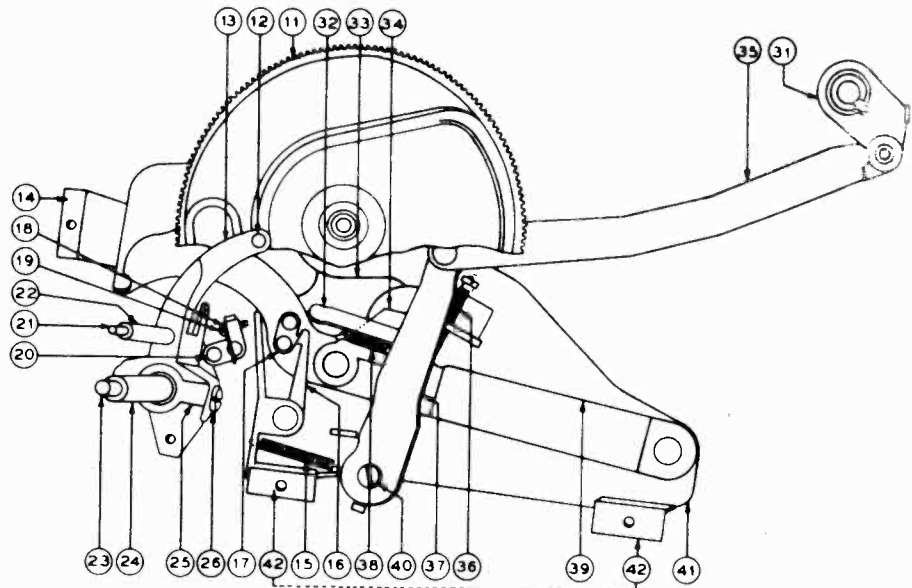


FIG. 2. CUTAWY VIEW SHOWING PARTS UNDER SUB-PLATE ASSEMBLY (83) FIG. 3

Numbers on Figs. 2 and 3	PART DESCRIPTION	Numbers on Figs. 2 and 3	PART DESCRIPTION	Numbers on Figs. 2 and 3	PART DESCRIPTION
11	Cam Gear	38	Spring	77	Manual Rod
12	Stud	39	Cam Lever	78	Reject Rod
13	Guide Arm	40	Shoulder Screw	79	Extension Rod
14	Bracket	41	Sub-Plate	80	Truss Bar
15	Trigger Spring	42	Bracket	81	Adjusting Cam
16	Trigger	51	Grommet Sleeve	82	Cam Gear
17	Trigger Catch	52	Shim	83	Sub-Plate Assem.
18	Trip Adj. Screw	53	Main Plate	84	Spring
19	Lock Spring	54	Changer Switch	85	Cycling Switch
20	Release Lever	55	Motor	86	Bracket
21	Pickup Plunger	56	Connecting Plug	87	Spring
22	Pickup Sleeve	57	Changer Connect. Rod	88	Link
23	Swivel Shaft	58	Cam Connecting Rod	89	Release Lever
24	Swivel Tube	59	Spreader-Hub Assem.	90	Upper Spreader
25	Swivel Trunnion	60	Shaft	91	Lower Spreader
26	Shoulder Screw	61	Spring Roller	92	Rod
31	Spreader-Hub Assem.	62	Spreader Spring	93	Lever-Hub Assem.
32	Bridge	71	Post Nut	94	Lever
33	Lifter Cam	72	Lever-Hub Assem.	95	Swivel Spring
34	Pawl	73	Flat Spring	96	Lever Spring
35	Cam Connecting Rod	74	Shaft	97	Lead Spring
36	Spring	75	Key Unit		
37	Lift	76	Key Bracket		

ADJUSTING THE RISING HEIGHT OF PICK-UP ARM

The pick-up arm should rise high enough during the change cycle so that the top of the tone arm clears the record resting on the support arms by $\frac{1}{8}$ ". When the maximum load of records are on the turntable, the needle should clear the top record, if not adjust as follows:

Loosen the lock nut in pick-up sleeve (22). Turn the sleeve in the direction necessary to lengthen or shorten the pick-up plunger (21). After correct adjustment is found, tighten lock nut.

ADJUSTING DISTANCE FROM TURNTABLE SPINDLE AT WHICH REJECT WILL OPERATE AND CYCLE WILL BEGIN

The mechanism is designed to reject records of all types whether they are provided with special grooves or not. The mechanism is adjusted to operate 1 7/8" from the center of the record spindle; this distance has been found to be the most satisfactory point for all modern records so that they will be rejected after they have been played through. To adjust the reject mechanism for this distance or any distance that may be desired, a trip adjusting screw (18) is provided. By turning this screw toward the trip trigger (16), the mechanism is caused to operate at a closer distance from the spindle. Turning the adjusting screw (18) away from the trip trigger, operates the reject closer to the turntable spindle.

It may be found on some records of very early manufacture that it will not be possible to obtain a satisfactory adjustment that will always operate the changer mechanism.

MECHANISM WILL NOT REJECT AT THE END OF RECORDS

There are several parts that will cause the mechanism to fail in the operation of rejecting of records. These items are listed as follows:

1. Examine swivel spring (95) for stretching. This spring is attached to the lugs at the end of the swivel spreaders (90) (91). The purpose of this spring is to keep the swivel spreaders (90) (91) closed, so that the trip trigger can be actuated. Increasing the tension of the spring (95) will prevent the swivel spreads from opening allow the trip trigger to actuate properly.

If after increasing the tension of the spring (95) it is found that the needle jumps across the record, it may be necessary to adjust the horizontal level of the pickup. Sometimes the pickup leans towards the center of the record. To remedy this condition, the pickup mounting post should be examined for proper mounting position or the pickup arm may be twisted out of shape. In either of these cases the pickup arm should be replaced or adjusted to its original position. When the pickup arm is properly adjusted, it should lean slightly in an outward direction (toward the edge of the record).

2. After it is found that the trip trigger (16) is operating properly, trouble may be found due to the cam lever (39) binding against sub-Plate (41). In this case, look for some obstruction or foreign material on these two parts. Also see that the rivets are operating freely. If lever (39) engages cam lever pawl (34) so that lift (37) forces its rollers up into the groove on cam gear (82) and if the set screws are tight, the change cycle should go into motion as the cam gear (82) turns.

3. Sometimes friction between the trigger (16) and trigger catch (17) due to burrs or rough surfaces may also prevent the reject from operating. If the trigger unlatches but the cam lever (39) does not move, it indicates binding between sliding surfaces. This may be caused by above mentioned burrs or by the cam lever being slightly warped.

To eliminate this condition, locate the position where there is excessive friction. If it is found that the parts are out of shape due to being bent, new parts should be added or the old ones straightened. When it is found that trouble is due to a burr on the edge of the metal parts, burrs should be removed with a very fine file or scraper. After eliminating this trouble, a small amount of oil should be applied to the sliding surfaces.

REJECT BUTTON "R" WILL NOT OPERATE MECHANISM

If the "R" button does not cause the mechanism to go through a change cycle check the following parts:

a. Examine key control unit (75) for parts that have become out of shape or any obstruction that will prevent the "R" button from moving to its maximum length of travel.

b. Inspect reject rod (78). If this rod does not trip the mechanism even when properly revolved by complete depressing of "R" button, the rod has probably been bent out of shape. Replace the rod or reshape it to its former position.

c. If trigger (16) is properly actuated but without starting a change cycle see instructions as given under "Mechanism Will Not Reject at End of Records" paragraph 3.

PRESSING "M" BUTTON DOES NOT CHANGE MECHANISM FROM AUTOMATIC TO MANUAL POSITIONS

Observe action of "M" button. Button should travel far enough down when depressed to cause the manual rod (77) to actuate the key control unit. The key control unit (75) should also be checked for parts which have become out of shape or any foreign obstruction.

MOTOR STOPS IMMEDIATELY WHEN CHANGER SWITCH IS TURNED OFF DURING A CHANGE CYCLE

The normal action of the mechanism when the changer switch is turned off during a change cycle is to continue to operate until the needle is again on the record. The mechanism should then

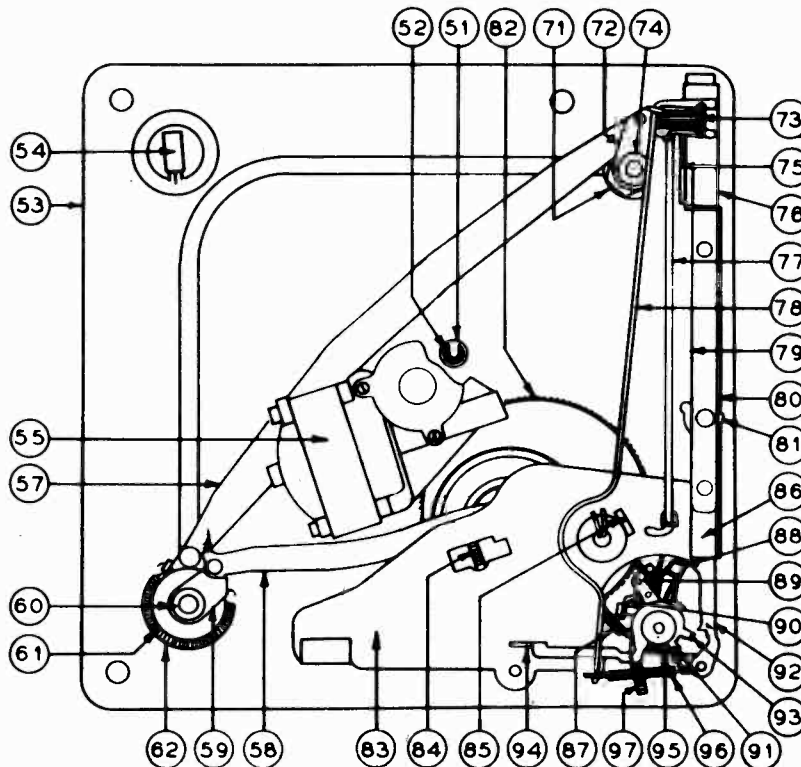


FIG. 3

stop. This action is caused by the cycling switch (85) short circuiting the manual changer switch during a change cycle. The switch should be changed when the above mentioned trouble develops.

TURNING CHANGER SWITCH OFF FAILS TO STOP MECHANISM

If after turning the changer switch off the mechanism continues to operate it indicates trouble in the cycling switch (85). Replace the switch when this trouble develops.

MECHANISM DOES NOT REPEAT THE LAST RECORD

If the mechanism does not repeat the last record, any one of the parts listed under "Mechanism Will Not Repeat at End of Records" may be causing the trouble.

RECORDS FALL UNEVENLY ON THE TURNTABLE

Records falling unevenly on the turntable is generally due to the turntable spindle not being correctly centered between the record loading posts. To correct this trouble, see "Replacing Motor."

LAST RECORD DROPS ON ONE SIDE

This trouble is due in most cases to the loading posts being bent out of perpendicular to the main plate. To check for this trouble, test the posts with a steel square as directed under "Replacing Motor". Replace or adjust post so that it will be perpendicular to the main plate.

CHANGER CONTINUES CYCLING

If the mechanism continues to change records constantly, it indicates trouble in the lift (37). Failure of this lift to disengage with the cam gear (11), Fig. 2, will cause the trouble. Check the various rivets at which motion occurs to find a point where friction or binding is interfering with freedom of motion. The cam lever (39), Fig. 2, should also be checked for too much friction. Oil this part if necessary.

SELECTOR BLADE FAILS TO SEPARATE BOTTOM RECORD FROM STACK

This is due either to a badly warped record or to its being of a thickness considerably different from records now in standard use. The selector blade and shelf blades are designed to accommodate a maximum variation in thickness and flatness of records now in standard use. There are certain records, however, that may be found which vary in thickness so much as to be impracticable for use in the automatic changers.

SELECTOR BLADES JAM INTO EDGE OF RECORD

This is generally caused by too small a spacing between the selector plate and the spacing between the selector plate and the shelf plate. This space should never be less than .050 inch when selector plate is in 10" position. Another cause of jamming is too sharp an edge on the selector plate.

To eliminate this trouble, check spacing of plates. Bend the selector plate slightly, if necessary. Smooth up the edge of the selector plate by means of a piece of fine emery cloth.

MECHANISM SLOW IN STARTING OR STALLS DURING A CHANGE OF CYCLE

Trouble is probably due to:

- Motor mechanism is not thoroughly lubricated. See heading "Lubrication".
- Check for loose set screws.
- Line voltage may be abnormally low or motor windings damaged. If the windings of the motor are damaged, replace motor. To remove motor, see heading "Replacing Motor".

REPLACING MOTOR

Replacing the motor necessitates extreme care in aligning and correctly mounting the new motor. The procedure listed below should be followed closely. When replacing a new motor or ordering a new one from your distributor, specify the power supply from which the motor is to be operated. The motor electrical wiring is shown in Fig. 4.

When mounting replacement motor, it is most important to see that record pin is centered between the two posts of the changer, that it stands perpendicular to main plate (53), and that it has not become bent so as to wobble. Even though the posts are stout and not easy to bend, it is well to check them also, with a 12" combination square laid clear across the concave upper surface of main plate. When the new motor has been attached, with three screws through grommet sleeves (51) (spacers) into its frame, and record pin is seen to revolve without appreciable wobble, the correct position of the record pin between the record-mounting posts can be accurately checked as follows: Place a single 12" record on the shelf plates, press "R" button, and turn turntable forward by hand. Immediately after the shelf plates open and allows the record to fall, turn turntable slightly backward, and with other hand support the record between the shelf plates; it can then be readily seen whether record pin is off center. If the record pin is found to be off center, remove the record and turntable, and loosen slightly the motor mounting screw or screws nearest the shelf plate to which record appeared closest. This should improve evenness of operation. However, unless the unevenness was very slight, it will be necessary for a permanent repair to insert a shim or two on one or more of the three screws (or change shims from one screw to another). The shims used are shaped like an ordinary washer, cut out at one side (see cut-away view at 52 on photo, showing a shim in place upon one of the grommet sleeves). Shims can readily be cut out with shears and punch from thin metal or cardboard—or an assortment of shims of different thicknesses can be had from your distributor. (Order "Assortment of Part No. 45-2785"). They should be inserted, around proper screws (when screws have been sufficiently loosened) between motor frame and the metal grommet sleeve. Do not insert shims next to rubber grommet.

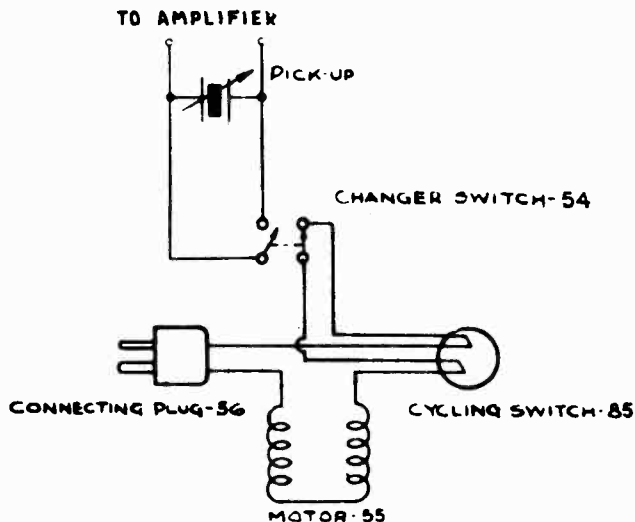


FIG. 4. MOTOR ELECTRICAL CONNECTIONS

DISASSEMBLING THE CHANGER

Before attempting to remove sub-plate assembly (83) detach key control unit (75) from main plate. To do this, start with control unit truss bar (80). Then take out the screw which holds left end of adjusting rod lever (94). Next remove adjusting rod (92) and adjusting rod extension (79). Take out the screw holding spring (73); then the screws holding key control unit (75) to main plate. Rods (77) and (78) can then, with due care, be extracted without bending. Free the cam connecting rod (58) by loosening setscrew holding spreader and hub assembly (59). Sub-plate assembly can then be detached without bending parts. In reassembling, reverse the procedure.

MODELS 35-1267, 35-1268,
35-1269, 35-1270, PHILCO RADIO & TELEV. CORP.
35-1271, 35-1276,
35-1279

MODELS 35-1231, 35-1233,
35-1239, 35-1241,
35-1259, 35-1261,
35-1266

Automatic Record Changers

35-1231, 35-1233, 35-1239, 35-1241, 35-1259, 35-1261, 35-1266,
35-1267, 35-1268, 35-1269, 35-1270, 35-1271, 35-1276, 35-1279

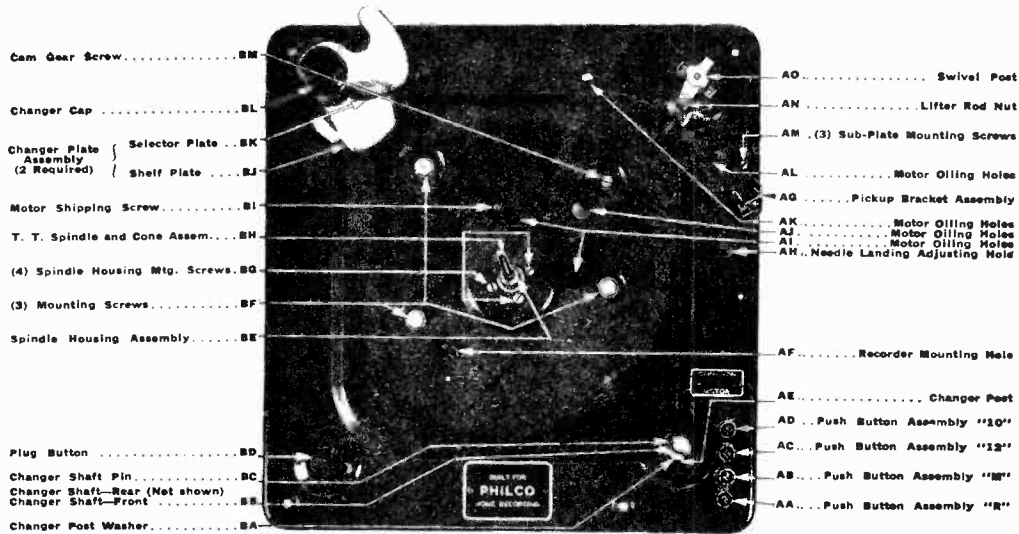


PHOTO A-B. TOP VIEW.

REPLACEMENT PARTS — RIM DRIVE MOTOR CHANGER

35-1266, 35-1267, 35-1268, 35-1269, 35-1270, 35-1271, 35-1276, 35-1279
RECORD CHANGER 35-1276 (115 Volts, 60 Cycle), 35-1279 (115 Volts, 50 Cycle)

The replacement parts listed below cover the turntable motor drive parts and selector plate assembly used in the rim drive record changers. All other parts used in this type changer are the same as those listed for the gear type motor changers on page two. The same mechanical adjustments listed in the Radio Service Bulletin No. 358 are also used for the rim drive motor changers.

Diagrams 1 and 2 Numbers	DESCRIPTION	Part No.	Diagrams 1 and 2 Numbers	DESCRIPTION	Part No.	Diagrams 1 and 2 Numbers	DESCRIPTION	Part No.
1	Selector and Shelf Plate Assy.	35-2222		Spring (Knob)	35-2218		Shaft (Rear)	35-2442
	Rear Shelf Post	35-2454		Selector Plate	35-2216		Pin (Shaft)	35-2440
	Knob (Selector Plate)	35-2219		Shelf Plate	35-2217		Washer (Post)	35-2404

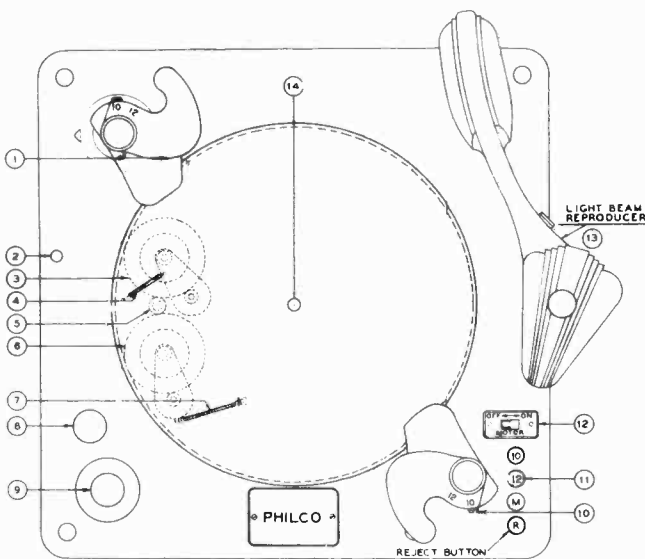


FIG. 1. PART LOCATIONS — TOP OF CHANGERS
RIM DRIVE TYPE

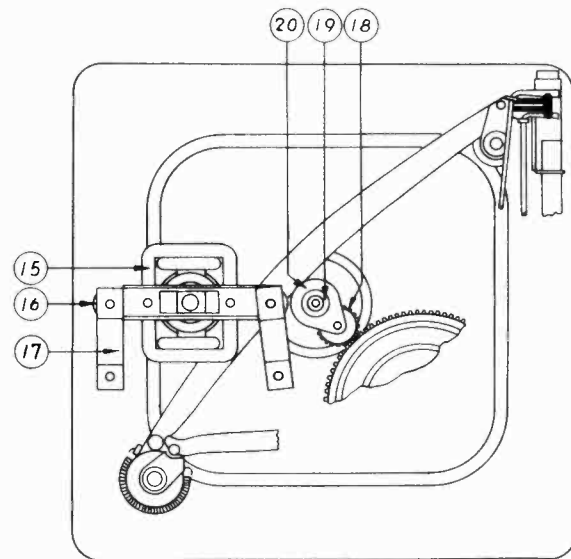


FIG. 2. PART LOCATIONS — BOTTOM OF CHANGERS
RIM DRIVE TYPE

PHILCO RADIO & TELEV. CORP. MODELS 35-1231, 35-1233, 35-1239, 35-1241, 35-1259, 35-1261, 35-1266, 35-1267, 35-1268, 35-1269, 35-1270, 35-1271, 35-1276, 35-1279

- CA Pickup Plunger
- CB Lifter Guide (Specify Type of Reproducer)
- CC Hinge Spring Screw (Specify Type of Reproducer)
- CD Hinge Spring (Specify Type of Reproducer)
- CE Key Control Assembly
- CF Pickup Plunger Spring (Inside Sleeve)
- CG Manual Key Rod
- CH Rejection Key Rod
- CI Pickup Plunger Sleeve
- CJ Lifter Rod Nut (AN)
- CK Trunnion Tube and Trunnion Assembly
- CL Trunnion Shoulder Screw (2 Required)
- CM Clutch Release Roller
- CN Guide Arm Spring
- CO Swivel Spreader Spring
- CP Spring
- CQ Clutch Assembly
- CR Clutch Lever and Sleeve Assembly
- CS Clutch Lever and Sleeve Spring
- CT Clutch Spring Retainer
- DA Spreader Hub Assembly (Lower)
- DB Cam Connecting Rod
- DC Cam Gear
- DD Cam Lever Spring
- DE Roller
- DG Lifter Cam (Cam Gear Assembly)
- DH Felt Wick
- DI Cam Lever and Pawl Assembly
- DJ Cam Connecting Rod Lift Assembly DA, DB, DE, DH
- DK Shoulder Screw
- DL Pawl Spring
- DM Clutch Release Bracket
- DN Release Trigger
- DO Clutch Screw
- DP Clutch Lever Spring

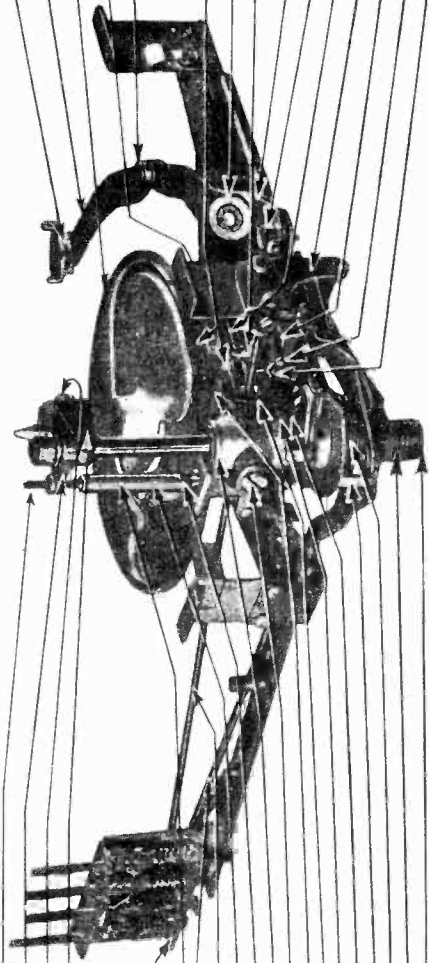


PHOTO C-D. VIEW OF SUB-PLATE ASSEMBLY, TOGETHER WITH CERTAIN OTHER ASSEMBLIES.

- EA Motor (Give Model No., Voltage and Frequency)
- EB Main Mounting Plate (Give Model No.)
- EC Plug and Shell
- ED Changer Shaft Collar
- EE Spreader and Hub Assembly
- EF Spring Roller
- EG Changer Spreader Spring
- EI Return Spring
- EJ Return Spring Catch
- EK Lever Pin
- EL Clutch Release Assembly
- EM Connecting Rod Nut
- EN Clutch Retainer Screw
- EO Clutch Release Adjusting Screw
- EP Cam Connecting Rod Lift Spring
- ER Changer Serial Number
- ES Adjusting Rod Assembly
- ET Lower Swivel Spreader
- EU Pickup Leader Spring
- EV Upper Swivel Spreader
- EW Post Nut (3 Required)
- EX Lock Washer (3 Required)
- FA Motor Mounting Plate
- FB Coupling Assembly
- FC Motor Mounting Screw (3 Required)
- FD Motor Mounting Grommet (6 Required)
- FE Motor Mounting Stud (3 Required)
- FF Tee Nut
- FG Changer Connecting Rod Assembly
- FH Manual and Rejecting Rod Spring
- FI Idler Gear
- FJ Changer Lever and Hub Assembly (Front)
- FK Adjusting Rod Spring
- FL Adjusting Rod Extension
- FM Needle Landing Adjusting Cam
- FO Swivel Guide Arm Assembly
- FP Adjusting Rod
- FQ Adjusting Rod Bracket

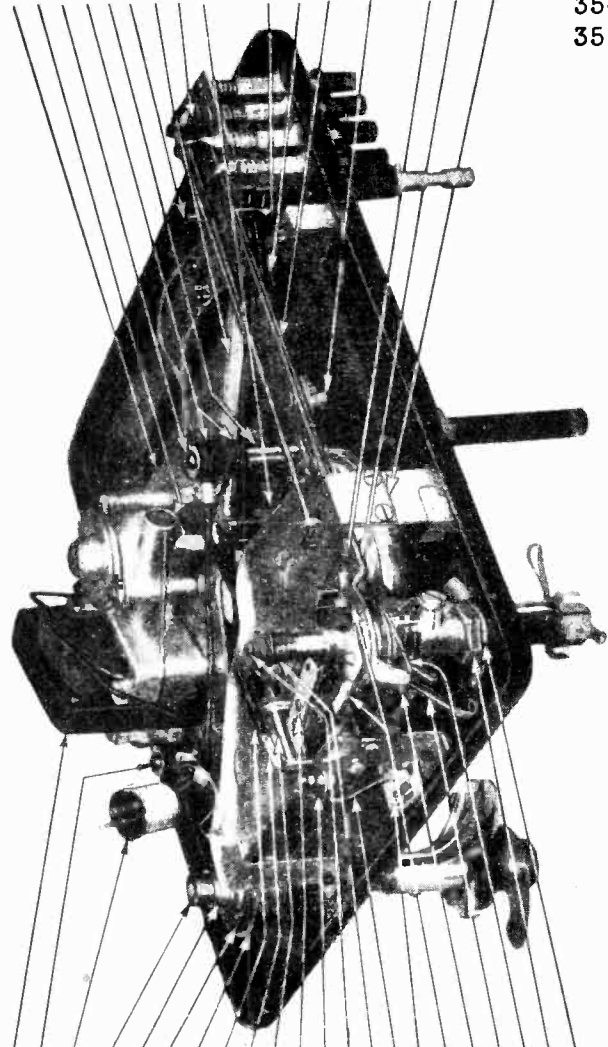


PHOTO E-F. BOTTOM VIEW.

MODELS 35-1231, 35-1233, PHILCO RADIO & TELEV. CORP. 35-1267, 35-1268
 35-1239, 35-1241, 35-1269, 35-1270
 35-1259, 35-1261, 35-1271, 35-1276
 35-1266 35-1279

GENERAL DESCRIPTION OF THE CHANGE CYCLE

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, interconnected and built together but largely separate in their operation.

(1) The record-changing mechanism — brought into operation originally by the contact of Lifter Cam DG with Pawl DI — is the simplest of the three. It is driven by the cam groove (not visible) on under side (in Photo C-D) of Cam Gear DC. As Cam Lever is forced, by the Pawl, out underneath Lifter DJ (which is shown revolved to the right for visibility) the Lift rises and forces roller DE into the under groove in Cam Gear. The motion is transferred to Rear Changer Shaft (at ED) through Cam Connecting Rod EH, thence through Changer Connecting Rod FG to Front Changer Shaft at FI.

(2) The pickup-operating mechanism — likewise brought into operation originally by the cam-and-pawl action upon Cam Lever — is driven in part by the groove in upper (visible) side of Cam Gear. As Cam Lever is forced out, at the beginning of the change cycle, against Link at FO, it causes the Link to push upward upon Pickup Plunger CA, thus lifting needle from record. The same pressure upon Link works, through Guide Arm at FO, to force Stud on Guide Arm down into the groove on the Cam Gear. This rotates the pickup arm, while Pickup Plunger holds it up off record. It is rotated first out beyond the turntable until Selector Plates BK have dropped the next record, then rotated back to proper position to start playing.

(3) The mechanism for bringing needle into correct starting position must operate accurately for both 10" and 12" records. Partly due to this requirement, the starting position is not determined by the cam action. The upper groove on Cam Gear is designed so that it, acting alone, would carry the needle farther back toward record pin than would ever be desirable as a starting adjustment. Travel of pickup arm toward Record Pin is then stopped, at proper point for lowering onto the record, by action of Lever Hub at CQ. The stopping takes place as lug (upon the Lever Hub) strikes the shoulder on Rod FP. This enables the entire mechanism rotated by cam action on Guide Arm to travel on past the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to Lever Hub, is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires therefore only correct adjustment of Rods FL and FP; the radial difference of 1 inch between correct starting position for 10" and 12" records is taken care of by exact dimensioning, at the factory, of surfaces at right end of Rod FP which stop against the "10" and "12" key stems. Due to this, when Adjusting Cam at FM is turned (as directed below under Adjustment A) the starting position

of needle is simultaneously altered for both 10" and 12" records.

ADJUSTMENTS

There are two adjustments that can be made, FROM ABOVE: CHANGER NEED NOT BE REMOVED FROM CABINET. All adjustments are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to readjust, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. If needle comes down on the sound track, playing of records will not start at their beginning. Insert screw driver through hole AH. Turn screw head on Needle Landing Adjusting Cam FM very slightly counter-clockwise. If needle comes down too close to outer edge of record, or out beyond edge of record, turn Adjusting Cam clockwise.

The factory adjustment of needle landing is $\frac{1}{8}$ " in from outer edge of record.

Compare also Paragraph 12 on page 6.

B. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES. The arm should rise, during the change cycle, high enough so that it clears by only $\frac{1}{4}$ " the record above it, next to be played. (Be careful, before deciding that readjustment is necessary, to see that the record at bottom of stack is not a warped one. To make this adjustment, loosen Lock Nut CJ and turn Pickup Sleeve CI to lengthen or shorten Pickup Plunger CA. However, if Pickup is made to rise too close to bottom record, Stud on Guide Arm at FO may not clear the groove in Cam Gear. In making this adjustment, therefore, care must be taken to see that Pickup Arm does not keep moving back and forth continuously (due to Stud remaining in engagement with groove). When correct adjustment is found, tighten Lock Nut securely.

TROUBLE SHOOTING

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it — or that set screws may work loose due to some external vibration. For tightening set screws, a No. 8 size Allen (hexagon) wrench is required. Be sure that set screws are properly seated on the holes or flats provided. Damage from tampering on the holes to take the form of bent parts; never bend any part during examination.

Among the principal trouble symptoms to which such causes may arise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT.

May be caused by:

- Failure to lubricate properly. Oil thoroughly. See oiling instructions.
- Check voltage. Line voltage may be abnormally low or high.
- Motor windings damaged. If windings are found damaged, replace motor.

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS.

This indicates trouble in Motor windings. Unless the damage is easily seen and repaired, replace motor.

3. MOTOR IS SLOW IN STARTING.

- Check oiling, as directed on page 2. It may not have been properly done; old oil may have become gummy.
- Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that Motor is defective.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

Check oiling, as directed on page 2. (If squeaks are heard, they will usually be found to come from the records — not from the mechanism.) See "To Check Oiling."

5. CHANGER IS NOISY WHEN IN CYCLE.

Check oiling. Also see if any part has become loose or bent and is rubbing against a moving part such as the Swivel Guide Arm against the Cam Gear.

6. MOTION OF PICKUP TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM.

Manual button down. See that shipping bolts are removed.

If trigger is being properly actuated, probably Cam Lever at EL is binding against Sub-plate. Look for dirt or obstructions; See that Pawl and Trigger DN are working freely on their rivets. If the Lever engages the Pawl so that Lift forces roller up into the under groove on Cam Gear, and if set screws are

tight, the change cycle must operate as Cam Gear turns.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

- Due to shipping bolts not being removed, causing a bind on manual rod, or manual button is down.
- Check Key Control Unit CE: See whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel.
- Examine Reject Rod CH. If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be restored in some way. Grasp the two ends and twist it slightly.
- If Trigger DN is being properly actuated but without starting a change cycle, see directions, Paragraph 6.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION.

- First see that button goes clear down; then follow its action through Manual Rod CH.
- Also caused by the manual rod being bent and not projecting up through Sub-plate and stopping Cam Lever when it is released from the Trigger.

9. TRIPS TOO SOON OR BEFORE RECORD HAS FINISHED PLAYING.

This caused by too little clearance between the trigger and the clutch lever assembly. To get more clearance on this adjustment, turn the adjusting screw DO in a clockwise direction a half-turn or whatever is necessary to make tone arm trip on $\frac{1}{4}$ " motion.

10. TONE ARM FALLS OFF RECORD.

Needle sits down too close to edge of records, not adjusted in far enough, or needle landing adjusting cam reversed. It should contact lug on adjusting rod on the long side of cam. Check pick-up leader spring EU. It may have become loose; more tension can be given it by bending down lug.

11. TONE ARM SITS DOWN TOO FAR IN.

Due to adjusting rod bending and not measuring properly. If found to be bent, should be straightened to correct shape so that it will operate freely.

MODELS 35-1267, 35-1268,
35-1269, 35-1270,
35-1271, 35-1276,
35-1279

PHILCO RADIO & TELEV. CORP.

MODELS 35-1231, 35-1233,
35-1239, 35-1241,
35-1259, 35-1261,
35-1266

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE.

Pickup arm is normally impelled toward center of records by Lead Spring EU. Should a slight increase in its tension be found necessary, this can be easily obtained by slightly bending the lug, to which it is attached, down against Main Plate.

13. WOW IN RECORD REPRODUCTION.

a. Record is warped or otherwise defective or instrument is not being operated at normal room temperature, 70 F°.

b. Motor mounting plate being bent will cause "wow." Straighten it if possible or replace with new plate if too badly bent to warrant straightening. This is only found where rough handling is evident.

c. Motor shaft out of alignment with the turntable shaft (also due to rough handling). To correct, move the motor on its mounting until motor shaft is parallel to the turntable shaft and the Universal coupling is exactly at right angles to motor and turntable shafts, then tighten motor mounting screws securely.

14. LAST RECORD DROPS ON ONE SIDE ONLY.

This suggests a Changer Post bent out of perpendicular to Main Plate. If Post must be straightened, be careful not to bend other parts.

15. CHANGER CONTINUES CYCLING.

a. Probably due to failure of Lift at DJ to be drawn back out of engagement with Cam Gear. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.

b. Make sure that trigger spring is not disconnected. Also that clearance between trigger and clutch lever is sufficient. A sticking pawl will also cause this condition.

16. RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME.

See that Pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type. If pickup cartridge is found not to deliver proper output, remove it and install another.

See Service Bulletin No. 354 for Philco Photoelectric Reproducer adjustments.

17. RECORD JAMS.

Most slicing trouble (record jams) is due to off-size or defective records, and is no fault of the record changer or record changer adjustment. Properly manufactured records have a uniform semi-circular edge and can be successfully handled by record changers, even though the records vary considerably in thickness.



Cross section of record edge showing a perfect and three imperfect edges.

Records that prove troublesome in the selecting or slicing process can usually be corrected by using a piece of fine sand paper or emery cloth to touch up the edge.

18. AUDIO HOWL.

Record changer not floating on cushions or spring mounting. See that shipping bolts are removed. If unit still does not float, loosen the nuts or mounting assembly allowing unit to rise and float.

19. TURNTABLE IS TIGHT.

This turntable is assembled to the turntable shaft with a taper lock fit in the center. To remove, grasp turntable with both hands, turn slightly forward and backward at the same time pulling upward, or run motor and grasp the turntable while it is revolving, and pull up.

20. THUMP HEARD IN RECORD REPRODUCTION.

This is caused by the motion of the friction clutch when it is momentarily released by the motion of the release lever, which in turn is actuated by the hump on the cam gear. If thump is objectionable, it can be reduced by adjusting the clutch lever at EO to allow only a slight amount of motion of the clutch assembly; also if the clutch spring is too strong, replace with a new spring or cut one-quarter of the length of the old spring or whatever is necessary to assure satisfactory operation. Be sure that clutch assembly parts are free from dirt and burrs and work freely without binding.

The De Luxe record changer automatically plays fifteen 10" records or thirteen 12" records at one setup or fourteen 10" and 12" records intermixed. Each of the three posts has three plates. The lower one on which the records rest is the shelf plate; the upper one is the selector plate which takes from the bottom of the stack the next record to be played and releases it to the turntable. The action of the center plate is to lift a 12" inch record up from a 10" record when the mechanism is loaded with intermixed records. To load for automatic operation see that all three shelf plates are turned down towards the turntable, then place the stack of records to be played over the turntable shaft so that they rest on the three shelf plates. Then see that pointer on control switch is set on "A," automatic, and press push button to put changer in operation.

To reject a record (or to start a change cycle as NOTE—In Model 41-616 the reject push-button on the changer is not used. To reject a record in this model press the "phono" push button on the Radio, this operates the reject relay.

changer No. 36-1236 (Model 41-616), however, has additional equipment which is controlled by Wireless remote control and push button control. These parts are indicated in figure (4). The parts are numbered and shown on the schematic diagram in Service Bulletin 373 and are as follows: Number 147, reject relay; number 154, reject series switch; number 148, cycling switch; and number 149, radio recording switch.

REPLACEMENT PARTS

When ordering parts for this mechanism, refer to the part number of the entire mechanism in addition to the number and names of the parts shown in the figures of this bulletin.

ILLUSTRATIONS

The six illustrations show all vital parts of the changer. Numbers are used to refer to parts shown on the photos. Parts that are not numbered, cannot be separately supplied. Order the assembly containing them.

GENERAL DESCRIPTION OF CHANGE CYCLE

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms interconnected and built together but largely separate in their operation. The motion for each is originated in one central cam gear which has three different and individual cam surfaces. The cam gear is normally at rest while a record is being played, but is put into operation by contact of a latch lever (located on the cam gear) with the teeth of an intermediate drive gear. This motion only takes place when the unit is put into a change cycle. The cam gear then makes one full revolution to complete the change cycle and then comes to rest in a normal position.

(1) The record changing mechanism is brought into operation by a segment (or lever) with a roller at one end which runs in a cam groove in the cam gear which drives with an oscillating motion the three pulleys by means of a metal tape or belt. The pulleys are fastened to the lower ends of the changer shafts which in turn transmit their motion to the changer plates which are fastened with set screws to the upper ends of the shafts. When the changer plate assembly is revolved the record resting on the shelf plate is then dropped to the turntable.

(2) The pickup operating mechanism is likewise brought into operation originally by the cam surface on the cam gear which operates a raising lever which receives a rocking motion from the cam gear through a roller which is part of the raising lever assembly. The flat spring on the opposite end of this lever is carried upward against a lifter pin which raises the pickup thus lifting the light beam jewel from the record. This motion also moves the hollow pickup shaft upward, pressing together the stop plate, the cork friction disc, and clutch bracket. While the light beam jewel is raised from the record, the clutch bracket receives an angular or swinging motion from the cam gear to a lever and link assembly and carries with it the locating plate which is directly connected to the pickup. The pickup is thus carried out beyond the turntable while the changer plates drop a record and is then brought back to the proper position to start playing. If there is no record on top of

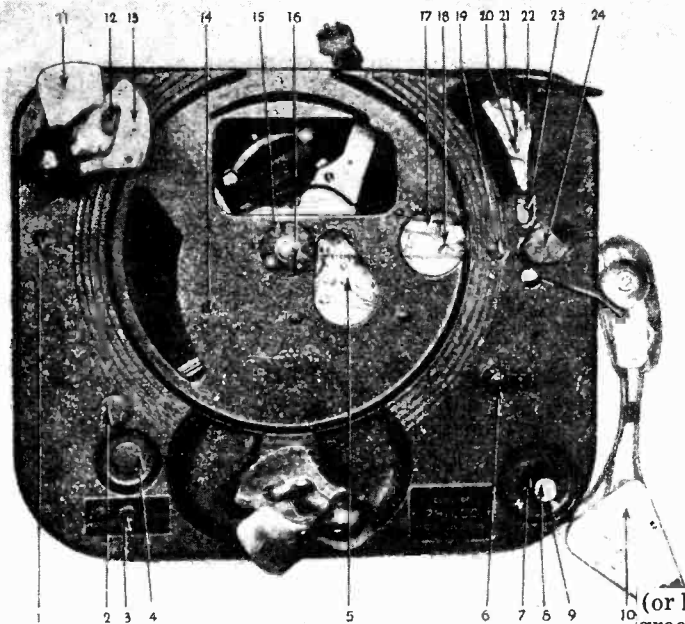


FIGURE 1

- | | |
|--------------------------|----------------------------|
| 1 Plug Button | 14 Recorder Mounting |
| 2 Plug Button | 15 (4) Spindle Housing |
| 3 Radio Recording Switch | 16 Turntable Spindle and |
| 4 Plug Button | Housing Assembly |
| 5 Cam Latch and Trigger | 17 Trip Arm Assembly |
| Assembly | 18 Trip Lever Assembly |
| 6 Tone Arm Rest | 19 Trip Adjusting Hole |
| 7 Switch Knob | 20 No Record Pin |
| 8 Push-button | 21 Center Blade Lift Pin |
| 9 Pointer | 22 Selector Plate Lift Pin |
| 10 Light Beam Pick-up | 23 Jewel Landing Adjust- |
| Assembly | ing Hole |
| 11 Upper Plate | 24 Light Beam Pick-up |
| 12 Center Plate | Mounting Bracket & |
| 13 Lower Plate | Swivel |
| Changer Plate Assem. | |

for testing purposes) simply press the push button at any time while light beam jewel is upon a record. To play manually, turn shelf plates up, set control pointer (9) on "M," for manual, then place a record on turntable and press button to switch on motor then lift pick-up into position on record. The changer can be turned off at any time by pressing down on pickup rest.

PART DIFFERENCES, CHANGERS NOS.

35-1234, 35-1236

Mechanical operations of the record changers, Part Number 35-1234 (Model 41-611) and Part Number 35-1236 (Model 41-616) are identical. The record

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MODELS 35-1234, 35-1236

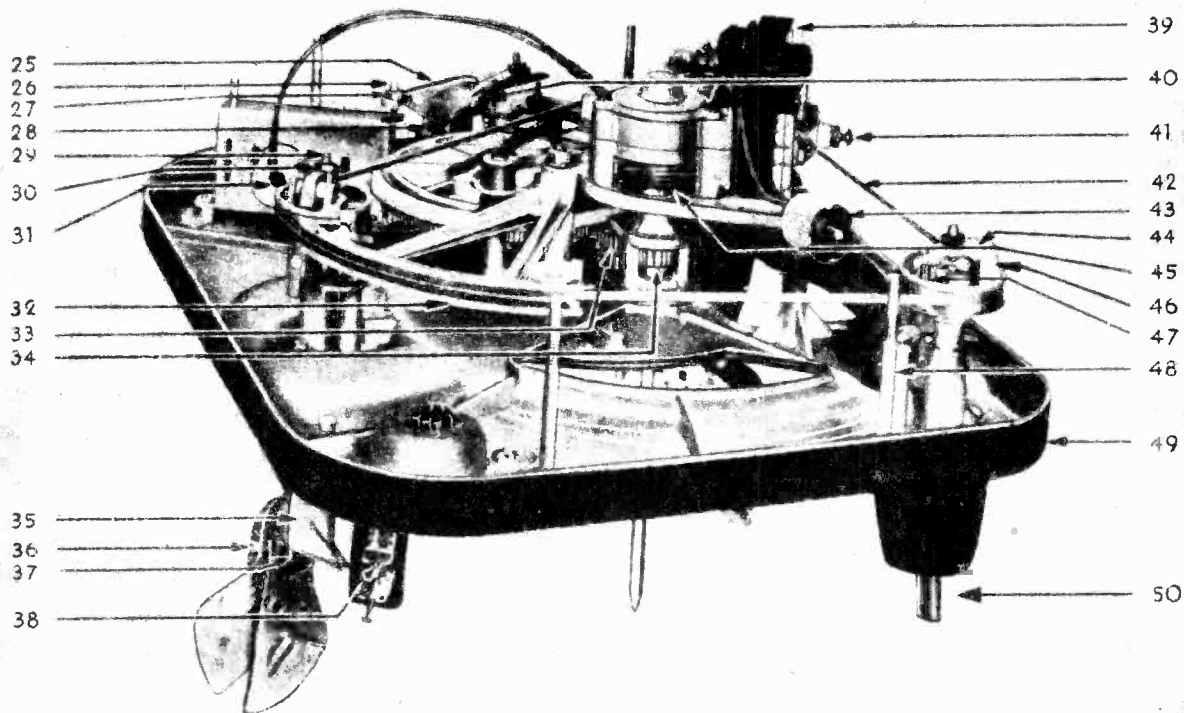


FIGURE 2

25	Raising Lever Assem.	35-2331	32	Tape Segment Assem.	35-2334	42	Tape	35-2326
26	Raising Lever Adjusting Screw	35-2332	33	Intermed. Gear Assem.	35-2335	43	Motor Connecting Plug	
27	Nut (Adjusting Screw)		34	Drive Pinion Gear	35-2336	44	Center Blade Lifter Assembly	35-2329
28	Roller		35	Changer Blade Bracket		45	Coupling Assembly	35-2327
29	Set Screw		36	Blade Hinge Pin	35-2337	46	Blade Lifter Pin	35-2328
30	Nut Cop.		37	Blade Lifting Pin	35-2338	47	Blade Lifter Spring	35-2330
31	A. C. Switch (Model 41-611 only)	35-2333	38	Light Beam Pick-up	35-2209	48	Mounting Stud	
	See Fig. 4 for Model 41-616		39	Motor (115 v., 60 c.)	35-1272	49	Main Plate	
			40	Motor (115 v., 50 c.)	35-1273	50	Blade Post Stem	
			41	Raising Lever Trunnion	35-2325			

changer plates when the cycle starts, the pickup arm will then remain out beyond the turntable and descend on the pickup rest automatically shutting off the motor after the last record has been played.

(3) Mechanism for bringing light beam jewel into correct starting position on the record. This mechanism must operate fairly accurately for both 10" and 12" records. Partly due to this requirement, the starting position is not determined by the cam action, as the cam surface on the cam gear is so designed that the movement of the lever and link assembly would normally carry the pickup arm farther toward the turntable shaft than would ever be desirable as a starting adjustment. Therefore, the travel of the pickup arm toward the turntable is stopped at the proper point for lowering onto the record by two eccentric adjusting studs on the locator plate which comes into contact with the stop arm which is automatically preset by the record which is about to be dropped from the changer plates to the turntable. If a 12" record is about to be played it rests on the center changer plate of the master changer post (which is located directly behind the pickup) causing same to push downward on center pin which in turn pushes downward on the center blade lifter lever which is pivoted on a hinge pin in the pulley. This brings the upper end of center blade lifter toward the pulley hub. When the pulley is oscillated or driven by the tape, the upper end of this lever will travel on the inside of the crescent shaped cam. This will move the setting lever (which is fastened to the same hub as the stop lever) in such a position that stop lever will contact the 12" eccentric adjust-

ing stud on the locating plate which accurately measures the starting point of the needle on a 12" record. A 10" record which is about to be played will not rest on the center plate, therefore the center plate and center pin and lever will be held upward by a spring on the pulley. The upper end of the center blade lifter lever will therefore be further away from the upper pulley and will travel on the outside of the crescent shaped cam moving the setting lever and stop lever in such a position that stop lever will touch the 10" eccentric adjusting stud also on the locating plate which accordingly measures the starting point of the needle on a 10" record. After the last record has been dropped from the changer plates and played, the lower changer blade is pushed upward by a spring which pushes up the no record control pin. The no record control lever is also carried up so that when pulley is oscillated the no record lever sweeps the setting lever and stop lever to the position where the stop lever engages with a heel on the locating lever and holds pickup out beyond the turntable. Then when the pickup descends it depresses the pickup rest, thereby tripping switch and shutting off the motor.

OILING

The changer should be lubricated once a year with a few drops of good light machine oil at each of the following points:

- No. 1. Three holes in motor gear housing.
- No. 2. Turntable spindle bearings.
- No. 3. All other bearing points. (Caution. Never oil the friction clutch (72) at any time as it will cause slippage.)

TO CHECK OILING

If squeaks are heard, compare the squeak with and without a load of records, as any stack of records in motion is apt to squeak with a pin through their centers. This can be corrected by rubbing a little wax on the turntable shaft. See that all three $\frac{1}{4}$ " round wicks in the motor frame are in position and are thoroughly saturated with oil (as it may not be if insufficient oil or too heavy oil has been used.) Lift out all three motor wicks with tweezers. See if old oil has become "gummy" (commonly due to use of low grade oil or low viscosity oil.) **If necessary clean gummed up wicks with kerosene.** See that each is saturated with good oil, then before replacing them drop a little oil into the holes. The gear box of the motor is packed with a semi-fluid grease at the factory and it should never be necessary to take it apart for lubrication purposes. However, if at any time it is necessary to take the motor apart or remove the transmission cover from the motor frame, be sure that motor is not in a position so that when transmission cover is removed the grease will not run out of the transmission case.

REPLACING MOTOR

In case of any serious fault within motor, it should be removed from the changer and replaced with a new motor. See that motor frame is well grounded by wire, soldered to lug on Sub-plate. (In ordering a replacement motor, specify the power supply and give model number.)

CHANGER ADJUSTMENTS TROUBLES

Cases of failure to operate satisfactorily will generally be found due to either to neglect of proper lubrication, or to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it — or that set screws may work loose due to some external vibration. For tightening set screws an Allen (hexagon) wrench is required. Be sure that set screws are properly seated on the holes or flat provided. Damage from tampering is likely to take the form of bent parts. Never bend any part during examination.

ADJUSTMENTS

TONE ARM ADJUSTMENTS

A. Tone Arm Rest Position Adjustment

1. Start change cycle.
2. Then stop changer just before the tone arm starts to lower on the rest.
3. In this position the outer edge of the pickup should clear the hook of the rest (6) by $\frac{1}{16}$ of an inch.
4. If it does not position properly on the rest make adjustments as follows: Hold clutch index lever (69) which moves with the tone arm, against the index hook sleeve (67). Then loosen the clamp screw on pickup mounting and move tone arm so that it sets down into the pickup rest.

B. Tone Arm Height Adjustment

The tone arm when lifted to its maximum height, the light-beam jewel should clear fifteen 12" records on the turntable, by at least $\frac{1}{16}$ of an inch. If it does not clear records at this distance then the adjustment screw underneath the tone arm directly above the plunger in the pickup mounting bracket should be turned out to the proper distance required.

C. Adjusting Tone Arm to Index on 10 and 12-inch Records

Adjusting landing position of light beam jewel on the record. The position at which light beam jewel lowers to record can be adjusted by inserting screw driver through hole (23) just in back of tone arm (shown in Fig. 1). For adjusting the 10" setdown, insert screw driver into the inside eccentric adjusting stud. For adjusting the 12" setdown, insert screw driver into the outside slotted stud. Turn very slightly clockwise or counterclockwise to move light beam jewel landing in or out. The factory adjustment for the light beam jewel landing on the record is $\frac{1}{8}$ " in from the outer edge.

D. Reject Adjustment

Adjusting the trip eccentric cam for correct clearance between trip lever (18) and trip arm (17); changer in neutral position out of cycle. Insert screw driver through hole (19) in main plate and locate it into slotted stud. Adjust eccentric cam so that the distance between the trip lever and trip arm is approximately .005. This can best be done by first adjusting the trip eccentric cam so that there is no clearance or gap then back off very slightly until trip lever is free to pulsate with the clutch motion or action of the release lever. If the clearance is not sufficient between the trip lever and trip arm, the pulsating motion of the clutch release lever will gradually cause the trip lever to move the trip arm causing an early trip.

GAUGING AND SYNCHRONIZING RECORD SELECTOR BLADES

To gauge and synchronize the record blades so that they will select 10" and 12" records properly proceed as follows:

1. With the changer out of cycle place a 10" record and then a 12" record on the record shelf plates. The records can be held tightly down on the record shelf blades by slipping a rubber grommet over the spindle. Loosen the two screws on the tape clamps on all pulleys. The slack in the tape line is then taken up by slightly pushing the tape segment (32) in the direction of forward motion (clockwise). In this position there should be a minimum clearance of $\frac{1}{16}$ " between the leading edge of the cam (53) and the point of the lifter lever (52) (see Fig. 6). In this position the point of the lifter lever should also slide inside of the cam (53). If it is necessary to obtain this clearance rotate the shelf plate of pulley (51) in the proper direction. If the lifter levers do not just slide inside of the cam they can be adjusted by the screw and lock nut located on each lifter lever. Tighten the tape clamp set screws on this pulley (51). The lifter levers and cams on the other selector posts are then adjusted in the same manner as given for post (51) above. The tape clamps on these pulleys are then tightened after they are set.

2. Remove the 12" record from the mounting plates and leave the 10" record remaining. Start the changer through its cycle allowing it to continue until the shelf plates are just about ready to drop the record (see Fig. 5). If all shelf plates are not in the same position, they should be adjusted so that they are synchronized with the shelf plate (21). This is done by loosening the tape clamps of these pulleys and slightly moving the shelf in the direction necessary to synchronize the blades.

ADJUSTING SELECTOR BLADE CLEARANCE

The selector blades are adjusted to slide over 10" and 12" records by two adjusting screws located in the side of each record mounting post. The upper

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MODELS 35-1234, 35-1236

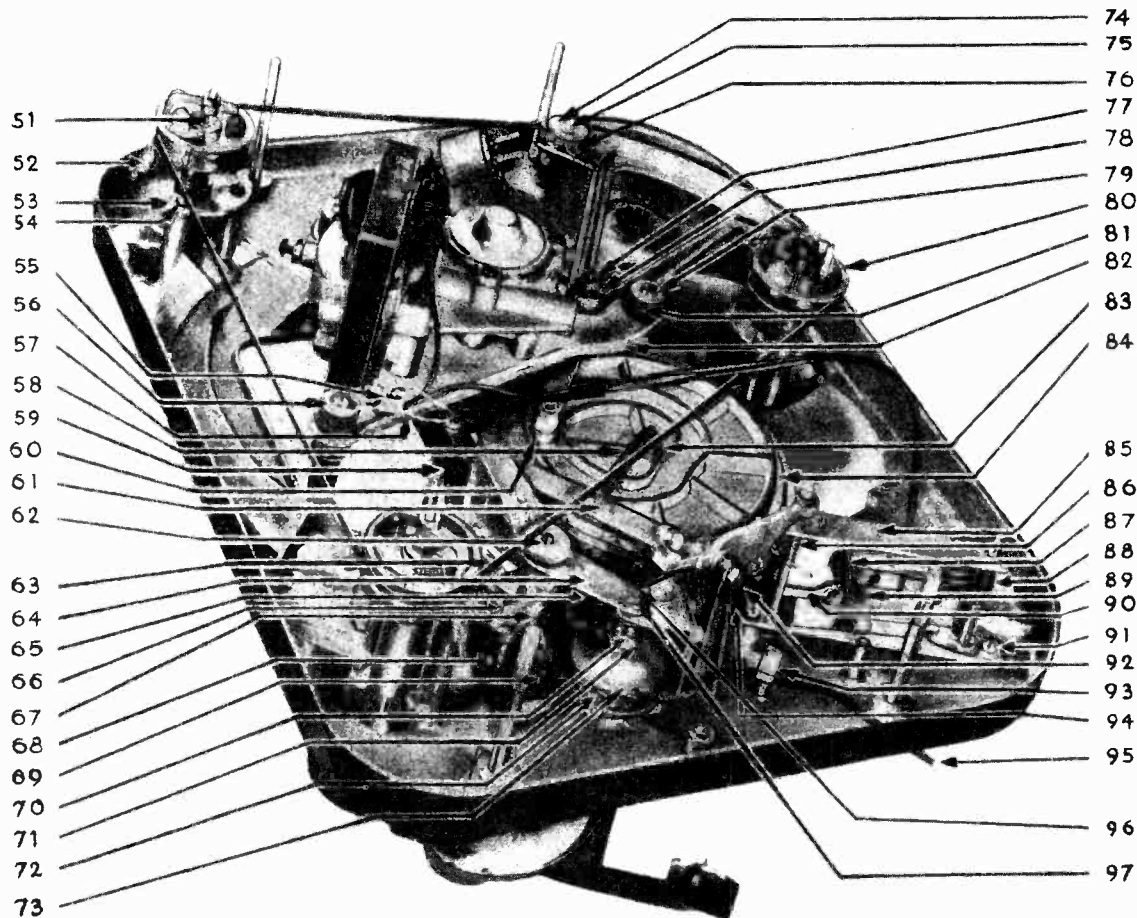


FIGURE 3

51	Ctr. Blade Raising Pin	35-2308	67	Setting Cam Assembly	35-2318	82	Motor Mtg. Plate
52	Center Blade Lifter Pl.		68	Adjusting Screw	.....	83	¼-20 Hex. Nut	.....
53	Center Arm Lifter Cam	35-2309	69	Tone Arm Shaft Assem.	35-2319	84	Cam Gear Assembly	35-2299
54	8-32x½ R. H. Self Tap		70	Clutch Spring	35-2320	85	Switch Assembly	
	Screw		71	T. A. Pressure Release			(Give Model No.)	.....
55	Cord Clamp	.....		Sleeve	35-2321	86	Tone Arm Rest Shaft	
56	Grd. Lead Assembly	.....	72	Cork Friction Disc	35-2322		Spring	35-2300
57	Washer	.....	73	T. A. Btm. Friction Cup	35-2323	87	Switch Latch Spring	35-2301
58	Swing Lever Spring	35-2310	74	Clutch Spring Retainer	35-2295	88	Push-button Stem Spg.	35-2302
59	Trip Arm Spring	35-2311	75	6-32-¼ Self Tapping		89	Roller	.....
60	Roller	.....		Binder Head		90	Switch Latch	35-2303
61	Swing Lever and		76	8-32-¼ Binder Head		91	8-32x¼ Mtg. Screw	.....
	Bracket Assembly	35-2312		Screw	.....	92	10-32 Hex. Nut	.....
62	Stg. Lever Thumb Nut	35-2313	77	¼-20 Hex. Nut	.....	93	Cord Clamp	.....
63	Trip Lever Spring	35-2314	78	Washer	.....	94	Raising Lever Spring	35-2304
64	Swing Bracket Support		79	10-32-1-¼ Mtg. Screw		95	Pick-up Cord	
	Assembly	35-2315	80	Post Pulley	35-2296		(Give Model No.)	35-2305
65	Clutch Brake Spring	35-2316		Post Pulley Assem.	35-2297	96	Tone Arm Elev. Pin	35-2306
66	No Record Select Lever	35-2317	81	Rubber Grommet	35-2298	97	Tone Arm Shaft	35-2307

set screws adjust the selector blades for 10" records and the lower set screws for 12" records.

To adjust for 10" records place a 10" record about .075 inches thick on the mounting post. Start the changer through its cycle and then pull the power plug just as the selector blades touch the edge of the record. The upper screw in the post should then be turned in the direction necessary to set the blades so that it just slides over the record. The same procedure as given above for 10" records is used in adjusting the blades for 12" records. The lower set screw being used for this adjustment with a 12" record.

SHUT OFF SWITCH ADJUSTMENT

With the changer out of cycle (neutral position) the upper pin on the switch rod (86) should be approximately ¼ of an inch from the top of the switch case. If the pin does not set at this distance the tone arm raising lever adjusting screw (26) should be turned up until the upper pin meets this distance. Tighten the lock nut after the screw is adjusted.

ADJUSTING NO RECORD PIN

When there are no records on the turntable or record holding posts, the tone arm should not move from its rest. This is controlled by a no record pin (20), located inside of record selector post (21). This pin is actuated by the record shelf plate. The spring which holds up the pin should have enough tension to lift the pin fully and properly so that one 10" record will fully depress the rod and lever. The adjustment is as follows:

With the set screw loose in (66) casting at the lower end of the rod, and the rod held down by the weight of one 10" inch record, slide the casting down so that the selecting lever on the end of casting will just clear under the lower edge of the lower setting cam lever (67) by approximately .015 inches. Tighten set screw in this position.

TROUBLES

Among the principal trouble symptoms to which such cause may give rise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT

May be caused by:

a. Failure to lubricate properly. Oil thoroughly. See oiling instructions.

b. Check voltage. Line voltage may be abnormally low or high.

c. Motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair.

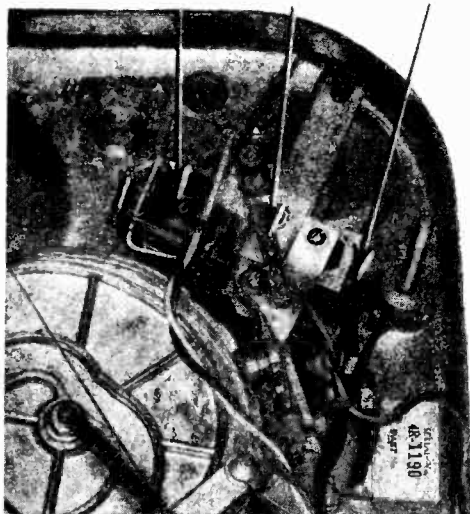
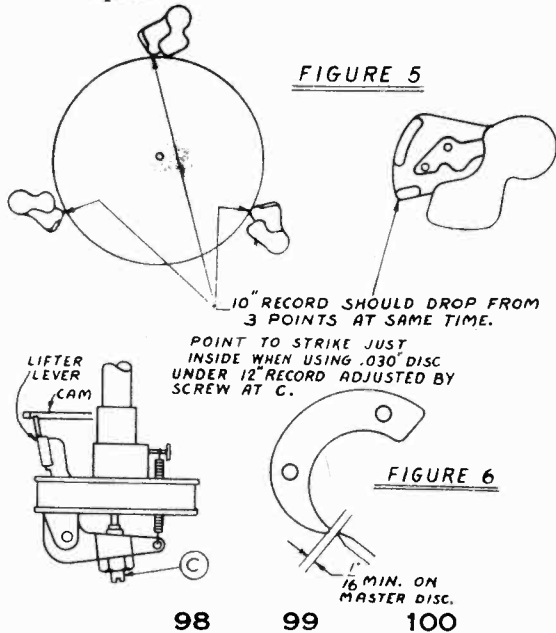
2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS

This indicates trouble in motor windings. Unless the damage is easily seen and repaired, replace motor, as above described.

3. MOTOR IS SLOW IN STARTING

a. Check oiling as directed above. It may not have been properly done; old oil may have become gummy.

b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that motor is defective. The changer is equipped with a constant-speed self-starting motor. Under all normal conditions it starts automatically and runs at correct speed.

**FIGURE 4**

MODEL 41-616 REJECT RELAY AND CYCLING SWITCH LOCATIONS

98	Reject Relay	42-1631
99	Reject Relay Switch	42-1630
100	Cycling Power Switch	42-1632

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS

Check oiling as directed above. (If squeaks are heard, they will usually be found to come from the records—not from the mechanism.)

5. CHANGER IS NOISY WHEN IN CYCLE

Check oiling. Also see if any part has become loose or bent and is rubbing against a moving part.

6. MOTION OF PICKUP TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM

a. See that control switch pointer (9) is not set on "M," manual.

b. Check friction clutch assembly (72) to be sure that parts are not disengaged. Also check for binding, bent or loose parts.

c. Can also be caused by too much clearance between trip lever (18) and trip arm (17). There should be a few thousandths clearance between them. This can be adjusted by the eccentric screw on the trip arm (17) through hole in main plate (19).

7. PRESSING PUSH BUTTON DOES NOT TRIP CHANGER MECHANISM

a. See that control switch pointer is not set on "M," manual.

b. Check control switch unit to see whether there is an obstruction or a bent or loose part. Also check for loose set screws.

c. Follow through on action from the push button to cam latch (90) and see that every part is in proper working order.

d. If the mechanism will not reject when the push button is pressed look for trouble in the reject push button mechanism such as binding, or bent parts. In the Model 41-616 changer the push button is not used, but the mechanism is actuated by the reject relay. If the trouble develops in this changer look for open coil or parts that are binding.

8. SETTING POINTER ON "M," MANUAL, FAILS TO PUT CHANGER MECHANISM OUT OF ACTION, SO AS TO ENABLE MANUAL OPERATION

a. Check for loose set screws in control switch.

b. Also check for loose or bent parts and be sure that manual latch (at 90) is holding the trip link rod to keep it from moving.

c. When the reject button is pressed with the selector switch in the "M" position the trip lever (17) must not bind or be under strain. The clearance at the rod hole on the end of the trip lever should be just taken up so that the shelf plate on the trip lever is not pushed off when the reject button is pushed down.

There should also be at least a few thousandths of an inch clearance between the trip lever (18) and the trip arm (17), otherwise the tone arm will backtrack and the tone arm shaft will bind due to the tension of the trip arm pushing the reject adjusting screw eccentric washer on the trip lever (18) against the fork lever (70) mounting bracket.

9. TRIPS TOO SOON OR BEFORE RECORD HAS FINISHED PLAYING

a. Not enough clearance between the trip lever (18) and trip arm (17). There should be a few thousandths clearance at this point. To get more clearance adjust eccentric by turning it slightly in a clockwise direction through hole in main plate (19).

b. Can also be caused by not enough clutch action (72). Bend forked release lever (70) slightly to increase clutch action.

c. Also check for loose parts.

10. TONE ARM FALLS OFF RECORD OR WILL NOT SWING INTO GROOVE OF RECORD

a. Light beam jewel sets down too close to edge of record. Not adjusted in far enough.

b. Can also be caused by too much clearance between cork clutch disc (72) and tone arm swing bracket (96). This can be adjusted by the thumb nut (62) being turned counter-clockwise. Also it may be necessary to add more tension to the flat spring by turning the adjusting screw (65) ¼ turn or whatever is necessary to assure satisfactory operation.

c. 1. To adjust the tone arm for proper swing-in after the light beam jewel lands on the record make the following adjustment:

With the mounting pivot of the tone arm just starting to come down after the light beam jewel lands on the record, the top cork of the clutch (72) should still be tight against the tone arm swing bracket (96). In this position the 10 or 12-inch index eccentric adjusting screw, depending on record used should be against the hook stop lever (68). This prevents the tone arm from swinging in further when the clutch cork is under pressure.

2. As the mounting pivot of the tone arm drops further to the point of where the eccentric adjusting screw just is slipping off the hook stop lever (68) the tone arm swing bracket (96) should continue to swing slowly and pull the

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tone arm inward. If it does not do this, more pressure is required and is obtained by tightening the spring (65) by the adjusting screw.

3. The distance of the swing-in after the indexing screws leaves the stop lever (68) is determined by the length of time the clutch cork remains in contact with the tone arm swing bracket (96). To obtain further swing-in loosen thumb screw (62). To shorten the amount of swing-in tighten thumb screw (62).

4. After the tone arm swings into the groove of the record there should be a clearance between the top clutch cork (72) and the tone arm swing-in bracket (96) of 1/16 of an inch. At this point there should be a clearance between the clutch indexing lever (69) and the hook stop lever (68) of about 3/64 of an inch.

11. TONE ARM VARIES WHEN SET DOWN ON RECORD

a. Check for loose parts or loose set screws or possibly the swivel shaft head (24) may be loose on the swivel shaft.

b. Be sure that hook stop lever (68) engages the eccentric adjusting cams (66) for both 10" and 12", holding them securely until light beam jewel has set down on record. Height of stop lever is adjusted by screw (at 68).

12. TONE ARM SETS DOWN TOO FAR IN

a. Due to not measuring properly (see paragraph 11b).

b. Out of adjustment. Probably due to tone arm being held, while in motion, from its original position on the swivel shaft. Also check for loose or bent parts.

13. LIGHT-BEAM JEWEL LANDS PROPERLY ON RECORD, BUT FAILS TO MOVE OVER INTO STARTING GROOVE

a. Refer to paragraph 10

14. LIGHT-BEAM JEWEL LANDS PROPERLY ON RECORD BUT SLIDES IN A FEW LINES ON RECORD

a. Turning thumb screw (62) slightly in a clockwise direction will probably correct this condition which necessitates a reverse adjustment for the condition in paragraph 10.

15. CHANGER CONTINUES CYCLING

a. No clearance between trip lever (18) and trip arm (17). To correct this condition adjust as in paragraph 9.

b. Also check for binding or bent parts.

16. "WOW" IN RECORD REPRODUCTION

a. Record is warped or otherwise defective or instrument is not being operated at normal room temperature, 70° F.

b. Motor mounting plate being bent will cause "wow". Straighten it if possible or replace with new plate if too badly bent to warrant straightening. This is only found where rough handling is evident.

c. Motor shaft out of alignment with turntable shaft (also due to rough handling). To correct move the motor on its mounting till motor shaft is parallel to the turntable shaft and the universal coupling is exactly at right angles to motor and turntable shaft. Then tighten motor mounting screws securely.

17. TURNTABLE IS TIGHT

a. This turntable is assembled to the turntable spindle cone with a taper lock to fit in the center. To remove turntable grasp with both hands at the same time pulling upward while it is revolving.

18. THUMP HEARD IN RECORD REPRODUCTION

a. Probably caused by excessive motion of the friction clutch when it is momentarily released by the clutch release lever (71) which in turn is actuated by the two high spots on the intermediate gear. If thump is objectionable, it can be lessened by slightly bending the clutch release lever (71) so that the motion of this lever is lessened to allow only a slight amount of motion of the friction clutch.

MODELS 35-1285, 35-1286,
35-1289

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The service information in this bulletin covers the adjustments and replacement parts for Philco automatic record changers Part No. 35-1285 (standard changer) and Part No. 35-1286, 35-1289 (Deluxe changers).

These record changers are identical with the exception of the color of the mounting plate, plating of parts on top of changers, motor, Light Beam Reproducer, and electrical wiring circuits for operation. The differences are indicated in the Replacement Part List, page 4, and the Electrical wiring diagrams, page 5.

CHANGERS USED IN PHILCO MODELS

Changer Part No.	Philco Models
35-1285	42-1008, 42-1009, 42-1010, 42-1011, 42-1012, 42-1013
35-1286	42-1016
35-1289	42-1015

GENERAL DESCRIPTION OF CHANGE CYCLE

An automatic record changer performs three principal functions.

- 1—Places record on turn table.
- 2—Lowers tone arm on record in playing position.
- 3—Raises tone arm at end of record or on reject.

These functions are controlled by three mechanisms, interconnected and built together, but each separate in its operation. The motion for each is originated in one central cam gear which has three different and individual cam surfaces. The cam gear is normally at rest while a record is being played, but is put into operation by a saw tooth clutch which takes its power from the turntable and drives an intermediate drive gear. This only takes place when the record changer is put into a change cycle. The cam gear then makes one full revolution to complete the change cycle and comes to rest in a normal position.

The record changing mechanism which places a record on the turntable is brought into operation by a lever with a roller at one end. The lever is attached to the shelf plate mounting post and is operated by a notch under the

CLUTCH ROLLER AND LEVER ADJUSTMENT

The teeth of the clutch should have approximately 1/16 inch clearance, when the lever roller is engaged snugly in the cam gear. If the clutch does not have 1/16 inch clearance the clutch bracket should be slightly bent as indicated in Figure 1. Place ten, 12" records on turntable when this adjustment is made.

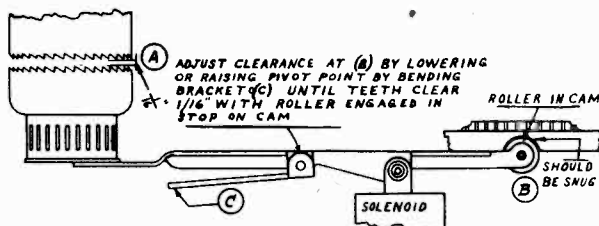


FIG. 1

cam gear. This causes the mounting post to move slightly, pushing the bottom record off the stack onto the turntable.

The pick-up operating mechanism is likewise brought into operation by the cam gear surface on the top side of the cam gear. The raising lever, when removing the pick-up from the record, receives a swinging motion from the cam gear through an eccentric track on the top outside surface of the cam gear. This eccentric track causes the pick-up to be carried out beyond the turntable while a record is being dropped on the turntable. The light beam pick-up is then brought back into playing position for 10" or 12" records (depending on the shelf positions on the shelf carrier).

The travel of the pick-up arm towards the turntable for lowering on a 10 or 12 inch record is stopped at the proper point for lowering by a movable track on the cam gear. This movable track is operated by a lever which is moved by a spring lever connected through a cord and spring attached to the 10" shelf plate. When the 10" shelf plate is lifted up the movable track is allowed to shift to the outer groove of the cam gear surface so that the pick-up needle will set properly on the outer edge of a 12" record. When the 10" shelf plate is in place for playing 10" records, the cord holds the spring lever and causes the movable track lever to shift to the inner groove as the cam gear revolves.

The electric reject trip causes the clutch to engage and allow the tone arm to be removed from the record by the cam gear. The reject trip operates through a pulsating plate and movable contact on the tone arm raising lever. When the pulsating plate and movable contact make connection, the solenoid is energized, releasing the clutch so that the cam gear can be revolved.

SOLENOID ADJUSTMENT

The solenoid Armature should set properly in the coil in order to prevent hum and chatter when the solenoid is energized. To make this adjustment, loosen solenoid mounting bracket screws and raise or lower solenoid until armature is set correctly in the coil. See Figure 2.

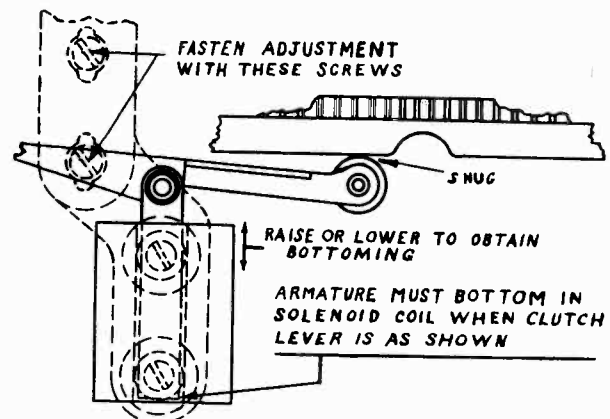
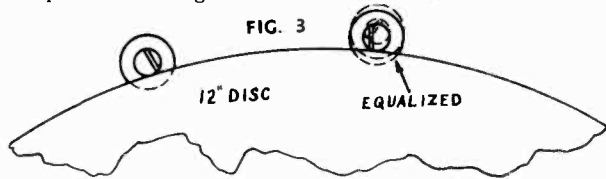


FIG. 2

PHILCO RADIO & TELEV. CORP. MODELS 35-1285, 35-1286,
35-1289

BUMP LEVER ADJUSTMENT

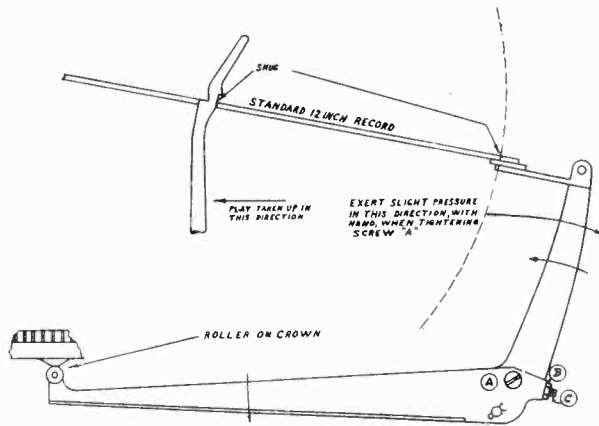
Set 12" shelf eccentrics bumper in outer position, neutral (large part of cam away from shelf) and then equalize each Bumper to touch edge of 12" record. See Figure 3.



FORWARD SHELF MOTION ADJUSTMENT— MINIMUM SIZE

(12" Record Push-Off)

1. Place 12" record on spindle and 12" shelf as shown in Figure 4. Start changer in cycle and then stop the change cycle when the crown on the cam gear touches the roller on the shelf lever as shown in Figure 4.
2. In this position loosen screw "A" and lock nut on screw "C"; turn out screw "C" slightly and then retighten screw "C" until eccentric record bumpers fit snugly against 12" record. Then tighten screw "A" and lock nut of screw "C."

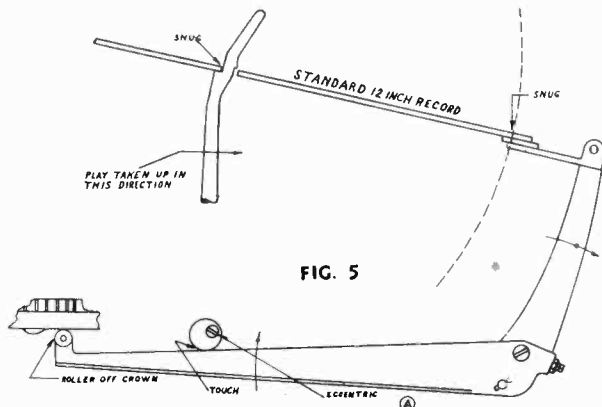


NEUTRAL SHELF POSITION

(Bump Lever Eccentric)

When the changer is in Neutral position (out of change cycle) the shelf lever should be in the position as shown in Figure 5. To make this adjustment, proceed as follows:

1. Place standard 12" record on the turntable spindle and 12" record shelf plate as shown in Figure 5. The roller of the shelf lever must be off the crown of the cam gear when this adjustment is being made.
2. Hold record snugly against the spindle and shelf bumpers.
3. Loosen screw and adjust eccentric (A) Figure 5, until it touches shelf lever.



10" SHELF ECCENTRIC ADJUSTMENT

The 10" shelf bump buttons are equalized as follows:

Place standard 10" record on spindle and 10" record shelf. The record should be snug against spindle notch as shown in Figure 5 for 12" records.

Adjust 10" shelf bump buttons so that they are equalized and just touch record.

Do Not Change "Bump Lever Eccentric" shown in Figure 5 and which should be adjusted as given in paragraph "Neutral Shelf Position."

TONE ARM HEIGHT

1. Load the turntable with twelve 10" records.
2. Start changer through its cycle, then stop when tone arm is in full raised position and swinging towards records on turntable. If adjustment is correct, the jewel needle will clear the top record by $\frac{1}{8}$ " as the tone arm swings into position for landing on record. If it does not clear top record by $\frac{1}{8}$ ", adjust screw No. 14 in top of tone arm (see Figure 9) until distance is obtained.

ADJUSTING TONE ARM TO INDEX ON 10" AND 12" RECORDS

The position at which the pick-up jewel lowers on the edge of the record is controlled by a vernier adjustment screw on the raising lever. This screw is reached through the hole (12) Figure 9 in the top of the base plate near the tone arm pivot. This screw is used for normal adjustments of the tone arm set down and moves the pick-up approximately $\frac{1}{4}$ ". Adjust the screw so that the tone arm needle will set down approximately $\frac{1}{8}$ " in on record edge. When set for either size record, the adjustment will also take care of the other size record positioning point.

When the tone arm is removed for replacement or greater movement of the tone arm is desired, beyond that obtainable with the preceding vernier adjustment, the two set screws in the collar of the pull-in lever underneath the changer should be adjusted. This is done by loosening one set screw and tightening the other, depending on which way the tone arm is to be moved. Under ordinary circumstances this adjustment will not be required as it has been preset at the factory for proper positioning. When making this adjustment, a .005 shim gauge should be placed between the ball race washer and the tone shaft bearing.

PULSATING PLATE ADJUSTMENT

When the turntable is revolving the pulsating plate of the reject mechanism should clear the main plate by $\frac{1}{32}$ of inch when the crown on the cam attached to the underside of the turntable touches roller of pulsating lever as shown in Figure 6. To make this adjustment proceed as follows:

1. Rotate turntable until the crown of the cam under turntable touches roller of pulsating lever as shown in Figure 6.
2. Adjust screw on pulsating lever until pulsating plate is $\frac{1}{32}$ of an inch from main plate (use gauge).

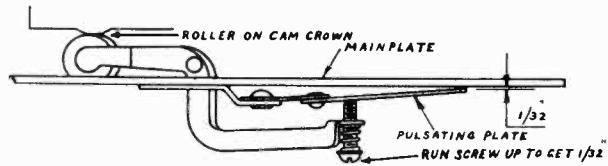


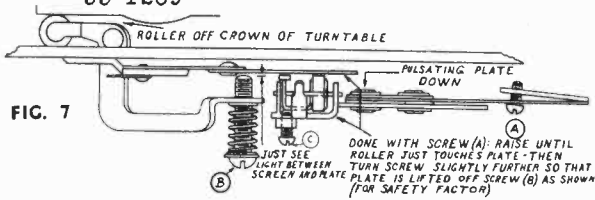
FIG. 6

TRIP ARM ADJUSTMENT

1. Rotate turntable so that the crown on the cam under the turntable is OFF roller of pulsating lever. (See Figure 7.)
2. Move tone arm in towards record until the rubber roller and contact is at the outer edge of pulsating plate. See Figure 7.
3. Turn screw (A) Figure 7 on trip arm until rubber roller just touches pulsating plate, then turn screw (A) slightly further so that the plate moves slightly.

MODELS 35-1285, 35-1286,
35-1289

PHILCO RADIO & TELEV. CORP.



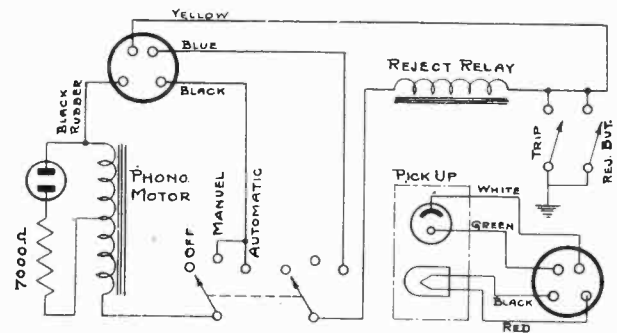
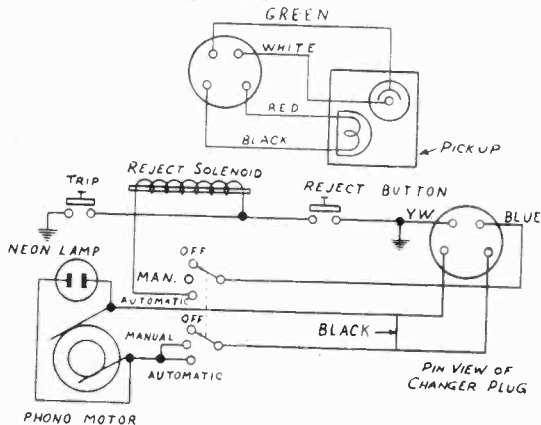
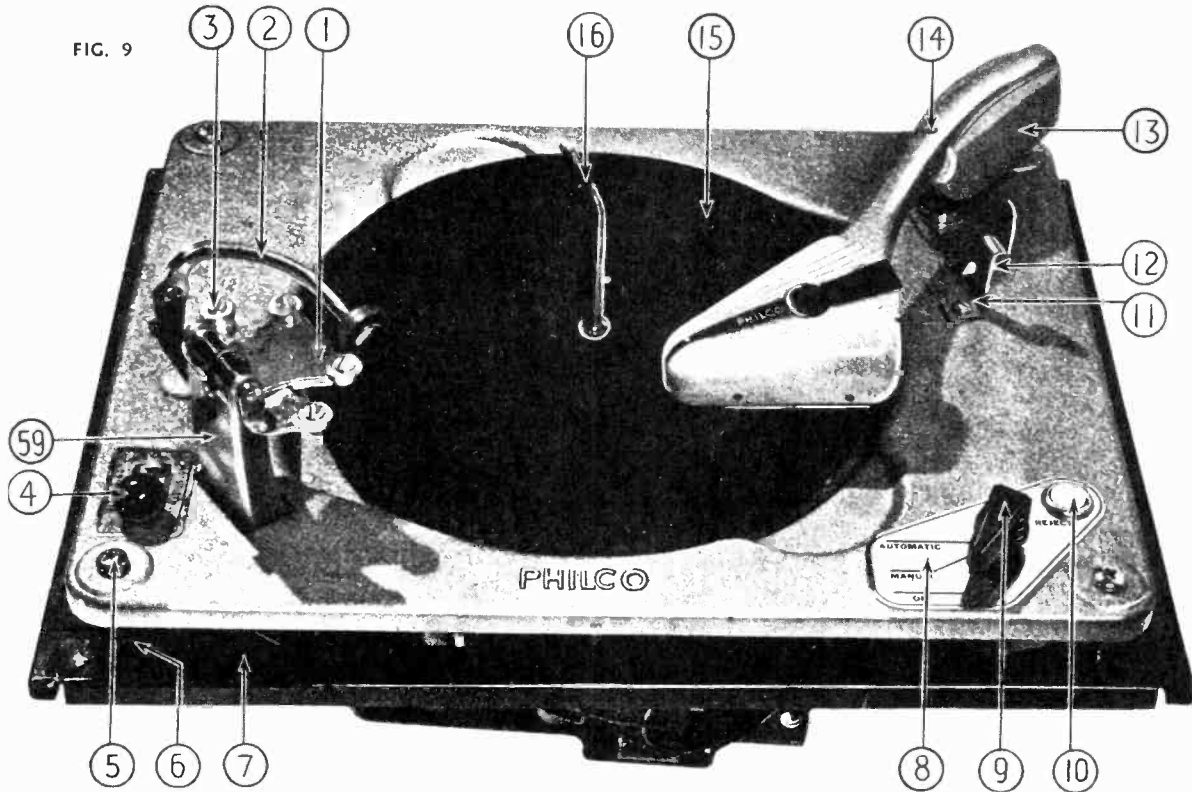
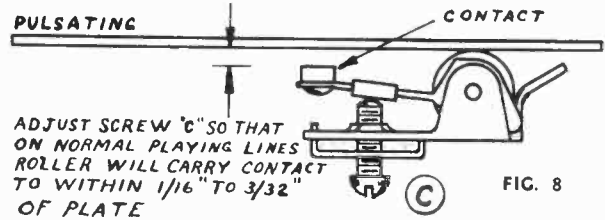
REJECT CONTACT TRAVEL ADJUSTMENT

Place a record on turntable and tone arm in playing position about halfway in on playing lines of the record. In this position the contact operated by the rubber roller on the trip arm should be carried to within 1/16 to 3/32 of an inch of the pulsating plate as the roller moves towards center of changer. (See Figure 8) If contact does not have this spacing as the roller moves and pulls contact up, then adjust screw (C) Figure 8 until correct spacing is obtained.

TURNTABLE SPEED ADJUSTMENT

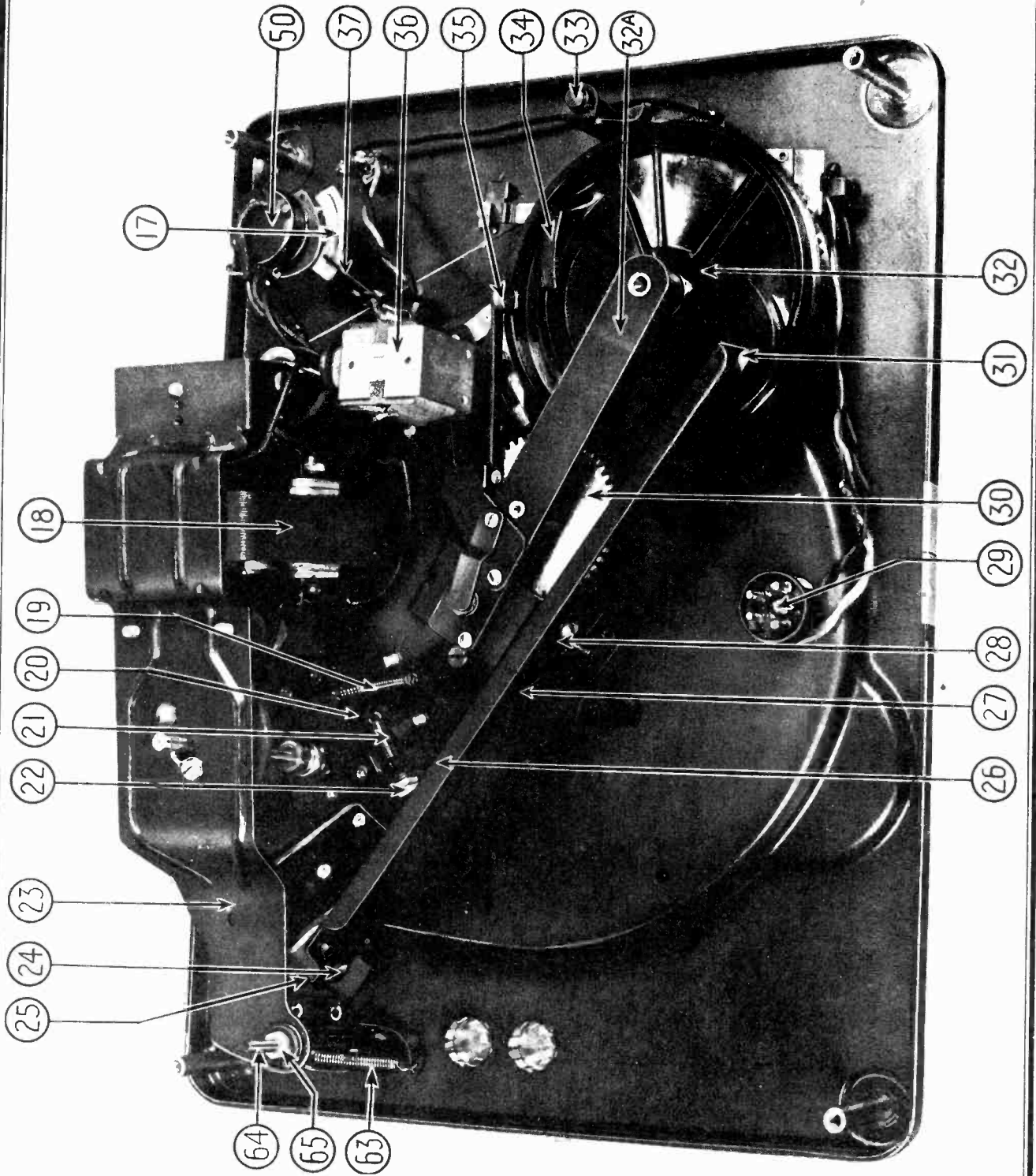
To set the turntable speed control for the speed range covered by the control, proceed as follows:

1. Push speed lever knob to the "normal" position. Turn ball knob until the motor mounting plate drops to its lowest position. In this position the turntable should be turning at approximately 77 R.P.M. This is indicated by the lines on the edge of the turntable appearing to be slightly moving backwards (counter-clockwise). In order to see these lines move the neon lamp must be energized.
2. If the lines do not travel slightly backward, the nuts on the motor mounting plate retaining shaft should be loosened and the plate moved up or down to get the proper speed, then tighten nuts.
3. After this adjustment, set ball knob to the point where lines on turntable appear to be standing still.



MODELS 35-1285, 35-1286,
35-1289

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MODELS
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35-1289

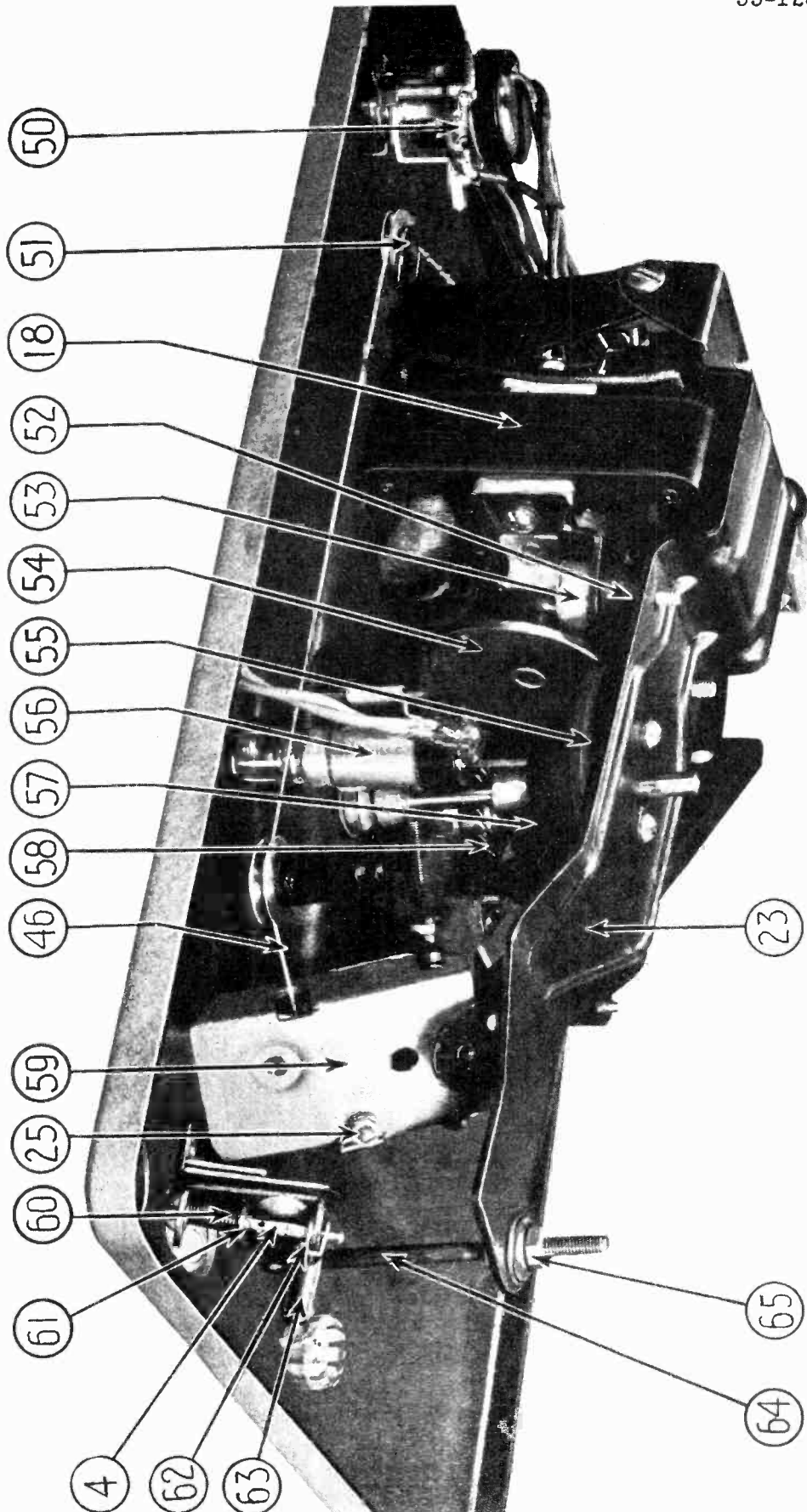


FIG. 12

MODELS 35-1285, 35-1286,
35-1289 PHILCO RADIO & TELEV. CORP.

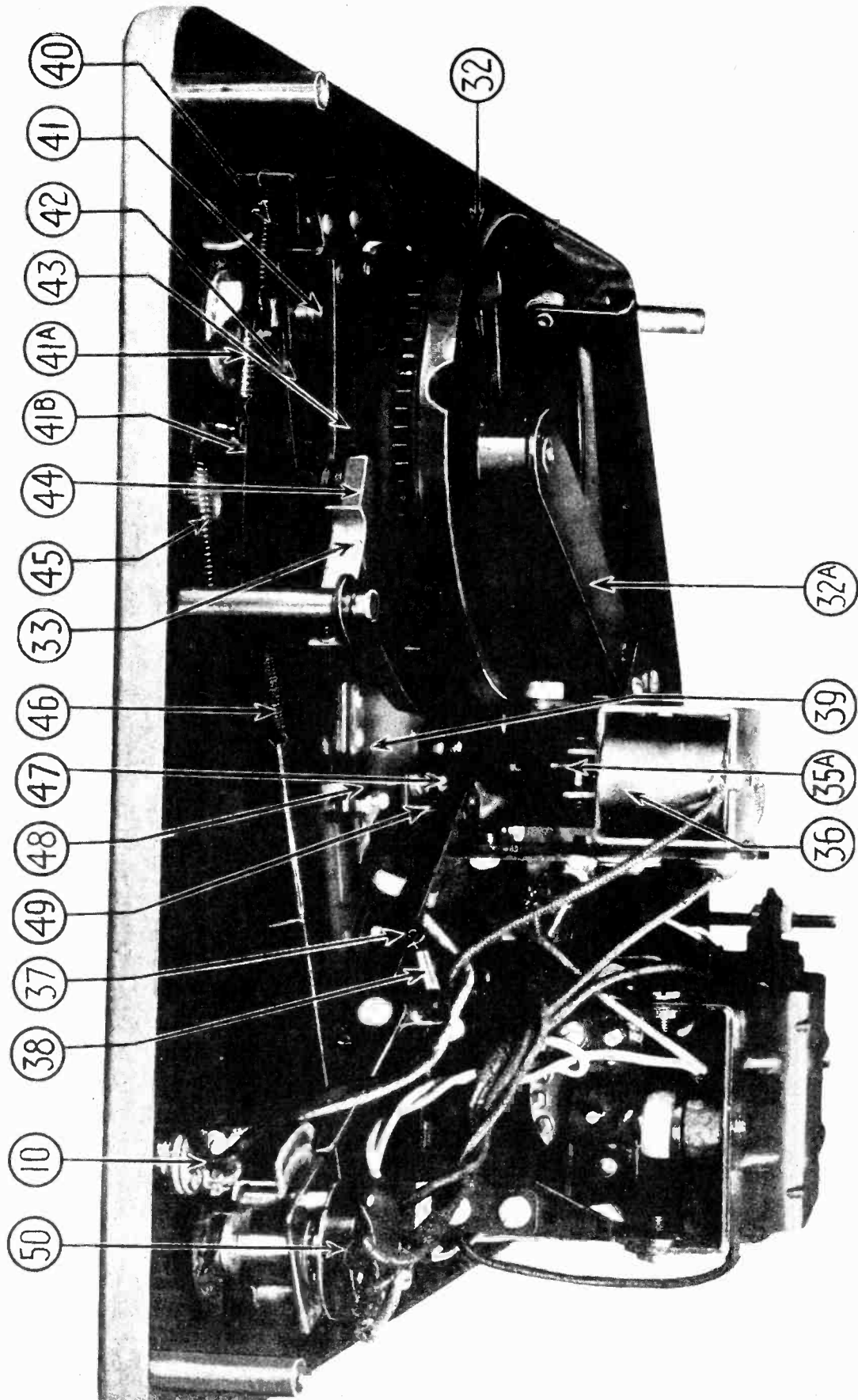
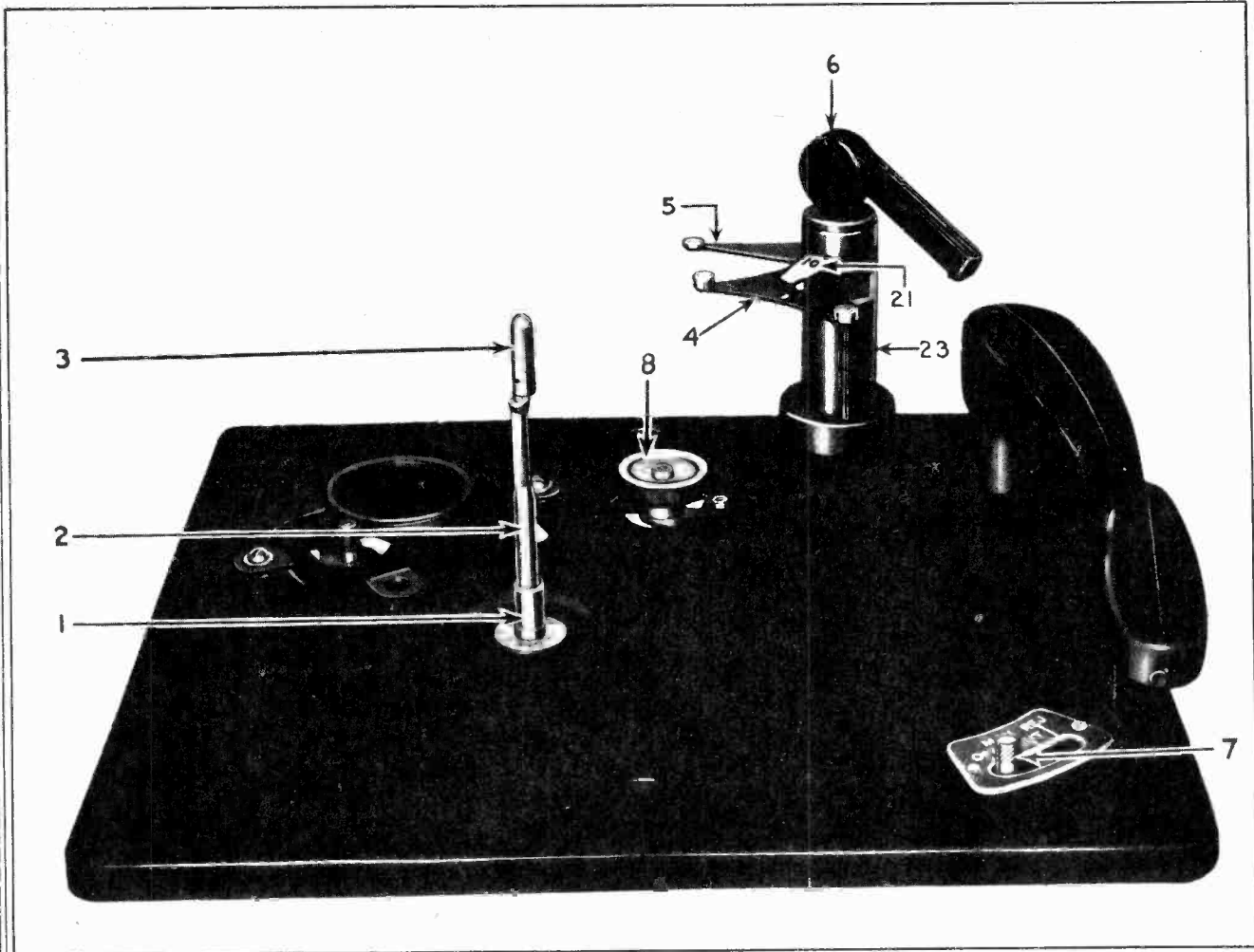


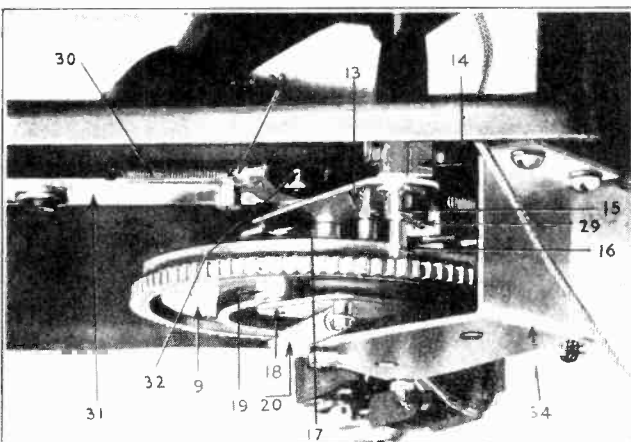
FIG. 11

PHILCO RADIO & TELEV. CORP.

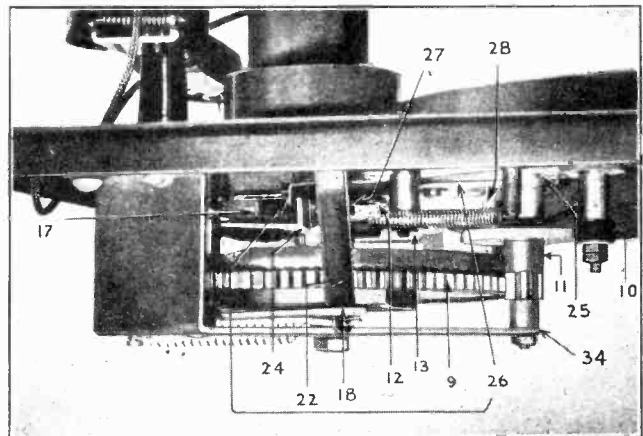
MODEL 35-1293



TOP VIEW - TURNTABLE REMOVED



VIEW LOOKING AT RIGHT SIDE



VIEW LOOKING AT BACK

MODEL 35-1293

PHILCO RADIO & TELEV. CORP.

This mechanism consists of a rim driven turntable (not shown) running on a fixed bearing (1), which supports the record spindle (2). The spindle is equipped with a rotatable cap (3) to provide for holding records in automatic operation, when in one position, and removing records or playing manually when in the other position.

The outer edge of the record is held by record supports (4) and (5), adjustable for 10- and 12-inch, and is steadied by a rubber tipped, spring loaded finger (6).

Control of operation is by a single control button (7), having four positions: "Off" - "Man" - "Aut" - "Rej".

Automatic operation starts when rubber tired drive wheel (8) is moved into contact with turntable rim by tone arm movement or control button. All change functions are controlled by main cam (9) which is driven by drive wheel (8) thru a friction (10) and gear (11) train.

The main cam assembly consists of main cam (9) and automatic trip cam (12). The latter disengages the drive wheel (8) at the end of the change cycle.

The upper side of the main cam (9) controls tone arm swing by engagement with pin in sweep lever (13) attached to tone arm by means of clamp (14) around tone arm pivot sleeve (15). Tone arm lift is controlled by vertical section of main cam (9) operating tone arm thru lift pin (16) inside of sleeve. A boss projecting from the upper side of the main cam (9) displaces the stop lever (17) at the end of the change cycle to permit the tone arm to proceed across the record.

The lower side of the main cam (9) moves the feed lever (18) by means of a roller (19). This movement charges the feed spring (20) and at the proper time permits discharge of the spring causing the feed lever (18) to thrust the feed finger (21), (in top view), forward to feed the record. Connection between feed lever (18) and feed finger (21) is thru feed intermediate lever (22) pivoted in record support post (23). (In top view.)

The stop lever (17), normally held out of engagement by the boss on the main cam (9), swings into position at the start of the change cycle. Its selection of stop points for 10- or 12-inch records is controlled by dog (24) on the record selector shaft running up front of record support post (23) and actuated by swinging record support (4).

The drive wheel (8) is mounted on the carrier lever assembly (25) which is pivoted about the intermediate drive (11). This assembly consists of the carrier lever with its bearings and the trip lever (26). The trip lever (26) carries a pin (27) engaging the automatic trip cam (12); a pawl (28) to engage the serrated edge of sweep lever (13); a positive trip screw (29) to interfere with sweep lever (13). Engagement of pin (27) with automatic trip cam (12) pulls drive wheel (8) out of engagement with turntable at end of

Figure No.	Description	Part No.	Figure No.	Description	Part No.	Figure No.	Description	Part No.
1-2-3	Spindle Assembly	35-2570	13	Sweep Lever Assembly	35-2578	—	Stop Lever Spring	35-2587
6	Feed Cap Assembly	35-2571	31	Operators Lever Assembly	35-2579	—	Tone Arm Pull In Spring	35-2588
11	Intermediate Drive Assembly	35-2572	25	Drive Wheel Carrier Lever Assembly	35-2580	—	Record Support Friction Spring	35-2589
—	Thrust Bearing Assembly	35-2573	—	Switch and Bracket Assembly	35-2581	—	Drive Wheel Tire	35-2590
9	Main Cam Assembly	35-2574	5	Stationary Record Support Assembly	35-2582	19	Feed Lever Roller	35-2591
18	Record Feed Lever Assembly	35-2575	4	Swinging Record Support Assembly	35-2583	—	Intermediate Gear Spacer	35-2592
21	Feed Finger Assembly	35-2576	—	Turntable Assembly	35-2584	—	Spacer for Motor Mounting	35-2593
17	Stop Lever Assembly	35-2577	16	Lift Pin	35-2585	10	Rubber Drive Wheel	35-2594
			20	Record Feed Spring	35-2586	—	Motor 60 cy. - 110V	35-2595

PHILCO RADIO & TELEV. CORP.

change cycle. Reversal of the tone arm movement rotates pawl (28) to release trip lever (26). Thrust of sweep lever (13), when tone arm approaches spindle (2), against positive trip screw (29) releases trip lever (26).

The control lever (31) operated by the control button (7), -a- turns switch on and off, -b- prevents carrier lever assembly (25) from swinging when in manual position. -c- permits carrier lever assembly (25) movement to engage drive wheel (8) with turntable, when in automatic position, -d- displaces trip lever (26) causing drive wheel (8) engagement with turntable when pushed to Reject. Function (a) is accomplished by pin which engages dog of toggle switch. Functions (b) and (c) are controlled by shape of rear edge of control lever (31) and a fixed stud (32) in the carrier lever. Function (d) is accomplished by stud (33) in control lever (31) striking edge of trip lever (26) and unlatching pin (27) in same from automatic trip cam (12).

Bearings are separated and center distances maintained by aligning bracket (34) which also carries bearing for record feed lever (18).

ADJUSTMENTS

Positive Trip

The tripping point is adjusted by turning positive trip screw (29) counter-clockwise to trip earlier in playing cycle and clockwise to delay tripping.

Tone Arm

The drop point is adjusted by loosening the screw in clamp (14) slightly to permit repositioning of tone arm in relation to sweep lever (13). Care must be exercised to see that tightening the screw does not cause bind in tone arm swing.

The rise and drop of tone arm is adjusted by bending short arm of lift pin (16) slightly. Long arm must not be distorted or it will bind in pivot sleeve (15).

Record Feed

The feed finger (21) should strike only the bottom record of the stack. Record supports (4) and (5) should be adjusted up or down to obtain this result. Adjustments must be checked for both 10- and 12-inch records as one of the buttons is used in both cases.

Fixed record support (5) can be adjusted for engagement with record by removing hold down finger assembly (6) and loosening two screws under feed finger (21).

Friction drive

The rubber wheel (10) engaging with the intermediate drive assembly (11) should be compressed just enough to prevent slipping or skidding at any portion of the change cycle. Compression is controlled by the nut and locknut, below the rubber wheel.

General

Carrier lever assembly (25) must be perfectly free on its shaft and trip lever (26) must be perfectly free on the carrier lever. All moving parts should be lubricated with oil. Rubber drive wheels under the turntable and the rim of the turntable must be free of grease or dirt.

Turntable thrust bearing can be lubricated with heavy oil or light grease and radial bearing with light oil.

Pickup lead from tone arm must have slack to permit free movement of arm.

INFORMATION ON
1942 MODELS

PHILCO RADIO & TELEV. CORP.

Basically, changes were made to overcome three conditions:

- A — Rumble in the early production sets, particularly on the Models 42-1010 and 1016
- B — Erratic operation of the trip mechanism.
- C — Flutter and change of speed.

A. The rumble in the Models 42-1010 and 1016 can be easily corrected by replacing the turntable bearing. Remove the turntable and the spindle and then take out the brass cone and the ball bearings and washers. Rebuild the bearing, using the old washers and the new flat fiber washer and the concave steel washer. (See Figure 1). Add "Stay-Put Grease" or "Lubriplate" between the washers to eliminate friction. When replacing the spindle assembly, the spindle must be more than $\frac{1}{2}$ turn loose while lining it up with the record support shelf.

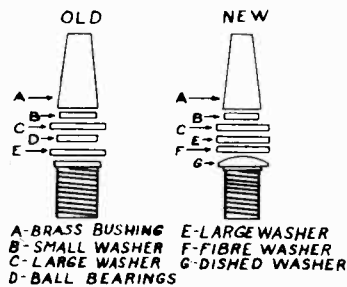


FIGURE 1

B. The pulsating plate in the trip mechanism is actuated by the pulsating arm and the cam on the underside of the turntable. If the pulsating arm is loosely riveted to the bracket, the screw on the end of the pulsating arm will move back and forth over the pulsating plate. This changes the distance the plate is lifted by the pulsating arm and affects the trip adjustment. A spring has been added in production to hold the end of the lever under tension so that it does not move "in" and "out" and change the trip adjustment. On record changers not equipped with this spring, use the lead spring Part No. 28-8919 and connect as shown in Figure 2. Attach the spring to the wiring terminal on the end of the bracket and to the adjusting screw. Check to make sure that the pulsing roller does not scrape the hub on the under side of the turntable.

C. Flutter and change of speed is caused by friction in the vertical drive assembly and by the action of the regeneration spring (SEE MODEL 35-1285 SERIES). The following changes involving the regeneration spring and the vertical drive assembly should be made on every changer on which there is an opportunity to do so.

Remove the regeneration spring and the threaded adjusting screw and nuts. (See Figure 3).

Loosen the two, bell drive disc bearing screws on the bottom of the motor mounting bracket.

Push the motor drive disc and armature to the extreme right, against the thrust spring. Allow $\frac{1}{16}$ " clearance between the rim of the bell drive disc and the motor drive disc and tighten the two bearing screws securely. (See Figure 4).

The change consists of removing the cupped washer and the flat washer below the upper bearing plate and adding two fiber washers, one on each side of the steel washers above the oilless bearing. The collar should be reset allowing approximately $\frac{1}{4}$ " clearance between the collar and the upper bearing support. The oilless bearing should seat in the upper bearing support and should not turn with the vertical shaft. (Figure 5).

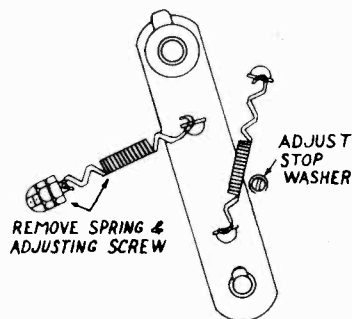


FIGURE 3

There is a small fiber washer which is used to limit the motion of the upper bearing support assembly. (See Figure 3). Loosen the screw holding this eccentric washer. Hold the vertical drive shaft at approximately 3° to the right of perpendicular and adjust the washer and fasten in place. (See Figure 6).

CLUTCH ROLLER AND LEVER ADJUSTMENT — The only change in the adjustment as given in the MODEL 35-1285 SERIES is that instead of spacing the clutch teeth $\frac{1}{16}$ " apart, the clutch should be meshed but should have a slight clearance between the upper and lower teeth. In the playing position there should be $\frac{1}{16}$ " or more clearance between the two sections of the clutch.

The purpose of the clearance between the teeth when they are meshed is to insure that the turntable will not be lifted by the operation of the solenoid. Turntables are not interchangeable without readjusting the clutch lever and also the trip mechanism.

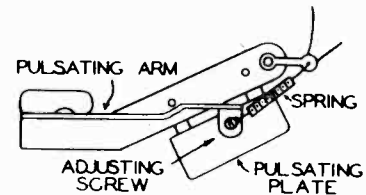


FIGURE 2

SOLENOID ADJUSTMENT — There are no changes to the instructions given in the bulletin. The action of the clutch and lever assembly should be checked for free operation. It should not require a pull of more than seven or eight ounces at the roller to bottom the solenoid. Solenoid brackets are easily bent out of adjustment when handling record changers. When a record changer is removed from a radio phonograph, set it down on its front edge, never lay it down on the top or bottom.

FORWARD SHELF MOTION ADJUSTMENT — There may be a tendency when making this adjustment, to overpush the record against the spindle, causing wear of the hole in the record.

ADJUST TONE ARM TO INDEX ON 10" AND 12" RECORDS — If the shelf plate string is loose, the spring will not change the guide track properly on the large cam. The pulley on the corner of the motor mounting bracket can be moved to take up the slack.

PULSATING PLATE ADJUSTMENT — The spring should be installed to take up side play in the lever. The roller may roll freely or it may be tight and bind. Either way will be all right. Simply put some "Lubriplate" on the cam on the bottom of the turntable hub.

It is important that clearance be maintained between the pulsing plate and the main plate to prevent clicking but, in conjunction with this adjustment, the pulsing plate should first be checked for tension. Rotate the turntable until the roller is off the crown on the cam. Place the tone arm on the rest and back up the adjusting screw. The pulsing plate should project down at an angle of approximately 30°. SEE MODEL: 35-1285 SERIES FOR FURTHER DATA. If for any reason, a turntable is replaced, readjust the pulsing plate.

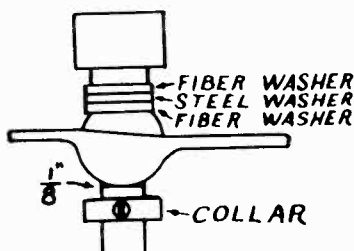


FIGURE 5

TRIP ARM ADJUSTMENT — Particular attention should be paid to obtain a slight clearance between the plate adjusting screw and the pulsing plate when adjusting the screw on the trip arm for the correct roller height. The edge of the pulsing plate should be parallel to the record changer base.

REJECT CONTACT TRAVEL ADJUSTMENT — It often is necessary to disregard the adjustment as given in the Radio Service Bulletin 402. Some records are known as swingers because the playing grooves are not concentric with the hole in the record. These records cause the tone arm to swing back and forth with each revolution, requiring more latitude in this adjustment. Turn the screw back and, in severe cases, remove the screw entirely. If the adjustment originally specified is maintained, a swing record may cause pre-trip and will cause the tone arm drag and light beam pull-off.

TURNTABLE SPEED ADJUSTMENTS — In addition to the adjustments given in MODEL: 35-1285 SERIES there are some other precautions to observe. First, the change for the vertical drive assembly specified in the first part of this Service Summary should be made on all record changers worked on.

The record changers are adjusted for a minimum speed of 78 RPM and, in the slow speed position they can be adjusted for 39 RPM. The Neon lamp should be turned so that one of the plates faces the rim of the turntable, otherwise it will not indicate the markings on the turntable when running at slow speed.

Excess paint on the inside of the turntable rim will cause WOW's. A flat on the rim on the turntable, due to its being dropped, will cause the same trouble.

The upper bearing bracket of the vertical drive should have a soft gentle action against the turntable rim. If the action of this bracket is stiff the result will be WOW's. This can be freed up by striking the rivet with a center punch.

Flutter is caused by vibrations set up in the changer drive mechanism which in turn are transmitted to the tone arm and cause the light beam to shift back and forth across the photo electric cell at the frequency of the vibrations.

A flat or nick on the rim of the bell drive assembly or on the rim drive pulley will cause flutter. It can usually be discovered by a visual inspection of the parts. An unbalanced bell drive disc will wobble while turning and will cause flutter also.

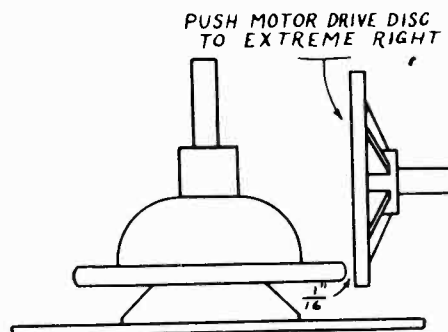


FIGURE 4

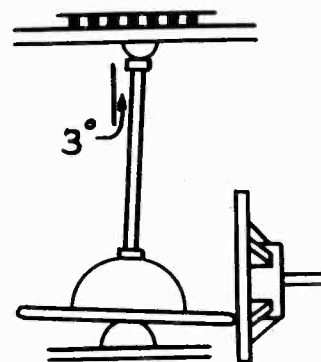


FIGURE 6

If the flat, motor drive disc is not assembled properly on the motor shaft and is not true, this will cause flutter. This condition will probably only occur on the earlier models on which the drive disc was fastened to the motor shaft with a set screw. It can be detected with the motor running, since it will cause the vertical drive assembly to oscillate. The correction for these conditions is to replace the faulty part.

SERVICE HINTS

The brass sleeve used on the shaft of the motor is to prevent the armature from slipping out of line. Some steel sleeves were also used, but these sleeves are apt to be noisy with the motor running. To overcome this, the steel sleeve can be cemented to the end of the armature with Philco Speaker Cement.

Due to the difficulty in getting materials, three different tone arms have been used:

- 1 — An aluminum arm.
- 2 — A zinc arm.
- 3 — A moulded bakelite arm.

Since the weight of each kind of arm is different, three counterbalance weights are required. The aluminum arm requires a 1½ ounce weight, the zinc arm a 5 ounce weight and the bakelite a 3 ounce weight. The zinc arm has a yellow paint mark under the tone arm.

Regardless of which tone arm is used, the weight of the tone arm on the record should be 1¼ ounces. The correct counterbalance weight must be used and the final adjustment made with the screw on the side of the tone arm swivel assembly. Do not use the incorrect counter balance weight and then adjust for the balance with the spring in the tone arm swivel, since this puts a side thrust on the tone arm spindle and will very likely cause tone arm drag.

Use only a 20 SAE grade oil mixed with ¼ special Shaler Rislone oil for lubricating the spindle. Other lubricants will cause the spindle assembly to stick, resulting tone arm drag. Tone arm drag may also be caused by the dress of the leads at the back of the tone arm. They should be dressed towards the turntable spindle at the end of the tone arm.

The tone arm spindle must be absolutely free. Any binding in either direction will cause the light beam to pull off the cell and produce WOW's and distortion. The drag should not exceed ⅛ ounce.

Do not, under any circumstances, try to adjust the angle of the jewel. The jewel normally extends ⅜" below the guard. It should be vertical with respect to the surface of the record when viewed from in front of the pick-up head. When viewed from the side, the jewel is at quite an angle to the surface of the record. On ¼ stack of records, the jewel should be at an angle of approximately 20°. When playing the bottom record, the jewel will be at an angle of approximately 13°. Do not attempt to change this angle. It permits the jewel to track in the groove with a minimum surface noise. Any change from the original setting will affect the frequency response, and if the angle of the jewel is less than given above, it will cause record wear.

Flutter, mistracking and distortion can all be caused by a stiff mirror and jewel assembly. Check the flexibility of this assembly. With the record changer stopped, put a record on the turntable and place the tone arm on the record. Open the peep hole in the pick-up cover — the light beam should be ⅜" wide and should be half "on" and half "off" the photo-electric cell. Hook the Philco Scale, Part No. 45-2851, under the cover at the nose and pull laterally, first toward the spindle and then away from the spindle. The jewel assembly should be sufficiently flexible to allow the light beam to be pulled completely off the cell and completely on the cell with less than 1 ounce of lateral pull — from ½ ounce to ¾ ounce is the most desirable. Replace the mirror and jewel assembly if more than 1 ounce pull is required.

PRESTO RECORDING CORP.

INSTRUCTIONS FOR OPERATING THE MODEL D"

The recorder comes packed without the tubes and tube shields in the sockets and to insert the tubes the following procedure is followed:

Remove tube screen cover located at the rear by removing the four screws holding this cover down. Insert the tubes in their proper sockets as shown in fig.1. The tube shields are made in 3 pieces. The bottom piece is already fastened in place on the chassis. After the tube is inserted in the socket, the middle section of the shield (longest section) is placed over the tube and pushed in as tightly as it will go. The grid lead for each tube has mounted on it a grid cap and this cap should be fitted over the grid stud of the tube which is located on the top of the tube. If the cap fits loosely over the grid stud of the tube it should be removed and squeezed slightly and then pushed over the stud again. A loose grid cap can cause noise and hum which will result in poor recordings.

Plug the microphone plug into the 3 way polarized receptacle (2) Fig. 2, located at the rear right of the top panel. The receptacle has a red mark on one prong and this prong should coincide with the red marked prong on the plug. After this plug is inserted it should be locked by tightening the lock nut located on the plug.

Insert the A.C. plug into any 110 volt, 60 cycle A.C. receptacle. On the top of the panel, above the name plate, are two toggle switches. The one on the left (10) is for turning the motor "on" and "off" while the one on the right (7) is

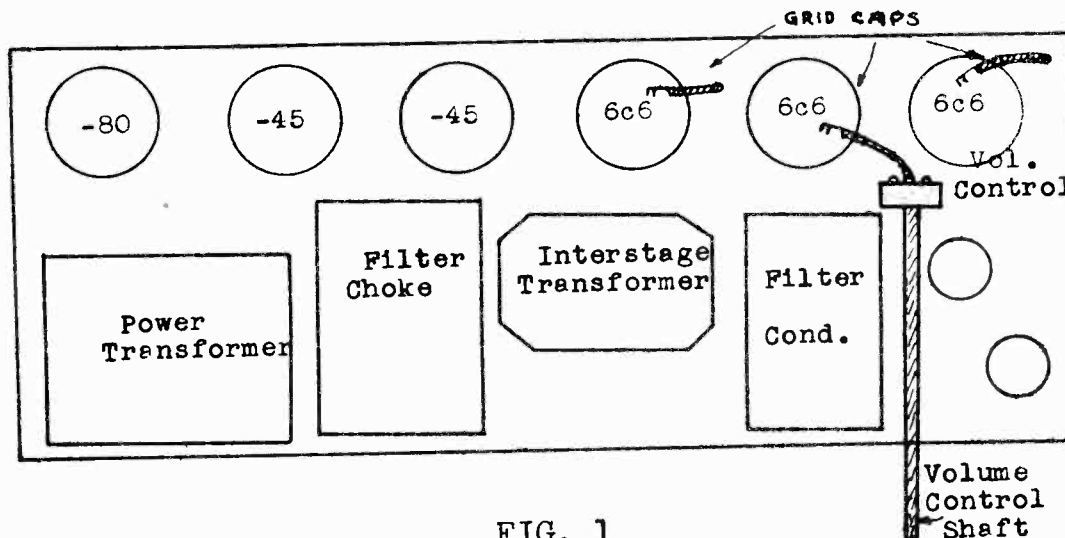


FIG. 1

MODEL D Compac

PRESTO RECORDING CORP.

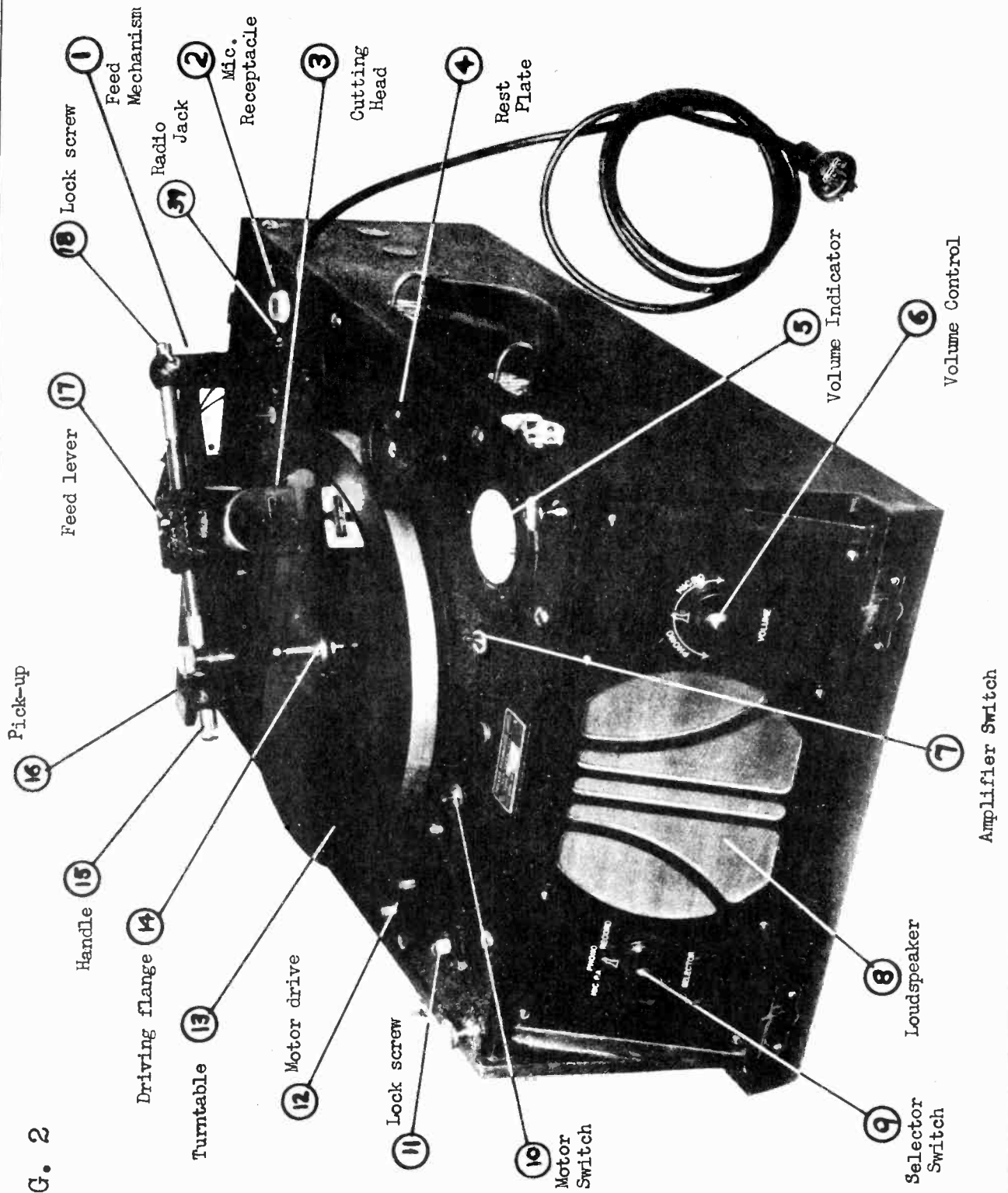


FIG. 2

PRESTO RECORDING CORP.

MODEL D Compact

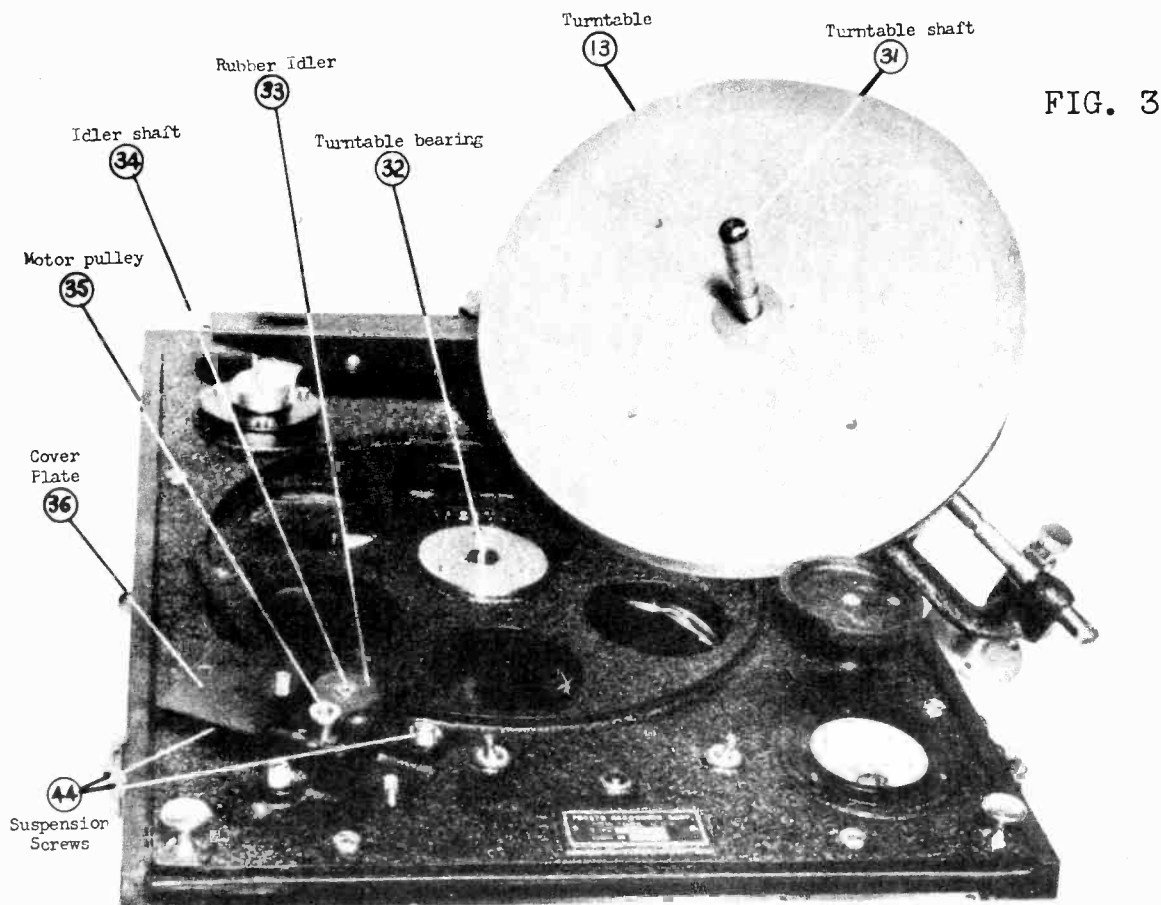


FIG. 3

for turning the amplifier "on" and "off". After turning the amplifier switch "on" wait at least 30 seconds for the tubes to heat up before recording.

Be sure that the 2 pins on the ends of the cutter leads are inserted in the 2 pin jacks located next to the radio jack (39).

In the front left hand corner is a knurled lock screw (11) which mechanically locks and unlocks the motor. The motor is mounted in live rubber and the shaft of the motor (35) Fig. 3 drives against a rubber idler (33) Fig. 3 which in turn drives against the outside rim of the turntable. The motor is therefore free to swing freely. If allowed to swing in this manner in transportation the machine will be damaged. When the machine leaves the factory the lock screw (11) Fig. 2 is turned to the locking position, that is turned to the right as far as it will go. The motor is now held very rigidly and will not rock in transportation. To un-lock the motor, turn the knurled screw (11) Fig. 2 to the left as far as it will go. The motor is now ready for use, and throwing the motor switch (10) to the "on and off" positions will start and stop the turntable. Please note that if the machine is to be moved at all, the motor should be locked.

PRESTO RECORDING CORP.

To eliminate the possibility of any hum developing, the machine should be connected to any ordinary ground system such as a radiator pipe, water pipe or radio ground. Place the ground wire under the knurled screw that holds the "pick up" clamp.

RECORDING ON ACETATE

Place disc on turntable. Remove the thumb screw that fastens the feed mechanism (1) Fig. 2 to the rest plate, (4). Now, grasp the handle (16) lift up, and swing the mechanism to the left and place it over the center spindle of the turntable so that the three screws that are spaced equidistant from the spindle on the turntable match the three holes in the driving flange (14) of the feed mechanism. FOR FURTHER NOTES ON RECORDING ON ACETATE AND ALUMINUM, SEE MODEL EU-7

CONTROL PANEL OPERATION

RECORDING

To record from the microphone turn the selector switch (9) on the front panel to the "record" position and operate the volume control (6) in the "micro" position. The proper volume to be used will be determined by the swing of the needle on the volume indicator meter (5). This needle should swing to mid-scale for average peaks. If it swings above mid-scale the volume is too high and should be reduced by turning the volume control (6) to the left. If the needle barely swings, then the level is too low and the volume should be brought up.

PLAYBACK

To playback records, turn the selector switch (9) to the "phono" position and operate volume control (6) in the section marked "phono". If ordinary commercial records are to be used for playback, remove the 3 driving screws, located on the turntable.

PUBLIC ADDRESS

Turn the selector switch (9) to the "Mo. P.A." position and operate the volume control (6) in the "micro" position and when the microphone is used for either talking, singing or instrumental playing, the sound will emanate from the loud speaker.

RADIO RECORDING

To the left of the three way receptacle (2) is located a radio jack (39) to be used when recording from the radio receiver. The impedance of this outlet is 8 ohms.

From the voice coil of the radio loudspeaker bring two wires to an ordinary telephone plug and insert the latter into the jack.

The output of the radio receiver is now being fed to the cutting head and volume indicator (5) is in the circuit.

The above procedure is to be followed for recording either on acetate or aluminum. In recording from the radio no controls on the machine are used. These controls for recording are automatically cut out when the plug is inserted in the jack. The only controls that are used are the radio controls. The volume indicator is used and the swing of the needle should be controlled as outlined above.

If the above procedure is not desired-place the microphone in front of the radio loudspeaker and proceed as if recording from the microphone. The results obtained using this set-up will not be as good as the results obtained by using the radio-jack.

REMOVING FEED SCREW AND CUTTING HEAD ASSEMBLY

Grasp cutting head casting (22) with the left hand and loosen lock thumb screw (18) with the right hand. Now pull out pivot (19) slightly. The feed screw with the cutting head can now be removed as shown in fig. (6).

To remove the cutting head assembly push down on lever (17) and slide the casting off the feed screw.

To replace the cutting head and feed screw reverse the above procedure. When inserting the feed screw into the feed mechanism the worm gear (29) on the end of the feed screw (21) is inserted first to mesh with the worm (25). The removable pivot (19) is then pushed in tightly and lock screw (18) is tightened. It is very important that when this operation is completed that there be absolutely no play between the feed screw and pivots. Check this by trying to move the feed screw from side to side. If there is any play, faulty cutting in the form of uneven grooves will result. Pivot (19) should then be reset.

LOCATION OF TROUBLES

High surface noise on acetate recordings may be due to a bad cutting needle, a faulty record, or cutting with too little volume. For details on these, see data under Model EU-7. In the event that the playback needle will not track, this might be due to a worn playback needle, insufficient depth of the groove, or the cutting head does not have free vertical motion. See following pages for detailed explanation of these troubles.

PRESTO RECORDING CORP.

MODEL D Compac

PROPER GROOVE

It is very important to have a proper cut to insure proper tracking. When the thread is cut out by the needle it should be about the thickness of an ordinary human hair. It should be black and shiny. If the cut is too light the thread will be grayish and if too heavy it will be about the thickness of a very heavy black sewing thread.

The depth of cut is dependent on the pressure on the needle point. The cutting head is counterbalanced by means of a small pressure spring (20) Fig. 7 located on the cutting head casting (22). This pressure spring is adjusted for the proper tension at the factory and this adjustment should not be tampered with unless absolutely necessary. In case an adjustment should be necessary on this spring the procedure outlined below should be followed:

With a screw driver loosen slightly, pressure lug screw (26). This screw should be loosened enough so that pressure lug (27) can be moved with slight pressure. If the thread of the groove is too light increase the pressure by moving pressure lug (27) slightly to the rear. If the thread is too heavy, move pressure lug (27) slightly forward. Too deep a cut will cause echo in the record.

A more exact method of determining the depth of cut is by the use of a magnifying glass of about 20 power. A proportion of width of groove of 55 to 45 width of wall will give proper depth. This proportion is subject to slight variation. Approximately it should be 6 to 4.

CUTTING HEAD DOES NOT HAVE FREE UP AND DOWN MOTION

This is due to the bracket (43) holding the cutting head (42) being too tight in the pivots. To check this, lift the cutting up and down by picking it up by the needle screw with the fore finger. If the movement is sluggish then follow the procedure outlined below in order to have the head move freely.

With a small wrench or a pair of pliers loosen the two lock nuts (23) Fig. 7. Then loosen the two pivot set screws (24) enough so that the head moves freely up and down. The pivot screws (24) must not be so loose that the bracket (43) will have play from side to

side. After these pivot screws (24) are adjusted so that the cutting head (42) has a free up and down motion without any side play—tighten the lock nuts (23) and then check the movement again. Sometimes the tightening of lock nuts (23) will tighten the pivot screws (24) and the vertical motion will be sluggish again. The pivot screws should be held with screw drivers while the lock nuts are tightened. NOTE: This head is adjusted at the factory and there is no reason why this adjustment should be made in the field. Before making this adjustment be sure that no other cause is the reason for the shallow cut.

WAYER OR "WOWS" IN RECORDING

These unsteady sounds may be caused by the record slipping or the worm shaft binding. Detailed explanations covering these subjects will be found under Model EX-7. Also "wows" may be caused by slippage between the turntable and the motor, which is covered below:

When the recorder leaves the shop it has been carefully adjusted to the proper driving speed and torque. However, there is a remote possibility that this adjustment might loosen and cause waver. If so, loosen the left hand large motor suspension screw (44) Fig. 8 slightly and also loosen the right hand suspension screw (44). Note that this right hand suspension screw slides in a slot. After loosening these screws, the entire motor mounting can be shifted either away from the rubber idler (33) or against it. Check the table by applying pressure with the thumb against the rim. If the table stops easily, move the right hand suspension screw (44) towards the table and tighten both suspension screws (44). The pressure of the motor pulley (36) against the rubber idler (33) should be such that a heavy pressure of the thumb against the rim will stop the table. If the table can't be stopped then the right hand suspension screw (44) should be moved away from the table.

The best procedure is to record a sustained note such as a piano or any other instrument, and play it back. You will then be in a position to judge whether the reproduction is faithful and constant. If.

MODEL D Compac

PRESTO RECORDING CORP.

Legend	Description	Part No.
R1	Resistor 5 MEGOHMS	1138
R2	750 OHMS	1140
R3	250000 "	1132
R4	10000 "	1148
R5	250000 "-25000 ohm volume control	1262
R6	1500 "	1143
R7	50000 "	1134
R8	5000 "	1146
R9	250000 "	1132
R10	2500 "	1144
R11	50000 "	1134
R12	1 MEGOHM	1147
R13	25000 OHMS	1255
R14	750 "	1254
R15	350 "	1139

CONDENSERS

C1	25 MF	1126
C2	1 MF	1117
C3	18 MF	1261
C4	1 MF	1225
C5	25 MF	1126
C6	1 MF	1117
C7	.1 MF	1225
C8	.25 MF	1118
C9	8 MF Filter	
C10	8 MF Condenser	1261
C11	18 MF Block	

MISCELLANEOUS

Legend	Description	Part No.
J1	Interstage	1171
P1	6 Prong plug	1156
P2	4 prong plug	1157
RE-1	6 prong wafer socket	1154
RE-2	4 prong wafer socket	1152
CU-1	copper oxide rectifier and motor	1257
LA-1	6.3V pilot bulb	1223
FL1	AC spring plug	1158
LS1	8" speaker 1000 M field	CB X B 1379

SWITCHES

S1	Selector Switch	1256
S2	S.P.S.T. "	1114
S3	S.P.S.T. "	1114

TRANSFORMERS

T1	Interstage Transf.	PPA1320
T2	Power	PRH30

CHOKES

L1	Filter Choke	PS41R
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however, the turntable wows, this reproduction will also sound uneven. One or two trials will enable you to make the correct adjustment. After you have found the adjustment to be correct, lock the two screws (44) securely with a heavy screw driver.

For troubles due to jerky, intermittent recording, see Model EU-7

LUBRICATING THE COMPAC MODEL D RECORDER

There are three essential parts on the motor drive mechanism that have to be lubricated.

1. The main turntable bearing (31) Fig. 3 must be lubricated

weekly with a good grade of vaseline. This may be accomplished by lifting the turntable from the bearing (see Fig. 3) and applying the vaseline to the turntable shaft (31). There is a thrust steel ball at the bottom of this bearing and care must be taken that this ball is not lost when removing the turntable. Sometimes the ball will stick to the bottom of the turntable shaft, in which case it should be removed and dropped into bearing (32).

2. Lubrication of the idler shaft (34) is very essential, it should be done daily, if the machine is used a good deal. "3 in 1" oil is advisable. One drop of oil in the center hole of the idler shaft (34) is sufficient. Be sure that the oil does not get on the idler. Always wipe clean as this might cause loss of friction.

3. The motor need not be oiled more than once in 3 months and then with the same quality of "3 in 1" oil as used on the idler shaft (34). It is advisable not to oil the motor too much. Too frequent oiling might cause defects in the winding of the motor. When oiling the motor, the entire panel mounting must be raised as shown in Fig. 9. The oil cups (38) are shown; one at the bottom and one at the top.

The oiling of the over head feed mechanism is of a very simple nature. Use "3 in 1" oil on the centers (28) Fig. 6 of the feed screw and the shaft that carries the worm. The feed screw can be kept moist with a little "3 in 1" oil and the lubricating of these elements can be done frequently at about one week intervals.

PRESTO RECORDING CORP.

MODEL D Compac

FIG. 5

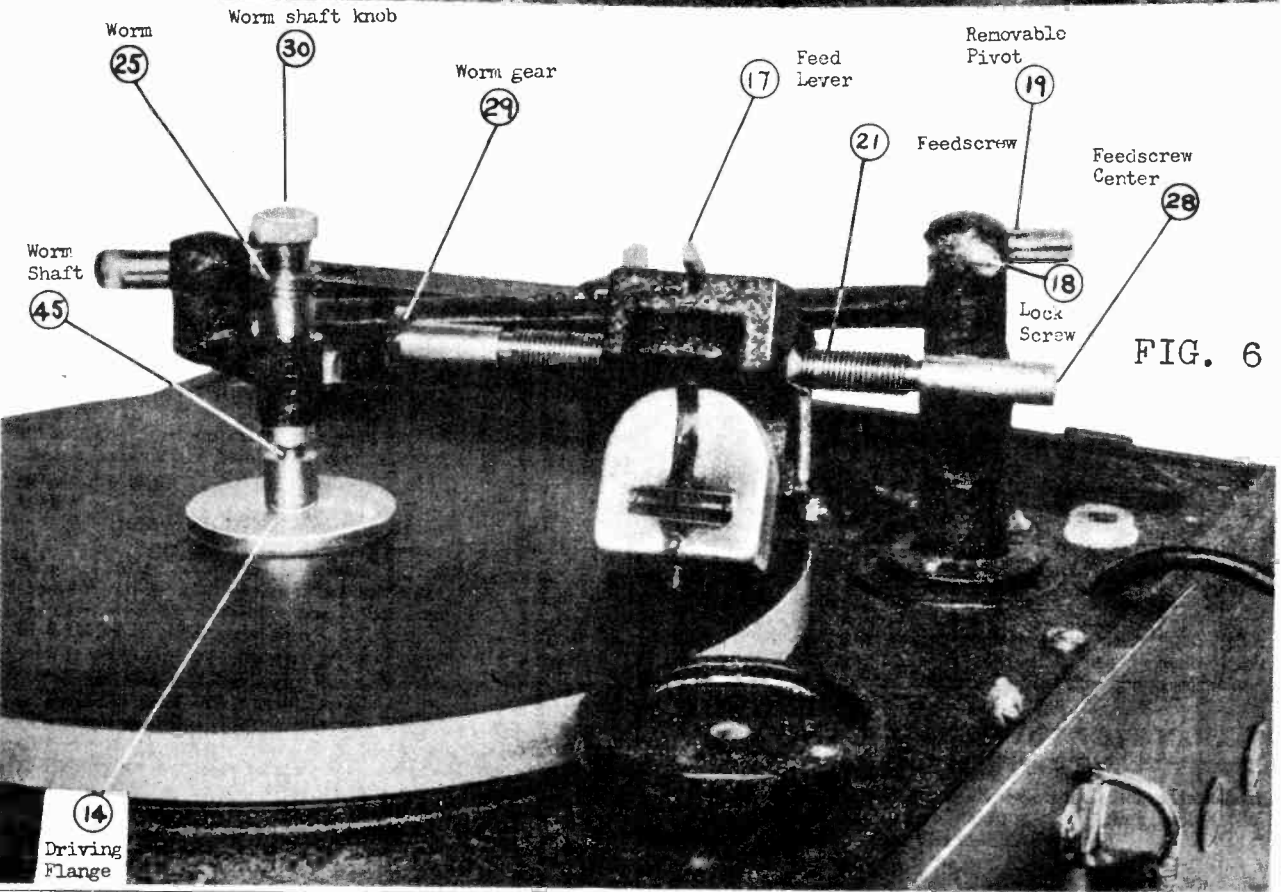
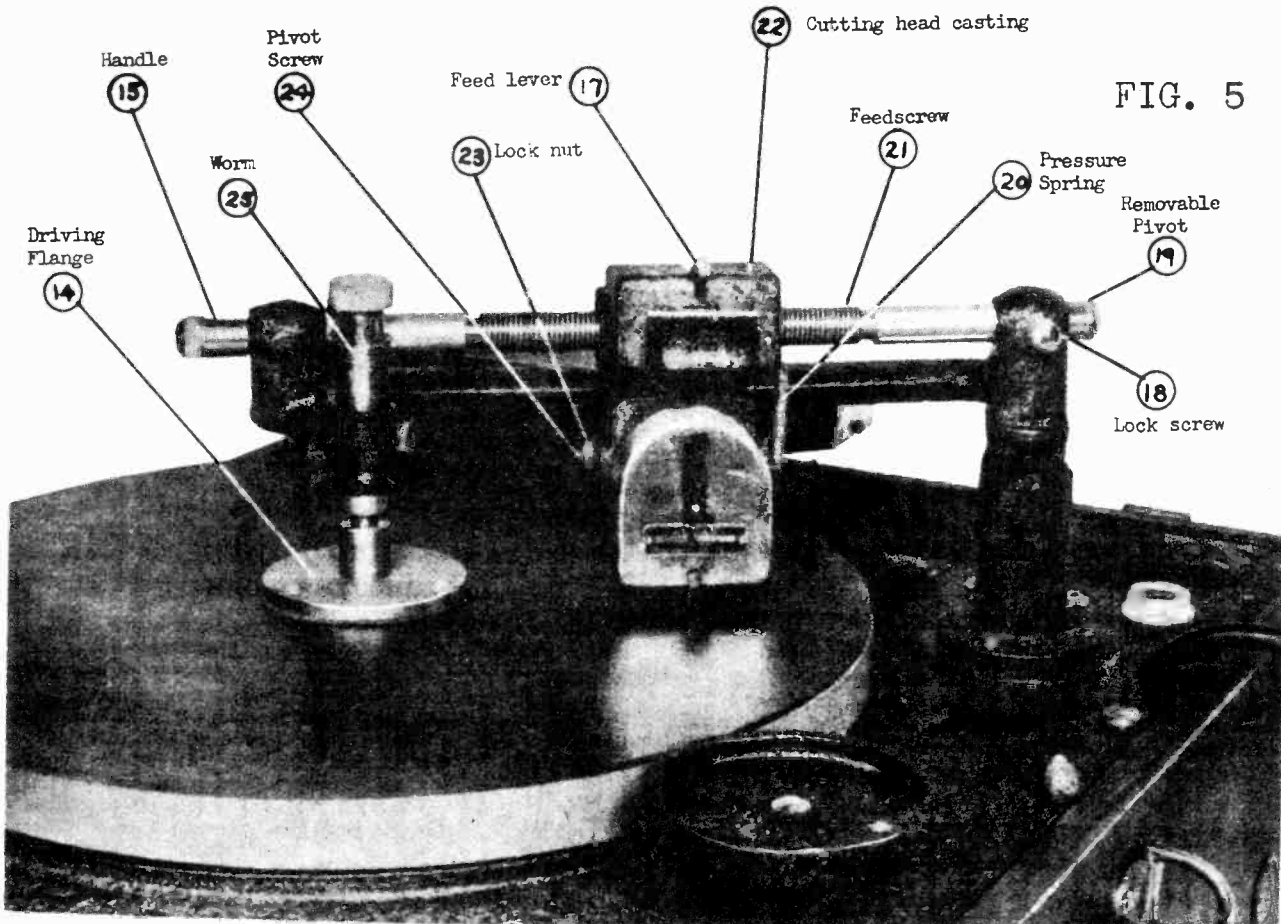


FIG. 6

MODEL D Compac

PRESTO RECORDING CORP.

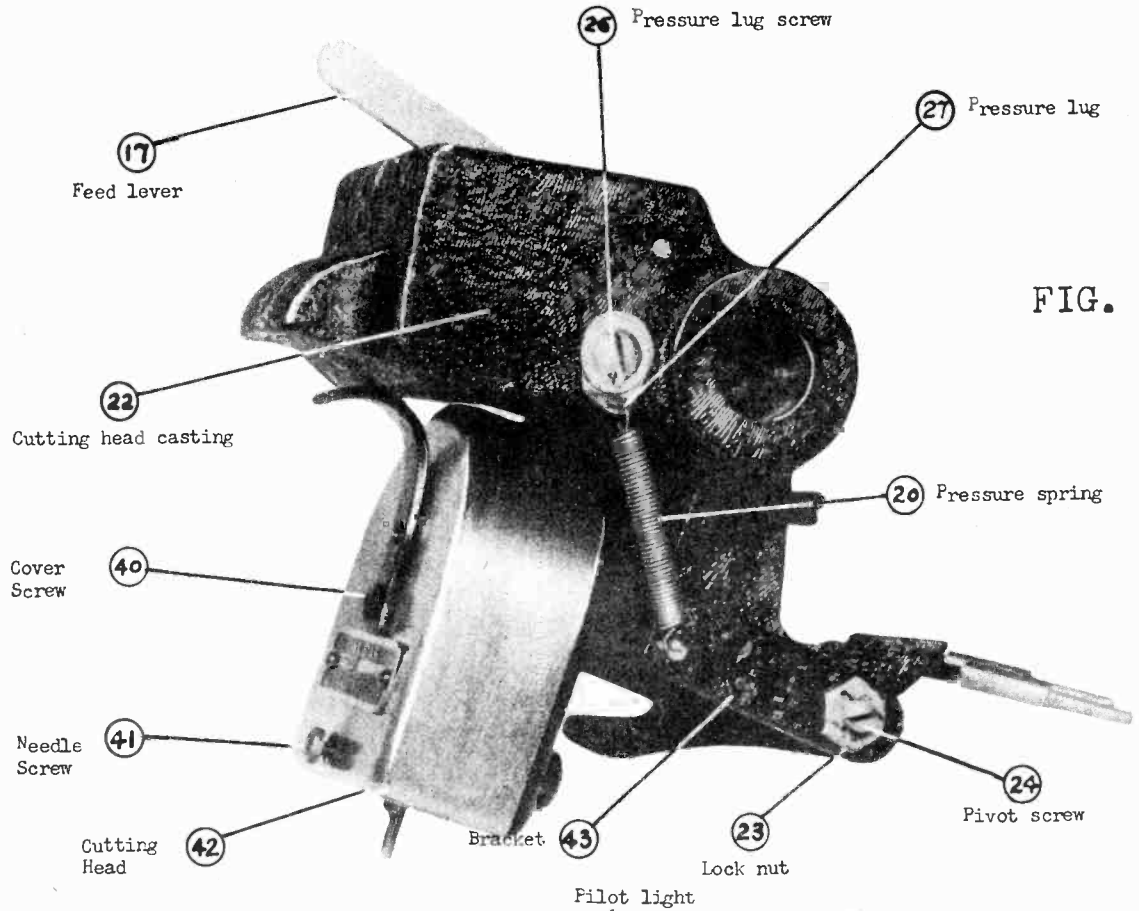


FIG. 7

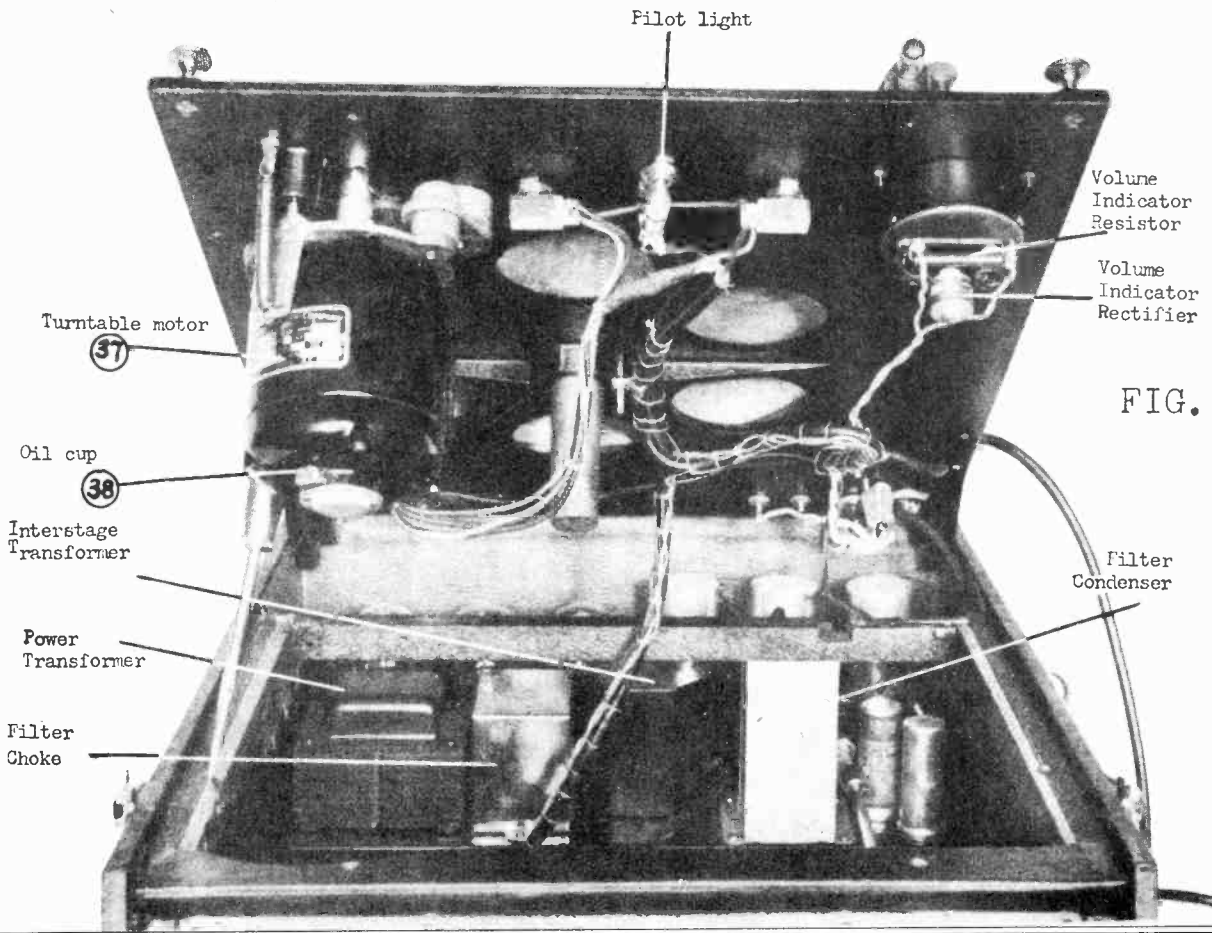


FIG. 9

PRESTO RECORDING CORP.

MODEL D Compac

POWER RATINGS:
 Rating A - 105-125 V, 50-60 Hz, 75 W.
 " B - 105-125 V, 2.5 Hz, 80 W.
 " C - 100-130/140-160/195-250 V,
 50-60 Hz, 75 W.

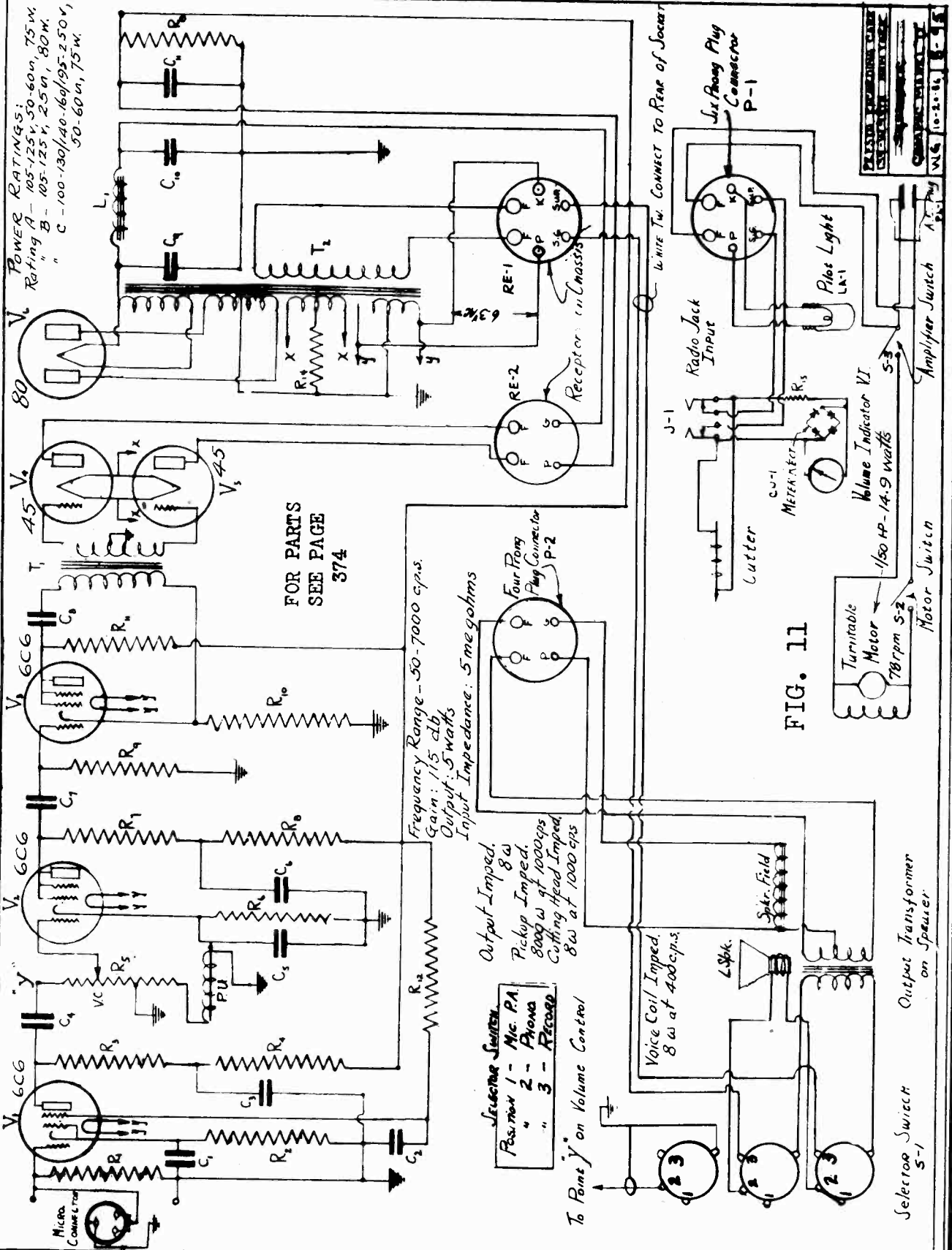


FIG. 11

Selector Switch
 Position 1 - Mic. PA
 " 2 - Phono
 " 3 - Record

Frequency Range - 50-7000 cps.
 Gain: 115 db
 Output: 5 watts
 Input Impedance: 5 megohms

Output Imped. 8 w
 Pickup Imped. 8000 w at 1000 cps
 Cutting Head Imped. 8 w at 1000 cps

Voice Coil Imped. 8 w at 400 cps

Output Transformer on Speaker

Selector Switch S-1

Motor Switch

Turntable Motor 78rpm S-2

Volume Indicator VI 1/50 HP - 14.9 watts

Lutter

Radio Jack Input

Six Prong Plug Connector P-1

RE-1

RE-2

Four Prong Plug Connector P-2

Spkr. Field

Spkr.

Amplifier Switch

Pilot Light LA-1

White Tw. Connect To Rear of Socket

Receptor in Chassis

6.3k

35

50

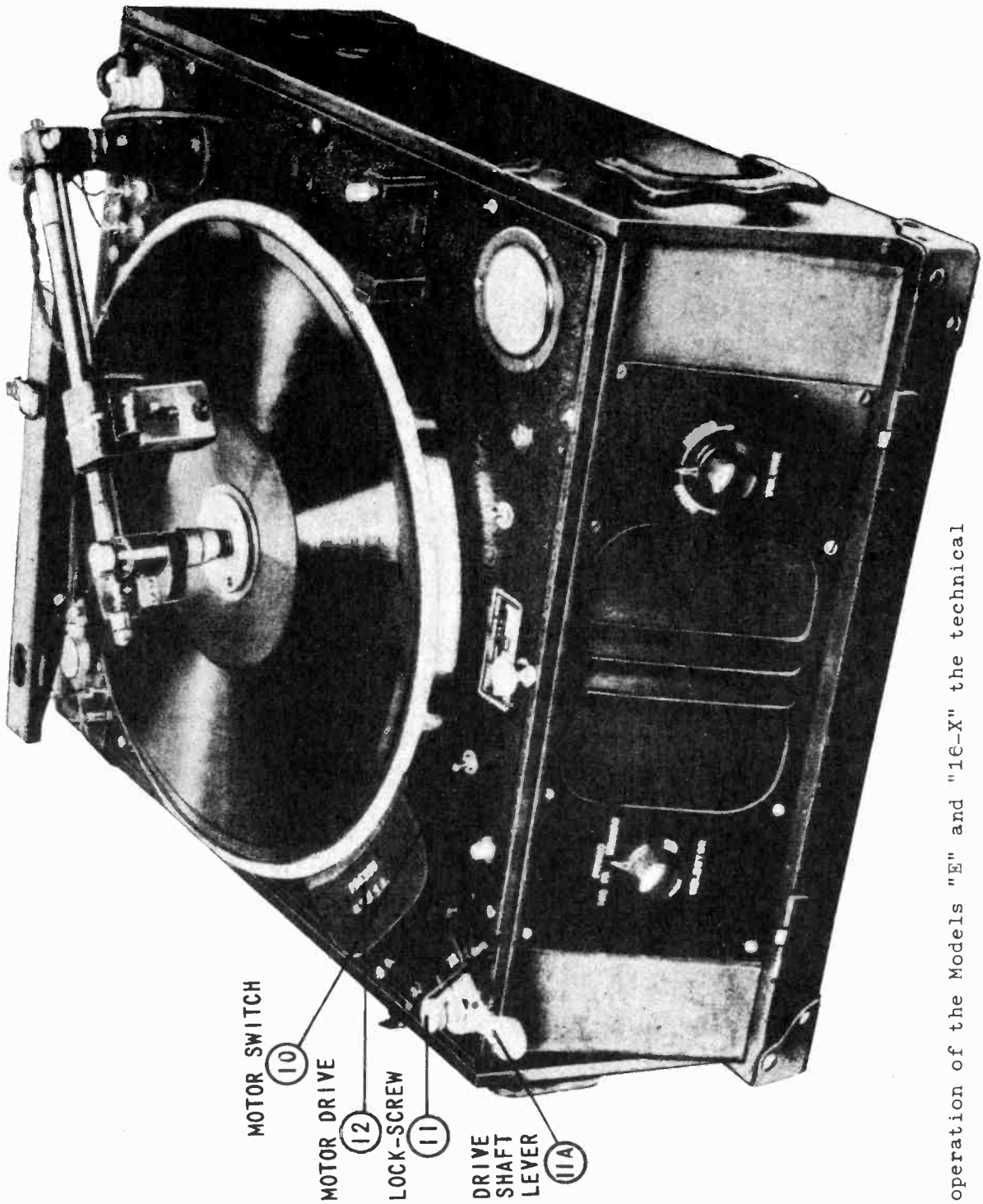
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MODELS E, 16X

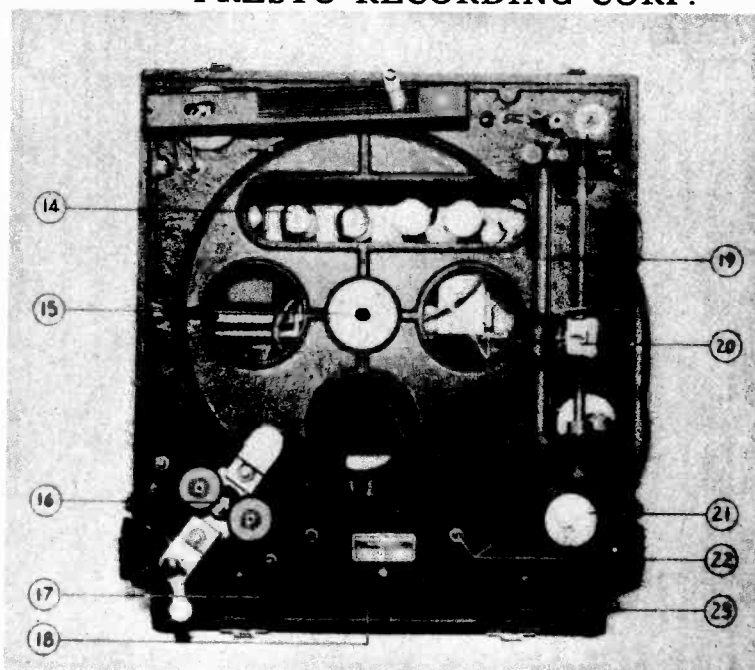
PRESTO RECORDING CORP.



For operation of the Models "E" and "16-X" the technical instructions are the same as the Model "D", with the exception of the new type shift lever.

PRESTO RECORDING CORP.

MODELS E, 16X



- 14 - Amplifier for recording and playback. Gain 115 db. power output 4 watts.
- 15 - Bronze turntable bearing.
- 16 - Drive mechanism showing rubber idler wheels operating between motor shaft step pulley and turntable rim.
- 17 - Selector switch for recording, playback and public address operation.
- 18 - Loudspeaker, 8" dynamic type.
- 19 - Cutter carriage guide bar.
- 20 - Presto 1-B high fidelity cutting head, response 50 to 6,600 cycles, impedance 8 ohms, required input level plus 20 db.
- 21 - Volume indicator meter.
- 22 - Amplifier power switch and bullseye.
- 23 - Double gain control for both recording and playback.

The Models "E" and "16-X" recorders are now equipped with the new type shift lever for operating at 33 1/3 and 78 R.P.M. For operation first turn-on motor switch (10). To operate at 78 rpm loosen "lock-screw" (11) pull shift lever (11-A) towards numerals "78" on motor housing and lock screw. For operating at "33 1/3" rpm repeat operation and lock shift lever at "33 1/3" numerals. When machine is not in use return shift-lever (11-A) to neutral position and lock screw (11).

MODEL K

PRESTO RECORDING CORP.

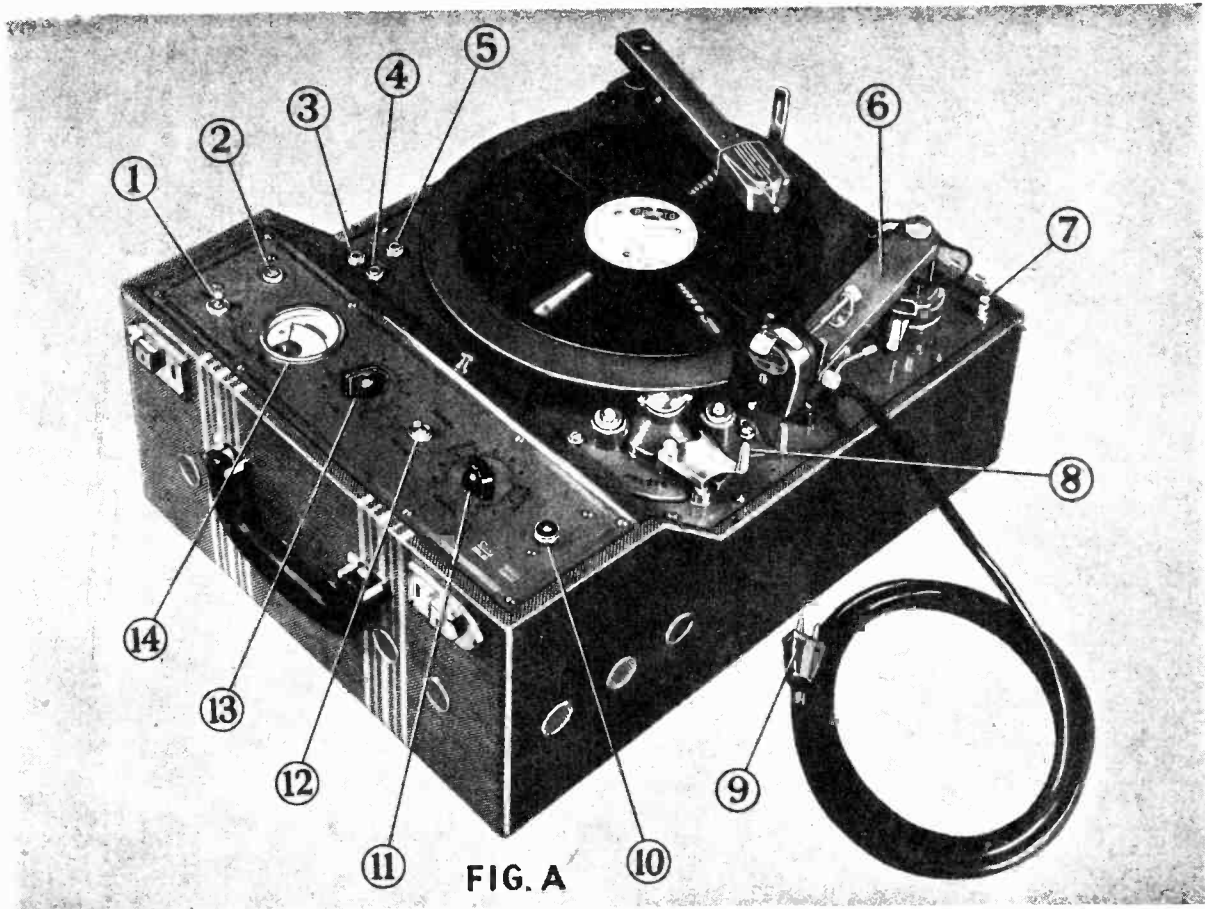


FIG. A

**OPERATING INSTRUCTIONS
FOR THE
PRESTO
MODEL "K" RECORDER**

**READ CAREFULLY BEFORE
ATTEMPTING TO OPERATE MACHINE**

Unpacking

In removing the recorder from the carton, take care not to pierce the wrapping with a sharp instrument that might damage the finish of the case. The recorder will be found unlocked. The keys are in a small paper envelope attached to the inside of the cover. The cover may be removed if desired by swinging it all the way back.

Open the case and carefully remove the wrapping from the cutting mechanism and pickup. The recorder is shipped with the amplifier tubes in their sockets, ready for operation.

A roll of insulated wire, for the ground connection is inside the recorder case. The brass spindle (B2) is in an envelope, next to key envelope, inside the cover. It is used to collect the thread, which is cut from the surface of the disc, while recording. The microphone and stand are packed in three separate cartons. When assembling microphone stand make sure that the base and microphone are screwed on tightly to prevent metallic rattling while recording.

**How to Set Up the Recorder
for Operation**

Connect a wire from the binding post (A7) to a water pipe or radiator. **This ground connection is essential for good results.** Screw the microphone plug to the receptacle (A10) on the amplifier panel. Insert the loudspeaker plug into the receptacle (A4), marked SPEAKER. If headphones are to be used while recording, insert the headphone plug into receptacle (A3) marked MONITOR.

Insert a Presto cutting needle in the cutting head (B7) making sure that the flat side of the needle shank faces the cutting head set screw (B8).

PRESTO RECORDING CORP.

Push the needle all the way in and tighten the set screw firmly.

Insert a Presto red shank playing needle in the pickup head (B1) and tighten the set screw.

Insert the power plug (A9) into a wall or lamp socket, **first making sure that your power supply is ALTERNATING CURRENT.** Plugging into a direct current outlet will blow the fuse in the turntable base. Throw the toggle switch (A1) to the on position. The red bulls-eye (A2) should light indicating that the amplifier is on.

How to Make a Record

Place a blank disc on the turntable, fitting the three holes over the pins near the center of the turntable. Fit the brass spindle (B2) over the turntable shaft. Set the switch (A12) in the "Record" position. Turn the tone control knob (A13) all the way to the right, pointing to zero. Speak into the microphone and at the same time turn the volume control knob (A11) slowly to the right until the hand on the meter (A14) starts to kick upscale. When the hand begins to kick up within the green section it indicates that you are using the proper amount of amplification for recording. Push the cutting head

cam lever (B6) all the way back so that it points away from you. Pull the lever (B4) toward you as far as it will go and move the cutting arm (A6) so that the cutting needle will start about one quarter inch inside the edge of the record. Holding the cutting head in position, push the lever (B4) all the way back to lock the cutting arm in place. **After locking the cutting arm press it gently to the right and left to make certain that the gear and worm beneath the table are properly meshed.** Because these parts are fitted very closely it is sometimes necessary to snap them into mesh. Start the turntable by pushing the lever (A8) all the way back. This lever engages the motor pulley with the turntable rim and also turns the motor on. Pull the cutting head cam lever (B6) forward all the way to lower the cutting needle onto the disc. A fine thread will start to collect in a ring on the surface of the disc about one half inch from the cutting needle.

You are now recording and any sound impressed on the microphone will be recorded. While cutting the record it is necessary to sweep the thread toward the center of the turntable occasionally letting it wind up on the brass-spindle (B2). The thread may be guided toward the center by resting your fingers lightly on the surface of the disc. Do

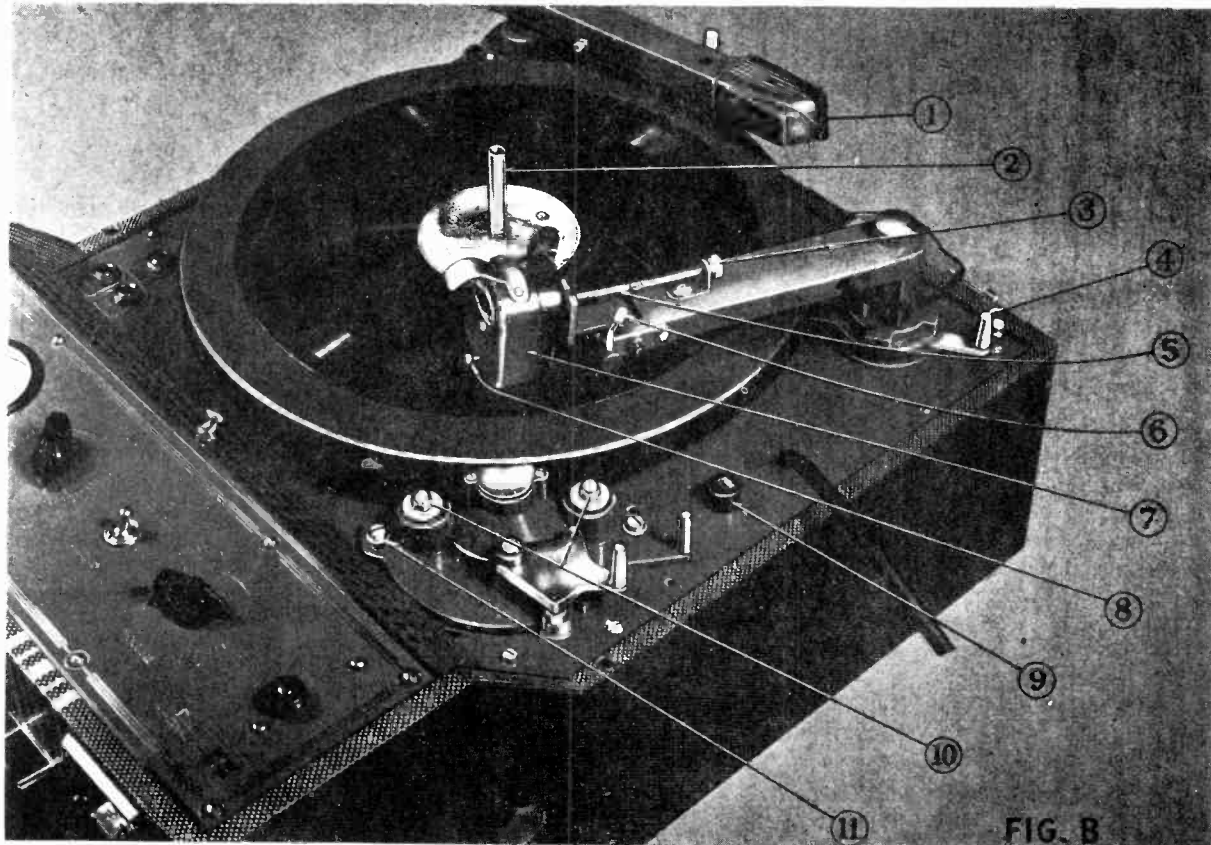


FIG. B

not allow the thread to become entangled under the cutting head as it will force the cutting needle off the disc and break the continuity of the groove, so that the record will not play properly.

How to Play the Record

When the record has been completed, turn the switch (A12) to the "Phono" position and cut a few grooves without sound to finish off the record. Push the cam lever (B6) back to lift the cutting needle off the disc. Pull the lever (B4) forward and swing the cutting arm all the way to the right. Then push the lever (B4) back to keep the arm clear of the turntable.

Place the playback pickup (B1) in the outside groove of the record and turn the volume control (A11) slowly to the left until the record plays with the desired loudness. Adjust the tone control (A13) to obtain what you consider the most natural reproduction. The proper position will usually be between 6 and 8 on the scale.

How to Operate the Presto Recorder as a Public Address System

To operate as a public address system, the switch (A12) should be thrown to the "Phono" side and the volume control (A11) turned slowly to the right noting the point where the loudspeaker begins to howl continuously. This is known as "feedback" and is caused by sound from the loudspeaker being picked up by the microphone and re-amplified. To correct this condition, place the microphone about ten or fifteen feet behind the loudspeaker so that it will not pick up too much of the direct sound. When the system is used in a fairly small room, sound reflected from the walls will also cause feedback. Therefore, it is always advisable to experiment with the location of the speaker and microphone to find the arrangement that permits using the maximum amount of amplification without feedback.

Recording from the Radio

The jack (A5) is connected into the second stage of the recording amplifier. When a plug is inserted into the jack the playback pickup is disconnected. The input impedance at this point is 25,000 ohms. Connection should be made from this jack to the output of the 2nd detector of the radio set. This work can best be handled by a local radio service man. Because of the differences in various radio set circuits, no specific information can be given in this booklet. As one side of the amplifier input is grounded, the polarity of the connections must be correct. The radio program will be heard through the loudspeaker of the recorder if the switch (A12) is

thrown to the "Phono" side and the volume control (A11) turned to the left. To record the program throw the switch (A12) to the "Record" position and turn the volume control (A11) to the left until the volume indicator meter kicks to the green section.

Duplicating Presto Recordings

To duplicate a Presto recording, play the original recording on a separate phonograph turntable. Connect the pickup on the external turntable to the jack (A5) and operate the same as when recording from the radio. For re-recording, a magnetic pickup having an impedance of 5,000 to 10,000 ohms should be used. The input impedance of the amplifier at this point is not suitable for the use of a crystal pickup.

COMMON FAULTS IN OPERATION AND HOW TO CORRECT THEM

Cutting Needle Runs in Single Groove Cutting through Coating of the Disc

You forgot to push the lever (B4) back before lowering the cutting needle onto the disc. Replace cutting needle.

Playback Pickup Repeats a Single Groove at Some Point in the Record

The thread from the cutter became entangled under the cutting needle lifting it from the disc and causing it to break into the adjacent groove. Watch the thread more carefully and brush it to the center oftener.

Very Little Sound on the Record Making it Necessary to Use Excess Amplification on Playback

Insufficient amplification used while recording. See that the meter needle kicks well within the green section on the meter scale.

When a speaker raises or lowers his voice or when music becomes louder or softer the volume control must be adjusted to keep the meter kicking within the proper range (about mid-scale). Avoid making rapid changes in the setting of the volume control. Try in all cases to anticipate changes in the sound intensity, shifting the volume control slowly to compensate for them.

Reproduction Ragged and Distorted

This will usually occur if the instrument is not properly grounded.

Also caused by the meter kicking too high while

PRESTO RECORDING CORP.

MODEL K

recording. Be careful to keep it kicking within the green section, but not beyond.

Sometimes caused by speaking too close to the microphone or shouting.

Playing Needle Will Not Stay in Groove—Slides Across Record

Groove was cut too shallow. The thread from a groove of proper depth should be about the thickness of human hair. Adjust the tension of the spring (B5) behind the cutting head using the thumbscrew (B3) to increase the pressure of the cutting needle on the disc.

If the groove is too deep the thread will be coarse and kinky. Adjust the spring to lighten the cutting pressure. Cutting too deeply will wear out the cutting needle quickly.

A worn playing needle will also fail to stay in the groove. Use a new needle each time a record is played and change the needle immediately if the pickup has been dropped or dragged across the surface of the record.

Tone of Music Wavers or Sounds Off Key

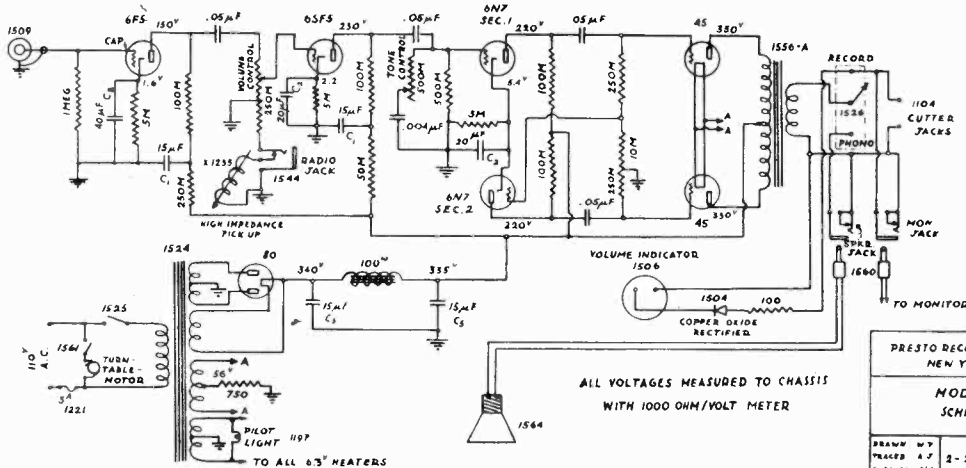
Usually due to oil or moisture on the rim of the turntable or because thread from the records has become fouled in the cutting head drive mechanism or motor shaft.

Clean the outside rim of the turntable with any household dry cleaning fluid such as, Carbona, Engerine, etc. Lift the turntable out of its bearing to examine motor and feed mechanism and remove any thread or dirt which has become caught in moving parts.

Occasionally the motor may move out of adjustment due to rough handling in transportation. This will necessitate loosening the screw (B11) and increasing or decreasing the pressure of the motor pulley against the turntable rim. If the pressure is not sufficient, the turntable will slip. If the pressure is too great, vibration will occur due to the motor being pushed off center. The pressure should be adjusted to give just sufficient traction.

Machine Has Tendency to Howl when Records are Played Loudly

Due to defective tube or tubes.



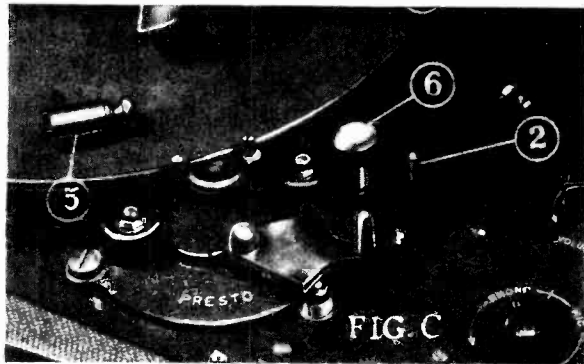
Excessive Vibration

This may be due to damage to the rubber tire on turntable. Remove the turntable from the bearing. Slip the tire off, and check to see that rim of turntable is clean. Turn the tire inside out, stretch it, and slip into rim by using a smooth instrument, such as a small screw driver. Be careful not to cut or mar the rubber. Then roll the turntable on a flat surface such as a table top, exerting appreciable pressure. This equalizes the tension of the tire around the entire circumference. Replace turntable into bearing.

Also may be caused by a bent motor shaft. In this case, the motor should be replaced. Also caused by a damage to the rubber cushions on which the motor hangs. Remove nuts (B10) and examine mounting cushions. If damaged they should be replaced.

Lubrication

Clean and lubricate turntable shaft and the worms and gears beneath the turntable with white vaseline. If the vaseline becomes stiff, add a few drops of light machine oil. Oil the motor once every three months, placing a few drops of "3 in 1" oil in the oil cups. To give proper results, the machine must be kept free of dust and dirt in all moving parts.



HOW TO CHANGE TURNTABLE SPEED

The turntable drive will operate at either 78 or 33 1/3 rpm. To change the speed, lift the brass pulley (C5) off the motor shaft

Loosen the thumbscrew (C6) and push the motor housing toward the turntable using handle (C2). Then tighten (C6).

Reverse this procedure and replace (C5) to change to 78 rpm.

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MODEL 6K SCHEMATIC	
DRAWN BY TRACER A J	2-23-40
CHECKED BY	B 227b

MODEL J5

PRESTO RECORDING CORP.

INSTRUCTIONS FOR UNPACKING

In removing the recorder from the carton take care not to pierce the wrapping with a sharp instrument that might damage the leatherette finish of the case. The recorder will be found unlocked. The keys are in a small paper envelope attached to the inside of the cover. The cover may be removed if desired, by swinging it all the way back.

Open the case and remove carefully the wrapping from the cutting mechanism and pickup.

Records, needles and Disclube will be found in a separate carton. The recorder is shipped with the tubes in their sockets. To get at the tubes, remove the screen cover by removing the screws holding this cover to the top panel and to the motor panel. See Fig. 1. Remove all packing from around tubes before turning on amplifier.

To remove tube packing or to change tubes,
remove these 5 screws and pull screen out.

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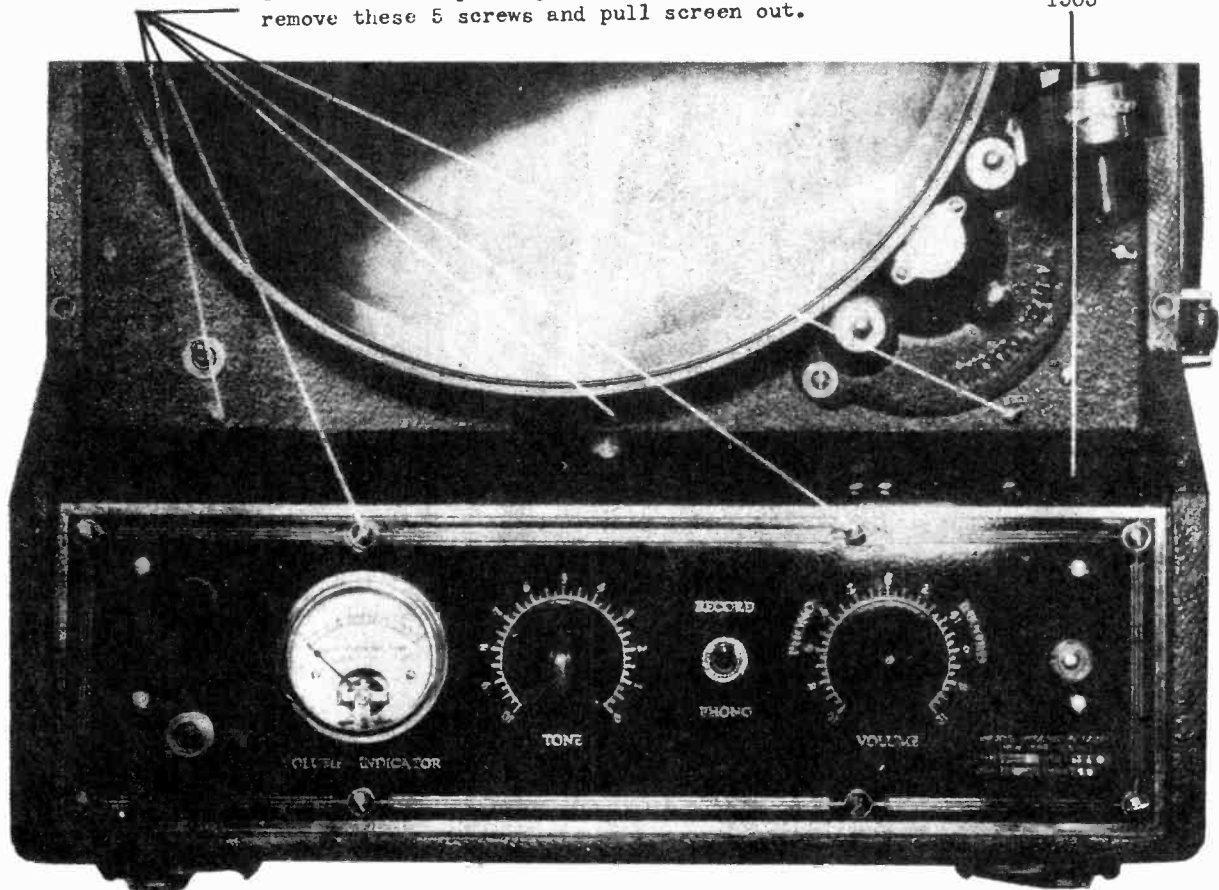


FIG. 1

PRESTO RECORDING CORP.
HOW TO SET UP THE RECORDER FOR OPERATION

MODEL J5

Screw the microphone plug (13) to microphone receptacle (14) Fig. 2 on the amplifier panel. Insert the power plug (11) into any 110 volt, 60 cycle, A.C. receptacle. Connect a wire from the ground post (5) to a water pipe or radiator. **THIS GROUND CONNECTION IS ABSOLUTELY NECESSARY FOR GOOD RESULTS.** There are three switches that are used for controlling the different operations on this recorder. Control switch (16) is used for recording and playback position. Switch (19) turns the amplifier "on and off". Turn the amplifier switch (19) on and wait at least 30 seconds for the tubes to heat up

before recording. Be sure that the 2 pins on the ends of the cutter leads are inserted in the 2 pin jacks located on the rear right of the motor panel. In the front lower right corner is a starting lever (20A) for operating motor starting switch (20). This starting lever starts and stops the motor and mechanically locks and unlocks it with respect to the turntable. To start turntable, push starting lever (20A) forward to a stop. This will start and unlock motor. To stop turntable, just pull starting lever to original position.

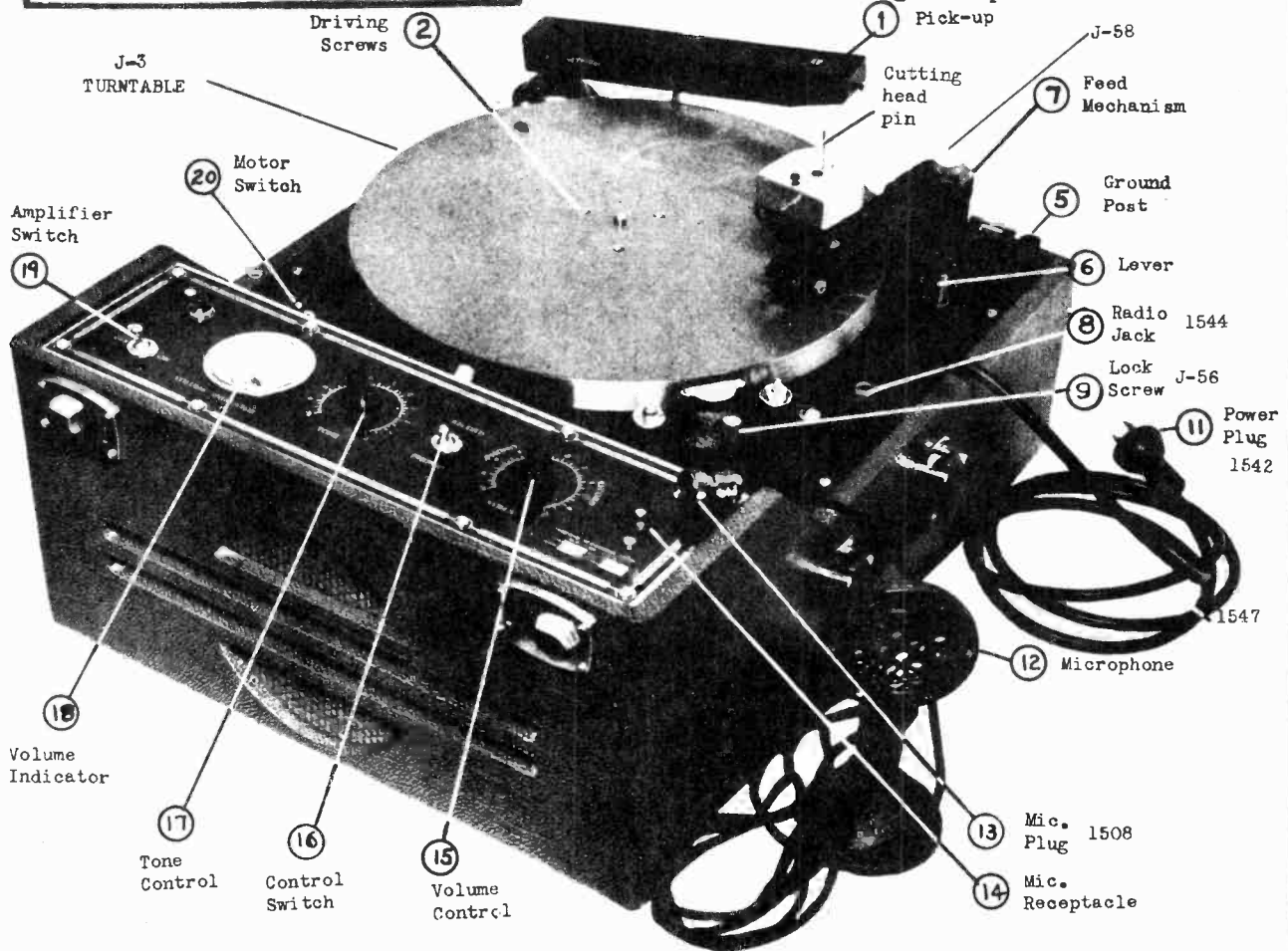
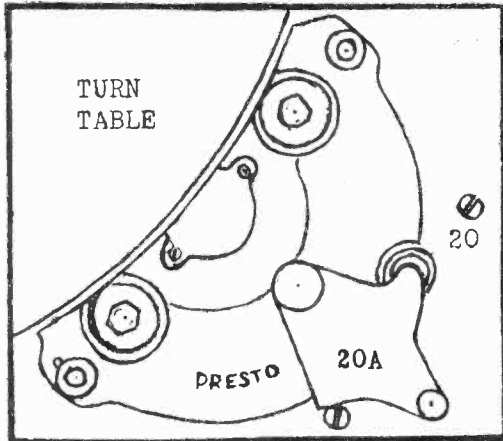


FIG. 2

RECORDING ON ACETATE

Pull lever (6) forward as far as possible. This disengages the feed mechanism (7) from the driving worm, and allows the mechanism to be swung to any position on the record. Swing the feed mechanism (7) to the right as far as possible, place the disc on the turntable so that the 3 holes will match the 3 driving screws (2). Swing the mechanism (7) over the record until the desired starting point is reached. Push back lever (6) as far as it will go. This locks the mechanism to the driving worm. Now move the cutting head slightly to the right and left to make sure that the mechanism is in perfect mesh with the driving worm. Start the turntable and lower the cutting head slowly on to the record in order not to injure the point of the cutting needle.

NOTE: THE PRESTO GREEN SEAL DISCS ARE NOT INFLAMMABLE, BUT THE SHAVINGS ARE, AND THEREFORE THE LATTER SHOULD BE DISPOSED OF IN A METAL CONTAINER. KEEP THESE SHAVINGS AWAY FROM MATCHES, LIGHTED CIGARETTES, ETC.

Be sure and place the removable spindle (5) Fig. 6 on top of the turntable spindle. This spindle will help the shavings to collect at the center and will prevent them from obstructing the progress of the needle.

ALUMINUM RECORDING

For this type of recording, place the heavy weight (22) on the cutting head pin and insert a diamond needle into the cutting head. This diamond needle should have its shaft bent slightly, so that it drags along the disc. See Fig. 4.

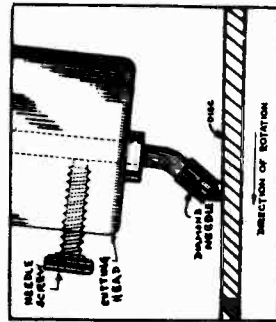


FIG. 4

CONTROL PANEL OPERATION

To record from the microphone throw switch (16) to the "record" position and operate the volume control (15) in the "record" position. The proper volume to be used will be determined by the swing of the needle on the volume indicator (18). This needle should swing to the red mark for average peaks. If it swings above this red mark, the volume is too high and should be reduced by turning the volume control (15) to the left. If the needle barely swings, then the level is too low and the volume should be brought up.

When the record is finished lift cutting head from the disc, pull lever (6) forward and swing the feed mechanism to the right. Remove the spindle (5) and the shavings (thread), and dispose of the latter in a safe place. You are now ready for playback.

PLAYBACK

The records made with this machine may be reproduced immediately after they have been recorded. Throw the switch (16) to the "phono" position and operate volume control (18) in the section marked "phono". Insert a shadow-graph steel needle into the pickup (1).

FOR OTHER DATA ON PLAYBACK SEE MODEL EU-7.

If ordinary commercial phonograph records are to be reproduced on this Recorder, remove the 3 driving screws (2) that are located at the center of the turntable.

TONE CONTROL

The tone of the amplifier may be adjusted by the tone control (17). Turning this control to the right increases the high frequency response while turning it to the left decreases the high frequency response. It may be used either in the recording or playback position.

It is recommended that in recording the control be turned to the extreme right. On playback adjust the control to what you consider the most natural reproduction.

When reproducing commercial phonograph records, this control will be found very effective in reducing excessive needle scratches.

RADIO RECORDING

To the right of the turntable is located a radio jack (8) Fig. 2 to be used for recording from the radio receiver. The impedance of this jack is 5 ohms. From the voice coil of the radio loudspeaker bring two wires to an ordinary telephone plug and insert the latter into this jack. The output of the radio receiver is now being fed to the cutting head and volume indicator (18) is in the circuit.

The above procedure is to be followed for recording either on acetate or aluminum. In recording from the radio, the controls for recording are automatically cut out when the plug is inserted into the jack. The only controls that are used are the radio receiver controls. The volume indicator is used and the swing of the needle should be controlled by the radio receiver volume control as outlined above.

If the above procedure is not desired for radio recording, place the microphone in front of the radio loudspeaker and proceed as if recording from the microphone. The results obtained using this set-up will not be as good as the results obtained by using the radio-jack.

LOCATION OF TROUBLE

Below will be found descriptions of some troubles peculiar to the Model J-5 Recorder. For other general trouble data, see Model EU-7.

CUTTING NEEDLE RUNS IN SINGLE GROOVE CUTTING THROUGH THE COATING OF THE DISC

If the lever (6) is not pushed back far enough, the feed mechanism (7) will not engage the driving worm and as a result, the needle will not be fed across the face of the record.

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NOTE: This head is adjusted at the factory and there is no reason why this adjustment should be made in the field. Before making this adjustment be sure that no other cause is the reason for the shallow cut.

PLAYBACK PICKUP REPEATS A SINGLE GROOVE ON THE RECORD.

This is due to the thread from the cutter becoming entangled under the cutting needle, lifting it from the disc and causing it to break into the adjacent groove.

In cutting, the shavings should be kept away from the cutting needle. Follow the precautions outlined under "Recording on Acetate".

WAVER OR "WOWS" IN RECORDING

This condition shows itself usually when musical recordings are made. The reproduced sound will be unsteady—for example, piano will sound like a guitar and any sustained note will waver. This is due to one of 3 reasons:

1. RECORDING SLIPPING
2. WORM SHAFT BINDS

If the thread from the records gets under the turntable and gets snarled between the worm shaft and the driving segment and also between the driving worm and the main worm located on the turntable shaft, it will cause the turntable to run unsteadily and as a result the recording will have wavers in it. To correct this condition pull lever (6) forward, push the feed mechanism to the right as far as possible, then lift the turntable out of the bearing and clean all threads from the moving parts.

3. SLIPPAGE BETWEEN TURNTABLE AND MOTOR

When the recorder leaves the shop the motor housing (28) Fig. 8 is carefully adjusted to the proper driving speed and torque. However, there is a remote possibility that in shipment it might have become loose and as a result is now causing waver. If so, loosen the large adjusting screws (29) slightly. Note, that the left hand adjusting screw slides in a slot. After loosening these screws, the entire motor housing can be shifted, either away from the rim of the turntable or towards it.

Check the table by applying pressure with the thumb against the rim. If the table stops easily, move the motor housing (28) towards the table and tighten both suspension screws (29). The pressure of the motor pulley against the outside rim of the turntable should be such that a heavy pressure of the thumb against the rim will stop the table. If the table can't be stopped, then the housing should be moved away slightly from the turntable. In checking for this proper pressure, the best procedure is to record a sustained note such as a piano or any other instrument, and play it back. You will then be in a position to judge whether the reproduction is faithful and constant. If, however the turntable wows, this reproduction will also sound uneven. One or two trials will enable you to make the correct adjustment. After this adjustment has been found, the two screws (29) should be locked securely with a heavy screw driver.

PLAYBACK NEEDLE WILL NOT TRACK

This condition is due to one of the following reasons:

1. WORN PLAYBACK NEEDLE.

The playback needle may be so worn that the point is too large to fit properly in the groove. This condition can usually be detected by bad quality of the reproduced sound (distortion). Replacing the reproducing needle will clear this up.

2. GROOVE WAS NOT CUT DEEP ENOUGH

This is a common fault on records that will not track. It is very important to have a proper cut to insure proper tracking. When the thread is cut out by the needle it should be about the thickness of an ordinary human hair. It should be black and shiny. If the cut is too light the thread will be grayish and if too heavy, it will be about the thickness of a very heavy black sewing thread.

The depth of cut is dependent on the pressure on the needle point.

The cutting head is counterbalanced by means of a small pressure spring (23) located on the cutting head casting (25) see Fig. 8. This pressure spring is adjusted for the proper tension at the factory and this adjustment should not be tampered with unless absolutely necessary. In case an adjustment should be necessary on this spring, bend the lug (24) back to decrease pressure and forward to increase pressure. If this lug is bent forward and backward too many times, it will eventually break. If this happens, replace the lug with an ordinary heavy soldering lug.

Too deep a cut will cause "echo" in the record and too light a cut will cause improper tracking. A good way to determine the depth of cut is to use a magnifying glass of about 20 power. A proportion of width of groove of 60 to 40 width of wall will give the proper depth. This proportion naturally is subject to slight variations.

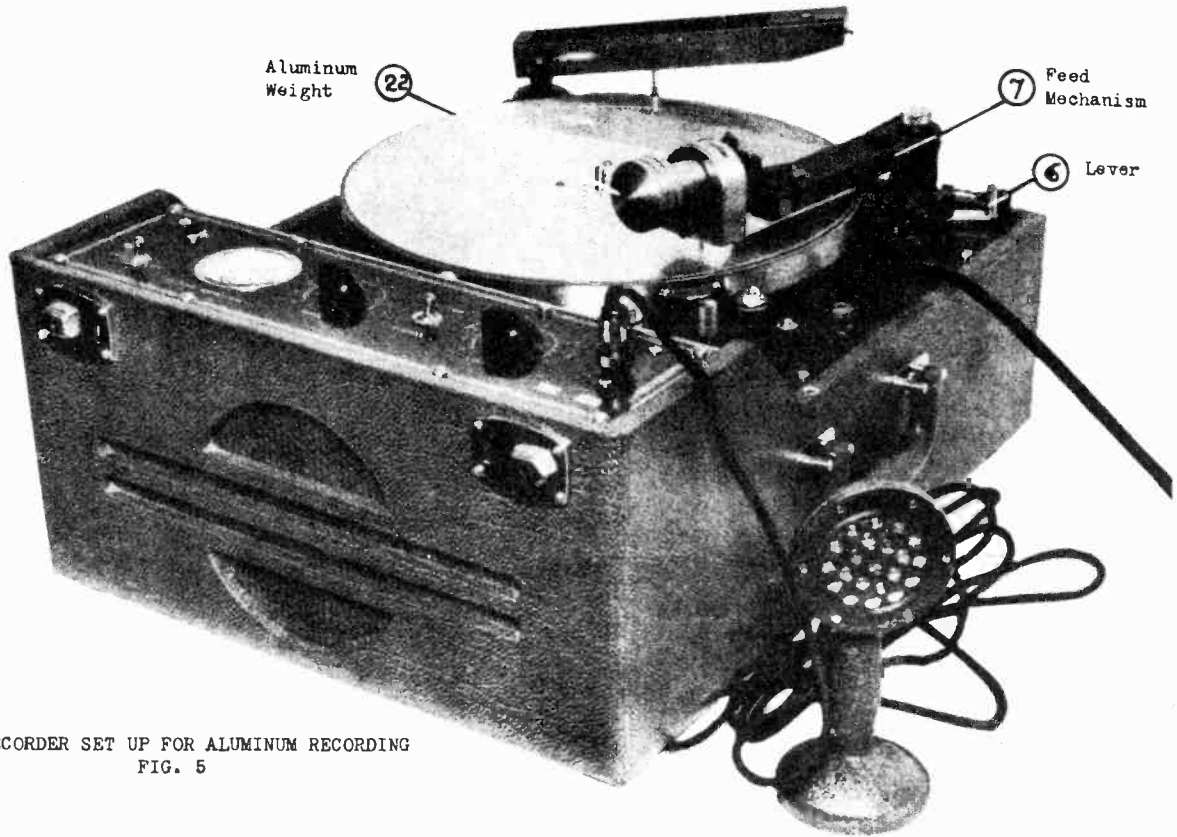
3. CUTTING HEAD DOES NOT HAVE FREE UP AND DOWN MOTION

This is due to the casting (25) holding the cutting head (21) being too tight in the pivots. To check this, lift the cutting head up and down by picking it up by the needle screw with the fore finger. If the movement is sluggish then follow the procedure outlined below in order to have the head move freely:

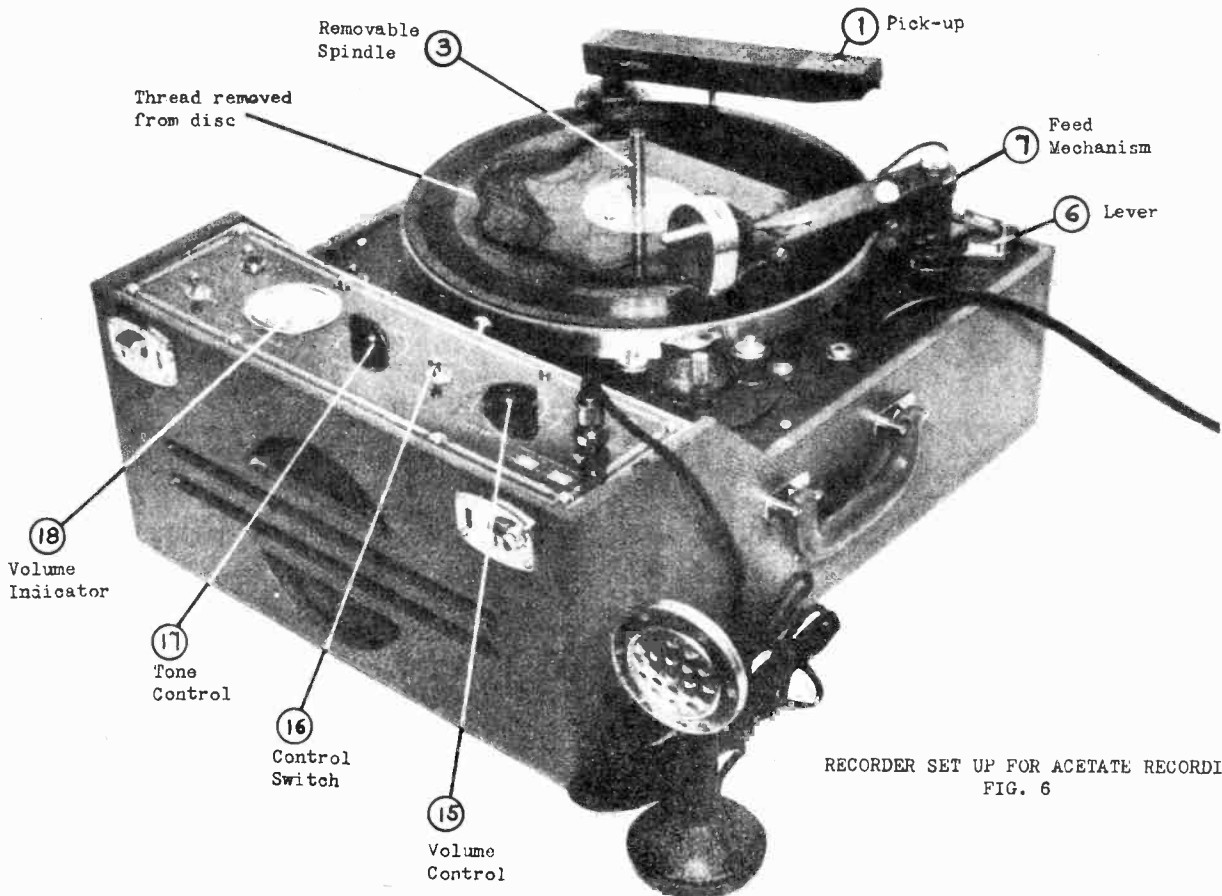
With a small wrench or a pair of pliers loosen the two lock nuts (26) Fig. 8. Then loosen the two pivot set screws (27) enough so that the head moves freely up and down. The pivot screws (27) must not be so loose that the casting (25) will have play from side to side. After these pivot screws (27) are adjusted so that the cutting head (21) has a free up and down motion without any side play—tighten the lock nuts (26) and then check the movement again. Sometimes the tightening of lock nuts (26) will tighten the pivot screws (27) and the vertical motion will be sluggish again. The pivot screws should be held with screw drivers while the lock nuts are tightened.

MODEL J5

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RECORDER SET UP FOR ALUMINUM RECORDING
FIG. 5



RECORDER SET UP FOR ACETATE RECORDING
FIG. 6

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MODEL J5

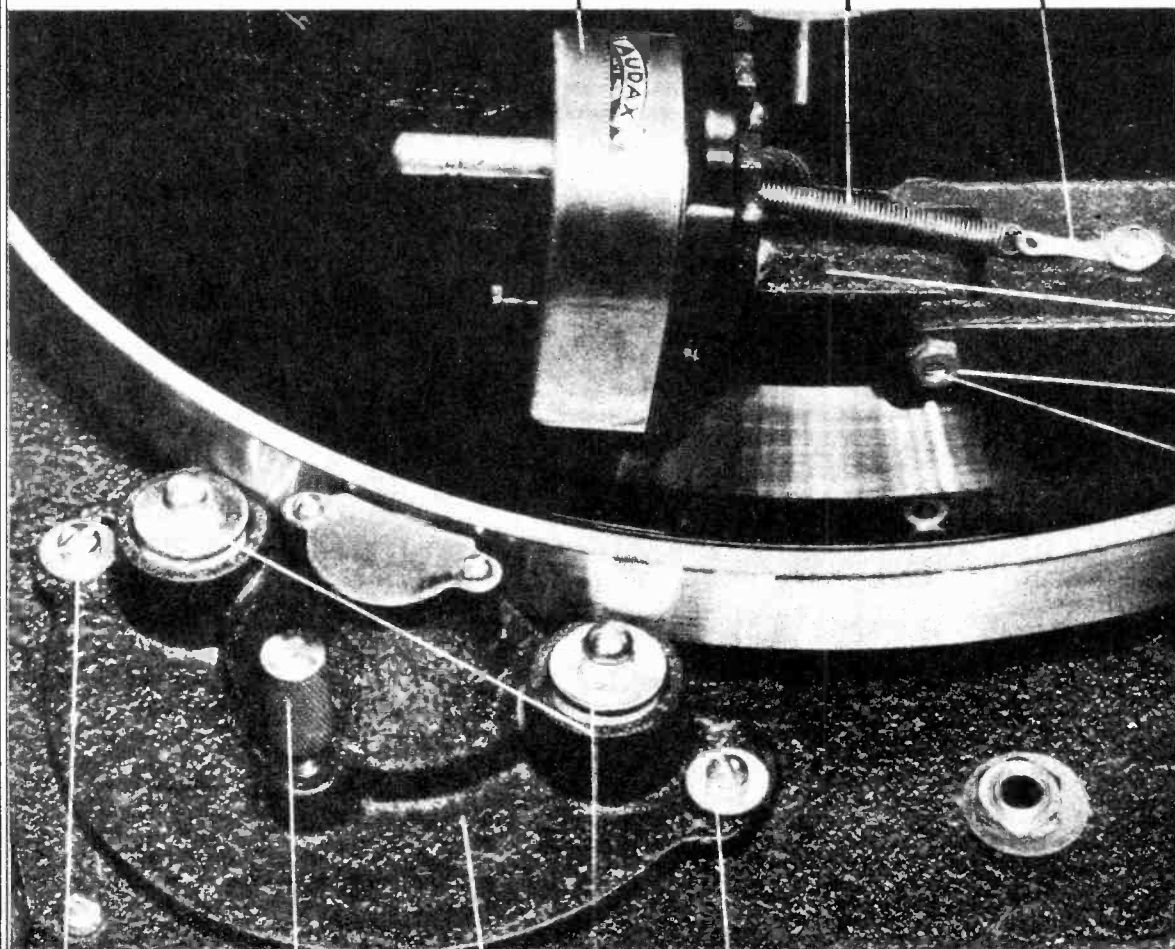
PLAYBACK POSITION
FIG. 7



Cutting Head 21

Pressure Spring 23

Lug 24



Cutting Head Casting 25

Lock Nut 26

Pivot Screw 27

Adjusting Screws 29

Lock Screw 9

Motor Housing 28

Motor Suspension Screws 30

Adjusting Screws 29

FIG. 8

MODEL J5

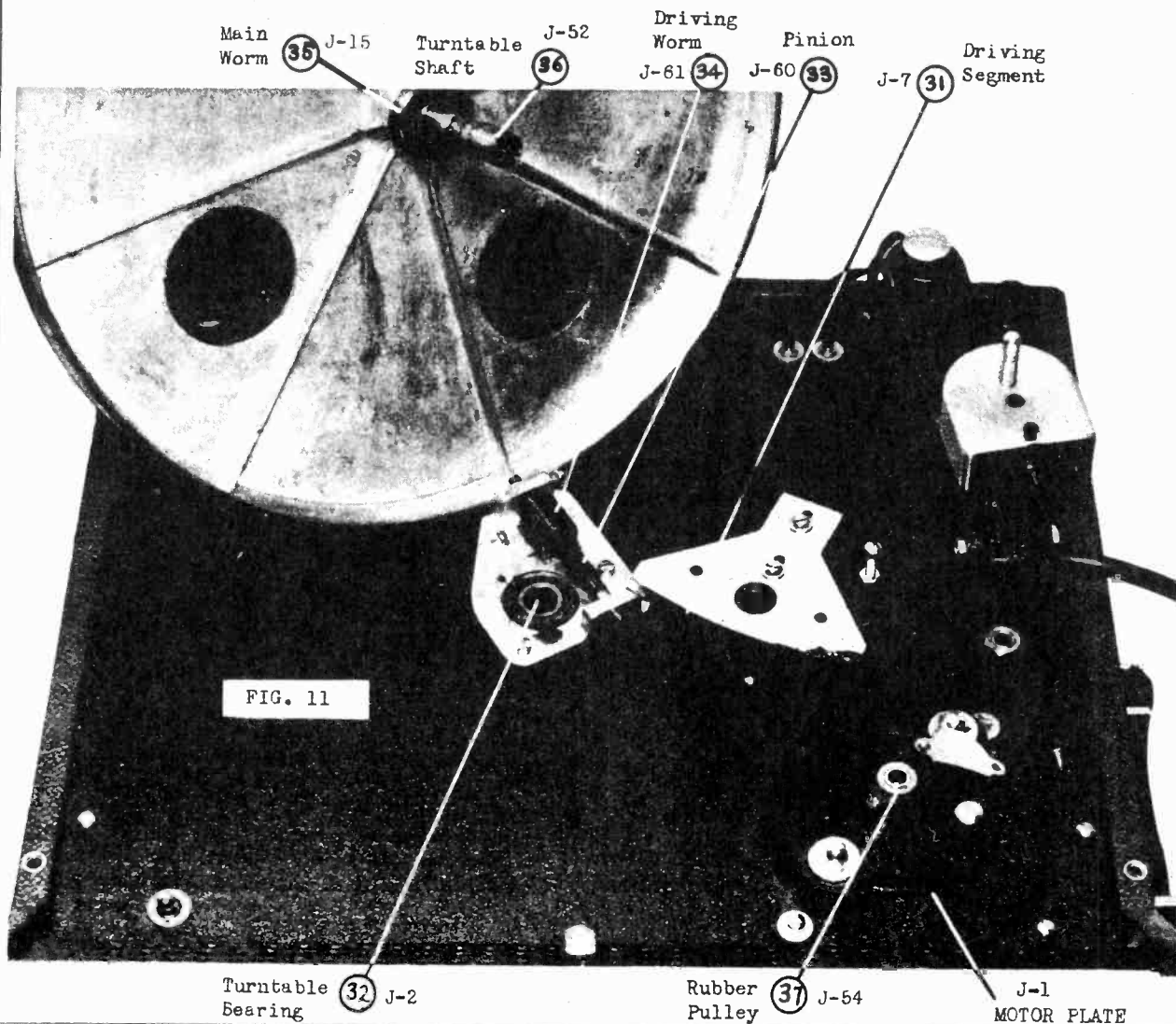
PRESTO RECORDING CORP.

LUBRICATING THE J5 RECORDER

1- The main turntable bearing (32) must be lubricated every two or three months with a good grade of vaseline. Pull lever (6) forward as far as it will come and then swing the mechanism to the right and remove the turntable from its bearings. See Fig. (11). Apply the vaseline to the turntable shaft (36). There is a thrust steel ball at the bottom of this bearing and care must be taken that this ball is not lost when removing the turntable. Sometimes the ball will stick to the bottom of the turntable shaft, in which case it should be removed and dropped into the bearing (32).

2. Lubrication of the driving worm (34) and the main worm (35) is very essential and should be done every time the turntable bearing is lubricated. Use vaseline on these worms and also on the pinions (33) and pivots.

3. The motor need not be oiled more than once in three months. Too frequent oiling might cause defects in the windings of the motors. When oiling the motor, the entire panel mounting must be raised as shown in Fig. 12. The oil cups are shown; one at the bottom and one at the top. Use "3 in 1" oil.



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MODEL J5

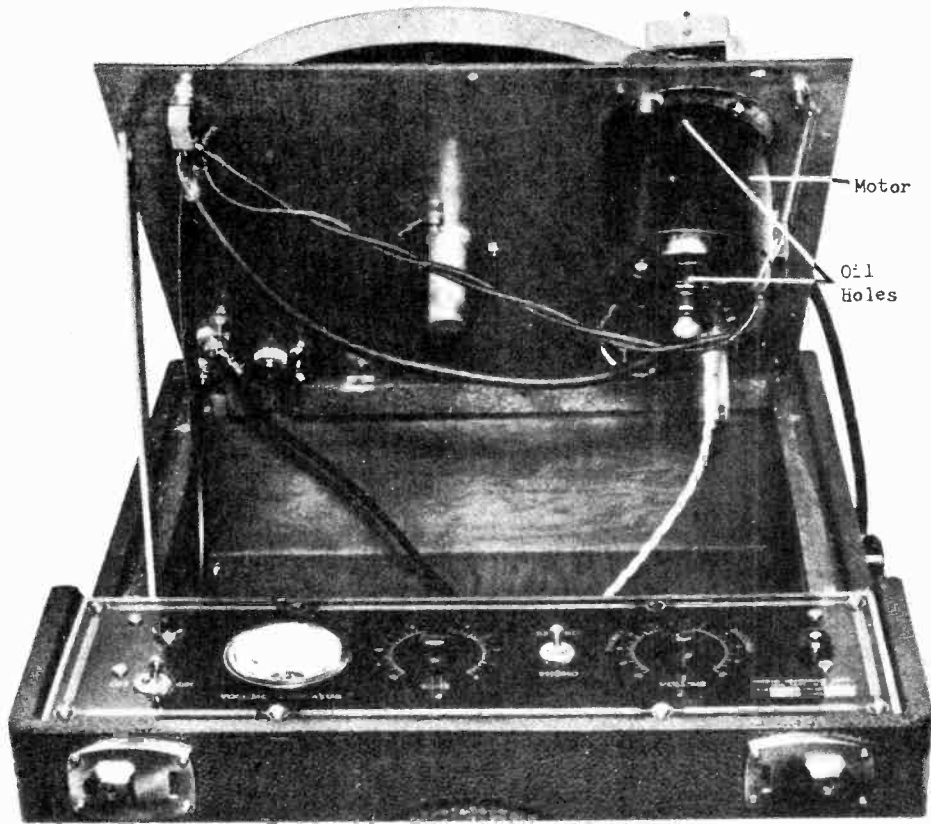


FIG. 12

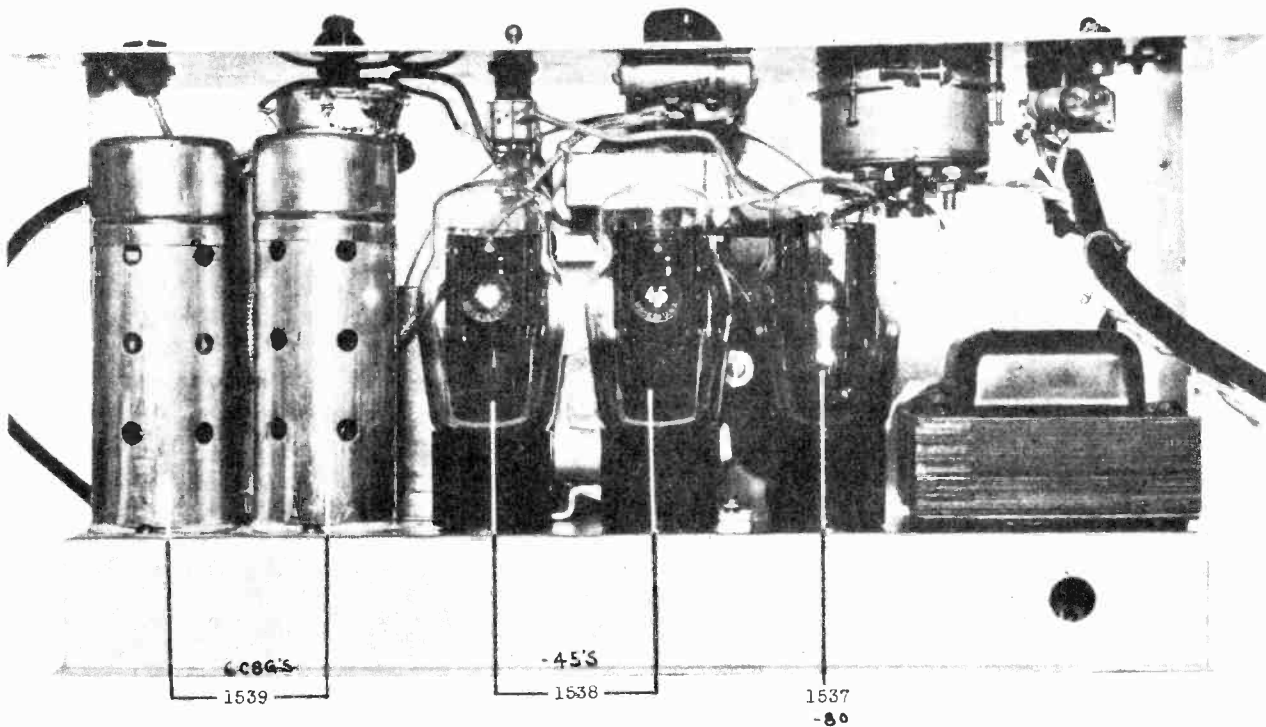


FIG. 13

TUBE LAYOUT

MODEL J5

PRESTO RECORDING CORP.

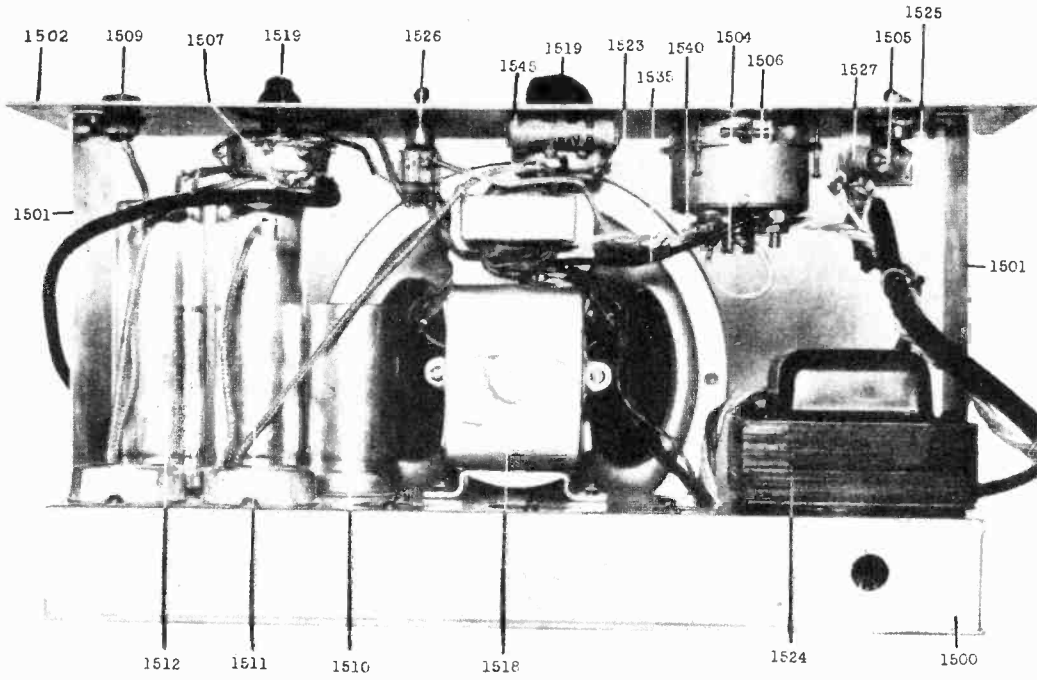


FIG. 14

REAR VIEW OF AMPLIFIER

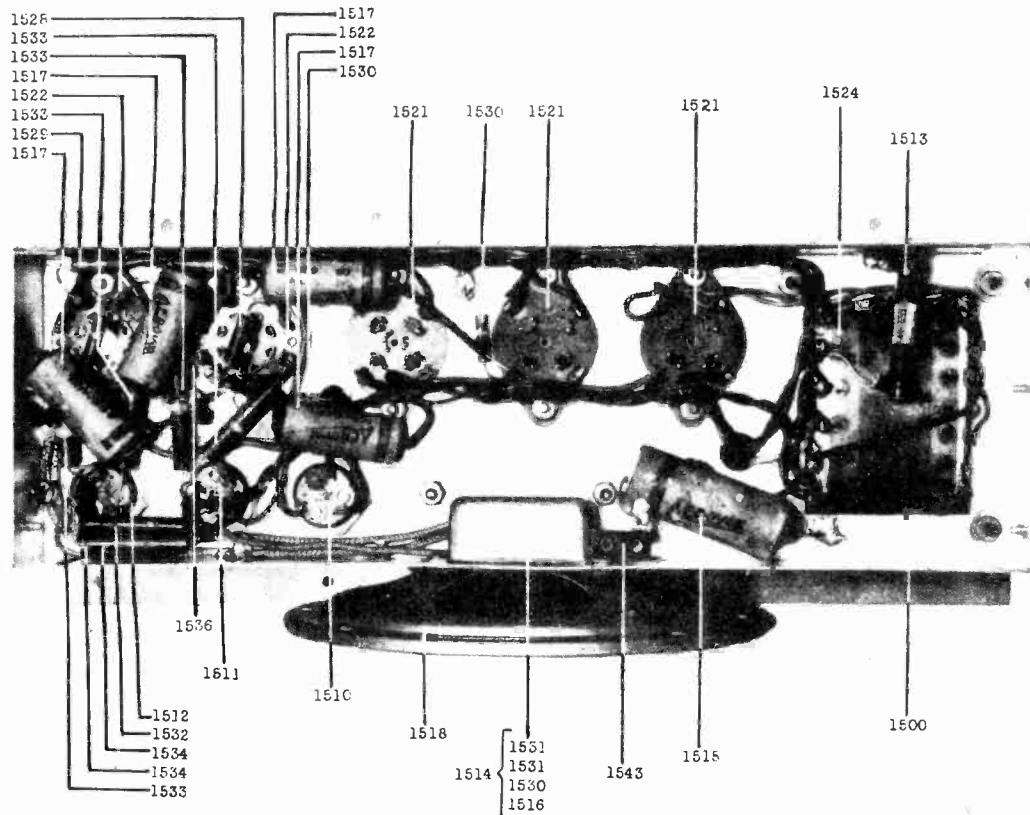
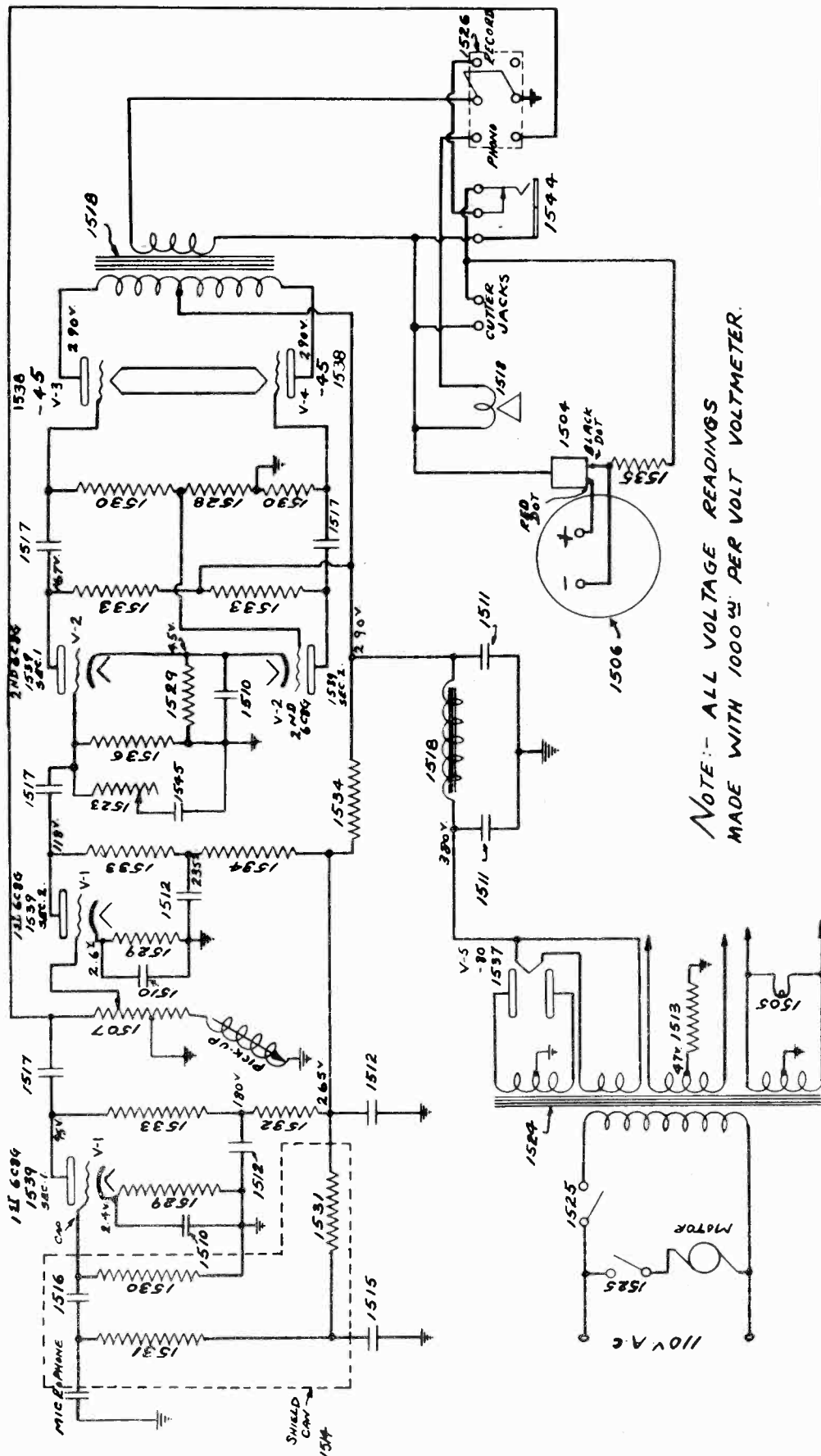


FIG. 15

BOTTOM VIEW OF AMPLIFIER

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MODEL J5



NOTE: ALL VOLTAGE READINGS
MADE WITH 1000 OHM PER VOLT VOLTMETER.

PRESTO RECORDING CORP. 139 W-19TH ST. NEW YORK	
J-5 RECORDER SCHEMATIC	
9/17/37	B-166

FIG. 16.

MODEL J5

PRESTO RECORDING CORP.

STOCK NO.	DESCRIPTION OF PART	TUBE COMPLEMENT:		FREQUENCY RANGE: 50-7000 cycles	
		V-1, V-2	6C8G	GAIN: 105 db	
		V-3, V-4	45	POWER OUTPUT: 3.2 watts	
		V-5	80	INPUT IMPEDANCE: 5 megohms	
				OUTPUT IMPEDANCE: 5 ohms	
J-1	Motor plate	PICKUP IMPEDANCE: 8000 ohms at 1000 cycles			
J-2	Turntable bearing	CUTTING HEAD IMPEDANCE: 5 ohms at 1000 cycles			
J-3	Turntable	POWER SUPPLY RATING ON AMPLIFIER:			
J-4	Recording arm	A- 105-125 volts, 50-60 cycles, 40 watts			
J-5	Cutting head bracket	B- 105-125 volts, 25 cycles, 45 watts			
J-6	Feed arm	C- 100-130/140-160/195-250 volts, 50-60 cycles, 40 watts			
J-7	Driving segment	RATING ON TURNTABLE MOTOR:			
J-8	Lever	POWER OUTPUT - 5 watts			
J-9	Feed arm base	TYPE - Induction			
J-10	Motor plate cover	LOUDSPEAKER:			
J-15	Main worm	TYPE - Electrodynamic			
J-51	Feed arm shaft	CONE - 6 inches FIELD RESISTANCE: 1250 ohms			
J-52	Turntable shaft	VOICE COIL IMPEDANCE: 5 ohms			
J-53	Pick-up rest pin	TURNTABLE:			
J-54	Motor pulley	DIAMETER: 12 inches SPEED: 78 rpm			
J-55	Motor screw extension	HEIGHT: 9.5 inches NET WEIGHT: 38 lb			
J-56	Motor release screw	WIDTH: 15.5 " SHIPPING WEIGHT: 65 lb			
J-58	Feed mechanism cap	DEPTH: 19.25 "			
J-60	Pinion				
J-61	Driving worm				
J-62	Pinion center				
STOCK NO.	DESCRIPTION OF PART	STOCK NO.	DESCRIPTION OF PART		
1500	Amplifier chassis	1524	Power transformer		
1501	Amplifier chassis bracket	1525	S.P.S.T. toggle switch		
1502	Top panel	1526	D.P.D.T. toggle switch		
1503	Screen cover	1527	Pilot light assembly		
1504	Half wave rectifier	1528	10,000 ohm 1/2 watt		
1505	6.3 V. pilot light	1529	3,000 ohm 1/2 watt		
1506	Volume indicator meter	1530	250,000 ohm 1/2 watt		
1507	Volume control	1531	5 megohms 1/2 watt		
1508	Microphone plug	1532	50,000 ohms 1 watt		
1509	Microphone receptacle	1533	100,000 ohms 1 watt		
1510	25-10-10 mfd. 25 volts	1534	10,000 ohms 1 watt		
1511	8-8 mfd. 450 volts	1535	50 ohms 1/2 watt		
1512	4-4-4- mfd. 450 volts	1536	1 megohm 1/2 watt		
1513	750 ohms 10 watts	1537	type 80 rectifier tube		
1514	Input section can	1538	type 45 power tube		
1515	0.4 mfd. 400 volts	1539	type 6C8G tube		
1516	.004 mfd. 500 volts	1540	Meter post terminal		
1517	.05 mfd. 600 volts	1541	tube shield		
1518	Loudspeaker 1250 w. field push pull 45's	1542	Power plug		
1519	Control knob	1543	Terminal lug		
1520	2 point terminal lug	1544	Closed circuit jack		
1521	4 prong wafer socket	1545	.02 mfd. 600 volts		
1522	8 prong wafer socket	1546	Grid caps		
1523	Tone control 500,000 ohms	1547	Line cord		

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Fig. 1

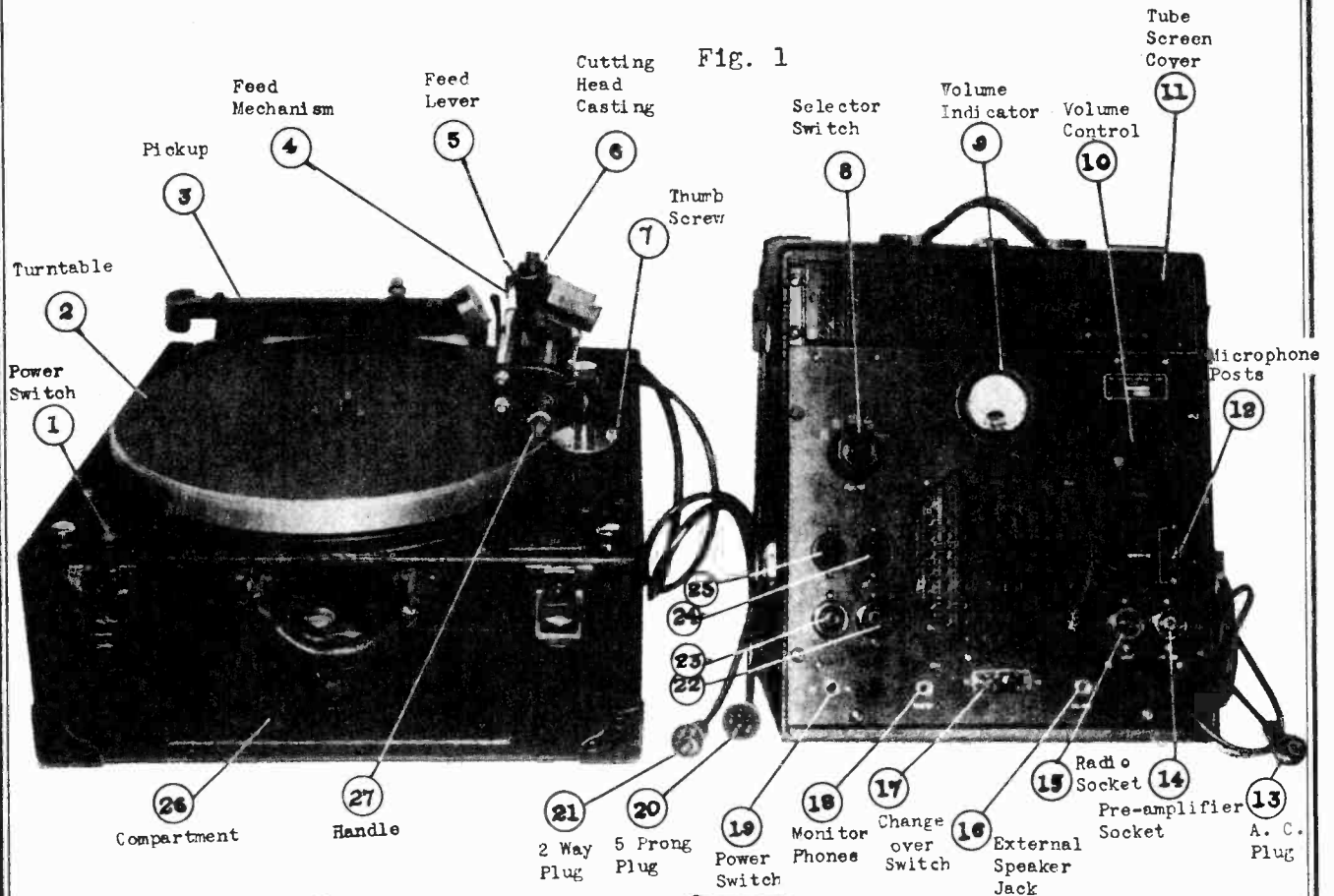
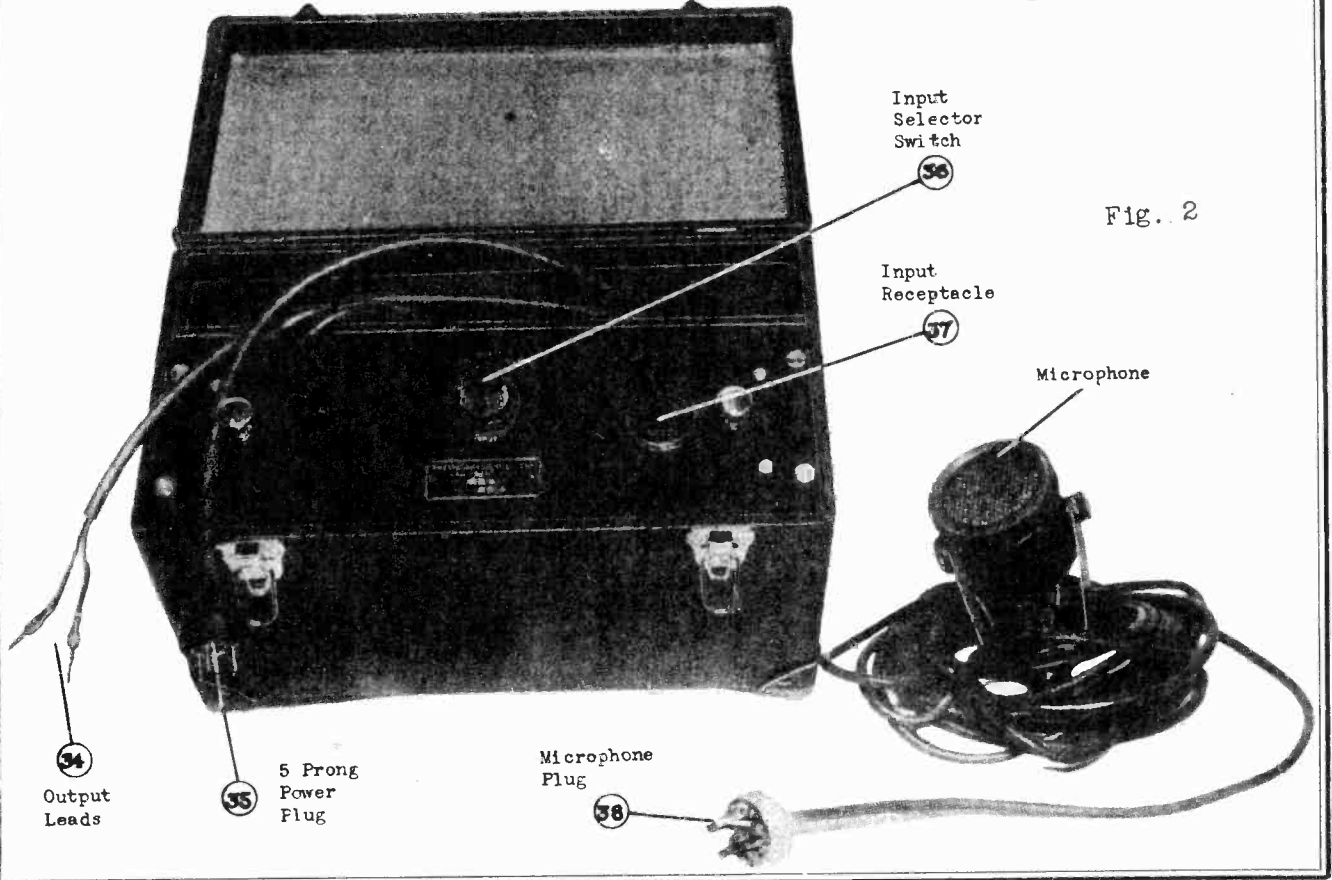


Fig. 2



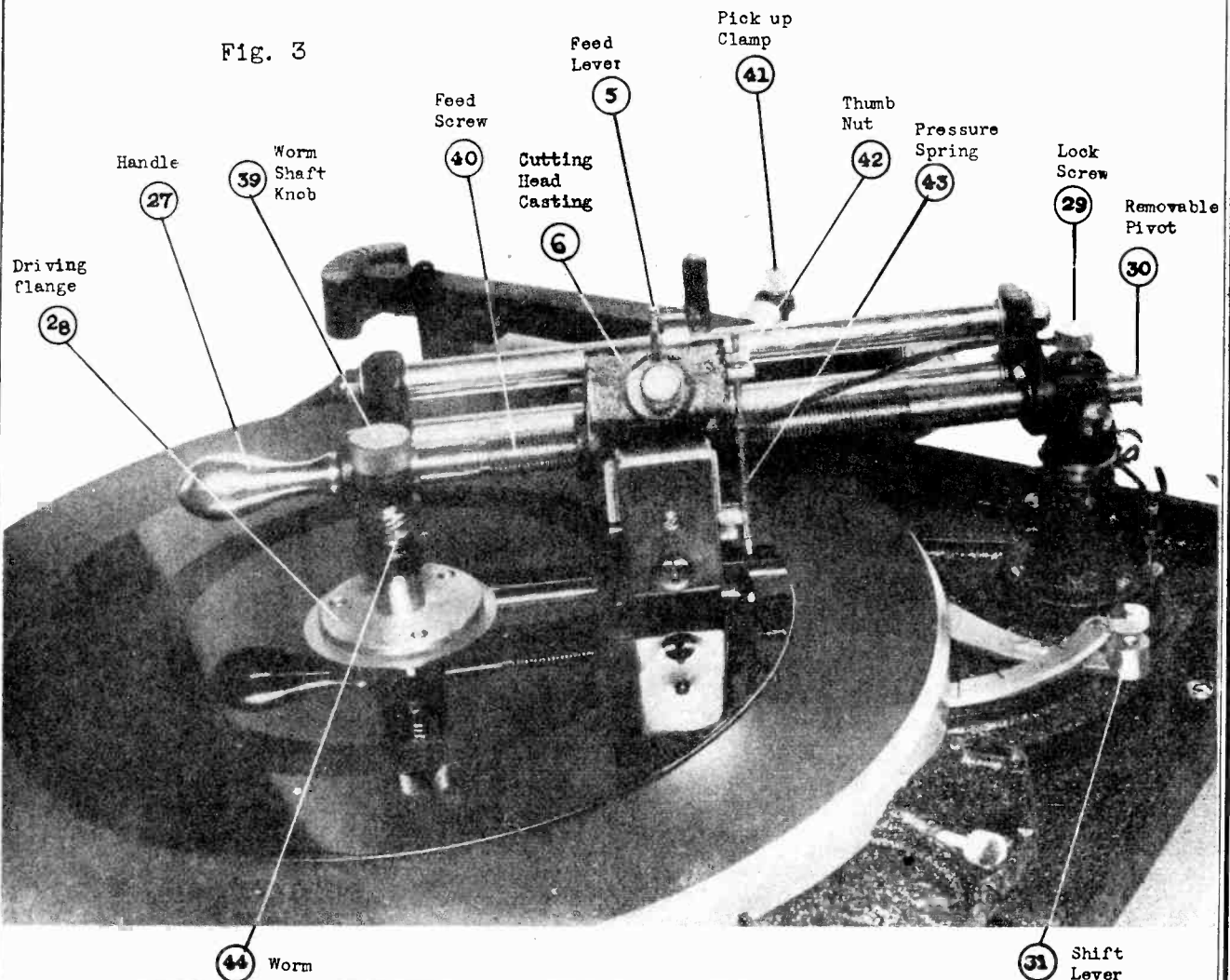
MODELS EU7, EU7E,
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PRESTO RECORDING CORP

MOUNTING THE CUTTING HEAD ON THE FEED SCREW

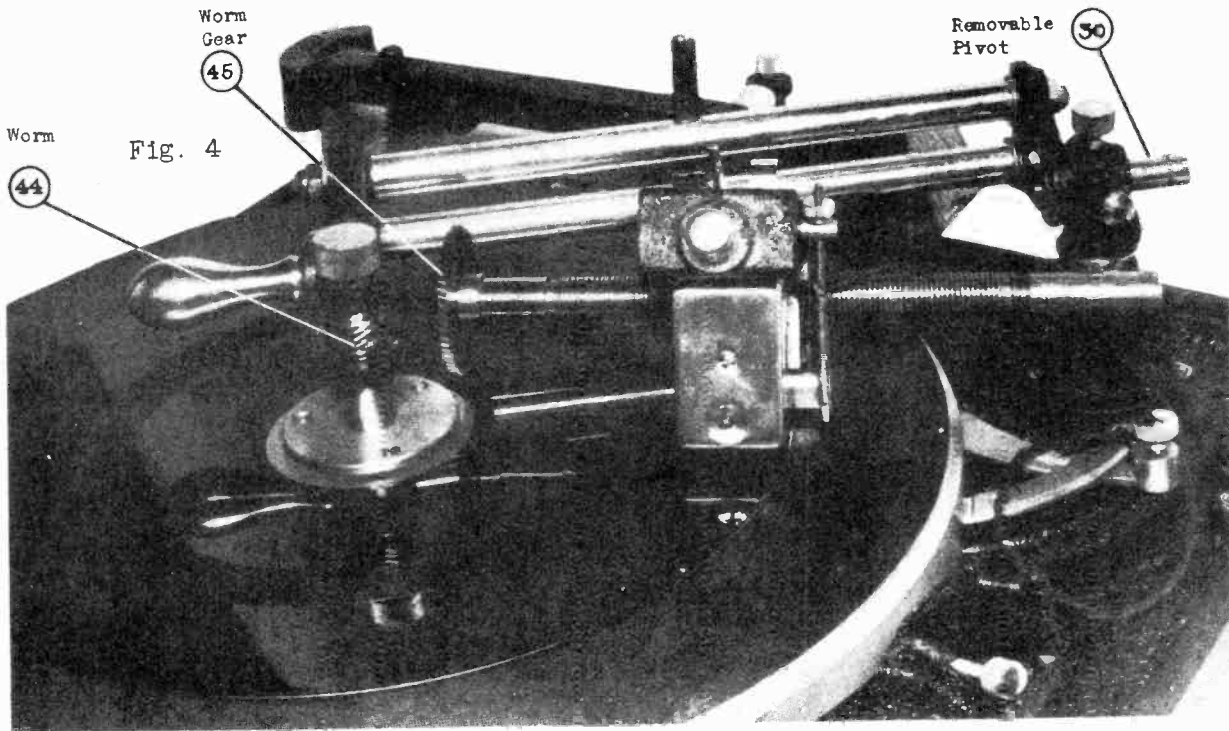
Grasp the feedscrew (40) in the left hand and loosen lock screw (29) with the right hand. See Fig. 3. Now pull out removable pivot (30) slightly. The feedscrew can now be removed as shown in Fig. 4. The cutting head with its assembly will be found in the compartment (26) Fig. 1 at the front of the case. Unwrap it carefully and proceed as follows: Hold the feedscrew (40) in the left hand with the worm gear (45) towards you and with the right hand hold the cutting head casting (6). Push down on feed lever (5) and slide the casting (6) over the feedscrew (40) keeping the feed lever (5) held down. When the casting (6) is in about the center of the screw, release the feed lever (5). This engages the casting (6) with the feedscrew (40).

When inserting the feedscrew into the feed mechanism the worm gear (45) on the end of the feedscrew (40) is inserted first to mesh with the worm (44). The removable pivot (30) is then pushed in tightly and lock screw (29) is tightened. It is very important that when this operation is completed that there be absolutely no play between the feedscrew and pivots. Check this by trying to move the screw from side to side. If there is any play, faulty cutting in the form of uneven grooves will result. Pivot (30) should then be reset. Now insert the cutter leads into the two pin jacks located behind the feed mechanism.



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Worm

Fig. 4

Worm Gear

Removable Pivot

44

45

50

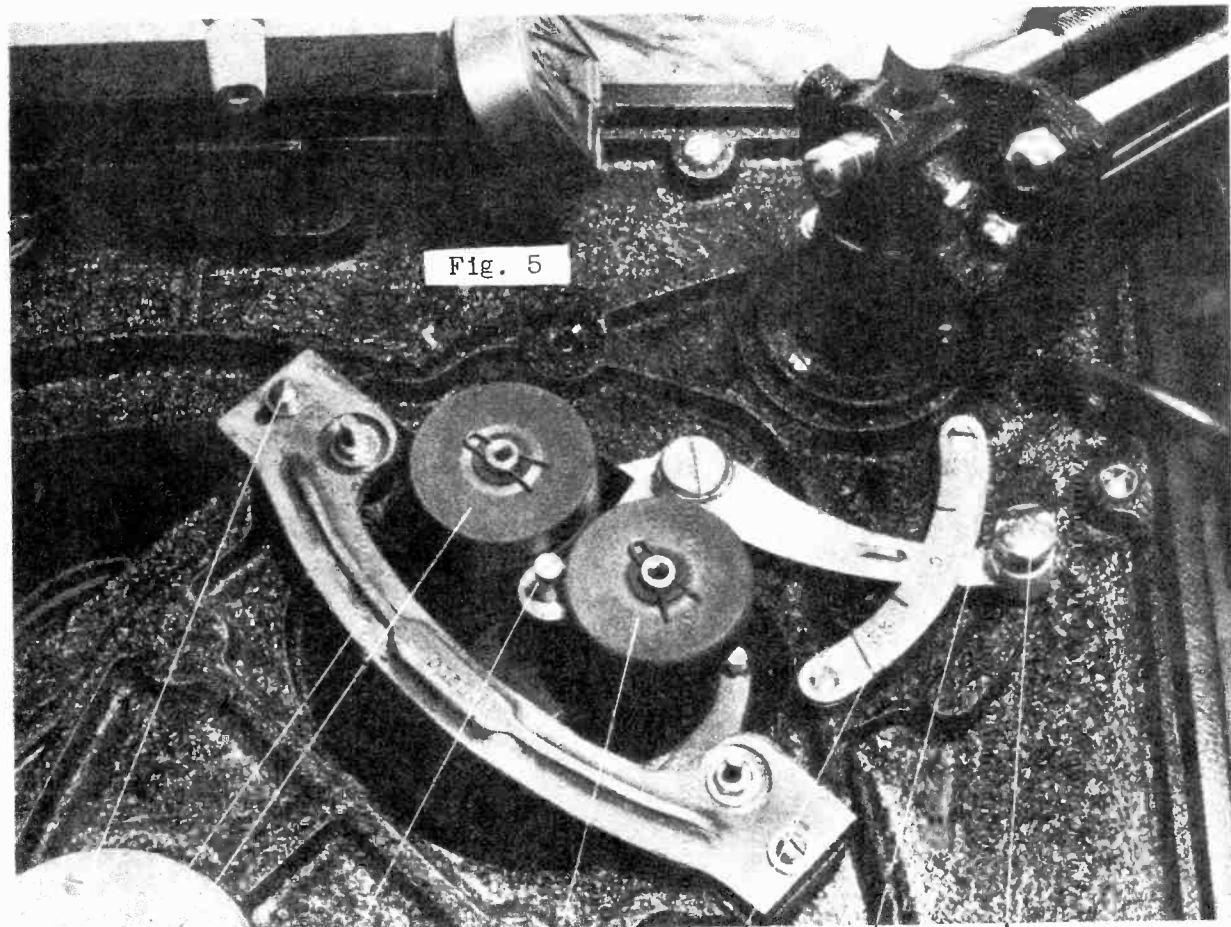


Fig. 5

63

Screw

46

78 R.P.M. Wheel

47

Step Pulley

48

33 1/3 R.P.M. Wheel

49

Speed Indicator

51

Shift Lever

50

Shift Lock Screw

64

Bracket

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PRESTO RECORDING CORP.

GENERAL FEATURES

The Presto instantaneous recorder makes sound recordings on either coated discs or aluminum discs. Recordings can be made either from a microphone or from a radio tuner.

By means of a five position selector switch, located on the front panel, the instrument may be set up to make records, reproduce records, act as a public address system, record from the radio or operate as a radio receiver. A second control adjusts the volume both for recording and playing back of records.

OPERATING INSTRUCTIONS

The recording chassis is carefully packed so that all the parts of the mechanism will arrive in good condition. When removing from the packing case dust the turntable case very carefully to make sure that no particles of packing material reach the machine when the latter is opened.

Remove thumb screw (7) which holds the feed mechanism to the rest plate (33) see Fig. 146. Now grasp the handle (27) of the feed mechanism and lift up and swing the mechanism to the right until it can be lowered so that the bottom chrome bar rests on support (32). Next, remove the turntable by lifting straight up. The pull should be exerted on diametrically opposite sides of the table. When removing the turntable be sure that a small steel ball is not stuck at the bottom of the turntable shaft. This turntable is of steel and of liberal length so as to obtain a long bearing effect. The bottom of this shaft sits on steel ball which rests in a conical cup at the bottom of the bearing. Since this shaft is lubricated with grease, the steel ball may become attached to it. If it does, remove the ball and put it back in the bearing. The ball will find its own position at the bottom of the bearing.

With the turntable removed, the drive system is exposed and the motor can be seen through the opening in the cast panel. For transportation purposes the motor is strapped with wire to prevent it from swinging. Remove this wire and the motor should now swing freely. If it doesn't, inspect it carefully to find what is holding it. It is of utmost importance that the motor swing freely on its supporting screws.

Replace table in its bearing making sure that the shift lever (31) is locked in neutral position. See Fig. 5. The turntable is driven from its inside rim by means of a synchronous motor and a set of interposed idler wheels (46) and (48) see Fig. (5). The motor is suspended on an extended bracket and it has mounted on its shaft a step pulley (47) having two different diameters. The idler pulleys (46) and (48) are mounted on a forked lever which in turn swings on a bell crank lever which is fastened to the frame of the chassis. When the shift lever is moved to either the 78 or 33 1/3 rpm position the pulleys are made to engage the respective diameters of the step pulley (47) on the motor shaft.

To start motor place shift lever (31) in neutral position and turn on motor switch. See Fig. 6. Then shift to whatever speed is desired (78 or 33 1/3 rpm). After shifting to speed desired, be sure to lock the shift lever (31) by means of the shift lock screw (50). When shifting from one speed to the other it is not necessary to stop the motor. Simply loosen the lock screw (50) and shift to the other speed.

Caution: When the table is not in use, place the shift lever (31) in the neutral position. This disengages the idlers from the rim of the table and prolongs their life indefinitely.

RECORDING AMPLIFIER

The type EU7 recording amplifier has three stages of Class A amplification, each stage being in push-pull. It has an input impedance of 200 ohms and an output impedance of 500 ohms. It employs resistance and transformer coupling. All transformers are thoroughly shielded against any stray electrostatic and electromagnetic fields. The gain is 85 db and the undistorted power output is 10 watts. Its frequency response curve is flat from 30 to 12000 cycles within plus or minus 2 db.

On the top of the panel in the center is mounted the volume indicator meter (9).

To the left of this meter is located the selector switch (8) which gives 5 different selections of input and output, as follows:

1. Microphone Public Address.
2. Microphone Recording
3. Playback
4. Radio Recording
5. Radio Reception

To the right of the volume indicator is located the master gain control (10) which is tapered to give smooth control over its entire range. See Fig. 1.

Under the selector switch are located four receptacles, 22, 23, 24 and 25. Two (24 and 25) are 2 prong and two (22 and 23) are 5 prong. One 2 prong and one 5 prong receptacle serve one table. The 2 prong is for the 110 volt A.C. turntable motor, while the 5 prong is for the 2 pick up leads, 2 cutter head leads and ground. If a second table is to be used for continuous recordings, it is plugged into the second set of receptacles (22) and (24).

Underneath the loud speaker is located the change over switch (17). When this change over switch is thrown to the left, the pick up and recorder leads in receptacle #1 are connected to the amplifier and when this switch is thrown to the right, the second set of receptacles are connected. In other words, when a continuous program is being made, transferring from one table to the other requires the flipping over of this switch from one position to the other. The change is instantaneous.

On the right of this switch is located an external speaker jack (16). This is for use with any standard external speaker with a 500 ohm output. When the speaker plug is inserted into this jack, the local speaker is automatically disconnected. The speaker supplied with this unit is located in the center and is a high fidelity 8" dynamic speaker. This speaker has sufficient power handling capacity to fill a good size classroom but if an auditorium type dynamic speaker is plugged into the external speaker jack a hall seating 2000 people can easily be filled. A monitor jack (18) is provided at the left of the selector switch for monitoring during recording by using high impedance phones or a high impedance speaker.

At the lower right hand corner is located a 4 prong receptacle (15) for use with a radio tuner. Two of these prongs on this socket supply 250 volt DC of "B" supply for a tuner while the other 2 prongs are for a standard 200 ohm input impedance.

To the right of this radio socket is located a preamplifier socket (14) which supplies 6.5 volts AC and 250 volts DC to a preamplifier.

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Above the preamplifier socket are located three binding posts (12) for microphone input. The input impedance of these posts is 200 ohms, and the middle post is ground so that a carbon microphone can be used if desired.

The tubes are packed in a separate box and should be unpacked carefully. Remove the tube screen cover (11) by removing the 4 wood screws and place the tubes in their proper sockets according to fig. 16, page 20. The 6C6's are shielded and care should be taken in replacing the cap of the shield in order not to ground the grid clip. Now replace the screen cover and insert AC plug (13) into A 110 volt 60 cycle AC receptacle.

The preamplifier should be kept as far away from the main amplifier as possible to prevent any danger of hum pickup. Insert the five prong pre-amplifier plug (35) Fig. 2 into receptacle (14) Fig. 1, marked "pre-amp". and connect the two wire preamplifier cord (34) to the two outside microphone posts (12). The center binding post is the ground post and need not be used except when using a crystal microphone. In that case it is imperative that it be connected to a good ground such as a water pipe, radiator pipe or radio ground. Now insert the microphone plug (38) into the three way microphone receptacle (37) on the preamplifier and turn the input selector switch to the proper impedance. This impedance is usually determined from the folder supplied with the microphone. Dynamic microphones use the 50 ohm impedance, while inductor and ribbon microphones

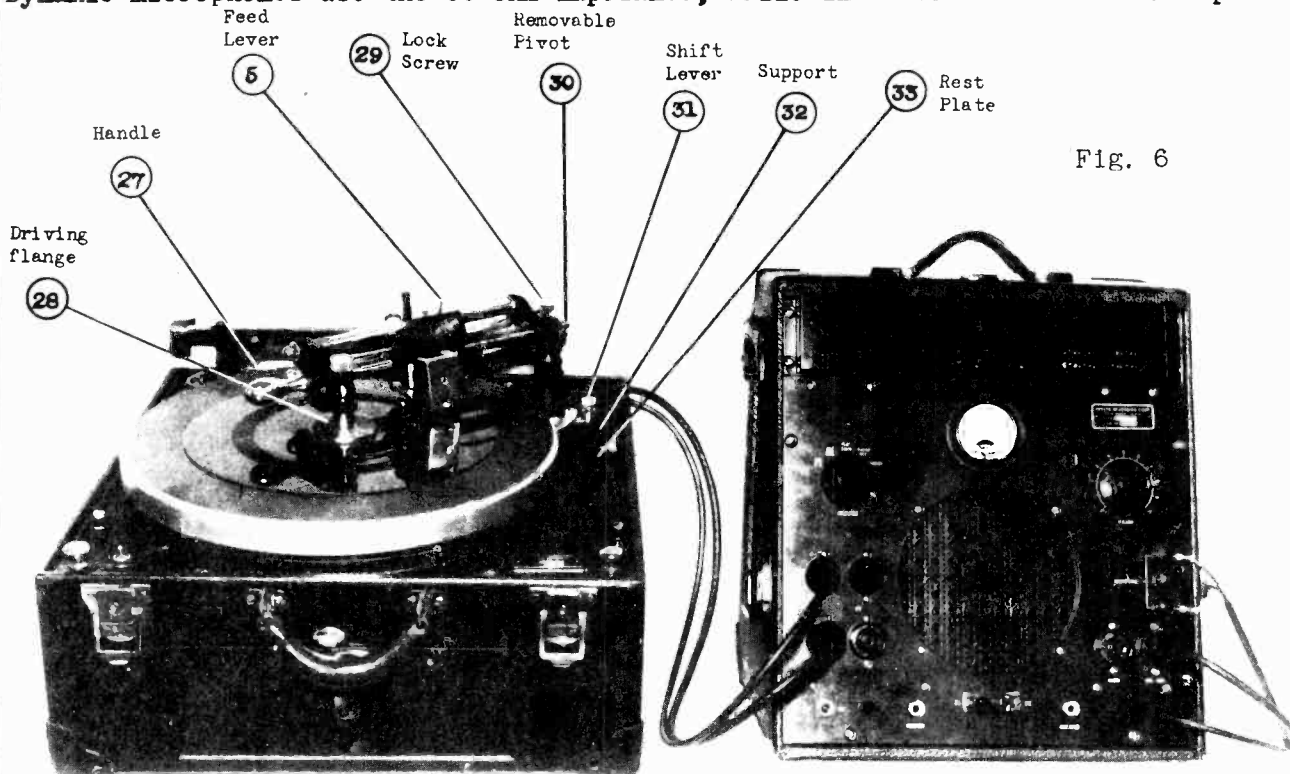


Fig. 6

use the 200 ohm or 500 ohm impedance. If the Presto Recording Corporation supplies the ribbon or inductor microphone, they will be 200 ohm impedance.

Insert the turntable plugs (20) and (21) into receptacles (23) and (25) respectively on the amplifier panel. If a second turntable is to be used for continuous recording insert the two plugs corresponding to plugs (20 and 21) into the second set of receptacles (22 and 24). The equipment is now ready for operation. When the amplifier power switch (19) is thrown to the "on" position the pilot jewel to the right of the switch will burn red.

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RECORDING ON ACETATE

Place disc on turntable. Now, grasp the handle (27) lift up, and swing the mechanism to the left and place it over the center spindle of the turntable so that the three screws that are spaced equidistant from the spindle on the turntable match the three holes in the driving flange (28) on the feed mechanism.

Insert the cutting needle into the cutting head as shown in Fig. 7. The shaft of the needle has a "flat" ground along its length and the needle should be so inserted that the needle screw tightens up against this flat.

It is of utmost importance to use sharp cutting needles in order to minimize surface noise. Always examine cutting needles by making a test cut on the inside of the record before recording. If the needle cuts quietly the reproduction will be quiet. If the needle can be heard cutting noisily then the reproduction will have considerable surface noise. A good way to check this is to put one's ear as close to the needle as possible and listen to the cutting. Under these conditions the needle should be barely audible. A few tests will make this procedure very easy and a good needle will be distinguished quite readily from a noisy needle.

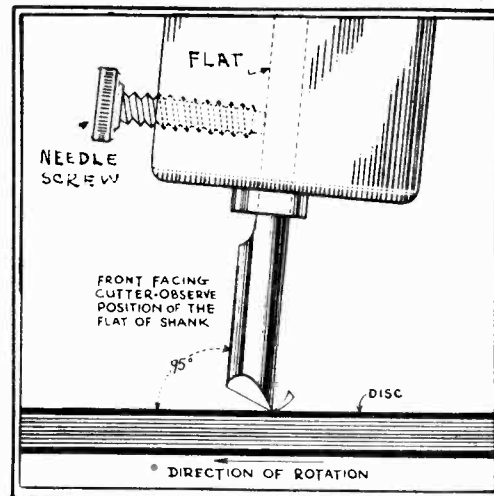


FIG.7.

Set the cutting needle into the cutter so that the angle, when facing the cutter, is approximately 95 degrees. See Fig. 7. If the needle is set so that it is 90 degrees or less with the record, the chattering will be so bad that the needle will actually jump the record and take pieces out of the material. The angle of cut can be controlled by inserting the needle further in or drawing it out until the proper angle is reached.

The Presto needles should be inserted as far as possible because the head is adjusted for these needles, but at the same time the above mentioned precautions should be observed.

78 R.P.M. Recording

The feed lever (5) Fig. 3, , located on the top of the cutting head casting disengages this casting from the screw by pushing down on it. When this lever is pushed down the cutting head is free to be moved to any desired point on the record. If cutting from the outside towards the center leave at least $\frac{3}{16}$ " from the outside. You may record to a $3\frac{1}{2}$ " diameter at the center. For inside out cutting start at $3\frac{1}{2}$ " diameter.

When the feed lever (5) is released the casting (6) engages with the feedscrew and the table is now ready for recording. Before recording, move the casting (6) from side to side to be sure that that lever (5) has engaged the bottom of the feedscrew thread and not the top. If it is resting on the top of the thread, moving the casting will cause it to fall into place at the bottom of the thread with an audible click.

Start the turntable and then lower the cutter onto the record slowly in order not to injure the point of the cutting needle.

PRESTO RECORDING CORP.

MODELS EU7, EU7E,
85, 85E33 1/3 R.P.M. Aluminum Recording

Recording at this speed on metal is not recommended if a record longer than 5 minutes duration is required. Fibre playback needles do not have a longer life than 5 minutes and there is considerably more surface noise than on acetate. This in itself is quite an objection.

"Microphone Recording"

After the needle has been checked and tested turn the selector switch (8) on the amplifier unit to the "mike rec." position, then proceed to record. Start the turntable by throwing the switch (1) See Fig. 1, to the "on" position. Lower the cutter slowly onto the disc in order not to injure the point of the cutting needle. The amount of power being supplied to the cutter is indicated by the volume indicator (9) located above the loud speaker. This needle will swing in direct proportion to the sound being put into the microphone. For good recording, this needle should swing up to mid-scale on the peaks. If it swings past mid-scale consistently, it indicates that there is too much power going to the cutter and this should be cut down by turning down the volume control (10). If the needle does not come up to mid-scale on the peaks, it indicates that too little power is being fed to the cutter and the volume should be brought up accordingly. For best results, the volume control should be set at one point and left alone to produce an even recording. When recording is completed, lift the cutting head off the face of the record, and grasp the feed mechanism by handle (27), swing it around and rest it on rest plate (33). Remove shavings and dispose according to previous instructions.

Radio Recording

Procedure in recording radio programs is the same as outlined in recording from the microphones except that the radio receiver or tuner should be used as a source of input instead of the microphone. If the Presto tuner is used, it should be plugged into the receptacle on the amplifier unit marked "radio" (15) Fig. 1. The Presto tuner has its own filament supply but obtains its B supply from the amplifier unit as shown in Fig. 17. Any other tuner that has to obtain its power supply from an amplifier can be used provided its power supply cord is wired to a 4 prong plug in accordance with the markings on Fig. 16 in the radio receptacle. The output impedance should be 200 ohms. If a receiver is used that has its own A and B supply, then the output should be connected to the same prongs in the 4 prong plug as mentioned above. In this case, the "B" supply prongs are not used.

Turn the selector switch (8) to "radio recording" and proceed to record watching the volume indicator (9) in the same manner as recording from the microphone.

How to Play the Presto Green Seal Disc

The Presto Green Seal disc may be played immediately after it has been cut. No baking or drying process is necessary. Best results both in quality of reproduction and playing life will be obtained on turntables which are accurately levelled and which are equipped with the latest type of balanced electrical reproducer. The lighter the pressure of the reproducing needle on the record, the longer the record life will be. A slanting turntable will cause the needle to rub against one side of the groove and wear the record more rapidly than if it were resting in the center, bearing equally against both sides. The playing life of a Green Seal Disc depends upon the quality of reproduction required. If the disc is to be used as a high quality transcription for broadcasting, the surface noise will be inaudible throughout the record for about 6 playings. Surface noise on a

Note:- The Presto Green Seal discs are not inflammable, but the shavings are. The latter should be disposed of in a metal container.

The shavings should be kept away from the cutting needle. The use of an inside out feedscrew will automatically take care of the shavings but occasionally in starting the thread will catch at the needle. It should be pushed away immediately towards the center. It will then take care of itself. If an "outside in" feedscrew is being used the shavings will collect in the center but since the cutting needle is traveling towards the center, it will tend to tangle with the shavings. Therefore, when cutting with this type of screw, the shavings should be cleared to the center with the hand before the needle reaches them.

33 1/3 R.P.M. Acetate Recording

Recording at 33 1/3 R.P.M. presents a slightly different problem than recording at 78 R.P.M. Due to the lower speed the surface noise problem is increased. It is very important, therefore, that only the finest cutting needles should be used and these should be checked very carefully for quiet cutting. Make a test cut with the cutting needle at 33 1/3 R.P.M. at a radius of 3". If it cuts quietly at this diameter it will be still quieter as the cutting diameter is increased. Observe carefully the procedure as to cutting angle etc., as outlined under 78 R.P.M. acetate recording.

There will be a noticeable decrease in high frequency response when recording below a diameter of 10" at this speed. This is due to the lower needle velocities and the shorter wavelength. Above 4000 cycles this becomes quite objectionable and the only remedy is to equalize. This means that the amplifier circuit is resonated at the frequency desired either 4000, 6000 or 8000 cycles. This gives a finished recording that on playback will give a uniform response over the entire range.

The Presto EU7E recording amplifier described has incorporated in its circuit a high frequency equalizer and is ideally suited for 33 1/3 R.P.M. recording. However, for best results it is recommended that a good cutting head such as the Presto type BA-1 cutting head be used. This head has a uniform response to 6000 cycles and is well able to take an equalizer. Heads that have a poor frequency response above 4000 cycles cannot be materially improved by the use of an equalizer.

78 R.P.M. ALUMINUM RECORDING

The cutting head casting differs from the acetate head in that the head is mounted in the casting and is not pivoted. The needle used is a diamond and is set in the cutting head so that it drags along the disc.

Once this needle is set it should not be removed. It does not require changing and is good for over 1000 recordings. The feed lever (6) performs the same function as in acetate and the same precautions should be observed to make sure that this lever is properly engaged with the thread of the screw. No thread is removed when recording on aluminum, so either type of feed "outside in" and "inside out" can be used with no precautions about shavings to be observed.

With this type of recording it is necessary to record at a higher volume. This is necessary due to the heavy weight required for the head in order to cut a deep enough groove. This heavy weight dampens the needle and therefore more power is necessary to drive the head. Increase the recording level by at least 3 db.

Use only fibre or thorn needles when reproducing aluminum records.

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PRESTO RECORDING CORP.

Presto recording increases to that of an ordinary phonograph record after about the 25th playing. Thereafter, it has a life equal to that of an ordinary shellac record.

PLAYBACK

Turn selector switch (8) Fig. 1 to the playback position and insert the shadowgraph steel needle into the pick up. These shadowgraph needles are ordinary phonograph needles that have been inspected under a microscope to insure that no burrs are on them. If there are burrs on the needle they will tend to rip the record. The use of shadowgraph needles is not necessary for the playing back of ordinary shellac phonograph records because the shellac record contains an abrasive material which wears out the imperfections in the needle so that the latter will fit the record groove. Acetate does not contain any abrasive material and it is for that reason that shadowgraph needles are recommended at all times. These needles are good for several playbacks and once removed from the pick up they should not be reinserted. After 3 or 4 playbacks the needle should be discarded. The volume for playback is controlled by the same volume control (10) that was used during recording.

For preserving the life of a Green Seal Disc, the Presto Recording Corporation, manufactures a substance called DISCLUBE. DISCLUBE is applied to a record with a soft cloth immediately after cutting and tends to harden and lubricate the groove, reducing the wear caused by the reproducing needle. DISCLUBE dries with a few seconds and will improve the playing life of the record considerably. It is particularly recommended where records are to be played on portable, acoustical or electrical phonographs.

PUBLIC ADDRESS

If the apparatus is to be used for public address work, only the amplifier unit in conjunction with the preamplifier and microphone are used.

Turn the selector switch (8) to the "Mic. P.A." position and when the microphone is used for either talking, singing or instrumental playing, the sound will emanate from the loud speaker. If the microphone is used in the same room with the amplifier unit increasing the volume too much, by turning the volume control will cause what is known as a "feed back". This manifests itself by a "howl" from the loud speaker. To minimize this "feed back" when using the microphone in the same room, the microphone should be located behind the unit. To eliminate completely the feed back, the microphone should preferably be located in another room that is completely closed off from the machine. However, for all practical purposes, where reinforcement in a class room or auditorium is desired, the placing of the microphone behind the speaker will allow for enough volume to fill the room. If more power is desired for an auditorium, a larger speaker than the one built into the unit is needed. This larger speaker should obtain its field supply from the main line, or it should be of the permanent magnet type. It should have an impedance of 500 ohms, terminating in an ordinary telephone plug. This plug is now inserted into the external speaker jack (16). When this is done, the built in 8" speaker is automatically cut.

DUPLICATING PRESTO DISCS

Duplications or dubbings of a Presto recording can be made by playing one record on to another. The pickup of one turntable is fed into the microphone posts of the recording amplifier and the procedure is followed as outlined under "Microphone Recording". This process can be repeated until the original record becomes noisy or the quality begins to deteriorate.

Records identical with standard phonograph records or electrical transcriptions can also be made from Presto recordings. Such records are known as pressings and the process involved is known as plating.

By this process duplicates of the original recording can be made in quantities of several thousand. When masters are to be made for processing, it is necessary to use the Presto over size Green Seal disc. When double face records are to be made, two masters are required. The over size master discs may be out on both sides so that the best side may be selected for plating.

Radio Reception

Turning the selector switch to the radio position makes this unit a very powerful radio receiver. It can be used to fill a hall or school room with radio reception and the procedure is the same as followed in public address.

Location of Trouble

HIGH SURFACE NOISE ON ACETATE

This can be due to any one of three reasons.

1. BAD CUTTING NEEDLE

The needle should be checked as outlined on page 9 and if found to be noisy should be replaced immediately.

2. FAULTY RECORD

Only the finest acetate blanks should be used. Blanks that have grit, uneven surface, etc. will not be satisfactory for recording. Presto blanks are supplied in air tight metal containers packed in lots of 25. Keep the blanks in the container and the cover on. Contrary to common belief, these blanks do not become so hard when exposed to the air that they cannot be cut. Exposure to the air will make them harder, but they can be easily cut by increasing the pressure on the needle slightly.

3. CUTTING WITH TOO LITTLE VOLUME

If the needle cuts quietly and the blank is good, then the trouble is low volume of recording. This means that the needle of the volume indicator meter did not swing to mid-scale. This can be corrected by increasing the volume by turning the volume control (10) to the right.

GROOVE RUNS INTO ADJACENT GROOVE FOR ONE COMPLETE CIRCLE.

This shows itself as muddled recording, that is, it seems as if the recording was superimposed on the previous groove. This will happen if feed lever (5) was not checked to be sure that it was in the proper place. When this feed lever (5) rides on the top of the thread of the feedscrew it will eventually fall into the proper place, and as a result will usually fall back one groove to modulate the previously modulated groove again.

Proper Groove

It is very important to have a proper cut to insure proper tracking. When the thread is cut out by the needle it should be about the thickness of an ordinary human hair, and it should be black and shiny. If the cut is too light, the thread will be grayish, and if too heavy it will be about the thickness of

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lever (31) fig. 5, in neutral position and lock securely. Next, loosen adjustment screw (63) slightly and move bracket (64) slightly forward.

The proper adjustment is reached when the following condition is satisfied. With the turntable removed and the motor running with the shift lever locked in neutral position, the two idler pulleys should remain stationary. With this condition the table will run at a constant speed with maximum torque.

ADJUSTING THE PRESTO TYPE BA-1 CUTTER

If the armature of the double action head collapses, proceed as follows:

Remove cover screw (56) Fig. 13, and cover. Grasp cutting head (57) on top and pull down. See Fig. 14. Loosen mounting screws (61) and slide head off bracket. Now remove back cover plate. With small screwdriver loosen locking screws (A'-A'') Fig. 12. The adjusting screws (A-A) can now be turned to center the armature. Reference to Fig. 12 shows how the centering screws (A-A) control the position of the armature. Whenever possible, it is strongly recommended that the cutter be returned to the factory for adjustment.

Under no condition is the lock screw (B-1) to be loosened or retaining spring screw be moved. Failure to heed this warning will throw the armature off the knife edge and this will necessitate a factory adjustment.

The method of holding the armature in the center is an exclusive feature with this cutter and the armature will not collapse unless the lock screws are tampered with. Treat your cutter as you would a high grade watch. Lubricating the Recorder

There are three essential parts on the motor drive mechanism that have to be lubricated.

1. The main turntable bearing must be lubricated weekly with a good grade of vaseline. This may be accomplished by lifting the turntable from the bearing, see Fig. 15, and applying the vaseline to the turntable shaft (51). There is a thrust steel ball at the bottom of this bearing and care must be taken that this ball is not lost when removing the turntable. Sometimes the ball will stick to the bottom of the turntable shaft, in which case it should be removed and dropped into bearing (52).

2. Lubrication of the idler shafts (53) and (54) is very essential and should be done at the end of each 50 hours of operation. "3 in 1" oil is recommended. One drop of oil in the center holes of the idler shafts (53) and (54) is sufficient. Be sure that the oil does not get on the idlers. Always wipe clean. Loose oil might cause loss of friction.

3. The motor need not be oiled more than once in 3 months and then with the same quality of "3 in 1" oil as used on the idler shafts. It is advisable not to oil the motor too much. Too frequent oiling might cause defects in the winding of the motor. When oiling the motor, the entire panel mounting must be raised. The oil cups of the motor are at the bottom and top.

The oiling of the over head feed mechanism is of a very simple nature. Use "3 in 1" oil on the centers of the feedscrew and the shaft that carries the worm. The feedscrew can be kept moist with a little "3 in 1" oil and the lubricating of these elements can be done frequently at about one week intervals.

a very heavy black sewing thread. Too deep a cut will cause echo in the record. If the thread is curly it indicates a wrong angle.

The depth of cut is dependent on the pressure on the needle point. The pressure of the cutting needle on the disc is regulated by the tension spring (43) Fig. 13, located on the right hand side of the cutting head. This tension spring is suspended from the threaded rod on the top of which is mounted a thumb nut (42). Turning this nut (42) to the right decreases the pressure on the cutting needle while turning it to the left increases the pressure. This adjustment is already made at the factory but if it gets out of adjustment it can be easily rectified by the turning of this nut. The needle pressure during cutting should not exceed 4 oz. This can be determined by using a small scale measuring in ounces and putting this scale on to the needle screw and lifting up to note the pressure, and then correcting it.

The best way to determine whether the proper groove is being cut is to use a 10-20 power magnifying glass to examine the groove. A proportion of 55 width of groove to 55 width of wall gives the best results on the Presto Green Seal discs.

Chattering

If the recording needle starts to jump or chatter on the record it indicates an improper recording angle of the cutting head. This can be corrected by pushing the cutting head back slightly along the swivel point of the cutting head bracket. It is not necessary to loosen the screw on the left to make this adjustment. Make sure that something else like a poor record with uneven surface or a poor recording needle is not causing this trouble before changing the angle of the head. This angle is properly adjusted at the factory and should not be changed unless absolutely necessary.

Waver or "Wows" in Recording

This condition shows itself usually when musical recordings are made. The reproduced sound will be unsteady, for example, piano will sound like a guitar and any sustained note will waver. This is due to one of three reasons:

1. RECORD SLIPPING

Driving screws on turntable were not used. If these driving screws have to be removed when reproducing commercial phonograph records be sure that they are replaced. Three driving screws are supplied, but when recording only one is really necessary. It is a good idea to remove two of the screws and keep them in a safe place as spares.

2. WORM SHAFT BINDS

If the thread from the record is not removed from around the worm and shaft it is liable to get in between the bearing and worm shaft and the latter will bind. Before recording lift the feed mechanism off the table so the driving flange (28) Fig. 3, clear the table and give worm shaft knob (39) a spin. The worm (44) should spin freely. If it doesn't, make sure that the shavings have all been removed. The construction of the feed mechanism is such that there is very little change of binding due to shavings, but nevertheless, the above precautions should be observed.

3. SLIPPAGE BETWEEN TURNTABLE AND MOTOR

When the recorder leaves the factory, it is carefully adjusted to the proper driving speed and torque. However, there is a remote possibility that this adjustment might loosen and cause waver. If so, put shift

MODELS EU7, EU7E,
85A, 85E

PRESTO RECORDING CORP.

Equalized Amplifier

The type EU7E amplifier has incorporated in its circuit an equalizer for increasing the response at 4000,6000,8000 and 10,000 cycles. The selection of the frequency to be equalized and the degree of equalization is obtained by means of the two equalizer controls located on either side of the volume indicator. The circuit is identically the same as the type EU7 except that the second stage contains 6C5G's instead of 76's. See fig. 10. The use of the 6C5G tubes increases the gain of the amplifier by about 10 db. This is necessary to make up for the insertion loss of the equalizer.

There is no hard and fast rule for using an equalizer, in recording. Its use will depend on the type of sound to be recorded and the intelligent use of the equalizer will depend on the judgment of the operator. Fig. 9 shows the different characteristics at the different settings of the selector switches.

Instantaneous recordings require equalizing at the high frequencies due to the fact that the recording material is comparatively soft. Equalizing at 78 rpm is not recommended when using the Presto Type BA-1 cutter. At 33 1/3 rpm, where there is a greater loss of high frequencies, the equalizer can be used to advantage. For all ordinary recording set "equalizer frequency" switch at position 6M and "degree of equalization" switch at position (4). On playback the equalizer should be disconnected from the circuit. This is done by turning either selector switch to the zero position. The method of operation of the EU7E and the location of the different receptacles, etc. are identical with that of the EU7 amplifier.

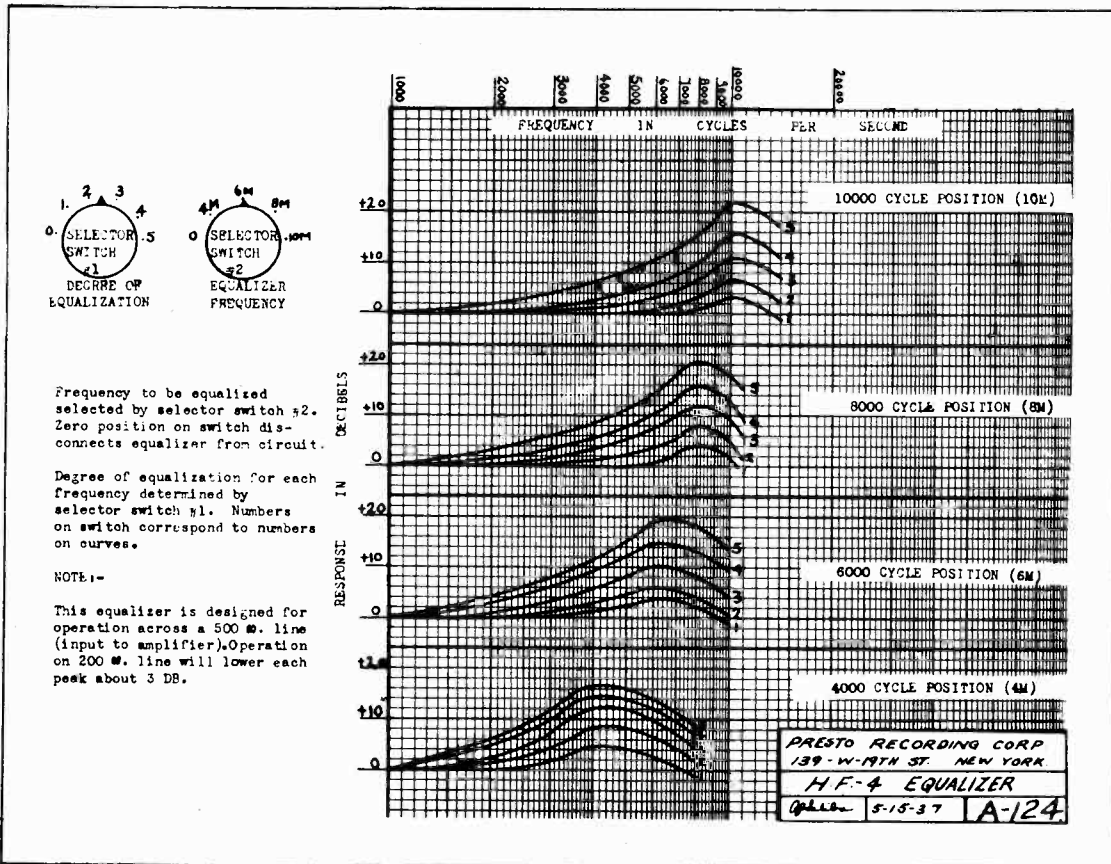
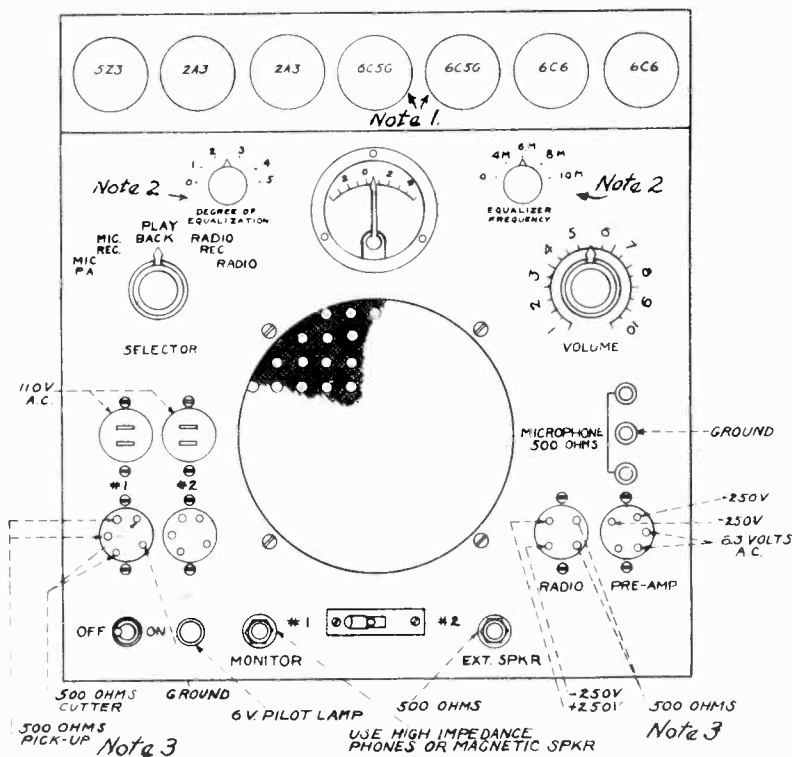


Fig. 9

PRESTO RECORDING CORP.

MODELS EU7, EU7E,
85, 85E



The layout at the left is that of the Type EU-7E. The layout of the Type EU-7 is similar with the following exceptions:

- Note 1. Type 76 tubes used instead of 6C5G.
- Note 2. These controls not used on Type EU-7
- Note 3. 200 ohms in Type EU-7.

PRESTO RECORDING CORP. 139 W 14TH ST NEW YORK	
FRONT PANEL DESIGNATION RECORDING AMPLIFIER TYPE EU-7E	
SGF 6-3-37	B-127

Fig. 10

PRESTO RECORDING CORP. 139 W 14TH ST NEW YORK	
FRONT PANEL DESIGNATION RECORDING AMPLIFIER TYPE EU-7	
SGF 5-2-37	B-126

Fig. 16

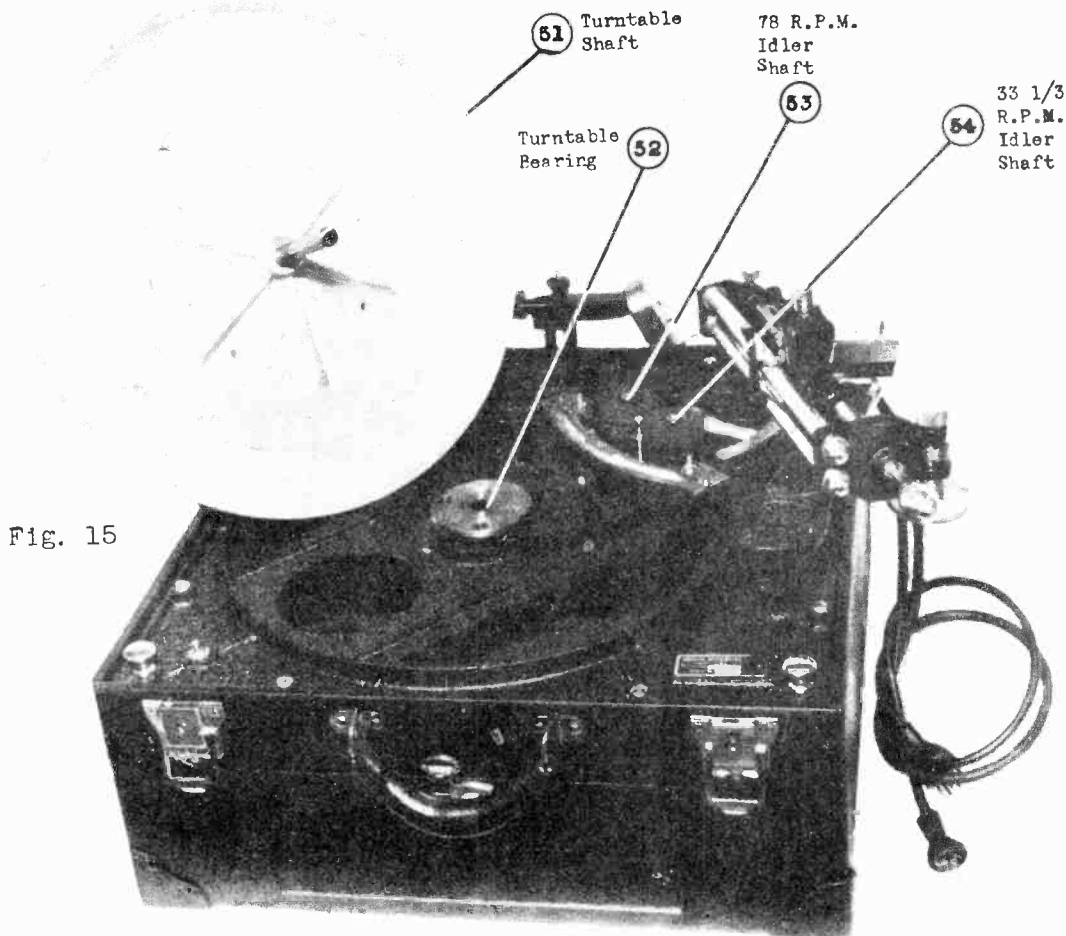


Fig. 15

MODELS EU7, EU7E,
85, 85E

PRESTO RECORDING CORP.

Jerky Intermittent Recording

This is usually due to two reasons:-

Loose cutting needle or collapsed armature in the cutting head.
Tightening the needle screw (55) Fig. 13, will take care of the first condition. If the armature is collapsed it will be leaning either to the right or to the left as shown in Fig. 10A. The dotted line shows the armature in collapsed position. This condition can be quickly ascertained by removing the needle screw (55) and cover screw (56). The cover can then be removed and the cutting head inspected.

Two types of cutting heads are used with this recorder, one is known as the "single action head" while the other is known as the "double action head". The former is identified by its gold colored cover and its single coil, while the latter has a dull chrome cover and two coils and is known as the "Presto type BA-1 cutter." Both heads operate on the electro-magnetic principle and are unaffected by moisture or high temperature. However, if the armature of the single action collapses, it is a simple matter to adjust it by following the procedure outlined below:

Remove warning label and magnet-holding strap. Now put a fairly stout steel keeper (66) across the magnet (65) as shown in Fig. 11. The magnet may now be removed from the cutting head, taking care that the keeper remains across the magnet. This is important in the preservation of the magnet strength.

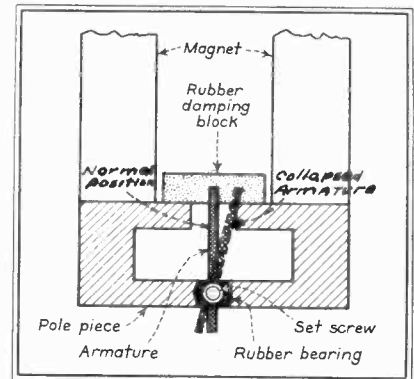


FIG. 10 a

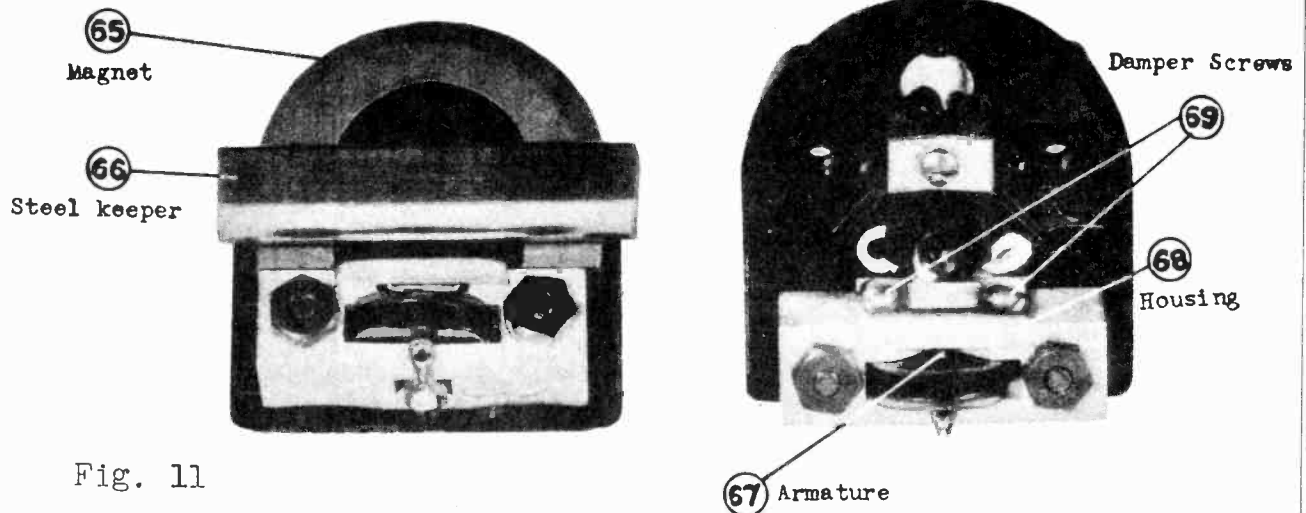


Fig. 11

Slightly loosen the two damper screws (69). Holding the damper housing (68) and with a touch of the screwdriver, shift the housing (68) slightly to the left or right, as may be needed, then tighten the two damper screws (69).

Now replace the magnet (65) and magnet holding strap in their original positions, taking care that the magnet poles are firmly in contact with the pole shoes. After all parts are back in their original positions, the keeper (66) may be removed and the cutter is ready for use as before.

PRESTO RECORDING CORP.

MODELS EU7, EU7E,
85, 85E

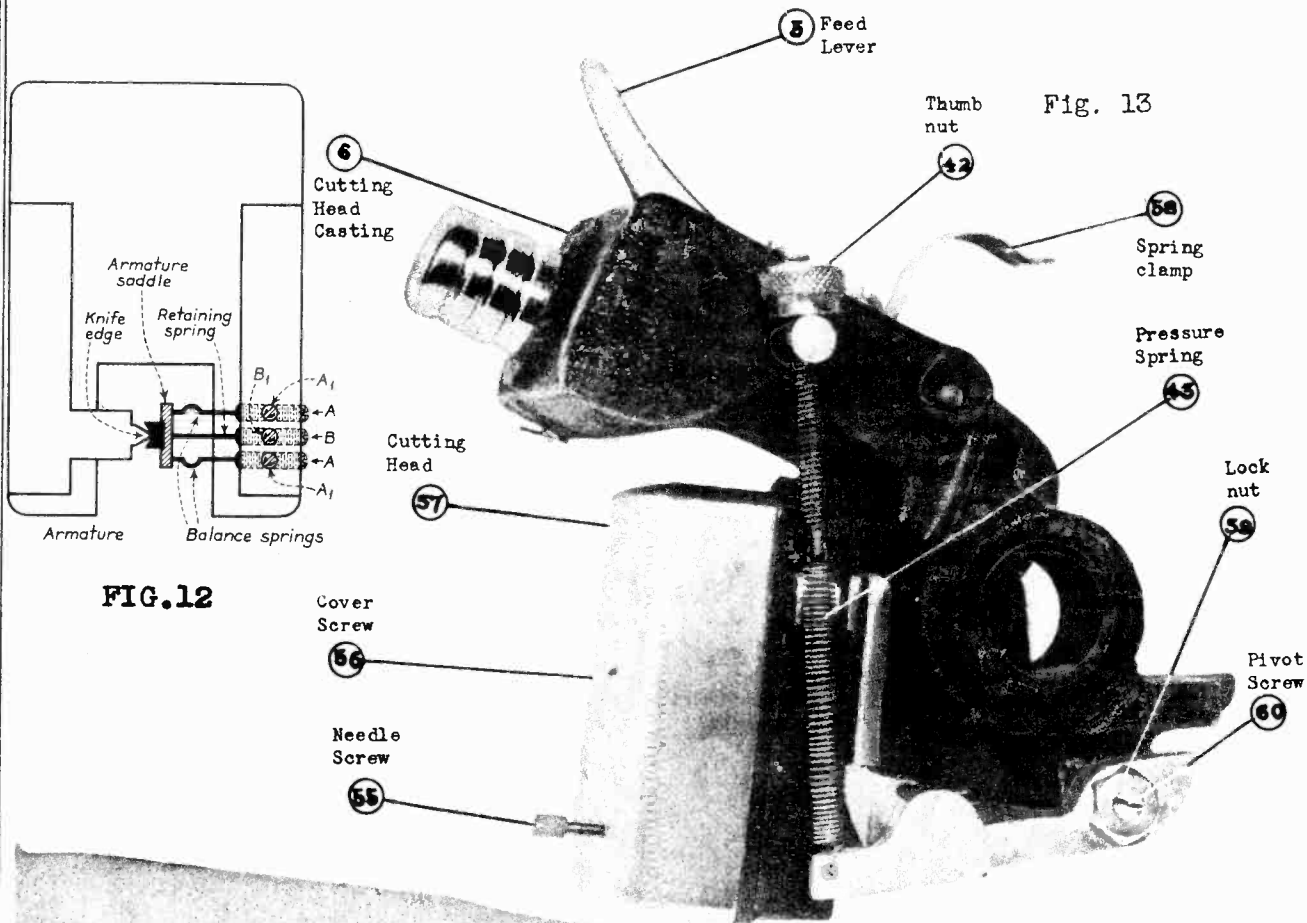


Fig. 13

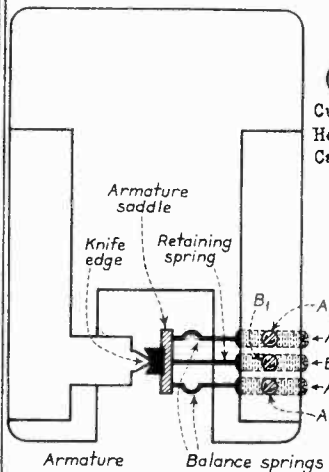


FIG. 12

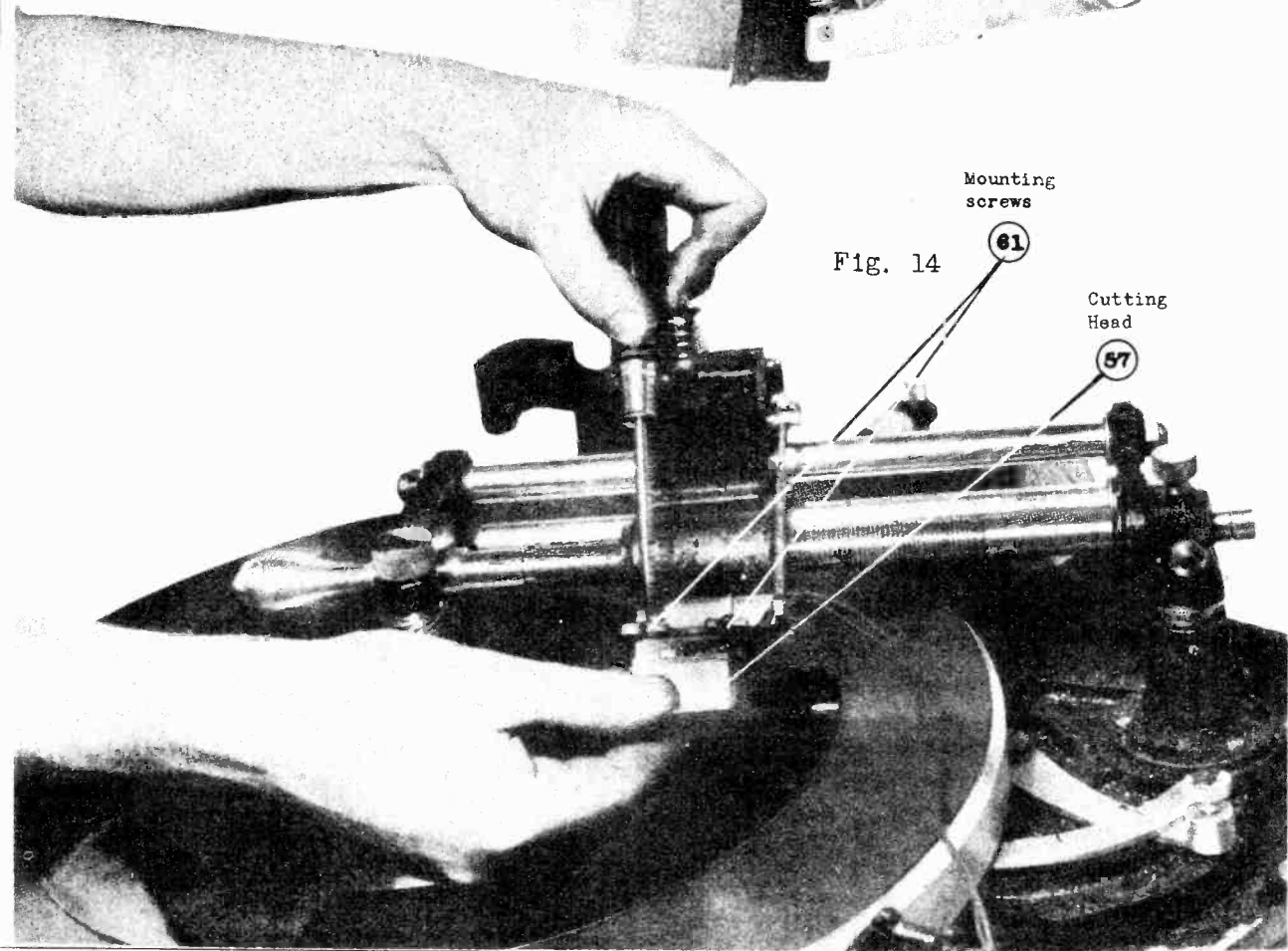


Fig. 14

MODELS EU7, EU7E,
85, 85E

PRESTO RECORDING CORP.

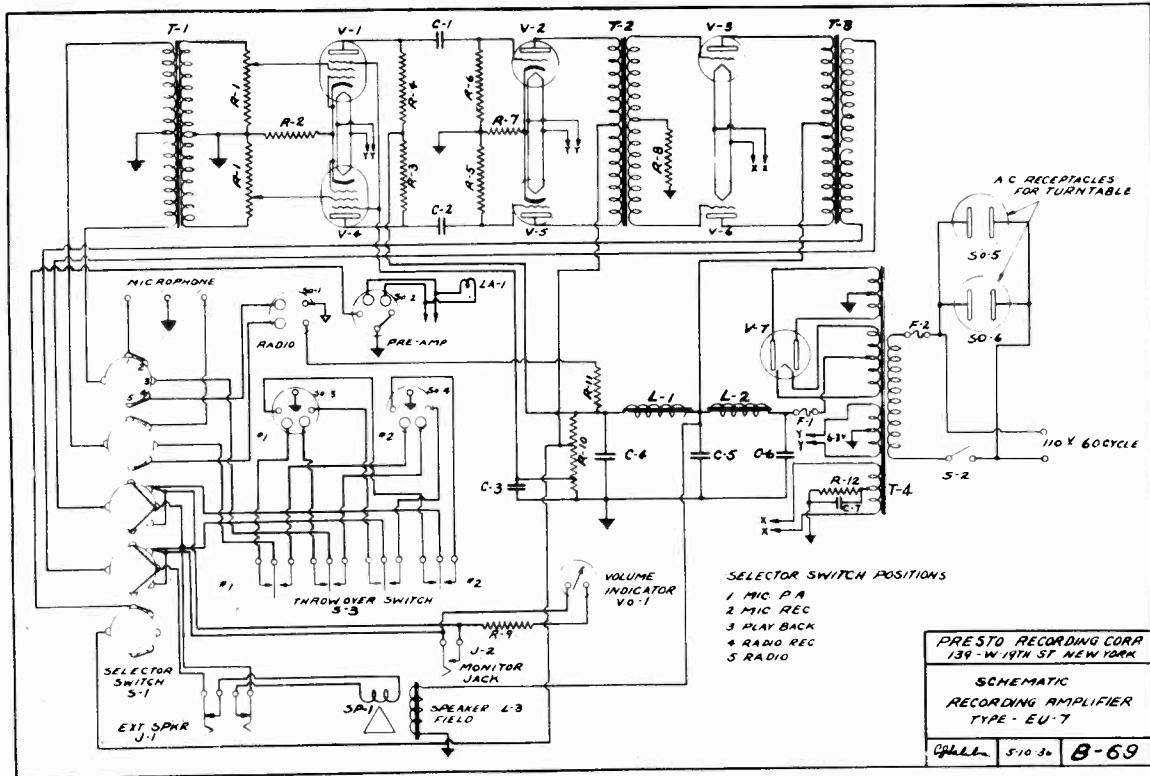


Fig. 17

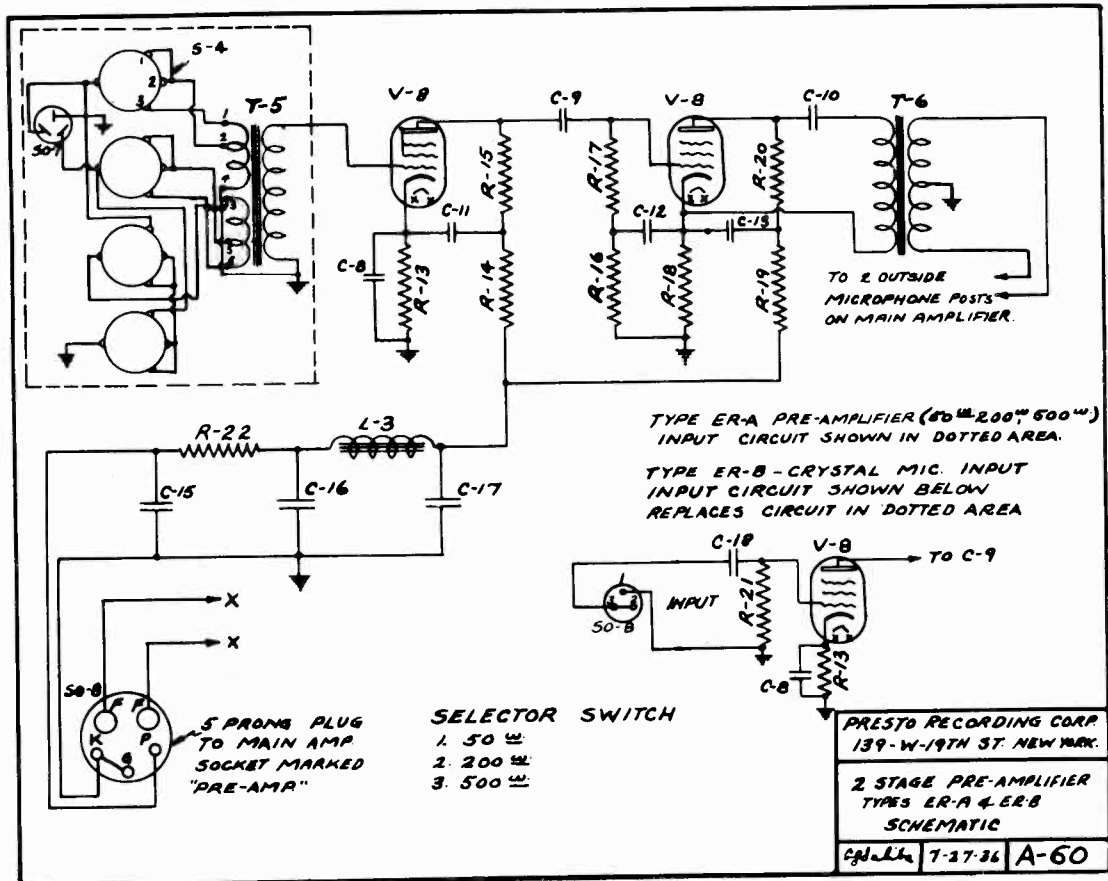


Fig. 18

The PRESTO RECORDER

TECHNICAL INFORMATION

EU7 RECORDING AMPLIFIER

V-1 6C6 1st stage
 V-4 6C6 1st stage
 V-2 76 2nd stage
 V-3 2A3 3rd stage
 V-5 76 2nd stage
 V-6 2A3 3rd stage
 V-7 5Z3 rectifier
 LOUDSPEAKER
 TYPE-Electrodynamic
 IMPEDANCE 500 ohms

FREQUENCY RANGE 30 to 12,000 cycles ± 2 DB
 GAIN- 85 DB Power output- 10 watts undistorted
 INPUT IMPEDANCE 200 ohms
 OUTPUT IMPEDANCE 500 ohms
 POWER SUPPLY RATING
 RATING A- 105-125 volts 50-60 cycles 115 watts
 RATING B- 105-125 volts 25 cycles- 120 watts
 RATING C- 100-130/140-160/195-250 volts 50-60 cycles
 115 watts

EU7E RECORDING AMPLIFIER

V-1 6C6 1st stage
 V-4 6C6 1st stage
 V-2 6CSG 2nd stage
 V-5 6CSG 2nd stage
 V-3 2A3 3rd stage
 V-6 2A3 3rd stage
 V-7 5Z3 Rectifier

FREQUENCY RANGE 30-12,000 cycles ± 2 DB
 GAIN- 95 DB. Power output-10 watts undistorted
 INPUT IMPEDANCE 500 ohms
 OUTPUT IMPEDANCE 500 ohms
 POWER SUPPLY RATING
 RATING A 105-125 volts 50-60 cycles 115 watts
 RATING B 105-125 volts 25 cycles 120 watts
 RATING C 100-130/140-160/195-250 volts 50-60 cycles
 115 watts

ER-A PREAMPLIFIER

V-0 6C6 1st stage
 V-0 6C6 2nd stage

ER-B Preamplifier
 same as ER-A except
 it has high impedance
 input. See page 21.

FREQUENCY RANGE 30-12,000 cycles 2 DB
 INPUT IMPEDANCE 50,200 and 500 ohms.
 OUTPUT IMPEDANCE 200 ohms if supplied for EU7
 amplifier and 500 ohms if supplied for EU7E
 amplifier.
 FILAMENT VOLTAGE 6.3 volts at 0.6 amps.
 PLATE VOLTAGE 250 volts .005 amps.

TURNABLE

DIAMETER 12" or 16"
 SPEED 78 RPM and 33 1/3 RPM
 MOTOR 1/20 horse power, 37.3 watts-synchronous
 PICK-UP electromagnetic 200 ohms impedance
 CUTTING HEAD electromagnetic 500 ohms impedance

net weight shipping weight
 65 lbs. 124 lbs.
 51 lbs. 102 lbs.
 59 lbs. 108 lbs.
 22 lbs. 44 lbs.

WEIGHTS AND DIMENSIONS

16" TURNABLE
 21" x 21" x 14"
 12" TURNABLE
 18" x 17 1/2" x 13 3/4"
 RECORDING AMPLIFIER
 9" top x 17" x 18"
 PREAMPLIFIER
 14" base
 8" x 15" x 9 1/2"

PRESTO RECORDING CORP.

MODELS EU7, EU7E,
 85, 85E

EU7 & EU7E RECORDING AMPLIFIERS

LEGEND	DESCRIPTION	PART NO.	LEGEND	DESCRIPTION	PART NO.
R-1	Vol. Cont.	100,000 ohms	C-1	0.1MFD	1279
R-2	1500 "	1143	C-2	0.1MFD	1279
R-3	250,000 "		C-3	25MFD	1118
R-4	250,000 "		C-4	8MFD	1249
R-5	100,000 "	1151	C-6	8MFD	1249
R-6	100,000 "		C-6	8-8MFD	1224
R-7	3000 "	1145	C-7	25MFD	1119
R-8	30,000 "	1135			
R-9	45,000 "	1151-A			
R-10	50,000 "	1179			
R-11	1200 "	1142			
R-12	750 "	1186			
T-1	Input	118	SO-1	4 prong	1159
T-2	Interstage	106	SO-2	5 prong	1160
T-3	Output	107	SO-3	5 prong	1160
T-4	Power	117	SO-4	5 prong	1160
			SO-5	2 prong	1213
			SO-6	2 prong	1213
L-1	Filter	108			
L-2	Filter	109			
L-3	Speaker Field	1274			
F-1	Fuse	1222			
F-2	Fuse	1222A			
R-13	1500 ohms	1143	C-8	8MFD	1177
R-14	10,000 "	1146	C-9	0.1MFD	1225
R-15	10,000 "	1148	C-10	0.5MFD	1113
R-16	100,000 "	1135	C-11	1.0MFD	1117
R-17	100,000 "	1133	C-12	1.0MFD	1117
R-18	1500 "	1143	C-13	1.0MFD	1117
R-19	10,000 "	1148	C-14	1.0MFD	1117
R-20	10,000 "	1148	C-15	8.0MFD	1177
R-21	ε megohms		C-16	8.0MFD	1177
R-22	15,000 ohms	1136	C-17	8.0MFD	1177
			C-18	8.0MFD	1177
SO-7	3 prong receptacle	1200	L-3	Filter Choke	100
SO-8	5 prong plug	1155	T-5	Input transformer	104
SO-9	3 prong receptacle	1267	T-6	Output transformer	113
			S-4	Selector switch	1212

ELECTRICAL SPECIFICATIONS

Motor
 Type of Motor..... Synchronous (Manual Starting)
 Turntable Speed..... 78.26 r.p.m.
Crystal Pickup
 Impedance..... 100,000 ohms at 1,000 cycles
 Average Output Voltage..... 1 1/2 Volts across
 250,000 ohm load at 1,000 cps

GENERAL DESCRIPTION

These instruments employ a crystal pickup unit which depends upon torsional vibration to provide the necessary output voltage. The crystal unit is contained in a metal case securely sealed against extremes of climate. An offset mounting for the pickup head gives an ideal tracking angle between the needle and record grooves.

The motor is a manual starting, synchronous type, designed to operate with good regularity of speed at the standard 78.26 r.p.m. Mechanically, the motor consists of a laminated rotor affixed to the turntable having a certain number of salient poles and a stator with a corresponding number of poles. Two field coils installed on the stator furnish the energizing magnetic flux. The rotor, stator and their bearing assembly are mechanically isolated from the turntable, motor mounting, and cabinet by adequate flexible couplings and supports.

CONNECTING RECORD PLAYER TO RADIO RECEIVER

In connecting this player to a radio receiver care should be exercised to connect it at a point where there is sufficient gain between it and the speaker to yield normal output. Usually two or more stages of audio amplification are required. The radio part must be thoroughly disconnected or killed when playing records, else the radio signals will be heard with the record's music.

DO NOT CONNECT THE RECORD PLAYER INTO A PLATE OR CATHODE CIRCUIT. It must always be connected into a high impedance circuit (100,000 ohms or more). If the player is to be used in connection with an AC-DC receiver it is necessary to insert a capacitor (0.1 mfd.—400 volts) in series with the ground chassis connection.

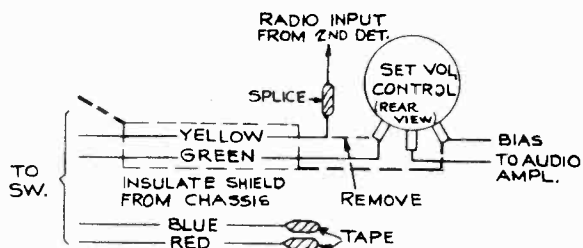
The two models are electrically and mechanically similar; they differ in that Model PRP-1 has a molded plastic cabinet, whereas Model PRP-2 has a veneer wood cabinet.

REPLACEMENT PARTS
 THE FOLLOWING ARE EQUIVALENT TO STANDARD RCA COMPONENTS

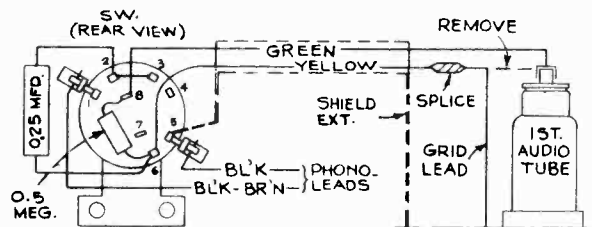
Stock No.	DESCRIPTION	Stock No.	DESCRIPTION
	MOTOR ASSEMBLIES PRP-1 AND PRP-2 (60 cycles—110 volts)		MOTOR ASSEMBLIES (110 volts—50 cycles) Note—For additional motor parts see 60 cycle motor assemblies at top of list.
32654	Ball—Steel ball	31918	Coil—Motor field coils
31045	Base—Motor support, damper and bearing cup assembly	33941	Frame—Rotor frame complete with spindle and rotor laminations
31046	Bearing—Bearing assembly	33658	Laminations—Rotor laminations
32472	Cap—PRP-1 rubber spindle cap	33354	Laminations—Stator laminations
31041	Cap—PRP-2 rubber spindle cap		For motors mounted in "T" shaped rubber hanger
31917	Coil—Motor field coil	34810	Mounting—1 set mounting hardware
31047	Cushion—Rubber cushion for bearing	33345	Cap—Rubber spindle cap for PRP-1
33654	Frame—Rotor frame	33353	Cap—Rubber spindle cap for PRP-2
33641	Lamination—Rotor lamination		PICKUP AND ARM ASSEMBLIES
34878	Lamination—Stator lamination	32624	Pickup Arm—less crystal, PRP-1
32469	Motor—110 volt, 60 cycle, complete with mounting for PRP-1	32474	Pickup Arm—less crystal, PRP-2
9841	Motor—110 volt, 60 cycle, complete with mounting for PRP-2	31050	Crystal—Pickup crystal and needle screw
31040	Mounting—Turntable top rubber mountings sufficient for one turntable—PRP-1	31745	Ring—Retaining ring for pickup arm base
32471	Mounting—Turntable top rubber mountings sufficient for one turntable—PRP-2	12539	Screw—Pickup needle screw
33041	Ring—Retaining ring and metal washer to mount turntable plate		PICKUPS USING CRYSTALS HAVING VISCALOID DAMPING
31042	Stator—Stator assembly comprising coils and laminations for 60 cycle operation	33587	Arm—Pickup arm shell only PRP-1
32473	Turntable—PRP-1 finished turntable top plate only—less rubber mountings	33588	Arm—Pickup arm shell only PRP-2
31039	Turntable—PRP-2 finished turntable top plate only—less rubber mountings	35720	Pickup pivot arm for PRP-1
4083	Washer—Leather washer	35722	Pickup pivot arm for PRP-2
14231	Washer—Metal spacing washer	35721	Base—Pickup arm base for PRP-1
33642	Wedge—Coil wedge	35723	Base—Pickup arm base for PRP-2
	MOTOR ASSEMBLIES (Motor mounted by "T" shaped rubber hanger) (110 volts—60 cycles)	33217	Crystal—Pickup crystal cartridge
	Note—For additional motor parts see 60 cycle motor assemblies at top of list.	32500	Mounting—Rubber spacer, flat washer and snap ring for mounting pickup arm base
35724	Cap—Rubber spindle cap for PRP-1	34311	Ring—Retaining ring for pivot arm and base
33345	Cap—Rubber spindle cap for PRP-2	31160	Screw—Needle screw
33346	Coil—Motor field coil		MISCELLANEOUS ASSEMBLIES
33350	Frame—Motor support frame and bearing cup	31052	Control—Volume control and power switch
35746	Frame—Rotor frame, laminations and spindle shaft assembled	14086	Cord—Power cord with male plug
34480	Hanger—Rubber mounting hanger	33680	Cup—Needle cup for PRP-2
35745	Lamination—Stator lamination and bearing—less field coils	35717	Decalcomania—Symphonic De Luxe"
33348	Washer—Leather and metal washer for stator bearing	31051	Foot—Rubber foot for cabinet PRP-1
34863	Wedge—Wooden wedge	33006	Foot—Rubber mounting foot for cabinet PRP-2
		34850	Hinge—Cabinet lid hinge PRP-2
		4323	Knob—Volume control knob for PRP-1
		3961	Knob—Volume control knob for PRP-2
		31053	Mounting—Motor mounting screw assembly complete
		35716	Mounting—Pickup arm mounting ring and rubber cushion
		31054	Mounting—Pickup arm mounting nuts, washers, and rubber spacer
		31048	Plug—Male plug for output cable
		32610	Rest—Rubber pickup arm rest for PRP-2

PUBLISHERS SERVICE
TYPICAL CONNECTION DIAGRAMS

MODELS PRP-1, PRP-2

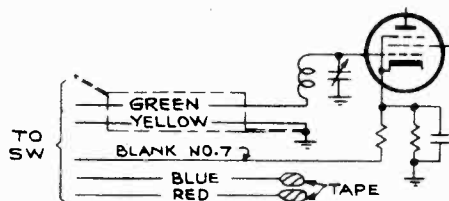


Radio Receivers where Receiver Volume Control is in Audio Input Circuit

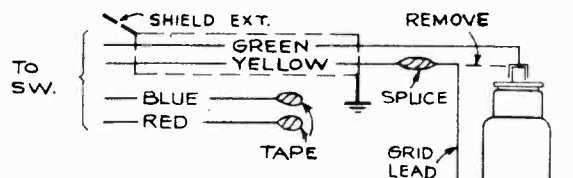


NOTE: REMOVE BLUE AND RED LEADS. CONNECT YELLOW LEAD TO TERMINAL NO. 6. ADD 0.5 MEG. RESISTOR AND 0.25 MFD. CAPACITOR AS SHOWN.

Radio Receivers where First Audio Tube is of the Grid Cap Type, and Fixed Bias for Tube is Obtained Through Grid Lead

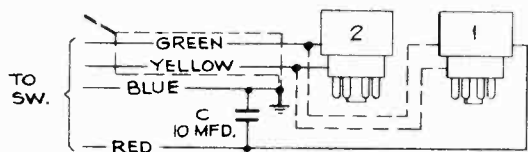


Radio Receivers using Biased-Type Detector



NOTE: THIS METHOD FOR USE ONLY WHEN BIAS FOR THE TUBE IS OBTAINED BY MEANS OF CATHODE RESISTOR.

Radio Receivers whose First Audio Amplifier Tube is of the Grid Cap Type



NOTE: WHEN NO. 1 IS USED AND TUBE IS OF "G" TYPE CARE MUST BE TAKEN TO SEE THAT SHIELD TERMINAL NO. 1 IS GROUND ON TUBE SOCKET.
WHEN NO. 2 IS USED TAPE RED LEAD, AND OMIT CAPACITOR.

- No. 1—Adaptor opens grid circuit and inserts a 2,700 ohm resistor in cathode of 6C5 or 6J5 tubes for bias on phono reproduction. Applies when bias is obtained through grid return.
- No. 2—Adaptor opens grid circuit of 6C5 or 6J5 tube. Applies when bias is obtained through cathode resistor.

Radio Receivers using 6C5 or 6J5, 6C5G or 6J5G, Tube for First Audio Amplifier

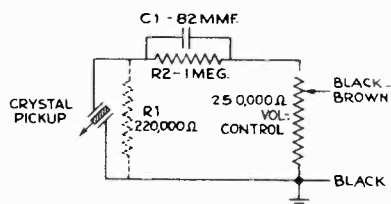
TONE COMPENSATION

Because of the widely varying frequency characteristics of various types of audio amplifiers with which these players may be used, it is desirable in some cases to make refinements in the pickup circuit to compensate for the characteristics of the amplifier.

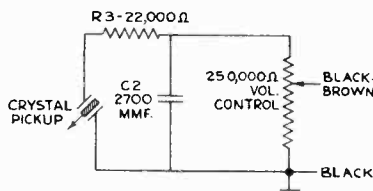
In "A" R1 controls the low frequency response; higher values of R1 give increased lows. For maximum low frequency response, remove R1. R2 controls pickup output, smaller values of R2 giving increased output. C1 controls high frequency response; to increase highs increase C1.

Where a decrease in high frequency response may be desired (for example, as an aid in reducing "needle scratch" on worn records), the circuit in "B" is applicable. In this circuit, C2 acts as loading on the pickup and is also a controlling factor on the high frequency response. Smaller values of C2 give more pickup output and also more highs. R3 gives a sharper high frequency reduction; increasing R3 decreases highs.

The suggested values shown in "A" and "B" should serve as a basis from which slight alterations may be made to suit individual cases.



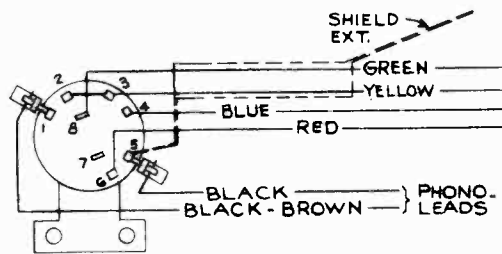
"A"



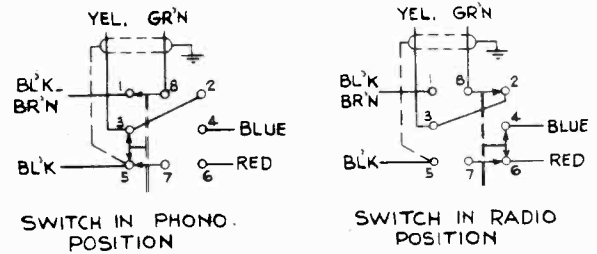
"B"

MODELS PRP-1, PRP-2

PUBLISHERS SERVICE



Radio-Phono Switch supplied with Record Player



Diagrams showing Switch in Radio and Phono positions

PHONOGRAPH AND MOTOR SERVICE DATA

The synchronous motor used in this instrument is designed to be simple and foolproof. Among its many features are constancy of speed, low power consumption, single moving part, ease of starting, rubber damper, ease of repair and long life. The parts that may require attention are plainly shown in the figures. The motor is started by turning "on" the power switch and giving the turntable a clockwise spin with the hand. Smooth starting and running will be insured by keeping the bearings well oiled and cleaned.

The rotor and turntable assembly rests on the ball bearing at the bottom of the vertical bearing, and may be removed by lifting out. Do not turn player upside down without holding turntable.

For rotor adjustment use three 16-mil shims for motors mounted in a solid base or for motors of the "T" hanger type use three 13-mil shims, spaced equally around the gap between rotor and stator. When the rotor is suitably adjusted securely tighten the three screws which hold the rotor to the turntable. The centering operation is very similar to that done with a dynamic speaker.

If the top of rotor lamination assembly is not flush with the top of stator laminations, additional steel washers should be inserted beneath the stator until the two are aligned.

A small amount of hum when starting, decreasing to a negligible amount while running, is normal. If excessive vibration occurs either at starting or running it may be due to one of the following.

1. Insufficient lubrication, or any failure that will cause binding of bearings.
2. Leather washer not oiled. Check to be sure that leather and steel washers are arranged in proper sequence, as indicated in the drawing.
3. Motor not properly fastened in the cabinet. Check for loose mounting bolts.
4. Burrs on poles of rotor and stator.
5. Loose laminations of stator.

6. Slight eccentricity of rotor or spindle.

7. Improper horizontal alignment of rotor and stator. Correct horizontal alignment is as shown in the figure. The position of the stator is raised or lowered by adding or removing washers below the leather washer.

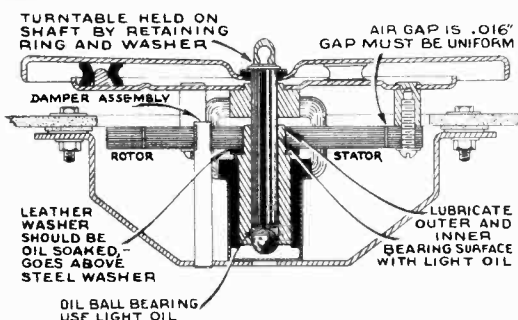
The damper spring must fit without binding or chattering, in the slot in the stator. The stator must be free to deflect and be flexible in either direction between the limits of the damper spring. Any binding in the washers or stator bearing which prevents the movement of the stator may cause speed variations in the motor. The damper spring must exert equal force in restoring the stator to its mid-position when the stator is deflected manually in either direction.

The following lead dress is important:

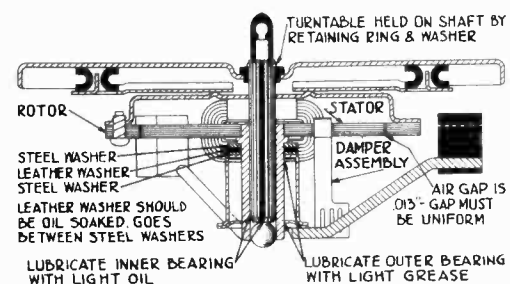
1. The power cord, stator leads and pickup cable should be dressed away from and not under the motor frame. Hum may be accentuated or rattles occur if this is not followed.
2. A periodic click will be heard when the power cord or stator lead rubs against the rotor. The leads should be dressed into the cabinet away from the rotor.

On high line voltages these players have considerable reserve torque. Any hum accentuated by such a condition may be further reduced at the expense of this reserve by inserting a 300 to 500 ohm 10 watt resistor in series with the line and motor winding.

The turntable is secured to the rotor drive table by means of a retaining ring and washer. In order for the turntable to be free of wobble, the rubber cushions between the drive table and the turntable must be secure in their positions. Slight wobble of the turntable can be eliminated by placing shims on the turntable side of these cushions, using that cushion where the table runs low.



Motor using Solid Base with Bolts for Mounting



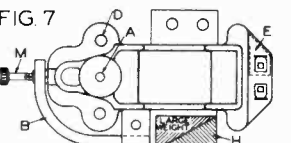
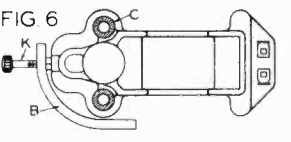
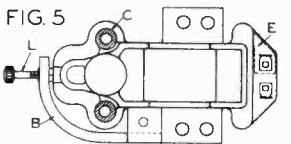
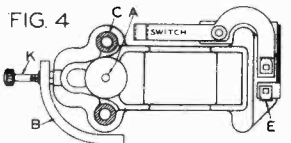
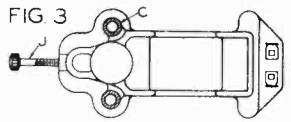
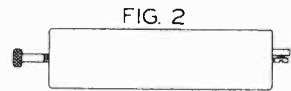
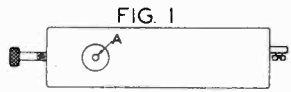
Motor using "T" Shaped Rubber Hanger Mounting

RCA MFG. CO., INC.

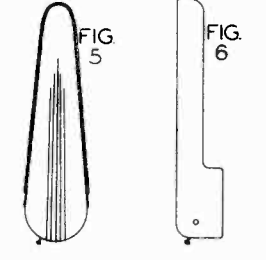
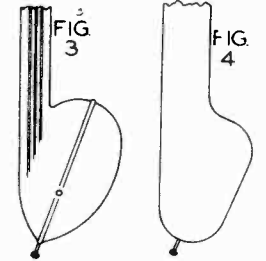
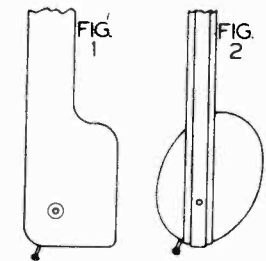
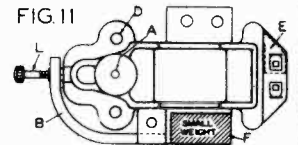
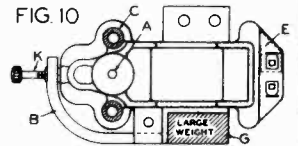
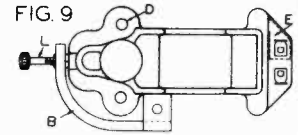
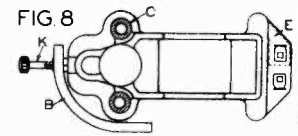
CRYSTAL PICKUP DATA

CRYSTAL CARTRIDGE DRAWING CODE

- "A" Top Needle Hole
- "B" Viscoloid Damper
- "C" Thick (5/16-in.) Mtg. Hole
- "D" Thin (7/32-in.) Mtg. Hole
- "E" Grounded Lug
- "F" Small Weight
- "G" Large Weight
- "H" Large "Cut" Weight
- "J" 5/8-in. Needle Screw
- "K" 11/16-in. Needle Screw
- "L" 13/16-in. Needle Screw
- "M" 15/16-in. Needle Screw



Model Number	Arm Stock Number	Arm Fig. No.	Crystal Cartridge Stock No.	Crystal Cartridge Fig. No.
QU2-C	33906	3	33905	7
QU3-C	33906	3	33905	7
*QU5	34011	2	33905	7
6QU	33125	5	33122	5
BQU5-C	34305	2	34307	9
U-8	33121	5	33122	5
U-9	33591	5	33122	5
U-10	33591	5	33122	5
*11-QU	31159	1	31156	4
*12-QU	31159	1	31156	4
U-12	33906	3	33905	7
*VA-15	33906	3	35171	7
U-20	33906	3	33905	7
VA-20	9842	4	31050	3
VA-21	33591	5	33122	5
*VA-22	33096	3	31156	4
			33905*	7
*U-25	33096	3	31156	4
*U-26	33096	3	31156	4
*U-30	33096	3	31156	4
*U-40	33906	3	35171	7
*U-42	33906	3	35171	7
*U-43	33906	3	35171	7
*U-44	33906	3	35171	7
*U-45	33906	3	35171	7
*U-46	34011	2	33905	7
O-50	33216	4	33217	6
U-50	33216	4	33217	6
R-60	33591	5	33122	5
R-89	31887	4	31050	3
R-91	9842	4	31050	3
R-93-B	9842	4	31050	3
R-93-C	9842	4	31050	3
R-93-F	33591	5	33122	5
R-94-B	31211	4	31050	3
R-98	33399	1	31156	4
R-100	33121	5	33122	5
V-100	33591	5	33122	5
V-101	33591	5	33122	5
V-102	36768	3	33905	7
R-103-S	33591	5	33122	5
U-104	32227	4	31050	3
U-106	14818	6	14820	1
U-107	14818	6	14820	1
U-109	14818	6	14820	1
U-111	9842	4	31050	3
U-112	9842	4	31050	3
U-115	32137	4	31050	3
U-119	31468	1	31156	4
U-121	32137	4	31050	3
U-122E	31468	1	31156	4
UY-122E	32016	1	31156	4
*U-123	32884	1	31156	4
U-124	31468	1	31156	4
UY-124	32016	1	31156	4
*U-125	31159	1	31156	4
*U-126	31468	1	31156	4
U-127E	32137	4	31050	3
*U-128	31159	1	31156	4
*U-129	33096	1	31156	4
*U-130	31159	1	31156	4
*U-132	31159	1	32632	4
*U-134	31159	1	32632	4
*RP-139A	33906	3	35171	7
*RP-139C	34776	1	34710	10
*RP-145	33906	3	35171	7
*RP-152	33906	3	35171	7
*RP-152A	36321	3	35171	7
*RP-152B	36322	2	37158	11
*RP-152C	36591	3	35171	7
*RP-152D	37181	2	33905	7
*RP-152J	36322	2	37158	11
*RP-153	36513	2	33905	7
*V-170	33906	3	35171	7
*V-200	36321	3	35171	7
*V-201	36321	3	35171	7
*VHR-202	36322	2	33905	7
*V-205	33906	3	37158	11
*VHR-207	36322	2	33905	7
*V-300	33906	3	37158	11
*V-301	36513	2	33905	7
*V-302	36513	2	33905	7
*VHR-307	36322	2	33905	7
*V-405	33906	3	37158	11
*VHR-407	36322	2	33905	7
	33586	4	34225	8
	30707		30708	2



*Automatic Record Changers.
**Used on 25 cycle model only.

RCA MFG. CO., INC.

MOTOR DATA

MOTORS

1. Q. How many different types of motors are used in the 1940 and 1941 lines of RCA record changer and home recorder mechanisms? What is the power rating of each? How does each operate?

A. Mechanism	Used in Models	Motor No.	Principle of Operation	Motor RPM	* Rating
RP-139A	U-21, U-40, etc.	32871	Shaded pole- induction	77-81	60 C, 105/120 V, AC, 21 watts
RP-139A		32872	Shaded pole- induction	77-81	50 C, 105/120 V, AC, 21 watts
RP-139A		32873	Shaded pole- induction	77-81	25 C, 105/120 V, AC, 22 watts
RP-145	U-42 (60 cycle) U-44 (60 cycle) etc.	34364	Capacitor- induction	3200- 3280	60 C, 105/120 V, AC, 14.5 watts
RP-145		36114	Capacitor- induction	2480- 2560	50 C, 105/120 V, AC, 14.5 watts
RP-152	V-170, V-205, etc.	36254	Capacitor- synchronous	3600	60 C, 105/120 V, AC, 14 watts
RP-152		36725	Capacitor- synchronous	3000	50 C, 105/120 V, AC, 14 watts
RP-152		36726	Capacitor synchronous	1500	25 C, 105/120 V, AC, 14 watts
RP-153	V-301, V-302, etc.	37295	Shaded pole- induction	78-80	60 C, 105/120 V, AC, 24 watts
RP-153		37296	Shaded pole- induction	78-80	50 C, 105/120 V, AC, 25 watts
RP-155	VHR-202, VHR-207, VHR-407	36820	Shaded pole- induction	1600- 1640	60 C, 105/120 V, AC, 36 watts
RP-155		37941	Shaded pole- induction	1240- 1280	50 C, 105/120 V, AC, 40 watts

* All Power ratings are at the maximum of 120 volts.

2. Q. How does the 1.1 mfd. capacitor used with the capacitor synchronous type motor (RP-152) function?

A.

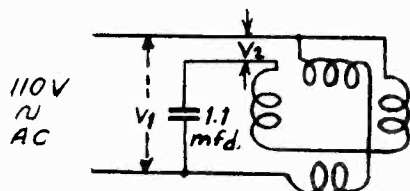


Fig. 1 - Motor Schematic

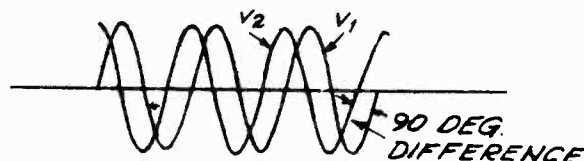


Fig. 2 - Phase relationship

The capacitor is inserted in series with one of the pairs of windings, as shown in Figure 1. This serves to split the phase, causing the voltage, V_2 , across one pair of windings to lead the voltage, V_1 , across the other pair by approximately 90 degrees. The result is good starting torque, and continuous running torque.

MOTOR DATA

RCA MFG. CO., INC.

If this capacitor is open, the motor will not self-start, and will stall if started by external means. A too-small capacitor results in poor starting torque, while a too-large capacitor will cause poor running torque.

3. Q. It has been noticed that some turntables do not run at exactly 78.26 rpm. What can be done in the field to regulate this speed more closely?

- A. This does not concern the synchronous type motor used in the RP-152 mechanism which runs at constant speed and deviates from 78.26 rpm only in proportion to tolerance or drive ratio. With motors of the induction type, line voltage and load affect the speed. Factory specification tests limit speed variation between

a minimum of 77 rpm (turntable fully loaded, pickup at start of 12" record)

and a maximum of 81 rpm (one 10" record on turntable pickup on the last music groove)

If speed is too high due to a high line voltage, a dropping resistor of proper resistance and wattage is a practical solution. If speed is too low due to a low line voltage, a step up transformer or "Variac" will be found suitable. Low speed at normal line voltage requires an inspection of the mechanism to see that lubrication is adequate and that there are no binds in drive gears, turntable bearings, etc. to cause excessive loading.

4. Q. Where and what kind of lubricator is required on current phono motors?

- A. RP-139A - After each 1000 hours of operation, a few drops of light machine oil (SAE 10 or lower) should be applied to the motor oil-hole adjacent to the spindle bearing. The oil-hole has a screw plug.

RP-145 (Stock No. 34364) and RP-152 (Motors No. 91655-1, 2, and 3). - These motors generally do not require lubrication in the field. Should it be found necessary, the plastic end cover should be removed and the rotor taken out. Care must be exercised not to disturb the center aligned stator laminations. A few drops of light machine oil (SAE 10 or lower) should be injected into the spindle receptacle.

RP-152 (Motor No. 91706-1) - After each 1000 hours of operation, the felt washers, on each end of the spindle, should be thoroughly saturated with a light machine oil (SAE 10 or lighter).

RP-153 - If the motor requires oiling, this may conveniently be done by means of two oil holes, one in the black collar surrounding the drive spindle bearing and another at the opposite end of the motor. A light machine oil (SAE 10 or lower) should be used.

RP-155 - After each 1000 hours of operation, if the motor requires oiling, it should be removed from the motorboard. A light machine oil (SAE 10 or lighter) should be used to saturate the felt washer adjacent to the bottom bearing (nearest lead damping weight). The spout of the oil can may be inserted in one of the holes on the top side, and a few drops injected on the top bearing.

RCA MFG. CO., INC.

QUESTIONS AND ANSWERS

RECORD CHANGER MECHANISMSTRIPPING - (Failure to Trip - Tripping ahead of time)

1. Q The friction clutch adjustment ("B" - in RCA-Victrola Service Notes) regulates tripping of the record-changing cycle when the pickup swings in the eccentric groove. Is friction clutch maladjustment always responsible for failure to trip and for premature tripping?

A Not always, although such conditions are often due to respectively too little and too great clutch friction, or to burrs and foreign material on the friction surfaces. Included among causes other than the friction clutch are the following:

Other Causes of Failure to TripOther Causes of Tripping Ahead of Time

- (a) Trip lever friction finger (7) on wrong side of stop stud.
- (b) Trip pawl (22) not free to move on shaft due to
 (1) Bind between bushing and stud
 (2) Bind between trip pawl and "drag" spring
- (c) Too much tension in trip pawl "drag" spring.

- (a) Trip pawl (22) touches latch rivet on motorboard side of gear (42).
- (b) Trip lever friction finger (7) hitting body of trip pawl (22) instead of trip pawl stop pin.
- (c) Burr on trip pawl (22) or gear latch (42)
- * (d) Trip regulator lever (21) out of engage with the trip lever stud (5)
- * (e) Stud on friction finger (7) getting over top of regulator lever (21)
- (f) Trip detaining lever (19) on wrong side of trip pawl pin (causes tripping on manual position)
- (g) Insufficient tension in trip pawl "drag" spring.

FOR ILLUSTRATIONS USED IN
 TEXT SEE RCA PAGE 430

*This does not apply to changers without a trip regulator lever (21).

2. Q Should the friction clutch be oiled or greased?

A NO. Any oil or grease present should be removed with quick-drying naphtha and a clean cloth to prevent erratic tripping.

3. Q What is the proper method of making the friction clutch adjustment?

A (1) Loosen adjusting screw ("B")(by turning in a counterclockwise direction) sufficiently so that tripping does not take place at the end of a record.

QUESTIONS AND ANSWERS

RCA MFG. CO., INC.

- (2) Play a 10-inch record. While pickup is traveling over the music grooves, tighten screw "B" just to the point where travel of the pickup towards the center of the record is seen to cause a uniform travel of the trip lever friction finger (7) towards the trip pawl.
- (3) Tighten screw "B" an additional half turn.
- (4) Check tripping at the end of a record.
4. Q A rough latch rivet (on the motorboard side of the drive gear, 42,) may be causing tripping ahead of time. How may it be repaired?
- A Using a fine file smooth down any rough rivet edges. It will be found more convenient to remove the gear from the motorboard. A warped gear will accentuate this condition. To provide greater clearance between the latch rivet and the trip pawl, the brass washer on the gear stud may be transferred to the motorboard side of the gear.
5. Q How may the trip pawl (22) drag-spring tension be adjusted?
- A Tripping difficulty may be the result of burrs or rough spots on the spring surface, or due to improper spring tension. The tension should be such that the trip pawl will readily move with applied force, but will not "coast." If the spring is suspected, remove the trip pawl assembly, inspect the spring for irregularities, and bend smoothly in the proper direction with a pair of long-nose pliers to increase or decrease tension, making sure that no irregularities or rough spots are introduced.

TONE ARM LIFT

1. Q What can be done to prevent binding of the tone arm in lateral motion
- (a) during record playing?
- (b) during record changing?
- A (a) If the pickup needle repeats grooves, this may be a sign of tone arm binding due to a friction clutch adjustment which is too tight. The remedy is to loosen and readjust as outlined under "Tripping - #2".
- (b) In case the tone arm hesitates, binds or locks while at its outermost position (away from the turntable) during the change cycle, the probable cause is binding of the friction lever pin (5) by a burr or constriction in the locating lever pawl slot.

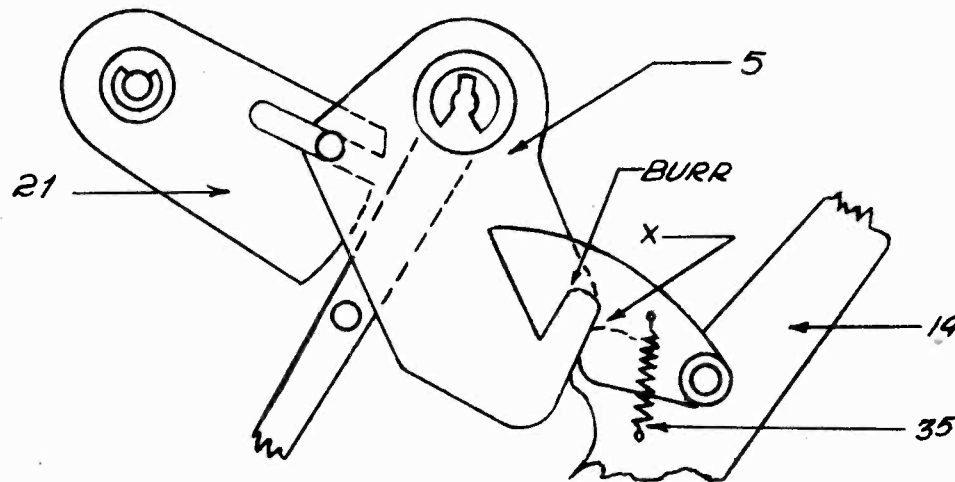
Should this be the case, smooth down the slot surface with a fine file, and apply a light machine oil such as 3 in 1. For this work, the locating lever (14) maybe removed from the motorboard after first disengaging the lever spring (35) from its motorboard stud, and removing the "C" washer (see sketch). Also see that the friction lever pin is not riding over the corner marked "X" in the sketch.

JAMMING

FOR ILLUSTRATIONS USED IN
TEXT SEE RCA PAGE 430

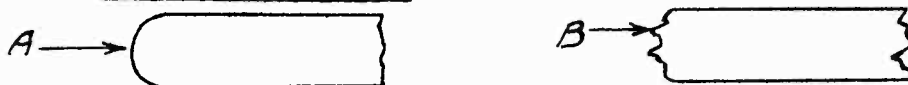
- A Due to improper record separation

1. Q What are the causes of improper record separation or "jamming" of the separator knives against the record edges?



A Although improperly adjusted knives, will of course cause jamming, this trouble is generally due to defective records. The defects are of three types:

- (a) Non-uniform thickness. Records which are either of greater or smaller thickness than standard records may easily cause trouble. If a 10-inch record, for example, is appreciably greater in thickness than the nominal .058 inches, there is a good possibility that the knives will jam against its edge. For a 10-inch record of appreciably less than .058 inches, there is a good possibility of jamming against the edge of the record immediately above it. Abnormally thin or thick records should not be used on automatic operations.
- (b) Rough edges. Record edges should be smooth and semi-circular in shape, such as (a) in the figure below. A record with edge shape as in (b) may cause trouble especially if it is warped or thicker than normal, or if the record below it on the stack is thinner than normal, or if the knife separation adjustment is slightly incorrect. Records with rough edges should be smoothed down with sandpaper.



- (c) Warpage. Warped records, besides giving "wow" reproduction, cause the same effect as records of non-uniform thickness, and non-uniform edges. Such records should not be used.

B Due to locking of trip pawl stop pin

2. Q Are there other causes of "jamming"?

QUESTIONS AND ANSWERS

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- A Another possible cause is locking of the trip pawl stop pin ("K" in Service Notes) against the main lever short arm causing loosening of main lever (15) and trip pawl (22) studs and breakage of the thick trip pawl stop pin "K". In all such cases, the pawl has not been cleared or kept out of the way for one or more of the following reasons:
- (a) The long main lever arm slides over the thin pawl pin instead of pushing against it during first half of cycle. CHECK FOR BENT MAIN LEVER ARM.
 - (b) After being cleared out of the way, the trip pawl bounces back due to vibration (dancing near the mechanism, etc). CHECK TRIP PAWL PHOSPHOR-BRONZE SPRING FOR SUFFICIENT "DRAG" OR PRESSURE AGAINST PAWL.
 - (c) The index lever is put into REJECT position while the mechanism is still in cycle. CAUTION CUSTOMER AGAINST THIS.

LANDING

1. Q How may 10-inch landing adjustment be made while the changer is in the cabinet?

A Follow the adjustment procedure outlined in the Service Notes up to the point where the tone arm set screws are about to be tightened. Tighten the blunt-nose screw to the point where it just grips the pickup arm shaft. Run the mechanism through cycle as a check, stopping just before the needle lands. Then if landing is obviously incorrect the pickup may be "forced" by hand outwards or inwards to the correct point. Run through another cycle as a check; after the correct landing has been obtained, tighten both adjustment screws.
2. Q How may the cone-pointed screw on 10-inch landing adjustment be identified from the blunt-nose screw without removing either?

A In sketch "D", the screw at the right is the cone-pointed screw - this is nearest the right hand side of the mechanism.
3. Q Once the cone-pointed landing adjustment screw has been tightened, it is difficult to obtain adjacent adjustments because the screw point tends to settle into its original groove. How may this be overcome?

A Move the set-screw collar either up or down the pickup arm shaft a trifle to permit a new position for the cone point. Be sure that a slight amount of play (1/32-inch) is left between the pickup arm bearing and the set-screw collar.
4. Q What is the cause of a pickup suddenly "flopping" heavily on the record during landing?

A (a) Improper height adjustment (see adjustment "C")

(b) This may be due to the pickup lift cable being pinched or bound during the part of the cycle that the pickup should be descending

RCA MFG. CO., INC.

QUESTIONS AND ANSWERS

gradually. The sudden release allows the pickup to fall before the slack in the cable is taken up.

5. Q How may erratic landing be overcome?

A This trouble, in which the pickup lands near the correct point but varies on successive trials, maybe due to loose staking between the set-screw collar and the trip lever. The remedy is to clamp firmly in a vise, and stake the set-screw collar sharply over the trip lever.

6. Q What causes the tone arm to land near the needle box, with the motor still running?

FOR ILLUSTRATIONS USED IN
TEXT SEE RCA PAGE 430

A This may be happening because

(a) the locating lever is not getting through the record discriminating lever latch to get to the step "T" (see Service Notes No. 40, page 13, sketch "D"); or

(b) the locating lever proper hits the discriminating lever stop before the pin has had the opportunity to reach step "T".

7. Q On 12-inch landing adjustment (sketch "E", why must the eccentric stud be kept below the center line?

A To prevent obtaining a false landing adjustment. Usually, two positions of the eccentric one above and one below the center line will determine the same landing point on a 12-inch record; however, only the position below the center line will be the true one. A setting above the center line will interfere with the already set 10-inch adjustment; this will **cause incorrect landing on 10"-records**

TRACKING INTO FIRST PLAY-GROOVE

1. Q Records manufactured since 1937 contain a starting groove which serves to "track" the needle from its landing point into the first play-groove. Will RCA changers "track" on older records without starting grooves?

A Yes. Should it be found that an RCA Victor changer does not track, proceed as follows:

1. See that the instrument is level (use a machinist's spirit level); a slope downward from left to right may be the cause - raise the right-hand side of cabinet by placing thin spacers under the legs.

2. Look for the following:

(a) bind in the trip lever (20) stud.

(b) bind in the trip regulator lever (21) slot or between trip finger (7) pin and trip regulator lever (21) corner

(c) a very tight friction clutch (5) (see question 2 under Tripping)

(d) cable twisted at bottom of pickup arm pivot

(e) pickup arm starting spring (26) binding on bracket

(f) main lever (15) does not release clutch lever (5) from locating lever pawl (28) properly.

QUESTIONS AND ANSWERS

RCA MFG. CO., INC.

3. Increase tension of pickup arm starting spring (26) by cutting off 1/2 turn.
2. Q What is the cure for a needle sliding over several play-grooves after landing?
- A 1. The needle may be badly worn - or broken. Try a new one.
2. See that the instrument is level (use a machinist's spirit level), a slope downward from right to left may be the cause - raise the left-hand side of the cabinet by placing thin spacers under the legs.
3. Ease up a trifle on the pickup-arm starting spring (26) tension.

STALLING

1. Q What should be done to prevent stalling of the RP-152 mechanism?

A Stalling going into cycle

1. Increase main lever spring tension by inserting an additional metal washer between the spring and its guide (11).
2. Check for oil on the drive disc rubber tire (under the turntable). Any oil should be removed by means of a quick-drying naphtha solution and a clean cloth.

Stalling coming out of cycle (pickup at farthest distance from turntable)

1. Decrease main lever spring tension by removing any metal washers between the spring and its guide (11).

TURNTABLES AND TURNTABLE DRIVES

1. Q What causes turntable spindle bearings to bind?

A Binding may take place due to

- (1) lack of lubrication. Houghton Stayput #240 oil may be used at this point.
- (2) a bent spindle. The spindle tip should not be more than 1/32 inch from the vertical.

2. Q Must the turntable be removed in order to oil the turntable spindle bearing on the RP-152 mechanism? How may this be done?

A It is necessary to remove the turntable; however, this is relatively easy. The turntable spindle is fastened by a screw to the turntable shaft drive gear below the motorboard. To release the turntable it is necessary only to remove this screw.

3. Q How may the turntable on VHR models be removed?

A Pull the turntable upwards with the fingers. At the same time hit the spindle tip smartly with a light hammer.

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QUESTIONS AND ANSWERS

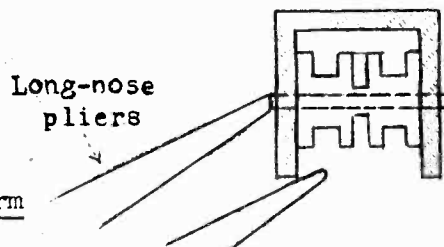
4. Q Of what material is turntable spindle bearing?
A Brass
5. Q Can turntable flock be conveniently repaired or replaced?
A Yes - consult your distributor.
6. Q May rubber tires for drive discs be ordered separately?
A Yes. This is listed as follows:

Stock No. 37873 Rubber Drive Tire for RP-152 (V-200, V-205, etc)

MISCELLANEOUS

1. Q How may the tone arm be removed for pickup replacement?
A To remove tone arm

Remove each of the two pins with the use of a pair of long-nose pliers, (see sketch below). A slight pressure on the handle is sufficient to drive out the pin. The pickup will now be open to view.



Using a hard smooth surface as a backing to take up shock, hammer in each pin.

2. Q What lubrication is necessary on RCA Victor record changer mechanisms?
A Besides motor bearings (see section on "Motors") the only other part on RCA-Victor mechanisms that may require occasional lubrication is the turntable spindle bearing. Houghton's Stayput #240 is recommended. Oil or grease on the friction clutch (5), and on the drive disc rubber tire will cause erratic operation. Remove with a quick-drying naphtha and a clean cloth.
3. Q What is the cause of sticking record separator shafts?
A Look for
(1) bind between shaft and gear (10) or in gear slot.
(2) a binding rack at its main lever stud (40) (41) (15) keeping pressure on the rack gears.
(3) binds in racks and rack slots.

The above may also be the cause of erratic shelf action.

4. Q Why does RCA continue to hold to a fairly complex mechanism in view of several "simpler" mechanisms now on the market?

QUESTIONS AND ANSWERS

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- A RCA changers operate on the eccentric groove principle. This means that RCA mechanisms will trip properly on all records having such a groove regardless of its position on the record. In other words, the eccentric groove need not be at a fixed distance from the record's center. This flexibility is important when we consider that the groove was not standardized by record manufacturers at a fixed distance from the record center until 1933. Thus, on records made from recordings cut previous to 1933 the eccentric groove was cut in at the end of the selection, this position varying considerably from record to record. Some of these older recordings have been so popular that records continue to be made from them. It would be easier for RCA to design a simpler mechanism which would trip only when the pickup had reached a definite point or "common diameter" on the record. Such a mechanism, however, would be useless to the customer whose record library includes a number of the "non-standard" records. The "simpler" mechanisms now on the market will invariably be found to operate on the common diameter principle. Their operation is limited to standard records.
5. Q What is the time duration of a record-changing cycle?
- A Six revolutions, or approximately 5 seconds.
6. Q Does RCA recommend playing 10" and 12" records in mixed sequence?
- A NO.
7. Q Can speed be adjusted on friction drive instruments?
- A (a) Synchronous Motor - NO
(b) Induction Motor - to lower - insert series rheostat
- to raise - use step-up transformer
8. Q What are the various possible causes for failure of crystal pickups?
- A (a) Mechanical breakage (due to dropping of tone arm on turntable, etc.)
(b) Dehydration due to excessive heat or dryness.
(c) Loss of output due to moisture causing leakage.
(d) Connection of record player output leads to power line or plate voltage.
1. Q. Why doesn't RCA provide knob control for cutter pressure adjustment?
- A. Once pressure has been correctly adjusted for one type of disk, no readjustment is necessary for that type. Knob control might tempt the layman to tamper unnecessarily with the adjustment.
2. Q. Does cutter pressure have to be readjusted when changing from one type of disk to another?
- A. Due to variations in material composition and hardness among different types of disks, the same cutting pressure adjustment will not give equal depth of cut on all types. Thus, it may be necessary to change adjustment when recording on a different type of disk.
3. Q. What is the cause of the high frequency whistle or squeak which sometimes appears during cutting of "Phonograms"? How can it be prevented?

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- A. This sound originates in chatter of the stylus as it is cutting the "Phonogram". This usually occurs when the stylus is blunt, loose in its holder, or cutting at a slightly incorrect angle. The remedy consists of (1) Tightly inserting a new, perfect stylus or (2) Slightly repositioning the stylus in its holder.
4. Q. Can the cutter crystal be overloaded to the point of breakage?
- A. No. The crystal is sufficiently strong to withstand much higher voltages than the maximum obtainable (606 V.) on modulation peaks.
5. Q. How does the crystal cutter compensation network function?
- A. (a) It is essentially a network whose tone response combined with that of the cutter results in a relatively flat overall tone response curve. (b) Because the cutter response peaks sharply at 6000 cycles the compensation network is designed to begin cutting off at about 4500 cycles.
6. Q. How much signal voltage is applied to the cutter head?
- A. At the maximum undistorted power output of 12 watts (VHR-207, 407) 430 volts r.m.s. or 608 volts peak is being applied to the cutter head. On model VHR-202, the corresponding figures are 350 volts r.m.s. or 495 volts peak.
- 7.(a)Q. What is the function of the speaker matching load on VHR models?
- A. When cutting disks with loudspeaker turned off, the cutter is correctly matched to the output tubes. If, then, the voice coil is connected directly, mismatching results. To restore balance, a matching load consisting of R39 and L15 (VHR-207, 407), is used to offset the unbalance due to the speaker.
- (b)Q. Is there another reason for the use of the resistor (R39) and the AF choke (L15), in the voice coil circuit of Model VHR-207, 407?
- A. In the recording of a radio program on Models VHR-207, 407, aural compensation is kept out of the cutter circuit, by inserting 100,000 ohms, R-32, in series with the aural compensation network. Because as much as 5 watts audio power is needed for cutting whereas the listening level may be only 100 milliwatts, a dropping resistor, R39, is used in series with the speaker voice coil. To restore bass response, R39, is shunted by an A.F. choke, L15.
- 8.(a)Q. Why is a 12 V₄ tube (12 K7GT) used as a microphone amplifier on VHR-207, 407?
- (b) Why does the 12K7GT use d.c. on filaments while rest of tubes use a.c.?
- (c) Why does VHR-202 use 6Q7 for voice amplification while VHR-207, 407 use 12K7GT as microphone amplifier?
- (a)A. The 12K7GT is the only multi mu (remote cut-off) tube available at present which has a shielded base. Due to the low input level and the high amplification needed in this stage, this freedom from hum is an important consideration.
- (b) D.C. on the filaments is a further precaution against hum. Since the 12K7GT draws only 150 m.a. filament current, the set power supply is used without fear of overloading.

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- (c) The VHR-207, 407 contractor circuit requires a remote cut-off tube such as the 12K7GT; the VHR-202 does not contain this circuit and thus can use a tube such as the 6Q7.
9. Q. Does the height of the recording arm (within workable limits) above the turntable affect recording?
- A. Provided the recording arm is not allowed to interfere with the cutting pressure, the height of the recording arm above the turntable does not appreciably affect recording.
10. Q. What is time - constant of contractor biasing circuit?
- A. The time constant is approximately one second.
11. Q. Why is the follower-arm guide made flexible?
- A. The vertical flexibility of the guide is an important design contribution to foolproof operation in unskilled hands.
12. Q. What is the cause of rumble? How may it be prevented?
- A. Rumble is a low frequency vibration which appears sometimes during reproduction of home recordings. It has its origin in the motor whose vibration is transmitted to the turntable and to the cutter. During cutting this vibration may be superimposed on the selection or voice frequencies being recorded.

Due to many preventives incorporated in the design of these instruments, rumble will not be recorded if the following precautions are observed:

Leveling - See that the instrument is perfectly level.

Freeness - Be certain that the motorboard and mechanism is "floating" free from cabinet. All four mounting springs should be at approximately equal tension.

Follower Arm Damping Weight - See that the lead weight is in place attached to the follower arm underneath the motorboard.

Stylus - Make sure that a perfect stylus is tightly inserted in the cutter head. Because both stylus and retaining screw are of hard steel there is a tendency towards loosening during cutting. Tightness should be checked before each cut.

Input Level - Set for sufficient input level so that the "Magic Eye" just closes on modulation peaks.

Tone Control Settings - During recording, the power-bass control should be set for maximum lows, just beyond the click of power switch. The treble tone control setting will depend on the degree of potential rumble present. For extreme cases, it should be set for minimum highs during recording only, in order that the low frequencies in the selection or voice may have a full chance to mask any possible rumble.

Depth of Cut - During recording, the shavings should be directed towards the spindle and prevented from obstructing the cutter path. The thickness of these shavings should be about that of human hair, or approximately .003 inches. An

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additional check on depth of cut is to inspect the recording under a magnifying glass. The groove width should approach but not exceed the distance between grooves. Depth of cut may be varied by means of the cutting-pressure adjusting screw at the top of cutter arm.

Turntable Drive - If rumble persists, inspect the idler wheel (between motor spindle and turntable) for possible runout, flat spots, and scraping against bottom of turntable. Inspect the motor spindle sleeve or pulley (Stock No. 37037) which drives the idler wheel for possible eccentricity. Also inspect the turntable surface, which contacts the idler wheel, for rough spots. These may be removed by rubbing lightly with an abrasive such as sandpaper.

Recording Discs - Due to variations in material composition and hardness among different types of discs, the same cutting-pressure adjustment will not give an equal depth of cut on all types. Thus, it may be necessary to change the adjustment previously set for one type of disc, when recording on a different type.

NEEDLES

1 Q How may the various RCA-Victor reproducing needles be classified?

A	<u>Needle</u>	<u>Number of Playings</u>	<u>Special Characteristics and Uses</u>
	Green shank chromium	up to 50 10" sides	high fidelity; excellent for use in automatic changers.
	Red Seal	up to 10 10" sides	low "needle chatter" and low scratch content.
	Steel	1	high fidelity; availability in "soft," "full," and "extra loud" provides means of volume control in manual-acoustical phonographs. Low scratch content.
	Tungstone	up to 25 10" sides	multi-playing; availability in "soft," "full," and "extra loud" provides means of volume control in manual-acoustical phonographs.
	Long-Life	" " 1000 10" sides	long life; high-fidelity; excellent for use in automatic changers.

2 Q What causes "needle chatter"?

A "Needle Chatter" is the name given to the sound reaching the ears by direct radiation from the pickup. As the needle tracks in the record play-groove, it is modulated and forced to vibrate. On passages of high intensity, this vibration is sufficiently strong to be audible.

QUESTIONS AND ANSWERS

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- 3 Q How may "needle chatter" be minimized?
- A Many RCA-Victor 1941 models contain the "Tone Guard" which does an excellent job of acoustically attenuating "needle chatter".
- 4 Q Compare frequency response of the sapphire vs RCA Long Life needle vs RCA chromium plated needle.
- A Frequency response is a function more of size and shape than of material, so that in the test of identically shaped needles in these three types, little difference could be noted among the respective responses. Both the RCA Long Life needle and the RCA Chromium-Plated needle are designed for high-fidelity reproduction.
- 5 Q Which RCA-Victor needle is best for use in playback of home recordings?
- A Anyone of the following may be used with good results provided it has not been previously used and reinserted in the pickup: Long Life, chromium, Red Seal and steel.
- 6 Q How does the "cactus" type needle affect frequency response and record wear?
- A Frequency response: Lack of rigidity causes loss of the high frequencies.
- Record wear: Although this type needle contributes little actual record wear, small pieces of the fibre ingrain themselves into the record and effectively shorten its life.
- 7 Q May sapphire stylii be resharpened at the RCA Plant?
- A Yes. RCA supplies a resharpening service for MI-4878-A sapphire stylii. Consult your RCA distributor for details.

RECORDS AND HOME RECORDING DISCS

- 1 Q (a) What causes surface noise in records?
(b) How do Victor Red Seal and Black Seal records compare with regard to surface noise?
- A (a) Several compounds are used in the manufacture of phonograph records. The most common is that of a cotton binder, a mineral filler, carbon black, and a combination of shellac and other resins. These materials are finely powdered, carefully measured and thoroughly mixed. If grit or other foreign material is present, or if the compound materials are too coarse, objectionable surface noise results during reproduction due to modulation of the needle by these random particles.
- (b) Both Red Seal and Black Seal Victor records compare favorably with the best of competitive records from the standpoint of surface noise. Of the two, Red Seal records have less noise due to finer selected materials, and to more finely ground and more expensive fillers.

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2 Q Home recordings made on Deluxe Recording Discs seem to have less needle scratch (surface noise) than commercial Bluebird and Victor records. To what is this due?

A To insure long playing life and to prevent premature groove breakdown by worn needles, commercial records are made of comparatively hard material containing a small percentage of abrasive. Small irregularities which would be overcome by the pickup inertia in the soft home recording disc sometimes causes an audible noise in the commercial type.

3 Q By what process is the recording disc material placed on the metal base?

A By a special horizontal spray process. The former dipping system has been superseded because of difficulty in obtaining a uniform coating of material.

4 Q What is the average playback life of various recording discs?

A 25 to 50 playings on the average depending on pickup mass and stiffness and assuming, of course, that good reproducing needles are used.

5 Q Are "hardening" preparations for home recording discs of any value?

A These preparations have yet to be proved consistently effective; they are at the present obsolete.

6 Q What is the remedy for rough-edged records?

A Smooth down with a fine abrasive such as sandpaper. A rough-edged record is often the cause of "jamming" on automatic record changers.

7 Q At times the top record will slide on the others during playing. What causes this?

A This is due to either or both of the top two records being so warped that there is insufficient contact area.

8 Q How can record warpage be avoided?

A (1) By correct storing (see next question).
(2) By removing records from the record changer shelves after playing.

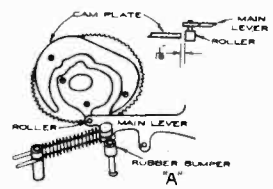
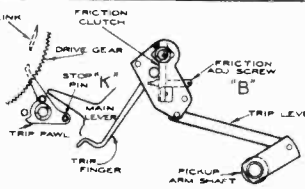
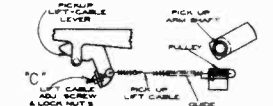
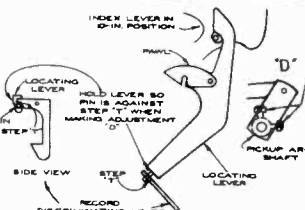
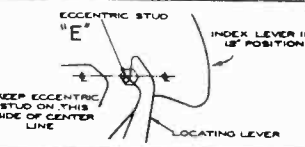
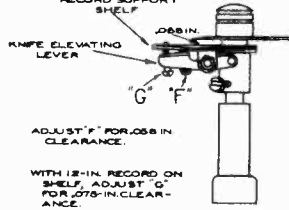
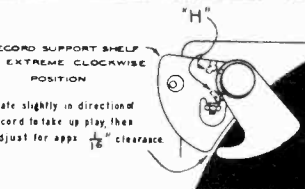

9 Q How should records be stored?

A They should be stored on edge (vertically) in an even-temperature, dry space.

MODELS RP-152 Series,
RP-153, RP-155

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Quick-Reference Chart for Automatic Record Changer Adjustments

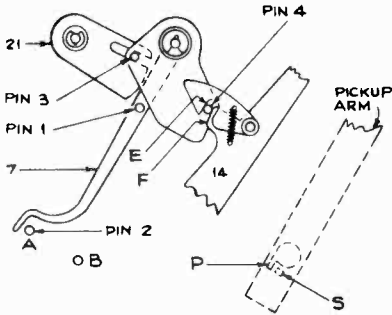
<p>General irregularity of operation.</p>	<p>With changer "out-of-cycle," the roller on main lever should clear the cam plate by 1/16-inch. Bend the rubber bumper stud, if necessary, to obtain this clearance.</p>	
<p>Fails to trip at end of record.</p>	<p>Increase clutch friction by turning clutch screw clockwise.</p>	
<p>Needle repeats grooves (does not follow the groove). Change cycle starts before record is finished.</p>	<p>Decrease clutch friction by turning clutch screw counter-clockwise. These troubles may also be caused by a defective record, binding of the pickup-arm bearing, twisted pickup output cable, or rubbing between the friction finger and the index-lever finger.</p>	
<p>Pickup arm strikes lower record in stack. Pickup needle drags across top record on turntable.</p>	<p>Rotate the changer "in-cycle" to the point where the pickup arm is raised to its maximum height above turntable plate, and has not started to move outward. Adjust the lift-cable screw and locknuts so needle point is 1-inch above top surface of turntable.</p>	
<p>Needle doesn't land at correct point on 10-inch record. (The correct landing point is 4-5/8 inches from the nearest side of the turntable spindle).</p>	<p>Place 10-inch record on turntable, push record-discriminating lever to forward position, push index lever to "reject" and return it to "10." Rotate mechanism through cycle until needle is just ready to land on record. Hold pin on locating lever against stop "T" as shown, loosen the two set screws at pickup arm shaft, and move pickup so needle is about 1/32-inch beyond the outer groove of record. See that there is 1/32-inch play between the pickup-arm bearing and set-screw collar, then tighten one (the blunt nose) set-screw. Run mechanism through cycle as a check, and then tighten the cone-pointed set screw.</p>	
<p>Needle doesn't land at correct point on 12-inch record. (The correct landing point is 5-5/8 inches from nearest side of spindle).</p>	<p>Adjust for correct 10-inch landing, as described above, then place 12-inch record on turntable, push index lever to "reject" and return it to "12." Rotate mechanism through cycle until needle is ready to land on the record. Turn eccentric stud to bring pickup needle about 1/32-inch beyond the outer groove in record. (Keep eccentric on stud toward rear of motorboard as indicated.)</p>	
<p>Record knives strike edge of records. (This is generally due to warped records, and records with rough edges).</p>	<p>It is essential that the spacing between the knife and the record shelf "27" be accurately maintained. The spacing for the 10-inch record is nominally .058 inch, and for the 12-inch record is .075 inch. To adjust, rotate the knife to the point of minimum vertical separation from the record shelf and turn screw and locknut "F" to give .055—.061 inch separation. Screw "G" must not be depressed during this adjustment. After setting screw "F," adjust screw "G" so that when its tip is depressed flush with top of record shelf, the vertical spacing between the knife, in its lowest rotational position, and the shelf, is .072—.078 inch.</p>	
<p>Records are not released properly, or do not fall flat. (If record shelves are bent, or not perfectly horizontal, improper operation and jamming of mechanism will result).</p>	<p>Place a 12-inch record on the turntable, rotate mechanism to point in cycle where the shelves have turned clockwise as far as the mechanism will turn them. Lift record up so it is in contact with both knives and check clearance between record and edges of shelves. It should be 1/16-inch as shown. If the clearance at either or both shelves is not correct, loosen set screws "H" and shift the shelves to obtain this clearance, with the backlash taken up by pressing the shelves toward the record. Tighten one set screw (the blunt-nose one), run mechanism through cycle several times to check action, then tighten the other (cone-pointed) set screw.</p>	
<p>Pickup arm support bent too low, or too high.</p>	<p>Bend the support (which is associated with the pickup arm bearing, so that with the mechanism out of cycle, the lower front edge of the pickup arm is 5/16-inch above surface of motorboard.</p>	
<p>Roller on main-lever won't enter cam.</p>	<p>Bend the trip pawl stop pin so that the roller on end of main lever, when entering the cam, will definitely clear the cam outer guide plate as well as the nose of the cam plate. (Adjustment "K.")</p>	
<p>Needle lands in 10-inch position on 12-inch record, or misses record when playing both types mixed.</p>	<p>Increase pressure of flat spring "M" at bottom of record discriminating lever.</p>	
<p>Needle fails to enter starting groove.</p>	<p>Raise the right-hand side of cabinet by placing thin spacers under legs.</p>	
<p>Needle slides over a few grooves in landing.</p>	<p>Raise the left-hand side of cabinet by placing thin spacers under the legs.</p>	

RCA VICTROLA MECHANISM DATA

RP-152, RP-153, RP-155:

The following changes have been made in these Record Changers:

- (a) Removal of Trip Regulator Lever (Part 21).
- (b) Removal of Pin 1 on Trip Lever Friction Finger (Part 7).
- (c) Repositioning of Stop Pin 2 from position "A" to position "B".
- (d) Removal of Pin 3. Since this pin does not interfere with the operation, it has been left in some mechanisms.



Trip Regulator Lever (21) is Removed in Some Production.

The Trip Regulator Lever was formerly used to prevent premature tripping due to a too early return of the Trip Lever Friction Finger at the end of each changing cycle. The same result is obtained by removing the Trip Regulator Lever and repositioning the Trip Finger Stop Pin as shown in the diagram.

Binding or Hesitation of Tone Arm:

This may be due to the following causes:

- (1) Small burr on edge "E." Correction: Carefully remove burr with a fine file until edge is entirely smooth.
- (2) Binding of Pin 4 between edges "E" and "F." Correction: File off edge "F" with a fine file to give just enough clearance for smooth operation.
- (3) Too far an outward swing of the Pickup Arm. This causes Pin 4 to be caught in the upper curved portion of edge "F." Correction: On some models the Pick-up Arm Shaft can be rotated by loosening the nut under the motor board. Rotate sufficiently to prevent Pin 4 from riding into curved portion mentioned, when Pick-up Arm is in the outermost position.

On models where the Pick-up Arm Shaft is positioned by a locating key, it is necessary to bend Stop Guide "S" on Pick-up Arm towards Stop Ear "P" on Pick-up Arm Shaft so that the condition mentioned in the above paragraph is obtained.

RP-152 SERIES

No. 38304 Spindle Bearing and Washer:

The turntable spindle bearing and washer for the RP-152 Series automatic record changer mechanism, used in Models VA-15, V-170, V-200, V-201, V-205, V-300, and V-405, are now stocked as No. 38304.

FLOCK FOR RP-152 TURNTABLE

Dark taupe colored flock is available as Stock No. 37952 (3/4 lb. package) for turntable repair on RP-152 series record changers used in Models V-170, V-200, V-201, V-205, etc. The

method of applying the flock is described on page 12 of the 1938 Bound Volume.

"RP" vs. "MODEL" NUMBERS

RP-139A and RP-145 mechanisms are used in models U-40, U-42, U-43, U-44, and U-45. RP-152 and RP-153 mechanisms are used in the following models:

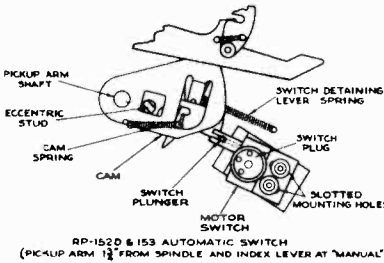
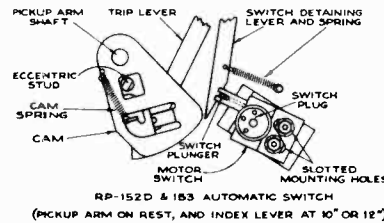
Model No.	Mech. No.	Model No.	Mech. No.
VA-15	RP152	V-300	RP-152J
V-170	RP-152	V-301	RP-153
V-200	RP-152A	V-302	RP-153
V-201	RP-152A	V-405	RP-152J
V-205	RP-152B		

RP156 mechanism is used in the home-recording models VHR-202, 207, 307, and 407.

RP-152D AND RP-153

Automatic Switch Adjustment:

In RP-152D and RP-153, an automatic motor switch is mounted under the motorboard, near the pickup arm shaft.



When the index lever is set at its "10-inch" or "12-inch" position, a detaining lever holds the switch plunger in and keeps the motor running.

When the index lever is set at its "manual" position, the detaining lever moves aside and the switch plunger is then actuated by a cam on the pickup arm shaft. In "manual" position, when the pickup is on its rest, the switch plunger is out and the motor circuit is open. When the pickup is moved from its rest to the edge of a 12-inch record, the cam pushes the switch plunger in and the motor starts. When the pickup needle reaches a point 1 1/2 inches from the centerline of the turntable spindle, the switch plunger is released by the sharp corner of the cam, thus shutting off the motor.

When the pickup is lifted off the record and moved to its rest, the motor starts momentarily. **ADJUSTMENTS:**

The slotted switch mounting holes permit positioning of the switch so that the plunger will be pushed in by the cam.

The eccentric stud on the cam should be turned so that the switch plunger is released by the sharp corner of the cam when the pickup needle is 1 1/2 inches from the centerline of the turntable spindle.

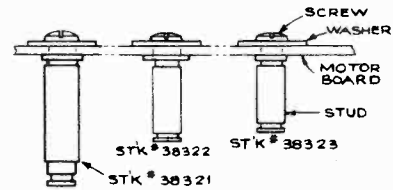
REPLACEMENT STUDS

For Main Lever, Cam-and-Gear, or Trip Pawl:

In automatic record changers of the RP-139A, 145, 152, 153, 155, and similar types, loosening of the mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted may be caused by jamming of the main lever against the pawl pin at the end of the change cycle due to one or more of the following reasons:

- (a) The long arm of the main lever slides over the thin pawl pin instead of pushing against it during first half of cycle. Check for bent arm on main lever.
- (b) After being cleared out of the way, the trip pawl bounces back due to vibration (dancing near mechanism, etc.) Check the trip-pawl phosphor-bronze spring for sufficient "drag" or pressure against the pawl.
- (c) The index lever is put into "REJECT" position while the mechanism is still in its change cycle. Caution customer against this.

Loose studs may be quickly and easily replaced by using special replacement studs that are fastened to the motorboard by means of a screw and washer. Three different studs are available:



- | | | |
|-----------|-------|---|
| Stock No. | 38321 | Main Lever replacement stud, with screw and washer... |
| | 38322 | Cam-and-Gear replacement stud, with screw and washer. |
| | 38323 | Trip Pawl replacement stud, with screw and washer... |

VHR-202, 207, 407 50-Cycle Motor Parts:

Stock No.	Description	Unit List Price
37943	Bearing—Bottom bearing and bracket (50 cycle).....	\$.50
37945	Field—Motor field—110 volts, 50 cycles.....	7.75
37941	Motor—105-120 volts, 50 cycles.....	14.00
37944	Pulley—Motor shaft pulley (50 cycle).....	.35
37942	Rotor—Motor armature (50 cycle).....	4.25

Parts originally listed in RP-155 Service Notes (VHR-202, VHR-207, and VHR-407) are applicable to 110 volts, 60 cycle motor only, except Stock No. 37040 Ring, which is used on both 60 and 50 cycle motors.

V-301, V-302

Mechanical Motor Noise:

Mechanical motor noise due to armature end play sometimes develops with wear in the above instruments which use type RP-153 record changers. This can be eliminated by tightening the armature thrust bearings. Care should be taken to avoid making them too tight which will cause binding.

REPLACEMENT OF RUBBER TIRES

On Turntable Drive Discs:

1. Remove old tire by stretching and pulling over drive disc edge.
2. Thoroughly clean drive disc to remove burrs or foreign particles.
3. Place new tire over the drive disc. Avoid any twisting or excessive stretching of the tire.
4. Roll disc and tire on a flat clean surface while simultaneously applying a slight downward pressure on the disc shaft. This will allow the tire to seat itself properly in the "V" shaped groove on the drive disc and take up for any uneven stretching of the rubber tire.
5. Clean rubber tire with carbon tetrochloride (Carbana).

MODELS U-9, U-10, U-12

Turntable Assembly Stock No. 33899:

The turntable and tire assembly Stock No. 33899 is superseded by: Stock No. 37971—Turntable and spindle, less tire Stock No. 37872—Tire only

SUPPLEMENTARY DATA

VHR-202, 207, 407

"Rumble":

Any instrument with the sensitivity and tone response of these home recorders is capable of picking up the mechanical vibrations of the motor. However, due to many preventives incorporated in the design of these instruments, rumble will not be recorded if the following precautions are observed:

LEVELING—See that the instrument is perfectly level.

FREENESS—Be certain that the motor-board and mechanism is "floating" free from the cabinet. All four mounting springs should be at approximately equal tension.

FOLLOWER ARM DAMPING WEIGHT—See that the lead weight is in place attached to the follower arm underneath the motorboard.

STYLUS—Make sure that a perfect stylus is tightly inserted in the cutter-head. Because both stylus and retaining screw are of hard steel there is a tendency towards loosening during cutting. Tightness should be checked before each cut.

INPUT LEVEL—Set for sufficient input level so that the "Magic Eye" just closes on modulation peaks.

TONE CONTROL SETTINGS—During recording, the power-bass control should be set for maximum lows, just beyond the click of power switch. The treble tone control setting will depend on the degree of potential rumble present. For extreme cases, it should be set for minimum highs during recording only, in order that the low frequencies in the selection or voice may have a full chance to mask any possible rumble.

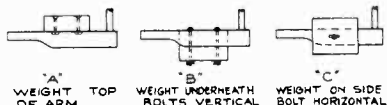
DEPTH OF CUT—During recording, the shavings should be directed towards the spindle and prevented from obstructing the cutter path. The thickness of these shavings should be about that of human hair, or approximately .003 inches. An additional check on depth of cut is to inspect the recording under a magnifying glass. The groove width should approach but not exceed the distance between grooves. Depth of cut may be varied by means of the cutting-pressure adjusting screw at the top of cutter arm.

TURNTABLE DRIVE—If rumble persists, inspect the idler wheel (between motor spindle and turntable) for possible runout, flat spots, and scraping against bottom of turntable.

RECORDING DISCS—Due to variations in material composition and hardness among different types of discs, the same cutting-pressure adjustment will not give an equal depth of cut on all types. Thus, it may be necessary to change the adjustment previously set for one type of disc, when recording on a different type.

Follower-Arm Weight:

Two other methods, besides the one shown in the Service Notes, have been used in attaching the lead weight to the recorder follower arm. These are indicated in the following sketches. All three provide similar results, "C" being the method used in latest production.



Three Mounting Arrangements of Follower-Arm Weight on Home Recording Models

The weight is packed separately for methods "A" and "B" and must be mounted as shown when the instrument is installed in the consumer's home. Excessive "rumble" occurs when the weight is not in place.

Pickup Arm Starting Spring:

The pickup arm starting spring in RP-155 mechanism in the home-recorder models is Stock No. 36278.

Motorboard Mounting Spring:

Change Stock No. of Mounting Spring from 31470 to 37878 (4 required).

RCA MFG. CO., INC.

RP-145, RP-152 RECORD CHANGER

Centering Motor:

Should centering of the rotor be necessary, it may be accomplished quickly in the following steps:

- Remove the two long machine screws, and lift off plastic end cover.
- Loosen the two remaining screws sufficiently to permit adjustment of stator laminations.
- Insert a .010-inch speaker shim between the rotor and each of the four stator field poles. Rotor should now be equidistant from each pole, and accurately centered.
- Tighten screws and replace plastic cover.

RP-152 RECORD CHANGER

Stalling Going into Cycle:

The mechanism should be loaded with one record on the turntable. If stalling going into cycle takes place, it is probably due to insufficient tension in the main lever spring or booster spring (43). An additional metal washer should be inserted between the spring and its guide.

Stalling Coming Out of Cycle:

If the mechanism stalls just as it is coming out of cycle, that is, when the pickup is at its farthest distance laterally from the turntable, it is probable that there is too much tension in the booster spring. Any metal washers in this assembly should be removed.

CAUTION: The mechanism is designed to handle a total of 8—10-inch records or 7—12-inch records.

RP-153 RECORD CHANGER

Motor Data:

Should it be necessary to rebuild or service any of these motors in the field by replacing end heads or using new rotors and shafts, it must be noted that the rebuilt motors should be operated continuously for at least 48 hours before installation. The use of bronze bearings, diamond-bored for accuracy, together with the burnished steel shaft at the rotor provides a very close fit. As a result, the motor must be run in approximately 48 hours, after which the oil has had a chance to fairly cover all contact surfaces of shaft and bearings, and a very smooth-operating long life bearing results.

RP-152, -152A

Tendency to Stall:

Some RP-152 and -152A automatic record changer mechanisms in Model VA-15, V-170, V-200, and V-201 use a motor identified by stamping number 91706-1. Slow speed and



Motor Stamped No. 91706-1 Used in Some RP-152, -152A Automatic Record Changers.

tendency to stall in this motor may be due to the motor bearings becoming misaligned with respect to the motor spindle.

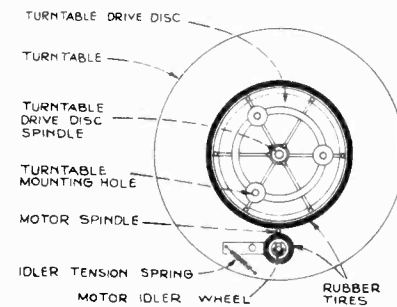
In most cases, the motor spindle may be freed by tapping the stator laminations while the motor is in operation.

For a permanent remedy it is advisable to install an idler wheel assembly to reduce side thrust on the motor bearings. The following parts are required:

Stock No.	Description	Unit List Price
1—36274	Idler wheel	.55
1—36275	Idler wheel arm	.25
2—33726	"C" washer for idler wheel	.02
1—30585	Spring for idler	.06

Installation Instructions:

- Remove one of the two motor support springs.



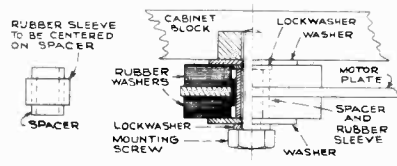
Arrangement of Idler Wheel Assembly to Improve RP-152, -152A Using Motor 91706-1

- Remove the turntable by removing the screw in the turntable spindle drive gear below the motorboard.
- Mount the idler wheel by means of a "C" washer on the single end stud of the idler arm.
- Install the idler assembly in place on the motor board as shown in accompanying sketch and fasten by means of the second "C" washer.
- Connect the tension spring between the end of the idler arm and the motorboard pin (below motorboard).

RP-153 (V-301, V-302)

Motor Hum:

Excessive hum may be caused by incorrect assembly of the rubber grommets on the two bolts that fasten the motor-mounting plate to the cabinet. The correct assembly is shown in the sketch. The rubber sleeve must be centered on the metal spacer so that the motor plate can not come in metallic contact with the spacer.



RP-153 MOTOR MOUNTING ARRANGEMENT

Excessive Motor Hum will Result in RP-153 if the Rubber Sleeves are not Centered on the Metal Spacers.

V-170, V-200, V-201

Rumble:

Rumble is related to motor vibration, combined with high gain amplifier, and prominent bass response.

The vibration of the motor in these instruments is as low as it can be made: Do not replace it to correct rumble. Rather, reduce the low-frequency response by shunting a 50,000-ohm ¼-watt resistor across the crystal pickup terminals.

V-205-A

Using RP-153 Automatic Mechanism:

A limited number of V-205 instruments contain the RP-153 record changer. These are labeled V-205-A. Refer to Service Note on RP-153 for service data and replacement parts.

NEW TYPE AUTOMATIC VICTROLA AND ELECTROLA

The information contained in this Service Bulletin is intended as a guide in making adjustments to the following automatic operating units:

10-35 above serial number	8126
10-69 " " " "	5001
9-54 " " " "	6401
9-56 " " " "	1701
and later instruments.	

A correct understanding of the operation and a complete familiarity with the mechanical parts are highly desirable to the proper maintenance of the instruments. The instruction books and the following general information and service instructions should be read carefully.

GENERAL

1. RECORDS—The instruments will not function as automatics unless Victor eccentric groove records are used. *Warped records or those with chipped edges or centers should not be used.*

2. LOADING RECORDS—When loading records into the magazine, always make certain that the records are placed centrally and are pushed back until they touch the two record support pins. Records should preferably be placed in the magazine one at a time, and should not be inserted while the changing mechanism is in operation.

3. REMOVING RECORDS—Do not allow more than one complete magazine of records (12) to accumulate in the record discharge compartment at one time. Damage to the records or to the mechanism may result if this point is not carefully observed

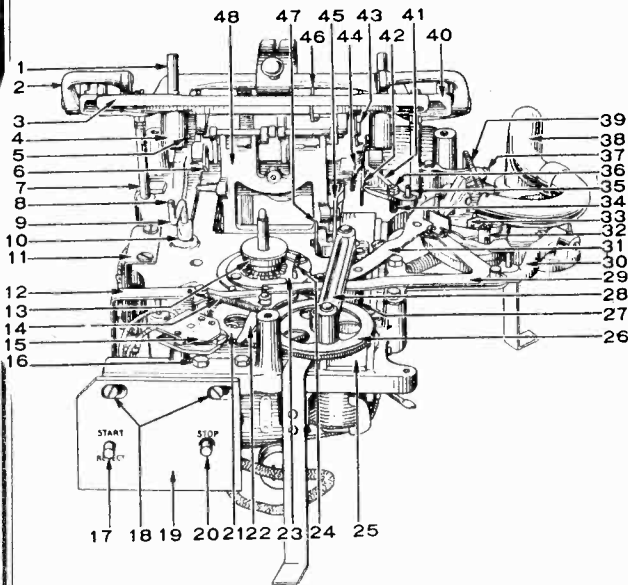


Fig. 1—Automatic Mechanism with Motor Board Removed

4. REGULATING SPEED—The speed regulator should never be changed except to regulate the speed of the turntable to 78 revolutions per minute while playing.

5. SOUND BOX AND PICKUP—Do not drop the sound box or the electric pickup forward or backward on its stop. If care is not observed, the vertical traveling height of the needle may be forced out of adjustment, which may, during operation, scratch the record or damage the sound box or pickup. The instruments should not be operated at any time with the sound box or electric pickup turned back to the stop. Failure to observe this point may result in the sound box or pickup striking the side of the cabinet or the lid support, thus "jamming" the mechanism, or causing the 12" eccentric stop to be forced out of its correct adjustment.

6. LUBRICATION—Lubrication is an essential factor in the operation of the automatic instruments, and should be given careful attention. It is suggested that the motor and automatic mechanism be lubricated at least once a month with the proper lubricants. If the instrument is being operated in a public place on the usual average of eight hours a day, this lubrication period should be reduced to at least once a week. The oiling diagrams are shown in Figs. 20, 21 and 22.

SERVICING

Before making adjustments to the mechanism, determine first that the trouble is not caused by badly warped records, records with damaged centers, or with chipped edges.

SPECIAL TOOLS RECOMMENDED FOR ADJUSTING AUTOMATIC MECHANISM

Name	Part No.
1. Screw driver for 10" eccentric stop	52323
2. Socket wrench for 10" eccentric stop	52324
3. Right angle screw driver	18461
4. Tool for removing "C" washers in hopper shafts	51719
5. Brackets for supporting mechanism out of cabinet (3 required)	51761
6. .120" Gauge for record support knives	52468
7. .065"—.070" Gauge for record support knives	53370
8. .120" Gauge for angularity of record support	52855
9. Socket wrench for spiral cam adjusting screws	52992
10. Socket wrench for start rod collar set screws	53306

All the major adjustments including lubrication can be made without disturbing the position of the automatic unit in the cabinet. The unit is so mounted on steel runners that it can be moved out from the back should it become necessary to replace any of the parts under the motor board. Certain adjustments can be made by removing the unit only part of the way out of the cabinet.

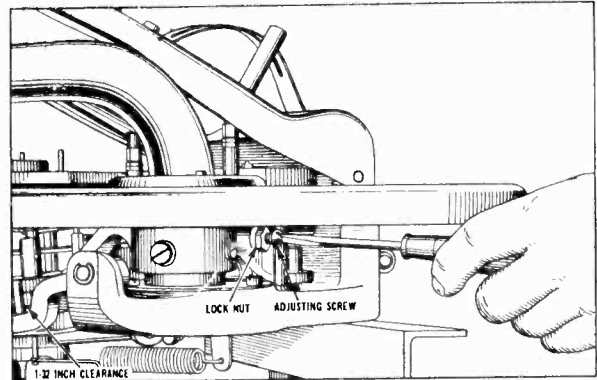


Fig. 2—Adjusting Sound Box Lift Lever

1. FAILURE OF NEEDLE TO SWING INTO FIRST RECORD GROOVE—If the needle fails to swing into the first record groove after striking the smooth outside rim:

- Determine if the instrument is level by placing a spirit level on the turntable.
- If the right side of the cabinet is low, raise this side slightly by placing a thin wooden wedge or other available material under the feet of the lower end.
- If the condition is not corrected by the above adjustment:

Loosen the lock nut and adjust the sound box lift lever adjusting screw as shown in Fig. 2 until there is a clearance of approximately $\frac{1}{32}$ " between the under side of the taper tube arm casting and the top of the sound box lift lever as shown. This clearance can be checked by placing a thin piece of cardboard between the two points and observing whether or not there is a dragging on the cardboard when the tone arm is moved toward the center of the record. *This clearance is highly important and will affect other conditions of the mechanism if not properly adjusted.*

2. EXCESSIVE WEAR ON RECORDS—If excessive wear on the records is noted, the same adjustments as described in subject 1 above should be made. It may be possible that the needle will move into the record groove after striking the smooth outside rim, but will cause excessive wear on the record due to a slight contact between the two points shown in Fig. 2 where the $\frac{3}{2}$ " clearance should exist.

There are fifteen primary mechanical adjustments to the automatic unit. A correct knowledge of these, their functions, and the method of procedure as outlined in the following pages should enable a service man to correct practically any of the more common troubles with the mechanism. It is suggested that in all cases a complete check of the adjustments be made in the order listed below.

ADJUSTER	PURPOSE	ILLUSTRATED
1. Sound box lift lever adjusting screw	Adjusting proper height of needle clearance above record	Fig. 2
2. Sound box crook stop	Adjusting height of needle above record	Fig. 3
3. Link pin adjuster	Adjusting for proper length of stroke on pusher plate	Fig. 4
4. Hopper adjusting nuts and screws	Adjusting height of hopper with respect to lift ring	Fig. 6
5. Lift ring screws	Adjusting height of lift ring with respect to hopper	Fig. 8
6. Spiral cam adjusting screws	Adjusting height of knives on record support pins	Fig. 9
7. Lift ring spring adjusting nuts	Adjusting tension of lift ring spring	No. 69, Fig. 11
8. Hopper arm adjusting screws	Adjusting hopper arms onto front of lift ring	Fig. 10
9. 12" eccentric	Adjusting overall horizontal position of tone arm	Fig. 13
10. 10" eccentric	Adjusting horizontal position of tone arm for 10" record	Fig. 14
11. Index trip lever	Adjusting for 10" and 12" indexing and stop	Fig. 15
12. Index lever adjusting nuts	Adjusting height of index lever	No. 36, Fig. 1
13. Reject rod collar	Adjusting for proper reject action	Fig. 16
14. Latch trip	Adjusting for proper eject action on eccentric groove	No. 33, Fig. 1
15. Collars on stop rod	Adjusting for proper stop action	No. 86, Fig. 12

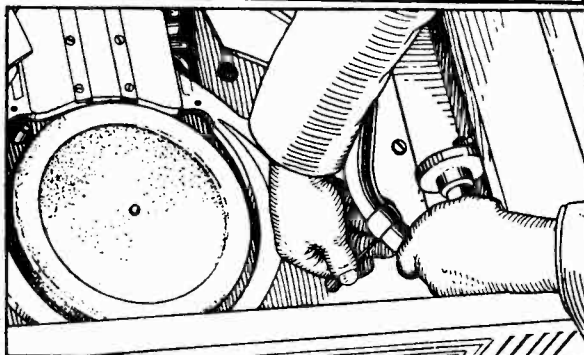


Fig. 3—Adjusting Crook Stop

3. NEEDLE DOES NOT LOWER SUFFICIENTLY—When the $\frac{3}{2}$ " clearance described in c of subject 1 above is obtained, the clearance between the needle point and the record should be approximately $\frac{1}{8}$ " on the return of the tone arm. If this clearance does not exist:

- a. Examine the position of the tone arm cover plate. It should be so placed on the motor board that the tone arm does not touch the plate at any time. The screws in the plate can be loosened if necessary, care being taken not to turn these so far that the nuts on the bottom are dropped, and the plate then moved slightly to allow clearance of the tone arm. Re-tighten the screws securely when the proper clearance has been obtained.
- b. Examine the sound box or pickup crook stop. Loosen the lock nuts and turn the stop screw, which is an eccentric, until the proper lowering has been obtained. Re-tighten the lock nut when the proper lowering has been obtained. See Fig. 3.

4. NEEDLE DOES NOT CLEAR RECORD—If the tone arm does not rise sufficiently for the needle to clear the record on the return of the tone arm:

- a. Examine the position of the tone arm cover plate and the crook stop making the same adjustments as described in subject 3 above except that the eccentric screw must be turned in the opposite direction.
- b. If the condition is still not corrected, particularly if there seems to be a sluggish action of the return of the tone arm, remove the sound box lift lever spring shown in Fig. 2, and increase its tension by shortening the straight section of the spring, bending it nearer the coiled section.

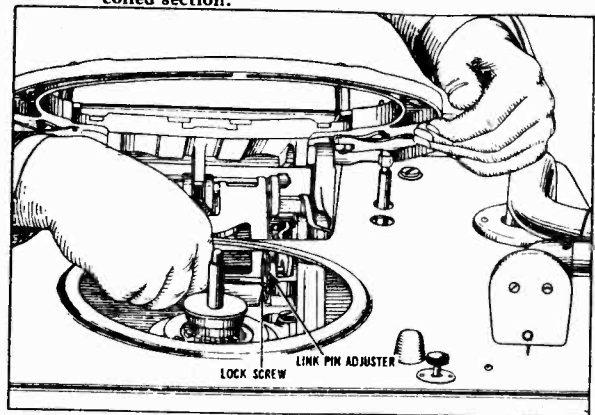


Fig. 4—Adjusting Link Pin Adjuster

5. LIFT RING DROPS SLIGHTLY WHEN DESCENDING—If the lift ring suddenly drops about $\frac{1}{4}$ " when first starting down, make the following adjustments:

- a. Remove the turntable.
- b. Loosen the lock screw in the link pin adjuster as shown in Fig. 4.
- c. Turn the mechanism until the main slide is in its extreme forward position.
- d. Turn the link pin adjuster until the rollers of the lift lever mechanism 48, Fig. 1, are in the slots pressing against the extreme end of their track (cam).

NOTE—Do not advance the adjuster so far that the rollers are too tight against the end of the cam since there will be a strain and possible binding of the entire mechanism.

- e. Re-tighten the lock screw.

6. LIFT RING FAILS TO REMOVE RECORD—If the lift ring fails to remove a record,

- a. The record may be warped. Place the record on a flat solid surface in a warm room, and weight the record with books or other records.
- b. The vertical height of the hopper (magazine) with respect to the lift ring is not correctly adjusted.
 1. Loosen the hopper support screws as shown in Fig. 6.
 2. With the lift ring in its highest position, turn the hopper adjusting nuts so that the top surface of the hopper is exactly flush with the top of the lift ring. A straight edge can be used as a gauge for this height. It should be placed across the two surfaces as shown in Fig. 7. This same method should then be used for gauging the height on the opposite side of the hopper. Turn the hopper support screws so that there can be an additional upward movement of the hopper of approximately $\frac{1}{16}$ " on each side with

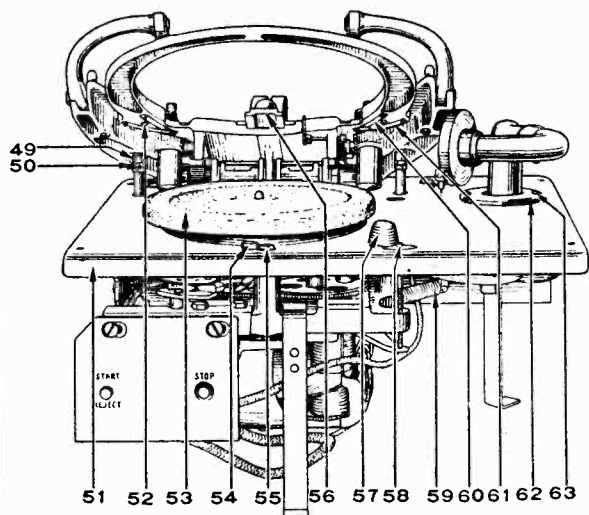


Fig. 5—Automatic Unit Front View

the hopper resting on each top adjusting nut. This amount of play will prevent any possible binding of the lift ring and hopper. Adjust the lift ring screws as shown in Fig. 8, until the ends touch the under side of the hopper when the ring is in its highest position.

3. Note the action of the knives on the record support pins. The height of these should be tested by means of the gauges 52467, 52458 and 52855. Pushing the top of the record support pins down, insert the .065"-.070" gauge. Part 53370, under each knife. This adjustment should be made when lift ring is up and knives turned inward. If the knife is too high or too low, it should be bent slightly by prying with a screw driver until the proper height is obtained.

Part 52855 can be used to obtain the proper angularity as well as the .120" height. With the lift ring down, insert the gauge 52855

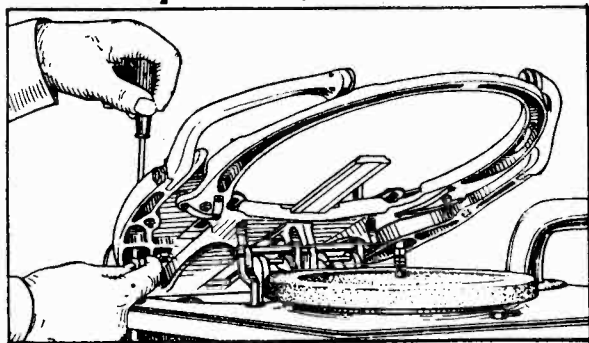


Fig. 6—Adjusting Height of Hopper

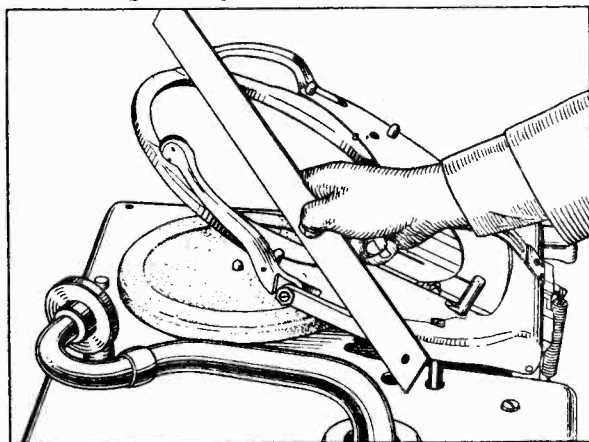


Fig. 7—Straight Edge on Lift Ring

as shown in Fig. 9. There should be no play in the height of the knives and the sharp edge should be against the curved surface of the gauge. If this condition does not exist, loosen the set screws in the spiral cams as shown in Fig. 9. Using a socket wrench such as part 52992, make the necessary setting of the knives, pushing the spiral cams toward the back center of the mechanism, and then re-tighten the set screws.

7. LIFT RING REMOVES TWO RECORDS—If two or more records are entirely removed from the hopper and deposited on the lift ring at the same time:

- a. Records are improperly loaded. (See Subject 2 under GENERAL).
- b. Hopper improperly adjusted with respect to lift ring. See b of subject 6 above.
- c. Hopper arm improperly aligned, allowing the two bottom records to pass under the arms. Lower the hopper arms by turning the small adjusting screws as shown in Fig. 10, so that both hopper arm spacers touch the lift ring when the latter is in its raised position and there are no records in the hopper. Spacing for gates on hopper arms should be between .093" and .107".

8. RECORD CENTER FAILS TO ALIGN WITH TURNTABLE SPINDLE—The mechanism is designed to allow a 10" record to fall directly over the turntable spindle and a 12" record to fall $\frac{1}{8}$ " in back and then fall of its own weight forward over the spindle. If this condition does not exist:

- a. Records are not properly loaded in hopper.
- b. Record is warped.

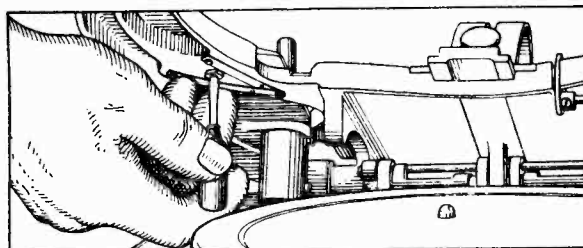


Fig. 8—Adjusting Lift Ring Screws

- c. Record guide pins 74 or 75, Fig. 11, not fitting properly in holes of lift ring. This fit should allow a free vertical motion of the pins, but a minimum side motion.
- d. Hopper improperly adjusted with respect to lift ring. Make the same adjustment as described in b of subject 6 above.
- e. Note the position of the record pusher pins on the back edge of the record. If both pins do not touch the back edge of the record as the latter is being moved into position, loosen the upper screw in the pusher plate, and adjust the plate until proper contact is made, or, if one of the pins is below the record, bend the pusher spring slightly until proper contact is made.

9. LIFT RING RISES TOO SLOWLY—If the lift ring rises too slowly with a resulting strain on the mechanism, or if it descends too fast, increase the tension of the spring 68, Fig. 11, in the back of the mechanism in the following manner:

- a. Loosen the two lock nuts on the eye screw.
- b. Increase the spring tension by turning first the top and then the bottom lock nut toward the eye in the screw.
- c. Test the adjustment by trial until the proper rising of the lift ring has been obtained and the ring descends slowly without a record. The ring should slightly over-balance the spring when the former is in its lowered position.

10. LIFT RING RISES TOO FAST—If the lift ring rises too fast, if it descends too slowly, or if it touches the under side of the record on the turntable during playing, decrease the tension of the spring 68, Fig. 11, in the following manner:

- a. Loosen the two lock nuts on the eye screw.
- b. Decrease the spring tension by turning first the bottom and then the top lock nut away from the eye in the screw.
- c. Test the adjustment by trial until the proper rising of the lift ring has been obtained, and the ring descends slowly without a record.

11. LIFT RING VIBRATES IN DESCENDING—If the lift ring does not descend evenly:

- a. Oil the bearings of the lift lever rollers.

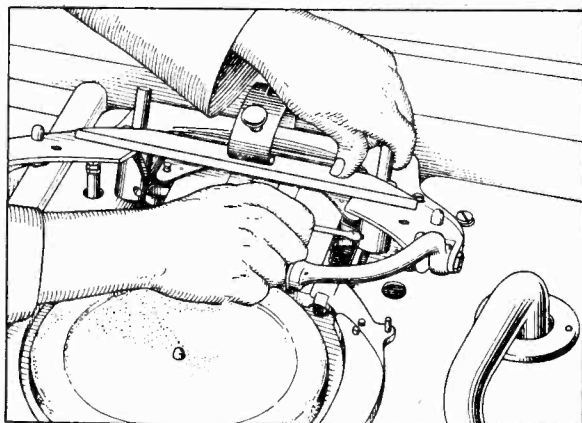


Fig. 9—Gauging Record Support Pin Knives

- b. Examine the pusher plate and the portion of the lift ring over which the plate moves, noting if there is any binding between the two when the pusher plate is advancing. Usually if there is contact between the two, a worn line will be noticeable on the lift ring, being produced by the contact of the bottom of the plate on the lift ring. This condition can be readily eliminated by bending up the plate slightly on the side which is touching the ring.
- c. Examine the pusher slide, noting if it is properly lubricated or if there is any grit or other foreign matter in the channel of the slide. *It is important that this channel be clean and well lubricated at all times.*

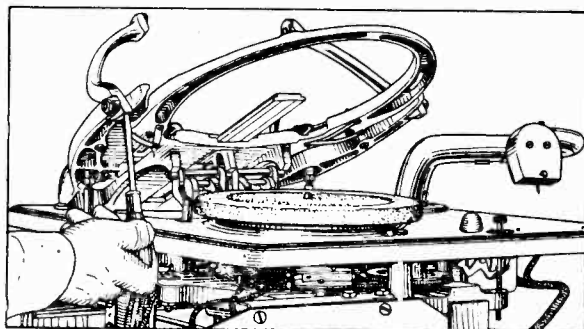


Fig. 10—Adjusting Hopper Arm Screws

72 73 74 75 76 77 78 79 80

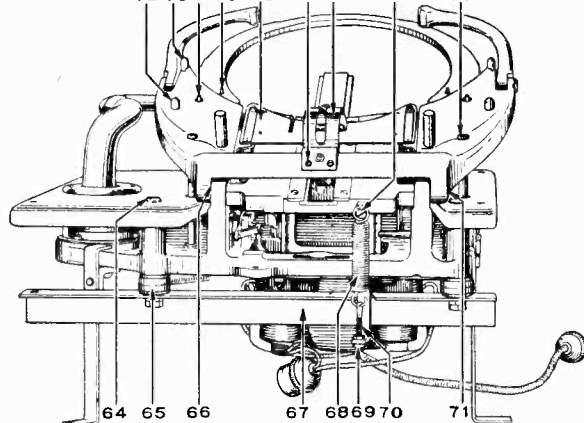


Fig. 11—Automatic Mechanism Back View

12. **NEEDLE LOWERS OUTSIDE 12" RECORD DIAMETER**—Should the needle fail to lower on the smooth outside rim of a 12" record, but lowers outside the record:

- Loosen the clamping screw for the eccentric screw, 32, Fig. 1, in the taper tube arm casting with a short screw driver.
- With a small rod or nail turn the eccentric adjustment as shown in Fig. 13.
- Check the setting after successive trials until the proper position is obtained, and then re-tighten the clamping screw securely.

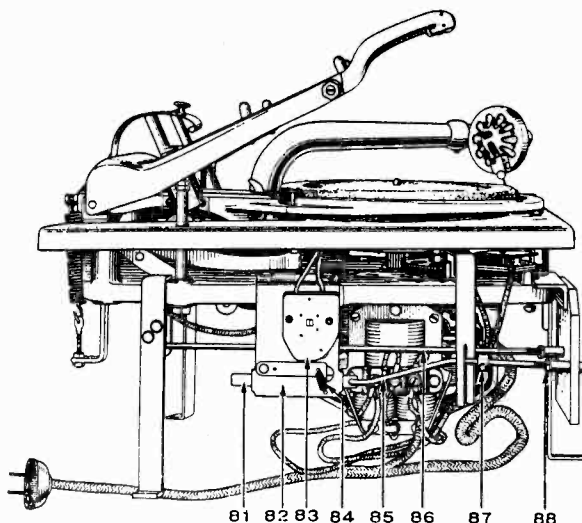


Fig. 12—Automatic Unit Side View

d. If the needle does not fall at the proper position on a 10" record after making the above adjustment, refer to Fig. 13.

- Place a socket wrench such as part 52324 over the lock nut on the under side of the 10" eccentric stop 35, Fig. 1, and a short screw driver such as part 52323 down through the hole in the motor board and into the slot of the 10" eccentric stop.
- Loosen the lock nut and turn the eccentric in either direction as may be required.
- Make a test after each successive trial until the proper setting has been obtained.

13. **NEEDLE LOWERS INSIDE 12" RECORD GROOVES**—If the tone arm swings inwardly too far before the needle lowers on a 12" record, but not as far as the 10" position:

- Make the same adjustments as described in subject 12 above, but turn the 12" eccentric in the opposite direction.
- Check the 10" position, making any necessary adjustments as described in d of subject 12 above.

14. **NEEDLE LOWERS OUTSIDE 10" RECORD DIAMETER**—Should the needle lower outside the diameter of a 10" record, but lowers properly on a 12" record, make the same adjustments as described in d of subject 12 above.

15. **NEEDLE LOWERS INSIDE 10" RECORD GROOVES**—Should the needle lower inside the record grooves of a 10" record, but lowers satisfactorily on a 12" record, make the same adjustments as described in d of subject 12 above.

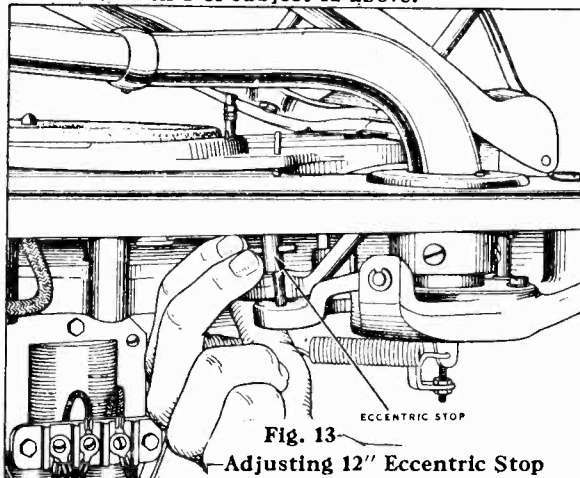


Fig. 13—Adjusting 12" Eccentric Stop

16. **FAILURE TO SELECT 10" AND 12" POSITION**—If the mechanism does not select the 10" and 12" position, that is, if the needle lowers in the 10" position on a 12" record, or on the rubber support block when a 10" record is on the turntable:

- a. Records are improperly loaded in hopper.
 b. Tighten the set screw on the index lever trip cam, shown in Fig. 15, so that it is against the flat of the index trip lever shaft. Loosen the lock nut in the index trip lever as shown in Fig. 15, and adjust the screw until the inside pin lowers on the stop lever and the outside pin lowers in the larger slot of the index lever when the lift ring comes down without a record.

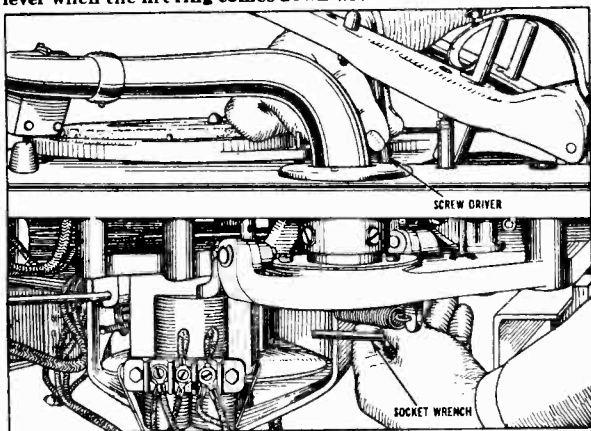


Fig. 14—Adjusting 10" Eccentric Stop

- c. If the mechanism still fails to select properly, adjust the lock nuts 36, Fig. 1, over the index lever so that the taper tube return lever strikes near the top of the 12" stop face on the index lever casting 41, Fig. 1, when set for a 12" record and the approximate midpoint of the 10" eccentric stop pin when set for a 10" record.

17. FAILURE TO REJECT RECORD—If the automatic mechanism does not trip when the "Reject" button is pressed, and the record is therefore not rejected:

- a. Note that the condition is not caused by a wire between the reject rod collar 87, Fig. 12, and the fork portion of the trip lever.
 b. If the condition is not yet corrected, loosen the set screws in the collar as shown in Fig. 16, using a socket wrench such as part 53306, and set the collar approximately $\frac{3}{8}$ " away from the trip lever. Re-tighten the set screws.

18. CONTINUED REJECTION—Continued rejection may be caused by any one of the following:

- a. Collar on reject rod set too near trip lever, preventing latter from disengaging from end of pawl.
 b. "Start" and "Reject" button stuck or binding.
 c. Pawl 23, Fig. 1, sticking between teeth of clutch wheel.
 d. Mechanism improperly timed. (See subject 26, below).

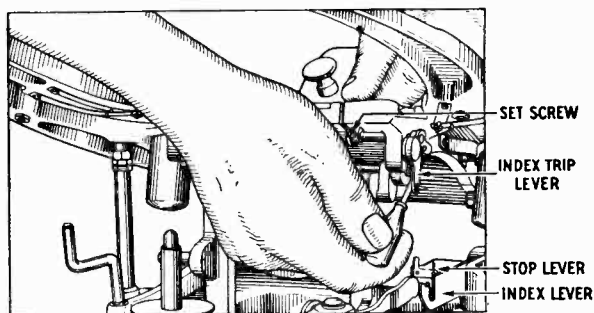


Fig. 15—Adjusting Index Trip Lever

19. FAILURE TO TRIP ON ECCENTRIC GROOVE—If the mechanism does not trip when the eccentric groove is reached:

- a. Observe the action of the sound box crook, noting if it is too loose on the tone arm. The crook should be so tightened that it is free to move up and down, and yet sufficiently tight to prevent any side motion.
 b. If the crook is found to be correct, remove the back of the cabinet, and with the aid of a flashlight, observe the action of the latch trip blade 33, Fig. 1, which is mounted on the 12" eccentric screw 32, Fig. 1. If the blade does not make contact with the latch plate, loosen the screws in the latch trip, and move the blade until proper contact is made with the plate.

20. FAILURE TO EJECT—If the eject lever 9, Fig. 1, fails to remove a record from the turntable, and the record lift ring raises the record, eliminate any binding in the eject lever cam 6, Fig. 1, near the end of the eject lever, by prying the cam away from the lever with a screw driver. The cam may be stuck slightly because of dirt or other foreign matter becoming lodged between it and the eject lever.

21. SLUGGISH ACTION OF EJECT MECHANISM OR RECORD EJECTS TOWARD FRONT OF CABINET—If the record is not entirely ejected from the turntable before the lift ring starts to rise, or if a record is ejected toward the front of the cabinet rather than in the discharge compartment:

- a. Note the height of the record on the motor spindle, and compare this height with the correct height as shown in Fig. 17. If the record is considerably lower, raise the height by placing one or more cork or fibre washers, part 51870, under the turntable.
 b. Examine the leather on the end of the eject lever. If this is worn smooth, roughen it by scraping with a sharp knife or file.

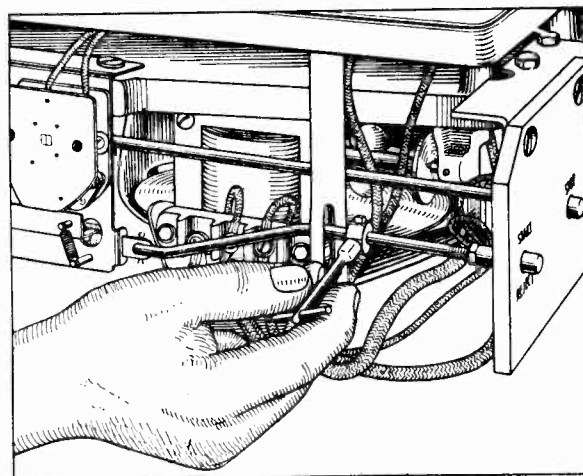


Fig. 16—Adjusting Reject Collar

22. FAILURE TO START—If the mechanism fails to start, look for any of the following:

- a. Open circuit in power supply. Check all plug connections both inside and outside the instrument.
 b. Defective motor coil.
 c. Open or shorted 3 Mfd. condenser.
 d. Start switch position 83, Fig. 12, out of adjustment, preventing switch slide 81, Fig. 12, from tripping switch.
 e. Defective start switch 83, Fig. 12.

23. FAILURE TO STOP WHEN STOP BUTTON IS PRESSED—The mechanism will not stop if the button is pressed during the cycle until the cycle is completed. If the mechanism still fails to stop, look for any of the following:

- a. Defective start switch 83, Fig. 12.
 b. Defective cycle completing switch 15, Fig. 1.
 c. Improper adjustment of mechanical connection between stop lever 44, Fig. 1, and start switch. When facing the back of the mechanism, adjust the right hand collar on the stop shaft until the collar on the stop rod just touches the stop arm on the switch when the stop button is out.

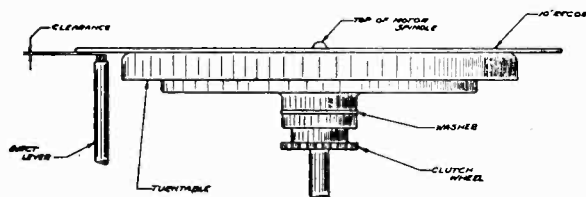


Fig. 17—Correct Height of Record on Turntable Spindle

24. FAILURE TO STOP AFTER LAST RECORD—
If the mechanism fails to stop after the last record has been played, look for any of the following:

- a. Improper adjustment of index trip lever, Fig. 15. See b, subject 16, above for proper adjustment.
- b. Defective start switch 83, Fig. 12.
- c. Defective cycle completing switch 15, Fig. 1.

25. PICKUP SHORTING SWITCH FAILURE—If the pickup shorting switch fails to open before the needle reaches the first music grooves, or fails to close after the eccentric groove has been reached:

- a. Remove the turntable.
- b. Loosen the screws in the switch with a small right angle screw driver, and adjust the position on the switch until the contacts are approximately $\frac{1}{4}$ " apart when the tone arm is in the playing position.
- c. Examine the bakelite arm of the switch, noting if there is any binding. Such binding should be removed by prying the arm loose with a screw driver.

26. TIMING MECHANISM—When the motor or any of the gears have been removed, it will be necessary to re-time the mechanism in the following manner:

- a. Remove the turntable.
- b. Turn the mechanism by hand until the roller A, Fig. 18, is engaged in the slot B of the cam gear C.
- c. Loosen the set screw in the clutch wheel D, lift the wheel, the pawl and pawl carrier E, and turn the latter until the roller F is in line with the slot G.
- d. Lower the pawl and pawl carrier and the clutch wheel, and then re-tighten the set screw, aligning the screw with the spot in the motor spindle.

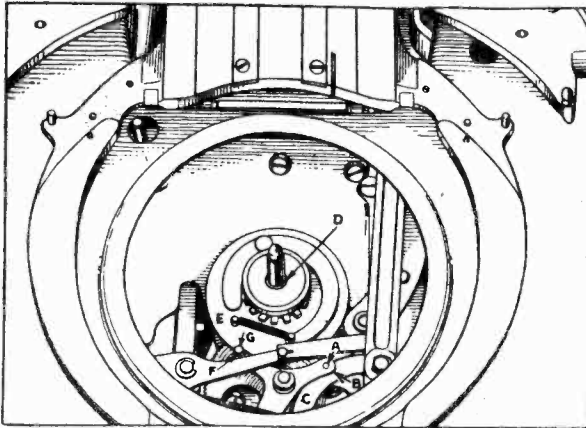


Fig. 18—Method of Timing Gears

27. POOR TONE QUALITY IN 10-35 AUTOMATIC ORTHOPHONIC VICTROLA—If the tone quality of the Automatic Orthophonic Victrola instrument is not up to standard:

- a. Replace sound box, bearing in mind if this is done that it may be necessary to re-adjust the tone arm as described in subject 3 above.
- b. If replacing the sound box does not correct the quality, it is possible that there is an air leak in the sound system between the end of the tone arm and the horn.
- c. Remove the sound box from the tone arm. Blow smoke lightly into the tube, taking care not to use too great force since the grease seal around the joint at the base of the tone arm may otherwise become broken. Smoke can be seen escaping where the leak exists.
- d. If the above tests show an air leak at the joint between the sound box crook and the tone arm:
 1. Remove the crook, and distribute firm cup grease around the joints in the sleeve inside the tone arm.
 2. Replace the crook, again test for air leaks.
- e. If the leak has been found to exist in the joint at the base of the tone arm:
 1. Remove the tone arm by taking out the three screws.
 2. Remove the spring 39, Fig. 1.
 3. Distribute firm cup grease around the two surfaces as shown in Fig. 19.
 4. Replace the tone arm, and again test for air leaks.

NOTE—Victor motor grease should not be used to seal joints as described above since this grease is too light for the purpose.

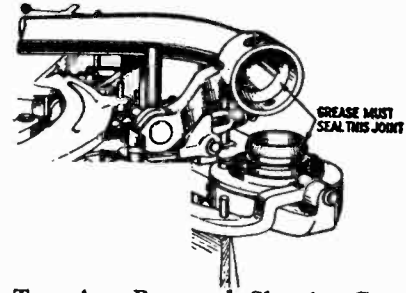


Fig. 19—Tone Arm Removed, Showing Grease Seal

If the leak has been found to exist between the top of the horn elbow casting and the horn elbow flange:

1. Remove the screws which hold the automatic unit to the cabinet.
 2. Remove the three screws which hold the flange to the unit.
 3. Lift the back of the automatic unit slightly, and then lift the flange from the horn elbow casting.
 4. Place firm cup grease around the inside surface which fits over the top of the horn elbow casting, and around the under side of the felt washer.
 5. Place shellac over the fibre washer which seals the joint between the flange and the automatic unit.
 6. Replace and re-connect the flange.
 7. Replace the motor board screws.
- g. If the air leak has been found to exist in the joint between the horn elbow and the horn:
1. Tighten the four screws in this joint.
 2. If this does not correct the leak, remove the four screws.
 3. Remove the screws which hold the automatic unit in the cabinet as described in f above.
 4. Lift the automatic unit about two inches and support it in this raised position.
 5. Remove the fibre gasket and shellac both its surfaces.
 6. Replace the gasket and screws, and then tighten the joint securely.

It is suggested that in all cases a small amount of grease or oil be placed around the end of the sound box crook so as to seal the joint between the sound box and the crook.

28. REMOVING MECHANISM FROM CABINET—Whenever possible, removal of the unit from the cabinet should be avoided. Certain adjustments to the controls on the control escutcheon will necessitate removing the mechanism part of the way out, and certain replacements will necessitate removing the unit entirely from the cabinet. The following is the procedure:

- a. Remove the back of the cabinet.
- b. Remove the four screws, at the sides of the motor board. NOTE—The automatic mechanism is supported to the motor board with three screws. Do not attempt to remove the motor board until the unit has been removed from the cabinet. The two back screws are fastened with lock nuts which must be removed before the screws can be taken out.
- c. On 9-54, remove the two support rods in the back of the unit. This can be done by turning the top nut to the upper end of the threads on the rod, loosening the lower nut slightly, and turning the rod until it can be dropped down and pushed over sufficiently to clear the unit when the latter is removed.
- d. Disconnect the power plugs from the unit and from the power-amplifier (in the Electrola models).
- e. On the automatic Electrolas, remove the pickup terminal strip from the cabinet partition and the ground lead from the terminal strip to the back support of the unit. On 9-54, remove ground lead from control panel to radio terminal strip at the latter point, marking the terminal so that the lead can be properly replaced.
- f. On the 10-35, remove the horn elbow.
- g. Pull the unit out from the back of the cabinet. It is suggested that three metal supports such as part 51761, be used to hold the unit after it has been removed from the cabinet.

When replacing the unit in the cabinet, great care must be observed that the start switch 83, Fig. 12, is not pushed against any part of the cabinet and its position thus altered.

When replacing the 10-35 unit, be sure that the sealing washer between the horn and the unit is re-shellaced and properly placed and the screws securely tightened to form an air tight joint.

29. REMOVING MOTOR BOARD FROM MECHANISM—Certain replacements will require the removal of the motor board from the mechanism after the latter has been removed from the cabinet. The following parts should first be removed in the order listed:

- a. Sound box or pickup from the tone arm.
- b. Speed regulator screw.
- c. Turntable.
- d. Tone arm cover plate.
- e. Spring washers, one on each hopper shaft as indicated at 66, Fig. 11. Push washers from the shaft with a thin blade or special tool such as part 51719.
- f. The two hopper support screws 80, Fig. 11.
- g. The three screws which hold the automatic unit to the motor board.

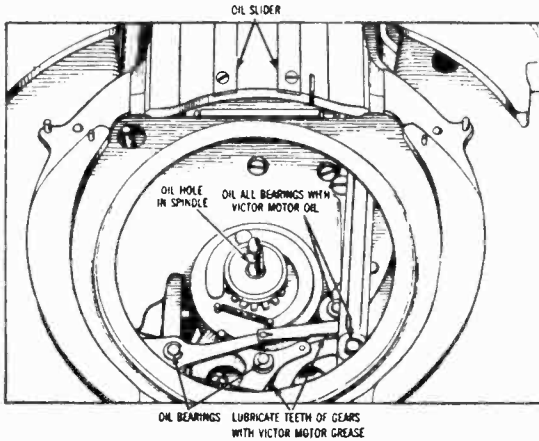


Fig. 20—Oiling Diagram Automatic Mechanism

Proceed in the following manner to remove the motor board:

- h. Push the two hopper shafts 71, Fig. 11, inwardly as far as possible.
- i. Turn the automatic mechanism by hand until the lift ring is in its raised position.
- j. Move the record pusher slide cam 56, Fig. 5, forward and at the same time raise the lift ring back far enough to allow the motor board to be removed.
- k. Lift the motor board high enough to clear the hopper supports 7, Fig. 1, and then carefully turn the board at the same time to allow it to clear the tone arm.

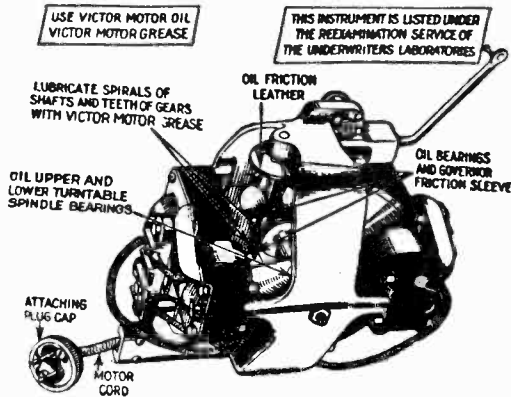


Fig. 21—Oiling Diagram Induction Disc Motor

30. LUBRICATION—A hollow motor spindle with openings at the various bearings permits lubrication of these parts as well as the back governor bearing from the oil hole shown in Fig. 20. The front governor bearing, the governor friction sleeve, and friction leather can be lubricated by inserting a long spout oil can down through the hole in the top of the mechanism below the intermediate gear.

OIL BEARINGS, GOVERNOR FRICTION LEATHER AND FRICTION SLEEVE

USE VICTOR MOTOR GREASE IN GREASE CUPS

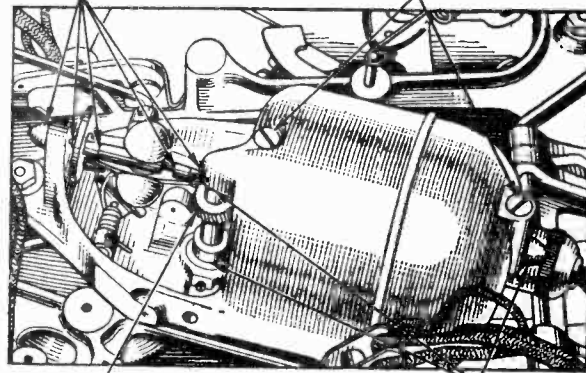


Fig. 22—Oiling Diagram Universal Motor

PARTS LIST

- | Name of Part | |
|-----------------------------------|---------------------------------|
| 1. Record Locating Pin (R. H.) | 45. Latch Lever |
| 2. Hopper Arm (R. H.) | 46. Index Lever Trip Cam Screw |
| 3. Hopper Arm (L. H.) | 47. Link Pin Adjuster Washer |
| 4. Spiral Cam (R. H.) | 48. Lock Washer |
| 5. Spiral Cam (L. H.) | 49. Lift Lever (Complete) |
| 6. Spiral Cam (L. H.) | 50. Hopper Adjusting Nut |
| 7. Set Screw | 51. Motor Board (complete) |
| 8. Eject Lever Cam | 52. Lift Ring Stop Screw |
| 9. Hopper Support | 53. Nut |
| 10. Lock Washer | 54. Turntable |
| 11. Nut | 55. Rubber Stop Pad |
| 12. Leather | 56. Motor Board Screw |
| 13. Eject Lever (Complete) | 57. Lock Washer |
| 14. Rubber Pad | 58. Pusher Slide Cam |
| 15. Switch Plate | 59. Rubber Button |
| 16. Trip Lever | 60. Speed Regulating Screw |
| 17. Clutch Wheel | 61. Spring |
| 18. Spring | 62. Sound Box Lift Lever Spring |
| 19. Cycle Completing Switch | 63. 10' Spring |
| 20. Screw | 64. Screw |
| 21. Lock Washer (1 used) | 65. Nut |
| 22. Start and Reject Rod | 66. 12' Spring (Same as No. 60) |
| 23. Screw (2 used) | 67. Taper Tube Cover Plate |
| 24. Control Panel (10-35) | 68. Screw (2 used) |
| 25. (10-69) | 69. Lock Washer |
| 26. (9-54) | 70. Nut |
| 27. (9-56) | 71. Motor Board Screw |
| 28. (10-69) | 72. Rubber Washer |
| 29. Stop Push Rod (10-35) | 73. Spring Washer |
| 30. (9-54) | 74. Mechanism Support |
| 31. (9-56) | 75. Lift Ring Spring |
| 32. Intermediate Gear | 76. Nut (2 used) |
| 33. Clutch Release Lever | 77. Eyebolt |
| 34. Pawl and Pawl Carrier | 78. Hopper Shaft |
| 35. Spring | 79. Hopper Pin |
| 36. Main Slide (Complete) | 80. Nut |
| 37. Gear | 81. 12' Record Stop Pin |
| 38. Main Slide Spring | 82. 12' Plunger |
| 39. Connector Link | 83. 10' Plunger |
| 40. Eccentric Stop Lever Bracket | 84. Pusher Plate (complete) |
| 41. Stop Lever Trip Plate | 85. Pusher Plate Screw |
| 42. Screw | 86. Record Tension Spring Clamp |
| 43. Nut | 87. Screw (2 used) |
| 44. Lock Washer | 88. Screw |
| 45. Sound Box Lift Lever | 89. Record Tension Spring |
| 46. Taper Tube Return Lever | 90. Screw |
| 47. 12' Eccentric Screw | 91. Hopper Support Screw |
| 48. Latch Trip Blade | 92. Switch Slide |
| 49. Screw (2 used) | 93. Switch Plate (Complete) |
| 50. Washer (2 used) | 94. Start Switch |
| 51. Spring | 95. Spring |
| 52. Washer | 96. Start and Reject Rod |
| 53. 10' Eccentric Stop | 97. Stop Rod |
| 54. Nut | 98. Reject Rod Collar |
| 55. Lock Washer | 99. Screw (2 used) |
| 56. Nut (2 used) | 100. Nut |
| 57. Sound Box Operating Lever | 101. Start and Reject Button |
| 58. Adjusting Screw | |
| 59. Nut | |
| 60. Taper Tube (Complete) (10-35) | |
| 61. Electropla | |
| 62. Spring | |
| 63. Hopper (Complete) | |
| 64. Index Lever (Complete) | |
| 65. Index Lever Extension | |
| 66. Index Trip Lever | |
| 67. Stop Lever | |

The mechanism should be oiled at least once a month, and in commercial installations, playing an average of eight hours a day, this period should be reduced to once a week. The gears and spirals should be greased once every six months.

The induction disc motor is for use on all Victor electric instruments operating on 105 to 120 volts, 25 to 60 cycles, alternating current, and consumes approximately 50 watts power. The following motor coils are in use, depending upon the service to which the motor is applied.

Coil	Part Number	For 105 to 120 Volts
No. 1	16355	40 to 60 Cycles
No. 2	17576	25 to 30 Cycles
No. 3	17860	40 to 60 Cycles*

FOR OPERATION ON 40 CYCLES—The 31 ohm resistor unit, part 19490, should be connected in series with the induction disc motor. Fig. 2 shows the tapped resistor connected in the motor circuit. For convenience in removing the motor board at a later time, it is suggested that the resistor be connected in one side of the line between the attachment plug and the motor plug. The 21 ohm connection is for 110 to 115 volts, 40 cycles, and the 31 ohm connection for 115 to 130 volts. The earlier type resistor with the pig tail terminals is connected in the same manner as the 31 ohm connection shown, but does not have the resistance tap. When operating instruments equipped with a power-amplifier unit on 40 cycles, the resistor should be connected in the motor circuit only, and not in the power circuit to the power-amplifier unit, nor in the main power supply circuit. In all cases the resistor should be mounted as far away from the motor as possible.

*Heavy duty for use on Automatic Instruments.

FOR OPERATION ON HIGH ALTERNATING CURRENT VOLTAGES—The following .250 kva 60 cycle transformers are available, and will supply sufficient power to operate a complete electrical reproducing instrument or power-operated radio combination.

Part Number	For Operation On
17726	220 Volts, 60 Cycles
18423	200 Volts, 60 Cycles
17912	150 Volts, 60 Cycles

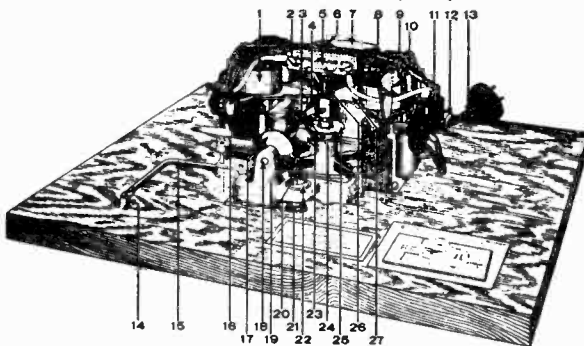


Fig. 1

PARTS LIST

See Parts Catalog when ordering replacements, as some of the items shown will be furnished only in assemblies.

Name of Part
1. Inductor 40-60 Cycles
2. Fuse Mounting (Early Type Motors)
3. Governor Spring
4. Governor Set Screw
5. Fuse (Early Type Motors)
6. Turntable Spindle Adjusting Screw
7. Top Plate
8. Connector Wire
9. Connector Wire Clip
10. Inductor Screw
11. Terminal Block
12. Moulding
13. Motor Cord
14. Regulator
15. Regulating Shaft

16. Speed Indicator (Early Type Motors)
17. Governor
18. Governor Bearing (Grooved)
Governor Bearing (Plain)
19. Regulating Lever
20. Motor Board Bolt (Short)
Motor Board Bolt (Long)
21. Felt Washer
Steel Washer
22. Lock Washer (New Style)
Lock Washer (Old Style)
Nut
23. Governor Ball
24. Governor Spindle
25. Governor Driving Gear
26. Turntable Spindle
27. Rotor Disc

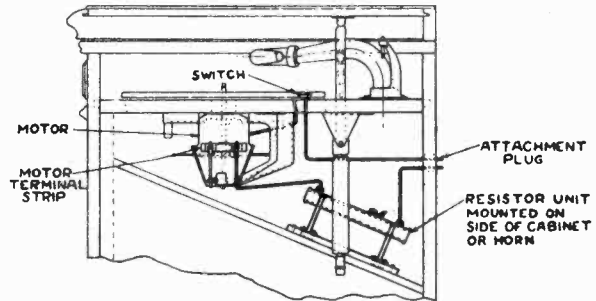


Fig. 2

SERVICING

The induction disc motor will not require any great amount of servicing, and if properly lubricated at least once every six months, the motor should run for years without attention. It should be remembered that two of the most common causes of motor failure are incorrect power voltage and lack of lubrication.

Too high voltage will cause the motor coils to heat excessively and thus destroy the insulation and dry the lubrication. Too low voltage will cause a lack of power and unstable operation. When servicing the induction disc motor, always check the power line voltage at the socket to which the motor is connected and if possible while the motor is running. This voltage should be between 105 and 120 volts. The servicing which the motor may require is in general of a minor nature, and in most cases adjustments will be mechanical rather than electrical.

1. LUBRICATION—In the majority of cases, the only servicing which the induction disc motor will require is proper lubrication. It is important that the motor be lubricated at least once every six months and with the proper lubricants. A motor lubricating diagram is shown in all instruction books. Victor Motor Grease should be used on the teeth of the governor drive gear and governor spiral. Lubricate the governor bearings, governor friction sleeve, and upper and lower turntable spindle bearings with Victor Motor Oil. If this oil is not available, a similar high grade oil of equal body can be used. Do not use an oil of a thinner body as this may prove injurious to the motor. Neat's Foot oil is recommended for lubricating the governor friction leather.

2. OPEN CIRCUITS—If the motor fails to start, the wiring should be carefully checked for open circuits. Connect a lamp in series with the 110 volt line, and test between the various external connections, the switch, and the fuse (if one is used). If these connections test correctly, test between the two terminals of each coil. Failure of the lamp to light will indicate a burnt out coil, or a broken wire within one of the coils. If the motor runs intermittently, and the external wiring checks correctly, there is likely a broken connection or wire in one of the coils.

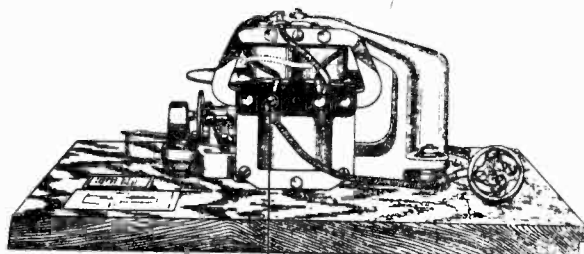


Fig. 3

3. REPLACING COILS—When replacing or changing coils on the induction disc motor, the following procedure should be used:

- Remove the motor board from the instrument.
- Tag all wires so that they can be properly replaced.
- Disconnect the wires from the 110 volt terminals shown in Figs. 3 and 4.
- Remove the three screws holding the motor coil to the frame or top plate.
- Lift the coil from the motor and replace with the new coil.

4. FAILURE TO MAINTAIN CONSTANT SPEED

—There are three points to be checked if the motor fails to maintain constant speed.

- Hardened or Gummed Lubrication**—Hardened lubrication will cause the motor to be unstable. Examine the moving parts; if necessary, remove them and wash with kerosene. Replace the parts and lubricate them as described in subject 1.
- Shifting of Motor on Motor Board**—In some cases a slight shifting of the motor on the motor board during shipment will cause binding. Loosen the three motor board screws, and re-tighten, alternately, while the motor is running until the binding has been eliminated and the motor runs steadily.
- Weak Coils**—A third and less frequent cause of speed variation is weak motor coils. If the lubrication and mounting of the motor have been examined as described in sections (a) and (b) above, and the condition still exists, replace one or both of the motor coils as described in subject 3.

5. REMOVAL OF DISC—The motor disc and the governor drive gear are each fastened to the turntable spindle with set screws. When removing the disc, loosen the two set screws, and pull the spindle away from the top plate. Care should be observed that the ball bearing on which the lower end of the spindle rests is not lost. When replacing the disc, it will be noted that the spindle is spotted for the governor drive gear and disc set screws, and that these spots are in line with the pin on the turntable spindle.

Note:—On the Model 91 motor it is necessary to remove one of the coils before the disc can be removed.

6. ADJUSTING POSITION OF DISC—The disc should be properly aligned between the upper and lower section of each coil so that it does not touch the iron core of either and does not cause binding of the governor gears. In case the disc rubs against the spindle adjusting screw 6, Fig. 1, in the top plate. Loosen the lock nut and turn the screw until the disc is evenly spaced between the upper and lower coils.

7. REDUCING HUM—There are a number of causes for hum in the induction disc motor, but in most cases any existing hum can be eliminated by proper adjustment.

- Loose Coil Winding on Iron Core**—This condition can be corrected by forcing a small wooden wedge between the outside of the coil and the core. It may be necessary to wedge both the upper and lower sections of each coil.
- Coil Loose on Top Plate**—The three screws holding the coil on the top plate should be tightened securely.

c. **Loose Laminations of Iron Core**—The bolts clamping the iron core laminations together should be tightened securely. In some cases, however, it may be found that the hum can be minimized by adjusting the tension of these bolts.

d. **Motor Not Fastened Securely to Motor Board**—Make certain that the nuts holding the motor to the motor board are fastened securely and with equal tension and that the felt washers between the motor and the motor board are not injured.

e. **Motor Not Properly Secured to Cabinet**—In many cases motor hum can be eliminated or minimized by adjusting the four corner screws which hold the motor board to the cabinet. Placing a piece of felt between the motor board and the motor board rail will often help to eliminate hum.

8. REDUCING MECHANICAL NOISE—There are several features which may cause motor noise other than a hum.

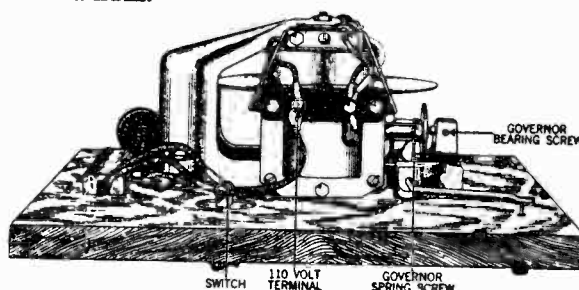


Fig. 4

a. **Governor Springs**—A noise or rattle may sometimes be caused by loose or broken governor springs. Tighten all the governor spring screws as shown in Fig. 4. If this does not stop the noise, loosen the screws on the disc end of the governor springs and allow the motor to run for a minute or so to allow the springs to assume their correct position. Stop the motor and re-tighten the screws. If any of the springs are broken or badly out of balance, they should be replaced. Removal of the governor can be accomplished by loosening the two governor bearing screws, one at each end of the shaft, and lifting the governor from the frame.

b. **Governor Thrust Bearing**—The thrust bearing at the disc end of the governor may sometimes cause noise while the motor is running. Hold one finger over the end of the bearing, and loosen the set screw which holds the bearing in position. Adjust the bearing to the most quiet running position, and re-tighten the set screw.

c. **Governor Spindle**—A bent governor spindle will cause binding in the gears and bearings as well as a noise. The bent spindle should be replaced with a new one.

d. **Governor Driving Gear**—Remove the turntable spindle as described in subject 5 above and examine the gear for wear. If the wear on the teeth is greater on one side than on the other, the turntable spindle is bent. The gear should be replaced.

e. **Turntable Spindle and Disc**—A bent turntable spindle or a bent or improperly adjusted disc will cause noise. The bent spindle may cause the disc to rub against the iron core of one of the coils as described in subject 6 above. A bent spindle can be detected by placing a pencil flat on the motor board with the point against the spindle. If the pencil point touches the spindle on one side only while the motor is running, the spindle is bent and should be replaced.

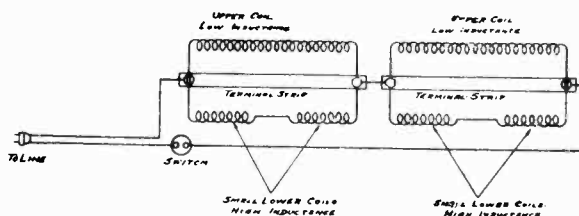


Fig. 5—Wiring Diagram of Victor Induction Disc Motor

9. SPEED REGULATION—The governor will maintain a constant speed of the motor within a range of sudden voltage changes of 15 volts, providing all parts are correctly adjusted. All the points mentioned in subject 8 above will have a certain effect upon the regulation of speed and should be taken into account even though there is no actual mechanical noise present.

UNIVERSAL ELECTRIC MOTOR

The Victor Universal Electric Motor is designed for universal operation at 32 volts A. C. or D. C. This operating voltage at the motor terminals is obtained from a power line of 100 to 230 volts by connecting the proper resistance in series with the motor.

The standard resistor units supplied for use on Victor Universal motors are listed below:

Part Number	For Line Voltages	Resistance Taps
15728	100 to 130 Volts	180-205-230 Ohms
19193	200 to 230 Volts	270-300-490-530-570 Ohms
16228	220 Volts	Motor Resistor 205-520 Ohms Lamp Resistor 1100 Ohms

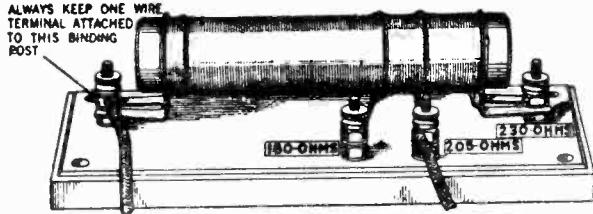


Fig. 1—100-130 Volt Resistor Unit

1. Operation on 100 to 130 Volts Direct or Alternating Current—Fig. 1 shows the 100-130 volt resistor unit, part 15728. This is the standard resistor for all Universal motor instruments operating from 100 to 130 volt circuits. On new instruments leaving the factory, the motor is connected to the 205 ohm tap, and the speed regulator adjusted at 110 volts to drive the turntable at 78 revolutions per minute. When installing Universal motor instruments, if the motor does not develop sufficient power when connected to the 205 ohm tap, shift to the 180 ohm tap, and re-adjust the speed of the turntable. If the motor runs too fast when connected to the 205 ohm tap, connect to the 230 ohm tap, and re-adjust the speed regulator. Always keep one wire attached to the end binding post shown in Fig. 1.

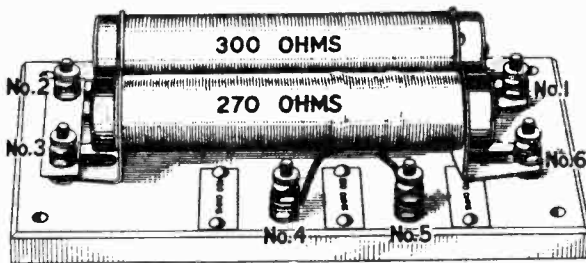


Fig. 2—200-230 Volt Resistor Unit

2. Operation of Universal Motor on 200-230 volts—Fig. 2 shows the 200-230 volt resistor unit, part 19193. The following table gives the resistance combinations of this unit to be used with different voltages:

Use Binding Posts	For Line Voltages
No. 1 and No. 4	200 to 210 Volts
No. 1 and No. 5	210 to 220 Volts
No. 1 and No. 6	220 to 230 Volts

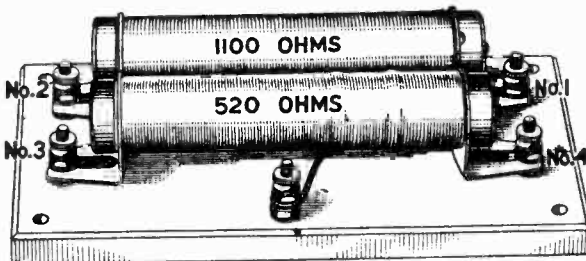


Fig. 3—220 Volt Resistor Unit for Operation with Compartment Lamp

3. Operation of Universal Motor on 220 Volts with Lamp—The resistor, part 16228, shown in Fig. 3, is designed for use on 220 volt circuits in which a compartment lamp is used with the instrument. Connection should be made between terminals No. 1 and No. 2 for the lamp, and between No. 3 and No. 4 for the motor. The circuit diagram for these connections is shown in Fig. 4.

In case it is desired to change from 220 volt to 110 volt operation, this unit can still be used by short circuiting the 1100 ohm resistor and connecting the wire on No. 4 terminal to the 205 ohm tap between terminals No. 3 and No. 4.

4. Operation on 32 Volt Power Source—The motor can be operated from a 32 volt power supply such as commonly used on farm lighting systems by connecting the power lines directly across the motor terminals without any series resistance. In those instruments using a compartment lamp it will be necessary to replace the standard 110 volt lamp with the 32 volt lamp, part 8594.

In all cases there can be a certain amount of voltage variation from that specified for a given resistance. The increase or decrease in turntable speed can be cared for by adjusting the speed regulator. In no case, however, should the voltage across the motor terminals be allowed to exceed 36 volts, or to go below 30 volts. The most accurate method of determining the correct resistance to use for a given line voltage is to connect a direct current voltmeter across the motor terminals, and vary the resistance until the meter reads between 30 and 36 volts. High voltage at the motor terminals

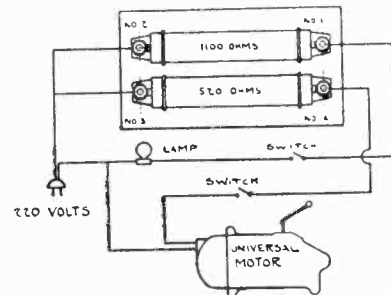


Fig. 4—Circuit Diagram for Resistor Unit Shown in Fig. 3

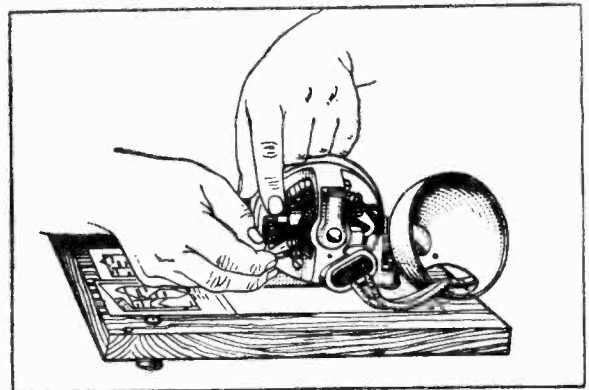


Fig. 6—Changing Brushes

will cause excessive wear and overloading of the brushes, dirty commutator, and noise in the motor. It is important, therefore, that the motor terminal voltage be kept within the limits described above.

MODELS 9-54, 9-56

RCA MFG. CO., INC.

MODELS 10-35, 10-69

SERVICING

The Victor Universal Electric Motor will not require any great amount of servicing with the

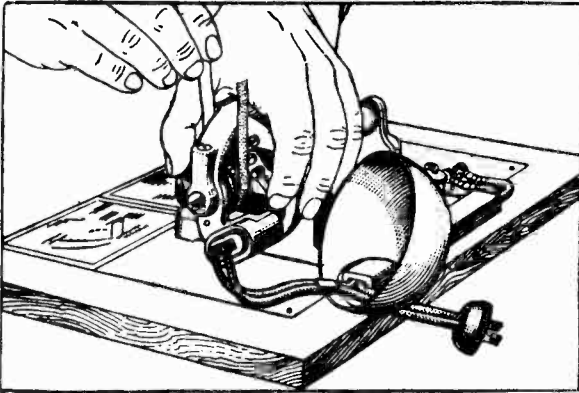


Fig. 7—Fitting Brushes

exception of occasional lubrication and renewal of brushes. Incorrect power voltage and lack of lubrication are the two most common causes of motor failure.

1. Lubrication—It is important that the motor be lubricated at least once every six months and with the proper lubricants. In the case of the Automatic, however, it may be necessary to lubricate the motor more frequently, particularly when the instrument is being played several hours every day. A motor lubricating diagram is shown in all instruction books and in Fig. 5. Use Victor Motor Grease on

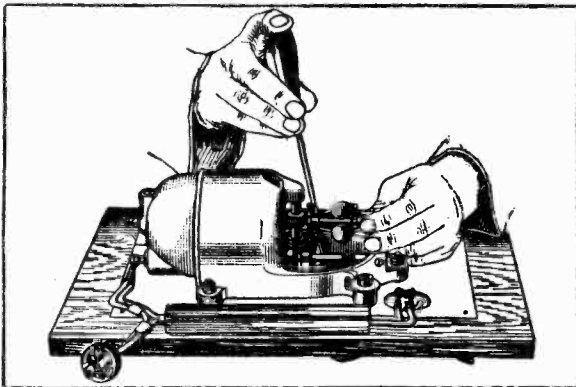


Fig. 8 Adjusting Governor Springs

the teeth of the governor drive gear, the governor spiral, and in the grease cups. Lubricate the governor bearings, governor friction sleeve, and turntable spindle bearings with Victor Motor Oil. If this oil is not available, a similar high grade oil of equal body can be used. Do not use an oil of a thinner body as this may prove injurious to the motor. Neat's Foot oil is recommended for lubricating the governor friction leather. If the leather has become hardened and glazed, it should be roughened with the sharp point of a knife so as to permit absorption of oil.

2. Renewing Brushes—The brushes should be replaced when they become badly worn. This condition will be noticed by excessive sparking and a noisy motor. Fig. 6 shows the method of changing brushes.

3. Sparking—Excessive sparking is usually caused by badly worn brushes or brushes that do not fit properly. Examine the brushes, and if necessary refit them by placing a narrow strip of No. 7-0 or No. 8-0 sandpaper around the commutator with the sand side out, rotating the commutator with

the sandpaper, at the same time placing pressure with the fingers on the tops of the brush holder spring latches. (See Fig. 7.) Do not use emery paper or cloth.

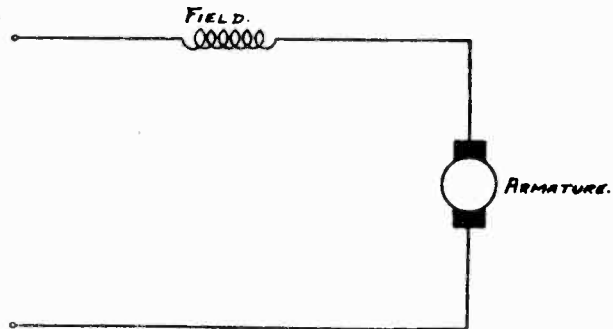


Fig. 9—Circuit of Universal Motor

A worn or dirty commutator will cause excessive sparking. It is well when adjusting or renewing brushes to clean the commutator, while the motor is running, using a cloth dampened with kerosene.

A badly pitted commutator will cause sparking; an open armature winding will cause excessive sparking at one point on the commutator. In both cases the motor should be returned to your distributor for repairs.

4. Failure to Maintain Constant Speed—There are several causes for failure of a motor to maintain constant speed.

- a. Hardened or Gummed Lubrication—Hardened lubrication will cause the motor to be unstable. Examine the moving parts; if necessary remove them and wash with kerosene. Replace the parts and lubricate them as described in subject 1 above.
- b. Shifting of Motor on Motor Board—In some cases a slight shifting of the motor on the motor board during shipment will cause binding. Loosen the three motor board screws, and retighten them alternately until the binding has been eliminated and the motor runs steadily.
- c. Broken Armature Wires and Burned Commutator—Armature wires may sometimes become broken, causing intermittent contact. The commutator may become badly burned after a motor has been in hard service for a period. In such cases the motor should be returned to your distributor for repairs.

5. Reducing Mechanical Noise.

- a. Governor Springs—A noise or rattle may sometimes be caused by loose or broken governor springs. Tighten all the governor spring screws as shown in Fig. 8. If this does not stop the noise, loosen the screws on the disc end of the governor springs and allow the motor to run for a minute or so to permit the springs to assume their correct positions. Stop the motor and retighten the screws.
If it is found after this test that any of the springs are broken or badly out of balance, they should be replaced.
- b. Governor Spindle—A bent governor spindle will cause binding in the gears and bearings as well as a noise. The bent spindle should be replaced with a new one.
- c. Governor Driving Gear—Remove the turntable spindle and examine the governor driving gear for wear. If the wear on the teeth is greater on one side than the other, the turntable spindle is bent. Both the gear and the spindle should be replaced.
- d. Worn Commutator—A badly worn commutator or worn brushes will cause noise. This can be eliminated by the adjustments described in subjects 2 and 3 above.

6. Speed Regulation—The governor will maintain a constant speed of the motor within a range of sudden voltage changes from 6 to 8 volts, providing all parts are correctly adjusted. All the topics under the subject of Servicing will have a certain effect upon the regulation of speed and should be taken into account even though there is no actual mechanical noise present.

**AUTOMATIC SWITCHES AND
AUTOMATIC BRAKES**

The automatic switch and the automatic brake described in this Supplement operate on the same principle as the earlier type switches and brakes, but their construction differs slightly. The switch and the brake are identical in construction except for the switch unit 15, Fig. 2 which is mounted on the brake plate. This unit is readily detachable; the automatic switch can be made into an automatic brake, or vice-versa.

The adjustments are the same as those described in Service Bulletin No. 11, and the points A and B in Fig. 2, correspond to the points A and B of Fig. 3, Service Bulletin No. 11.

The switch shown in Fig. 2 will ordinarily require no adjustment. In some cases, however, the upper spring shown in Fig. 1, may become bent upward far enough to prevent the contacts from coming together when the hand lever is turned on. When such a condition is found, bend the upper spring

down until the contact points make a firm contact when the hand lever is turned on. When replacing the switch on the brake plate, care should be observed in properly locating the switch on the plate so that the switch will make and break contact when the hand lever is turned on and off. The two screws shown in Fig. 2 can be loosened and the switch moved in the slot of the adjusting screw until the correct position is located. When the hand lever is in the off position, the contact points should be at least $\frac{1}{16}$ inch apart to prevent excessive sparking when the switch is turned off.

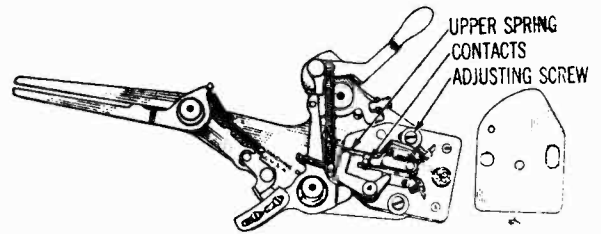


Fig. 1—Automatic Switch With Top of Switch Unit Removed

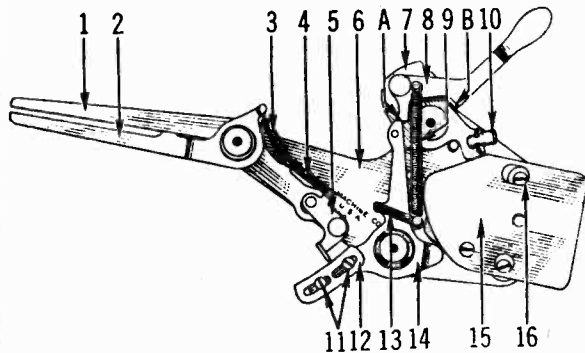


Fig. 2—Automatic Switch, Part 19950C

**PARTS LIST FOR AUTOMATIC BRAKE AND
AUTOMATIC SWITCH**

Name of Part	Part Number
1. Friction Lever	
2. Switch Lever	
3. Spring	
4. Spring	
5. Latch Trip Rivet	
6. Switch Plate	
7. Cam Lever	
8. Hand Lever	
9. Spring	
10. Brake Leather	
14. Screw	
12. Latch Plate	
13. Spring	
14. Latch	
15. Switch	
16. Screw Washer	

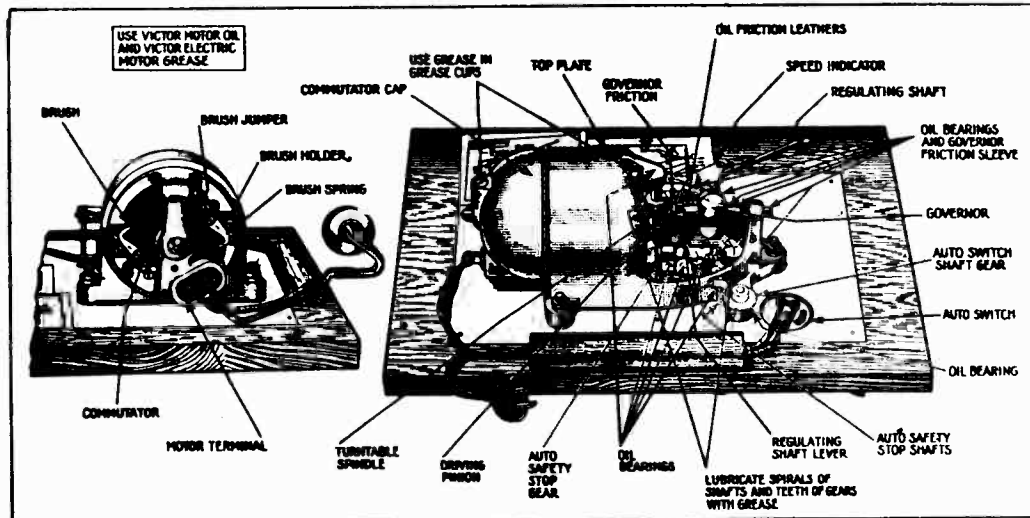


Fig. 5—Oiling Diagram

Note:—Dotted portion indicates auto safety stop equipment of early type motors.

RCA MFG. CO., INC.

MODELS 9-55, 10-50,
10-51, 10-70

Automatic Victrolas and Electrolas

10-50, 10-51, 10-70 and 9-55

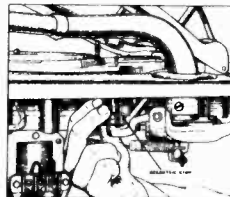
The important points of operation are:

1. THIS INSTRUMENT WILL NOT FUNCTION AS AN AUTOMATIC UNLESS VICTOR ECCENTRIC GROOVE RECORDS ARE USED.
2. Make sure that the index lever is properly set to either 10-inch or 12-inch, according to the size of records being played. Failure to do this may cause damage to the sound box or pick-up.
3. Do not allow more than twelve (12) records to accumulate in the record drawer at one time. Breakage or "jamming" of records will occur if this point is not observed.
4. ALWAYS PUSH THE RECORD DRAWER IN AS FAR AS IT WILL GO AFTER REMOVING THE RECORDS WHICH HAVE BEEN DEPOSITED THEREIN.
5. The speed regulator should never be changed except to maintain or set the speed at seventy-eight (78) revolutions per minute.
6. When starting to play as a non-automatic machine, it may be found that the tone arm will not swing freely when the index lever is turned to "VICTROLA" or "ELECTROLA." Do not force the arm—start the motor and allow the automatic mechanism to complete its cycle.
7. When playing as a non-automatic instrument, the switch will not throw off automatically, but must be operated by hand, and the sound box (or pick-up) removed, as in a non-automatic instrument, from the record surface.
8. When the record loader is being used to remove records from the program carriers, great care should be exercised in aligning the center holes. Chipping of the center holes and ruining of the records may result if this point is not observed.
9. After records have been loaded on magazine spindle, carefully lower magazine stand into playing position. Failure to observe this precaution will result in chipping the record in contact with the hook of the magazine spindle.
10. Do not allow the sound box or pick-up to drop backward or forward on its stop. If care is not used, the horizontal traveling height of the needle may be thrown out of adjustment, which may, during operation, scratch the turntable felt or ruin the record, sound box, (or pick-up).
11. Lubrication is an essential factor in the operation of the Automatic instrument and should be given careful attention. It is important that the motor and automatic mechanism be lubricated at least once every six months, with the proper lubricants, but if the instrument is being operated in a public place on the usual average of eight hours a day, this lubrication period should be reduced to at least once a week.

Re-Adjusting Tone Arm

After installing the electric pickup, it may be necessary to re-adjust the overall horizontal position of the tone arm in order to permit the needle to lower onto the smooth outside rim of the record.

- a. Loosen the 12" eccentric stop clamping screw in the taper tube arm casting.
- b. With a small rod or nail, turn the eccentric stop as shown in the illustration. In some cases it may be necessary to turn



the stop to the right, and in other cases to the left.

- c. Check the setting after successive trials until the proper position is obtained, and then re-tighten the clamping screw.

Name of Part

- | | |
|------------------------------|-------------------------------|
| 1. Motor Plate | 18. Taper Tube Return Lever |
| 2. Lifter Ring Post Front | 19. Connecting Link |
| 3. Lifter Ring Post Rear | 20. Spring |
| 4. Sound Box Lift Lever Stud | 21. Spring |
| 5. Slide Spring (Not Shown) | 22. Spring |
| 6. Main Slide | 23. Motor—60 Cycle |
| 7. Intermediate Gear | —25-30 Cycle |
| 8. Cam Gear | —Universal |
| 9. Index Lever | 24. Screw (3 Used) |
| 10. Index Shaft | 25. Thrust Washer (Not Shown) |
| 11. Sound Box Control Lever | 26. Pawl Carrier |
| 12. Clutch Release Lever | 27. Clutch Wheel |
| 13. Sound Box Lifting Lever | 28. Spring |
| 13a. Nut | 29. Index Control |
| Screw | 30. Reject Lever |
| 14. Collar | 31. Spring |
| 15. Shaft | 32. Taper Tube Assembly |
| 16. Nut | 33. Screw (6 Used) |
| 17. Trip Lever | 34. Screw (2 Used) |

NOTE:—The operating unit of the Automatic Electrolas differs from the Automatic Victrolas in the taper tube return lever No. 18, Fig. 1. All 10-50 units above serial No. 8950, all 10-51 above serial No. 800, and all 10-70 and 9-55 have a motor plate with provision for mounting the electric pick-up shunt switch and the remote reject control.

SERVICING

1. Should the sound box (or pick up) fail to swing into the record groove after the tone arm has descended to the playing position:

Check to see that the machine is level. If the right side (facing the front of the machine) is lower than the left, the sound box will not swing over into the record groove. If the left side is low the sound box will skip the first few grooves of the record. This is because the tone arm is mounted at a slight angle to the horizontal, allowing the arm to swing into the playing groove by force of gravity after lowering upon the smooth portion of the record.

True levelling is obtained by the use of a spirit level. The level should be placed on the turntable to accomplish the desired result. Level readings should be taken in a plane parallel to the front of the instrument and also at right angles to it. Obviously, the remedy for any instrument not in a horizontal plane is to place thin pieces of cardboard, or other available material under the feet of the lower end until the proper level is obtained. Bear in mind that this is a temporary remedy: it is advisable to check the levelling frequently.

2. If the record lift ring (No. 52, Fig. 2) fails to pick up record:

- a. The magazine spindle is bent either towards the front or back of the instrument.
- b. The magazine spindle (No. 36, Fig. 2) should either be lowered or raised slightly as the case may warrant, by adjusting screw (Part No. 19322).
- c. The record is warped.

NOTE:—To prevent interruption of the program it is IMPORTANT that BADLY WARPED records should not be used.

- d. Lift ring shaft is bent.

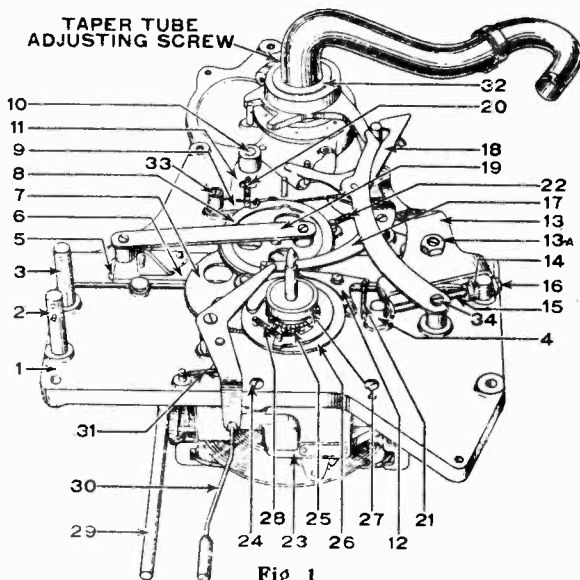


Fig. 1

MODELS 9-55, 10-50,
10-51, 10-70

RCA MFG. CO., INC.

- e. Operating unit and magazine stand are located either too far away or too close together, and will not permit the records to mount the buttons properly. Remove magazine stand and file bolt holes in board, if necessary, so that the stand may be placed in the correct position with reference to the operating unit.

3. If the record drops into the drawer after being lifted from the magazine spindle or fails to line up with the turntable spindle:

- The magazine spindle is bent either towards the front or the back of the instrument.
- A warped record has been used.
- Warped or bent lift ring.
- Lifter ring posts (2 and 3, Fig. 1) out of line.

4. Should binding of the record lift pad (No. 50, Fig. 2) occur:

- Remove the shaft (No. 49, Fig. 2.) If bent, it should be replaced with a new shaft.
- Note if sides of record lift pad are binding against nut of latch and link of record lift ring. If necessary, file the sides so as to clear the ring.

A bent shaft causes failure of the pad and lift ring to rise simultaneously. The record consequently is not raised from the turntable equally and is thus forced by the revolving turntable to strike the side of the record chute. This condition may cause breakage of records.

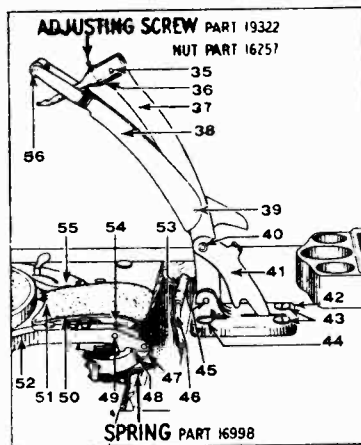


Fig. 2

Name of Part

- Screw
- Nut (Not Shown)
- Magazine Spindle
- Magazine Stand
- Tilting Lever
- Screw
- Nut (Not Shown)
- Nut
- Latch
- Base
- Screw
- Screw
- Screw
- Nut (Not Shown)
- Record Guide
- Latch
- Link
- Shaft
- Record Lift Pad
- Felt
- Record Lift Ring
- Felt
- Screw
- Switch
- Roller

5. If the lift ring fails to discharge a record into the drawer after it has been played:

The small spring (Part No. 16998) shown in Fig. 2 may be broken or disconnected.

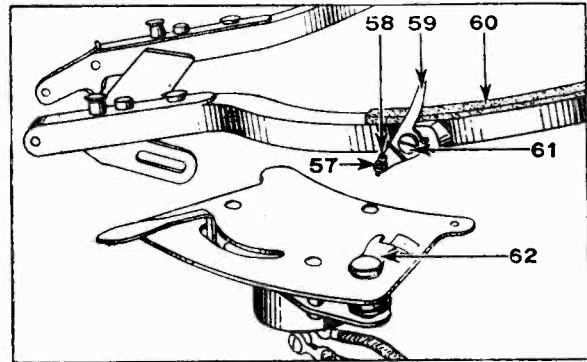


Fig. 3

Name of Part

- Nut
- Screw
- Trip Lever
- Felt
- Screw
- Latch Trip

6. If the brake does not shut off at end of program:

- The small screw (No. 58, Fig. 3) on the automatic stop is not properly adjusted.
- Set screw (No. 70, Fig. 4) located under brass plate on switch trip may be loose.
- One of the springs (No. 63 or No. 64, Fig. 4) on the brake may not be properly adjusted, or has become loosened.
- The electric switch contacts are sticking.

On 10-50 below serial number 8951 and 10-51 below serial number 801 proceed as follows:

Remove the bakelite cap of switch and spread contact points to permit easier operation. WHEN TAKING THE SWITCH APART BE CAREFUL TO OBSERVE THE POSITION OF THE INSULATING WASHERS SO THAT THEY CAN BE PLACED IN PROPER POSITION WHEN REASSEMBLING.

On all other automatic instruments the following procedure should be used:

Remove bakelite top, loosen screws holding contact mechanism and with switch in closed position, move switch towards the shoulder of the latch, leaving enough clearance so that there is no pressure on movable contact arm. This will allow the contacts to open to their maximum point and prevent arcing and sticking. File and clean contacts.

- Warped lift ring.

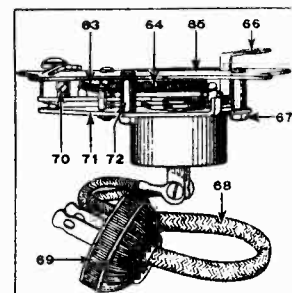


Fig. 4

Name of Part

- Spring
- Spring
- Top Plate
- Switch Lever
- Nut
- Cord
- Plug
- Screw
- Bottom Plate and Switch Assembly
10-50 Below Serial No. 8951
10-51 Below Serial No. 801
All Other Automatics Bottom Plate Only
- Spacer
- Switch (Used with Bottom Plate 20305A)

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MODELS 9-55, 10-50,
10-51, 10-70

7. Failure to reject a record when the reject button is pushed may be caused by:

- a. Reject button having been forcibly pushed in, bending connecting link to reject mechanism. This can be remedied by removing the front panel on which the index lever is mounted and bending the reject mechanism back to its original position.
- b. Defective reject magnet circuit. (Models 10-70 and 9-55).
 1. Bad switch—dirty contacts.
 2. Burnt out coil.
 3. Broken wiring.

8. Continued rejection when the button is not pushed may be caused by:

- a. The button being stuck, having been forcibly pushed in by the operator.
- b. Heavy grease or foreign matter in the cam notches of gear (No. 8, Fig. 1).
- c. Excessive pull in spring (No. 28, Fig. 1) or worn teeth on pawl.
- d. Worn trip lever.
- e. Mechanism improperly timed.

CAUTION:—Use nothing but specified springs throughout.

9. If the point of the needle rides over several grooves in coming to rest on the record, or does not rise high enough to clear the record on its return, proceed as follows:

- a. Place index lever in "Victrola" or "Electrola" position and permit mechanism to operate until the tone arm is in playing position and free.
- b. Note distance of point of needle below top of turntable. This should be between $\frac{1}{8}$ and $\frac{1}{4}$ of an inch.
- c. If the distance is not approximately the same as that given in (b), make the following adjustment: Loosen screws holding crook stop to tone arm and alter the position of the crook stop until the correct distance of the point of the needle below the turntable is obtained.
- d. Tighten screws.

NOTE:—Carelessness in mounting the sound box or the pick-up on the tone arm, and failure to fit screw on pick-up in hole provided for this purpose, will often result in a condition noted at the beginning of this section.

10. Should the mechanism trip when the index lever is in "Victrola" or "Electrola" position, and it has been definitely found that the cause does not lie in any of the points mentioned in subject 8:

- a. Remove the back panel of instrument and loosen taper tube adjusting screw (Fig. 1) one quarter ($\frac{1}{4}$) turn.
- b. Force the taper tube arm (the casting containing the adjusting screw) UP until the trip lever clears the ratchet by approximately $\frac{1}{8}$ of an inch, and retighten adjusting screw.

NOTE:—The normal position of the collar should now be approximately $\frac{1}{8}$ of an inch below the base of the taper tube, PROVIDING ADJACENT PARTS HAVE NOT BEEN BENT OR TAMPERED WITH.

11. If the sound box or pick-up does not lower at the proper position onto a ten- or twelve-inch record: falls into the record groove without first striking smooth outside margin: or does not reach the outside diameter of record before lowering:

- a. Place twelve-inch record on turntable with index lever in 12-inch position, start the motor and note the distance at which the needle strikes to right or to left of correct adjustment. (Needle should strike record at approximately the middle of the outside margin.)
- b. Turn index lever to "Victrola" or "Electrola," allowing mechanism to complete cycle so that tone arm is free and in playing position.
- c. Stop motor.
- d. Move the tone arm towards the center of the record, past the eccentric groove until it strikes the stop.
- e. Slightly etch the record label at this point with the needle.

- f. Remove the back panel of the instrument, allowing access to "Taper Tube Adjusting Screw," as shown in Fig. 1.

- g. Loosen the screw one quarter ($\frac{1}{4}$) turn so that the tone arm can be moved the proper distance in the casting either to the right or left of the etched mark on the record until the proper adjustment has been obtained. The adjusting screw should again be tightened. BEING VERY CAREFUL THAT THE TAPER TUBE ARM CASTING HAS NEITHER RAISED NOR LOWERED WITH RESPECT TO THE TONE ARM.

- h. Remove twelve-inch record and replace with ten-inch one.

- i. Start the automatic mechanism again and allow it to run until the taper tube return lever starts to draw the taper tube towards the record. Shut off power and revolve turntable by hand (if induction disc motor is used) noting the manner in which the needle comes to rest on the record. (If it is noted that the horizontal travel of the needle changes to a slope just before reaching the record and continues so, until surface of the record is reached, it is evident that the mechanism is lowering the sound box or pick-up prior to the termination of the needle's horizontal travel towards the record.)

As a condition of this nature will sometimes cause the needle to drop outside of the record edge and damage the adjacent mechanisms, or, due to the greater velocity attained on the slope, break down the walls of the first grooves, the following adjustments should be made:

- j. Slightly loosen lock nut (13A, Fig. 1) on cam button and with screw driver turn button about ten degrees in either a clockwise or counter-clockwise direction.

- k. Tighten nut and start the mechanism through its cycle, again noting the manner in which the needle strikes the record. Observations should show a needle path practically horizontal until the needle is almost directly over the margin of the record: then a gradual drop to the record's surface. In the event that this adjustment has not yet been reached, turn the cam button about ten degrees more in the same direction and repeat until the mechanism functions in the desired manner.

In order that this gradual adjustment is not carried too far and to prevent the cam button from resting too much on the slope of the main slide, a check may be made from the following requirements:

With the index lever in "Victrola" or "Electrola" position, and the needle resting on the margin of a ten-inch record, the clearance between the bottom of the fulcrum pin on the taper tube assembly and the fish tail on No. 13, Fig. 1, should be about $\frac{1}{8}$ of an inch, providing the fish tail has not been bent.

From the above description it should now be evident that the main function of the cam button is to determine the time or position with respect to the horizontal travel of the sound box or pick-up, in which the needle is lowered onto the record, and its adjustment should not therefore be altered for other failures.

12. Should the pick-up shunt switch (shown dotted in Fig. 9) fail to close or should it momentarily open after the reject button has been operated, or fail to open when the first music grooves are reached:

With roller "G" engaged in pawl carrier at point "H," Fig. 9, loosen screws holding pick-up shunt switch to the operating unit base, and adjust its position so that the contacts have a clearance of about $\frac{1}{8}$ of an inch.

If the condition cannot be corrected by the above adjustment, loosen the nut shown at 13A, Fig. 1, and turn the screw slightly as may be required.

13. Should the mechanism fail to trip in ten- or twelve-inch position:

- a. Loosen set screw under crook joint collar of tone arm and tighten collar until all side play is removed, being careful, however, that the up and down movement of the crook is not impeded.
- b. Remove any possible bind from trip pawl on fulcrum pin mentioned in (k), No. 11, above.

14. If the index lever does not point to the proper position on indicator plate, adjustment can be made in the following manner:

- a. Remove back of cabinet to give access to gears controlling index lever. The shaft and pinion are on a block which is attached to the top plate with two screws.
- b. With a short screw driver loosen these screws until gears are clear.

MODELS 9-55, 10-50,
10-51, 10-70

RCA MFG. CO., INC.

- c. Set index lever so that it points to proper position on indicator plate.
- d. Re-tighten the screws and then replace the back of the cabinet.

Figures 5, 6 and 7 explain details of oiling and cleaning the entire mechanism. **DO NOT USE HEAVY GREASE.** Heavy grease or foreign matter lodging in the cam notches or gears may cause failure of operation.

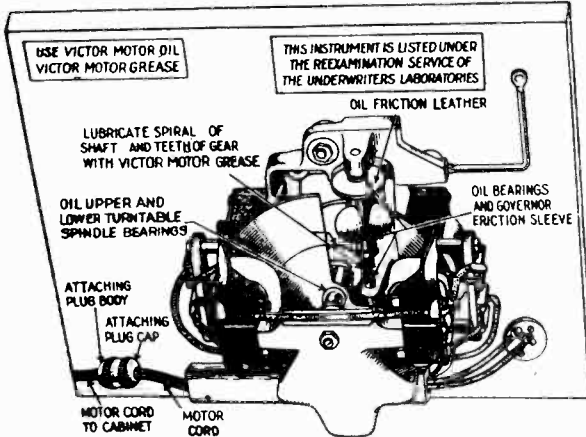


Fig. 5

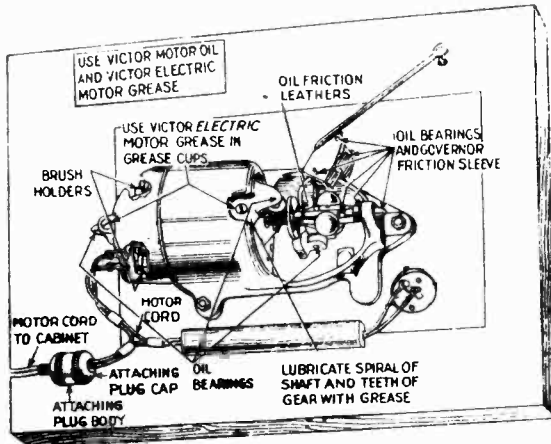


Fig. 6

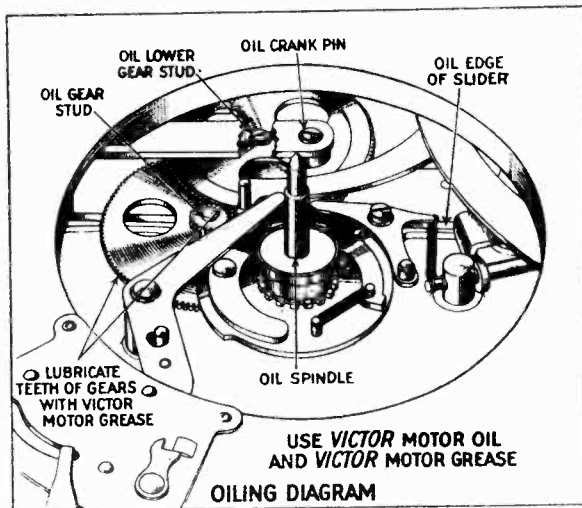


Fig. 7

15. Should it become necessary to make accessible parts other than those which can be reached by removing the turntable:

- a. Remove the screws "A" (Fig. 8) on the ferrule around the record chute.
- b. Remove the two (2) screws "B" in the tone arm plate.
- c. Remove the speed regulator screw "C."
- d. Loosen the set screw "D" on the record lift ring.
- e. Push out the holding rod "E," and remove lift ring and pad.
- f. Remove the four (4) large screws "F."
- g. Remove turntable.

After the motor board has been replaced, the speed regulator should be readjusted to seventy-eight (78) revolutions per minute.

NOTE:—If it is desired to operate motor with motor board removed, be sure to replace and adjust the speed regulating screw. **DAMAGE** to the governor **WILL RESULT** if this point is not observed.

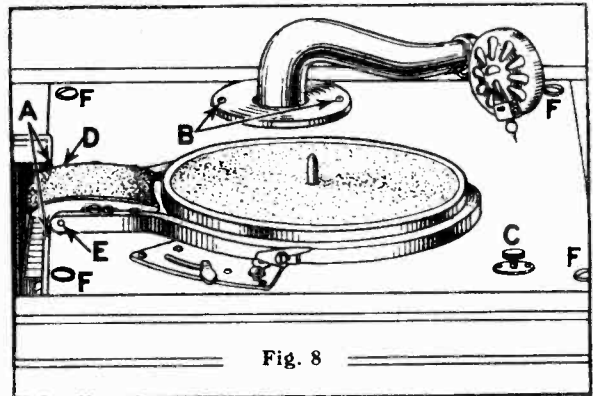


Fig. 8

16. To replace a coil, turntable spindle, or disc on the motor, it will be necessary to remove the mechanism from the cabinet. This is accomplished in the following manner:

- a. Remove the front panel on which the index lever is located.
 - b. Remove the three (3) bolts which hold the bed plate secure in the cabinet.
 - c. Remove the clips securing the motor wire to the cabinet.
 - d. On 10-50 and 10-51:
 1. Remove the two (2) bolts which lock the first joint of the horn elbow to the tone arm.
 2. Standing at rear of instrument, lift mechanism high enough to clear centering pins, and toward the rear of the cabinet until the end on which the regulator screw extension is located, can be raised over top of front rail. This allows the end on which the tone arm is located to rest on end rail and mechanism can then be removed.
 - e. On 9-55 and 10-70:
 1. On the 9-55 and 10-70 models, loosen screws holding pick-up shunt switch (shown dotted in Fig. 9) to operating unit base, and drop switch.
 2. Standing at front of the instrument, grasp the mechanism at the speed regulator end and raise it, until the centering pins are cleared. Twist mechanism in a clock wise direction, at the same time lifting the left rear end and pushing the unit upward and towards the rear of the cabinet until the index lever is raised clear of the front rail. The mechanism can now be drawn out without further difficulty.
- Disconnect motor wires so that the wires will go back into position without crossing. Mark the various terminals so that in reconnecting they will be replaced in the same order in which they were removed.
- g. In replacing mechanism, great care should be used so that the centering pins are not forced above the top of the bed plate. If this should occur, the mechanism will "jam" and refuse to function.

RCA MFG. CO., INC.

MODELS 9-55, 10-50
10-51, 10-70

17. In removing either the turntable spindle or the disc:

- Remove reject lever complete shown in Fig. 1, No. 30.
- Loosen set screw on clutch wheel No. 27, shown in Fig. 1.
- Remove clutch wheel No. 27 and pawl carrier No. 26, shown in Fig. 1.
- Remove three (3) motor top plate bolts and drop motor away from bed plate, so that necessary replacements may be made.

18. Precautions necessary in reassembling:

- Replace thrust washer (No. 25, Fig. 1).
- Remount motor on bed plate.
- Retime mechanism in the following manner, referring to Fig. 9.
 - Hold cam pin against cam slide and revolve gear in clockwise direction until pin strikes side of rise of cam.
 - Mark tooth of intermediate gear parallel with slide bar.
 - Revolve cam gear in counter-clockwise direction until cam pin touches opposite side of cam.
 - Mark tooth of intermediate gear parallel with slide bar.

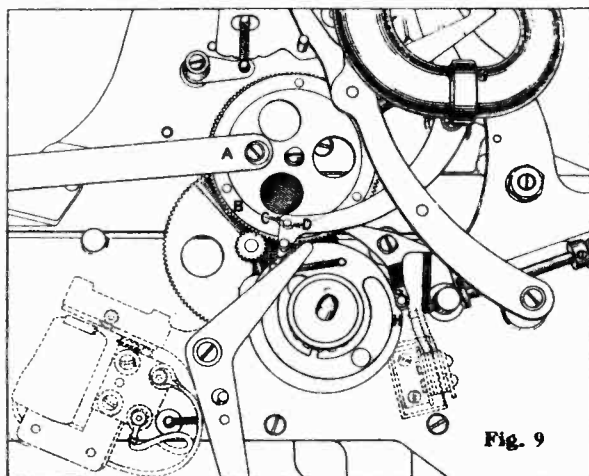
These preliminary actions will allow the determination of the extremes of the cam and permit the distance to be referenced on the teeth of the intermediate gear.

- Divide the distance between the two marked teeth on the intermediate gear and set the gear in a position where the third mark will be parallel with the slide bar.

The trip lever pin will now be centralized with reference to the cam sides.

Upon replacing pawl carrier, "G" and "H" should be in position, as shown in Fig. 9.

The center line of the connecting rod "A" should be slightly beyond the center of the gear "B" as shown. The face of the pawl "E" will then be against the trip lever "F."



(Dotted portion at left shows remote reject coil and on right electric pick-up shunt switch both used on 9-55 and 10-70.)

- Replace clutch wheel and tighten set screw in spotted point on turntable spindle.
- Replace reject lever.
- Replace mechanism in cabinet.
- Replace front panel.
- Replace motor board.
- Replace rear panel.

19. If the tone quality of the model 10-50 instrument is not up to standard:

- Replace the sound box, bearing in mind if this is done that it may be necessary to readjust the tone arm, as explained in subject nine (9).

NOTE:—It also would be well at this time to place a small amount of Victor Motor Grease on the end of the sound box crook, to make an air tight joint between this point and the sound box.

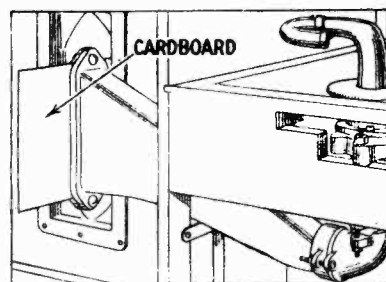


Fig. 10

- Loosen the horn elbow as shown in Fig. 10.
- Insert a piece of cardboard large enough to block the sound passage.
- Retighten horn elbow.
- Remove sound box from taper tube. Blow lightly into the tube, taking care not to use too great force, for by so doing, grease at the joint will be forced out.

NOTE:—If the passage is tight, a slight resistance will be noticed and a pressure can be established. If the passage is open, it will be impossible to establish a back pressure.

20. If the above test shows an air leak exists:

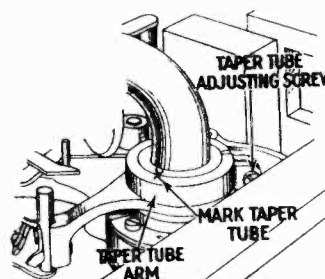


Fig. 11

- Take the following precautions prior to loosening taper tube adjusting screw:
 - Etch a mark across the gold plated portion of the base of the tone arm and taper tube arm as shown in Fig. 11, so as to mark the position of these two parts with relation to each other. The replacement can, thus be made with a minimum of adjustment.
 - Note the height of the base of the tone arm in the taper tube arm (casting).
- Loosen the taper tube adjusting screw.
- Remove the taper tube arm casting from the unit.
- Remove the three (3) screws (one of which is shown in Fig. 11) on the base of the tone arm.
- Lift the tone arm from the unit.

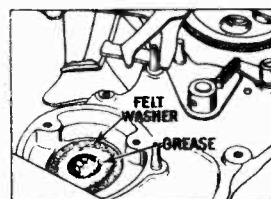


Fig. 12

- Examine the felt washer (shown in Fig. 12) to determine that it is properly packed.

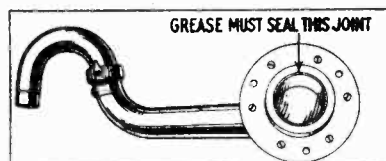


Fig. 13

MODELS 9-55, 10-50,
10-51, 10-70

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g. Place a liberal quantity of FIRM CUP GREASE around the inside diameter of the washer so that the joint shown in Fig. 13 will be well sealed when the tone arm is replaced. This joint is the most likely point of air leakage, but when properly sealed it should remain air tight indefinitely.

NOTE:—THE BODY OF VICTOR MOTOR GREASE IS TOO LIGHT FOR THIS WORK AND SHOULD NOT BE USED.

h. Replace the tone arm.

NOTE:—Make sure that felt washer shown in Fig. 12 does not overlap hole, as a careless replacement of this washer may cause taper tube to bind.

i. Again make tests for air leaks.

j. If the leak still remains make certain that the other joints of the horn elbow are tight. If there is any doubt about these joints they can be sealed with white lead.

k. When certain that all air leaks are closed, remove cardboard from horn elbow and tighten joint.

l. Adjust the tone arm until the mark etched on the two base parts correspond and the vertical position in the taper tube arm (casting) is the same as previously observed.

m. Make necessary tests with ten-inch (10") and twelve inch (12") records to check the adjustment of the tone arm.

n. When all adjustments have been completed, replace the motor board.

AUTOMATIC SWITCHES AND
AUTOMATIC BRAKES

The automatic switch is a system of cams and levers operating in such a manner that the movement caused by the eccentric groove in the record, trips the switch, forcing a friction leather against the turntable and at the same time cutting off the power to the motor. The automatic brake acts in the same way except that the braking effect on the turntable is stronger than in the case of the electric switch.

In the majority of cases there will be but two major adjustments to make. These adjustments outlined below apply to both the automatic switch and the automatic brake unless otherwise noted.

1. If the switch fails to trip, bend the lug A, Fig. 3, so that there will be a smaller bite of the hand lever at the point B.

NOTE: Failure to trip may sometimes be caused by a loose trip arm. Make certain that all screws of this assembly are tight.

2. If the switch trips before the completion of a record, bend the lug A back, so that there will be a larger bite of the hand lever at the point B, Fig. 3.

NOTE: Do not bend the lug too far as bending too often in opposite directions will snap off the lug.

In some cases it will be necessary to make the following adjustments:

3. The two surfaces at the point B must be square. If they have become worn round, they should be squared with a fine file.

4. If the switch lever 1, Fig. 1, swings with the eccentric groove, but the friction lever 2 fails to swing, or swings but slightly,

The latch trip 5 is probably caught in a burr on one of the teeth of the latch plate 6. Rub the teeth of the latch plate with a piece of emery cloth, taking off any burrs that may be present.

5. If the latch trip does not engage with the latch plate properly when the tone arm is swung to the starting position:

- a. Loosen the screws 12, Fig. 1.
- b. Adjust the plate 6 the required amount.
- c. Re-tighten the screws.

NOTE—The adjusting of the latch plate has nothing to do with the tripping of the latch.

6. If the brake does not stop the turntable soon enough, the condition can be remedied by one of the following:

- a. Examine the friction leather, making certain that it is not worn down too far to make proper contact with the inside rim of the turntable.
- b. In the case of the electric switch, place a drop of oil on the bearing between the brake lever 17, Fig. 1, and the cam lever 16. In the case of the automatic brake, place the oil between the brake lever 33, Fig. 3, and the brake plate 29.
- c. Increase the tension of the spring 10, Fig. 1, (or 32, Fig. 3) by cutting off one or more of the coils and then replacing the end of the spring over the lug. The tension of spring 10 must always be less than that of spring 13.

7. If the latch 28 does not strike the lug A when the hand lever is pulled to the ON position:

- a. Increase the tension of the spring 31 in the same manner as described above in (c) of 5.
- b. Decrease the tension of the spring 27 by stretching the coils.

8. If the switch contacts stick:

- a. Remove the two screws 19, Fig. 2, in the switch body, and remove the body from the plate, taking care that the two fiber washers are not lost.
- b. Examine the contacts at 18, and remove any corrosion that may be present.
- c. Spread the contact fingers 20 with a small screw driver.
- d. Care should be taken when re-assembling that the fiber washers in the switch contact unit are placed properly.

AUTOMATIC SWITCH FOR VE 8-30

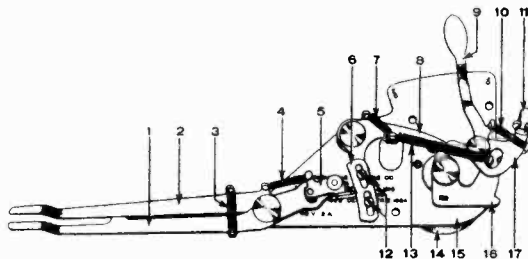


Fig. 1

- | | |
|--|---|
| <p>Name</p> <ul style="list-style-type: none"> 1. Switch Lever 2. Friction Lever 3. Spring 4. Spring 5. Latch Trip 6. Latch Plate 7. Spring 8. Latch | <ul style="list-style-type: none"> 9. Hand Lever 10. Spring 11. Brake Leather 12. Screw (2 Used) 13. Spring 14. Spring Body 15. Switch Plate 16. Cam Lever 17. Brake Lever |
|--|---|

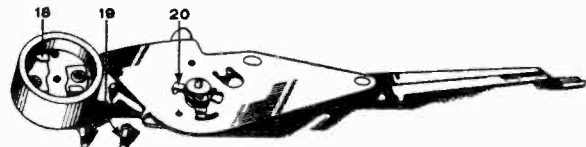


Fig. 2

- | | |
|--|---|
| <ul style="list-style-type: none"> 18. Contacts 19. Screw (2 Used) 20. Contact Finger Lever | <p>Name</p> <ul style="list-style-type: none"> Fiber Washer (2 Used) |
|--|---|

9. If the switch does not make contact:

- a. Proceed as for (a) and (b) of 8 above.
- b. Pinch the contact fingers 20 closer together.
- c. Replace the parts, taking care that the washer 21 is in its proper position.

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MODELS 9U, 9U2, D11-2,
15U, D22-1

TO ADJUST RISE AND SWING OF TONE ARM — WITH MANUAL INDEX LEVER IN 12° POSITION AND ROLLER ON MAIN LEVER A ENGAGED IN CAM AT HALF CYCLE POSITION AS SHOWN, AND SWITCH LEVER B AGAINST STOP SCREW C, ADJUST EYEBOLT D UNTIL LIFT STOP 'E' CONTACTS SLIDE AT THE SAME TIME ADJUST SCREW C SO THAT NEEDLE LANDS AT A RADIUS OF $5\frac{13}{16}'' + \frac{1}{16}'' - .000$ FROM CENTER OF TURNABLE SPINDLE.

WITH MOTOR BOARD LEVEL, BRING POINTER ON SPACER IN LINE WITH SCREW AS SHOWN. IF NEEDLE SLIDES OVER SEVERAL GROOVES, ROTATE SPACER COUNTER-CLOCKWISE BUT NOT FAR ENOUGH TO PREVENT NEEDLE FROM FEEDING INTO FIRST GROOVE AUTOMATICALLY.

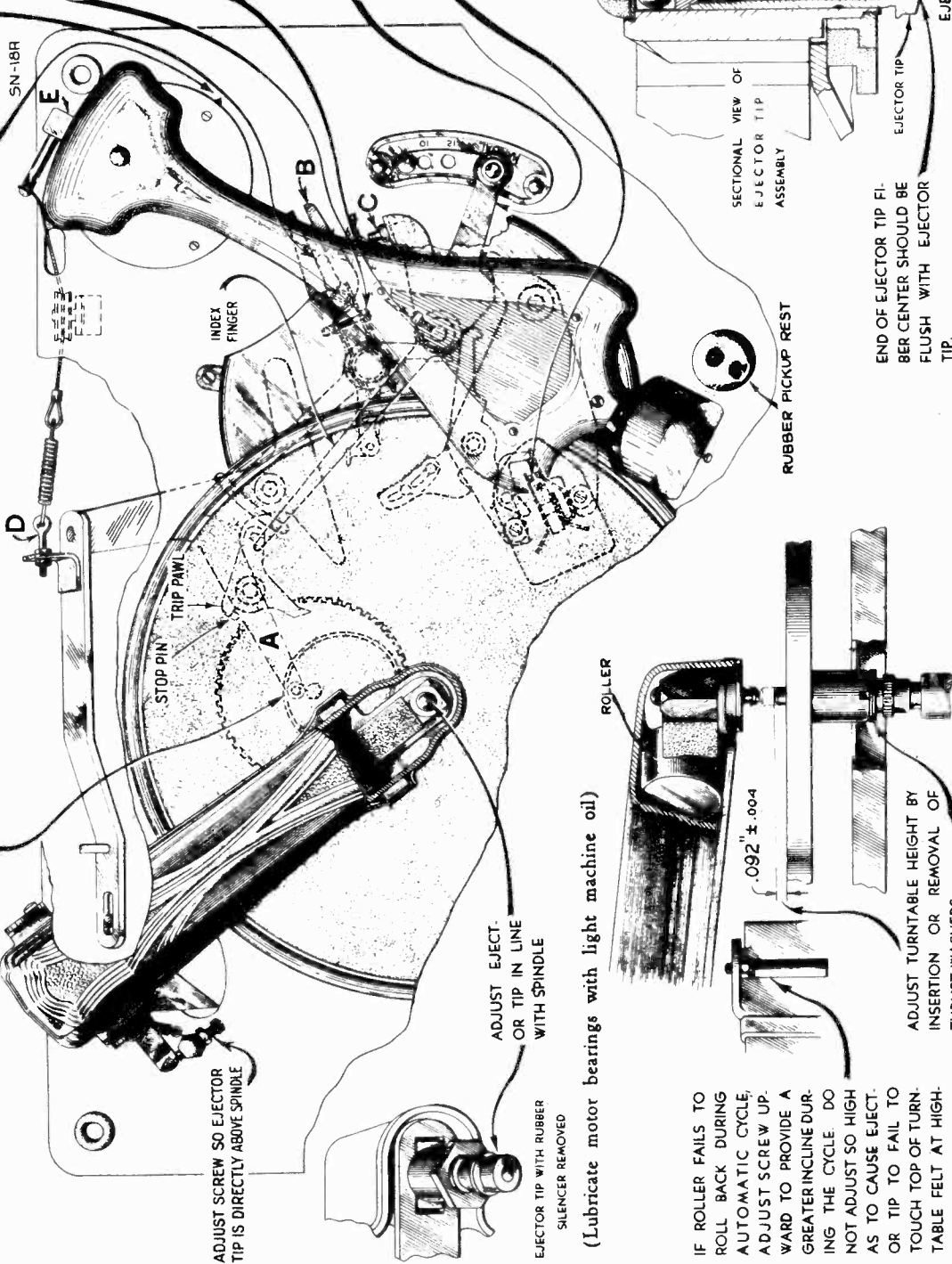
ADJUST TRIP ROD TO OBTAIN $\frac{1}{16}''$ CLEARANCE FROM MOTOR BOARD.

ADJUST SCREW UNTIL FRICTION WILL JUST FORCE FINGER TO MOVE TRIP PAWL (WITH COVER REMOVED)

TO ADJUST MANUAL INDEX FINGER: PLACE MANUAL INDEX LEVER IN THE POSITION SHOWN. SET MANUAL INDEX FINGER TO FORCE TRIP PAWL AGAINST STOP PIN. TIGHTEN SET SCREW.

ADJUST AUTOMATIC SWITCH AS FOLLOWS: PLACE MANUAL INDEX LEVER IN POSITION SHOWN AND WITH SWITCH IN TRIPPED POSITION, ADJUST IT UNTIL THE CONTACT POINTS ARE OPENED $.020'' \pm .010$ AS INDICATED (TURNABLE REMOVED)

ADJUST SCREW UNDER FRONT END OF TONE-ARM BRACKET SO THAT FORCE REQUIRED TO JUST LIFT THE NEEDLE FROM RECORD IS 72 ± 5 GRAMS (2.5 OUNCES). WEIGHT MEASURED WITH SCALE HOOKED UNDER NEEDLE SCREW.



ADJUST SCREW SO EJECTOR TIP IS DIRECTLY ABOVE SPINDLE

ADJUST EJECTOR OR TIP IN LINE WITH SPINDLE

EJECTOR TIP WITH RUBBER SILENCER REMOVED

(Lubricate motor bearings with light machine oil)

IF ROLLER FAILS TO ROLL BACK DURING AUTOMATIC CYCLE, ADJUST SCREW UPWARD TO PROVIDE A GREATER INCLINE DURING THE CYCLE. DO NOT ADJUST SO HIGH AS TO CAUSE EJECTOR TIP TO FAIL TO TOUCH TOP OF TURNABLE FELT AT HIGHEST POINT.

SECTIONAL VIEW OF EJECTOR TIP ASSEMBLY

RUBBER PICKUP REST

END OF EJECTOR TIP FIBER CENTER SHOULD BE FLUSH WITH EJECTOR TIP.

EJECTOR TIP SHOULD ROTATE FREELY

Figure 13—Automatic Record Changer Adjustments

SERVICE NOTES

for

RCA Victor Automatic Record Changing Mechanism

The RCA Victor Automatic Record Changing Mechanism is used in RCA Victor Models RAE-26, RAE-59 and RAE-79. Except for the finish of exposed parts, these units are identical. This mechanism is of simple, fool-proof design and will perform efficiently with a minimum of service requirements. Features of this mechanism are: continuous playing of one side of ten 10-inch records, operation at either 33 $\frac{1}{3}$ or 78 R.P.M. for playing standard or Program Transcription records manually or automatically, a special clutch to prevent jamming in case of failure of a part and a heavy duty motor operating at synchronous speed thereby eliminating any need for regulating devices. A general view of the mechanism is shown on the cover page. Figure 1 shows the schematic wiring diagram.

The Replacement Parts for this mechanism are listed in the Service Notes on each individual instrument. The identification nomenclature given on pages 10 and 11, will be found useful in identifying parts. Where parts are identical in all models the Stock Number of each part is given in addition to its name.

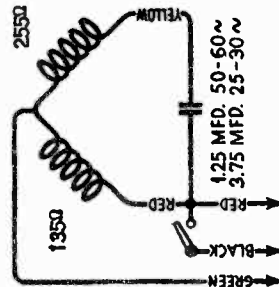


Figure 1—Schematic Diagram

INSTALLATION

After unpacking the instruments in which this mechanism is used, it is imperative that certain preliminary checks be made before they are placed in operation. These checks should be performed in the order given and any adjustments found necessary must be made.

1. When installing the instrument it is advisable to see that all parts are properly lubricated without excessive grease or oil on any parts. This is especially important in the speed reducing unit. A lack of oil in the spindle bearings or between the sprocket and the surface upon which it rests, may be the cause of a "wow" at slow speed. Also, excessive grease on the gears or on the damper pads may cause this same condition. The motor should be lubricated with light oil once every six months. Oil holes are provided at each end of the motor. Once a year the turntable and speed reducing unit should be removed and all exposed gears thoroughly cleaned and lubricated with light grease. All bearings should be lubricated with oil. Be careful not to lose the spiral spring in the end of the spindle or the washers under the turntable and speed reducing unit.

MODELS RAE-26, RAE-59,
RE-73, RAE-79,
RAE-84

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Notes
Part 1

3. The motor board must be level. This should be checked both ways by means of a small spirit level. Placing the cabinet legs on the same surface will usually insure the motor board being level.

3. A small spring is located in the center of the turntable spindle. Be sure that this is in position before placing the turntable on the spindle. After placing the turntable on the spindle make sure that the spindle nose may be easily depressed. If it is not, then remove the turntable and turn the spring upside down or replace it with a new spring.

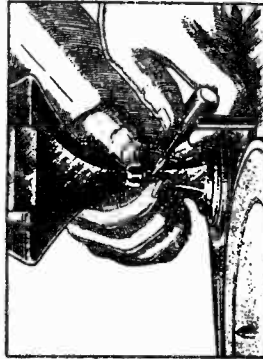


Figure 2—Adjusting height of tone arm

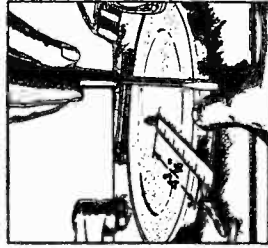


Figure 3—Adjusting elevator pad

4. Examine the wire cable that is attached to the back of the tone arm. It should be seated on the small pulleys over which it passes.
5. Place a Home Recording needle into the pickup as far as it will go. Then lower the pickup on the side of the turntable. The needle should extend from $\frac{1}{16}$ " to $\frac{1}{8}$ " below the top of the metal edge of the turntable. If it does not, an adjustment cap be made by means of a screw located under the tone arm. Lifting the arm provides accessibility to the screw. See Figure 2.
6. If when starting the automatic mechanism, the needle lowers onto the smooth outer rim of the record but fails to swing into the first groove, it may be caused by the following:
 - (a) Cabinet not level. Check as indicated in Paragraph 1.
 - (b) Weak tension in spring. A flat spring presses against the tone arm lever on the under side of the motor board. See Figure 17 Page 11. Bending it so as to increase its tension against the tone arm lever will cause the needle to swing into the first record groove. Be careful not to bend it too much as excessive tension will cause the needle to skip several grooves.

7. After the instrument has completed one record changing operation, a ten inch record should extend about three-quarters way over each elevator pad. If this condition does not exist, an adjustment can be made by means of the screws that hold the pads in position. A pair of pliers heavily padded with cloth or other soft material should be used to hold the elevator shafts while loosening and tightening the screws. The distance from the closest part of either pad to the edge of the spindle is approximately $4\frac{1}{16}$ ". Figure 3 shows the method of making this adjustment.

If any adjustments are necessary other than the foregoing, a reference to the Service Date section of this booklet should be made.

Remember That the Control Lever Can Be Changed from Automatic to Manual Only When the Mechanism is Not Changing Records

(3) FAILURE OF NEEDLE TO LOWER PROPERLY

Failure of the needle to lower onto the smooth outer rim of the 10-inch records when the instrument is playing automatically may be caused by:

- (a) Improper Tone Arm Setting. Loosen the set screws as shown in Figure 5. With the mechanism out of its cycle, press the locating lever at a point near the flat spring until the lever strikes the stop screw. Holding the locating lever, Figure 17, in this position, move the front portion of the trip lever, Figure 15, until the pin against which the flat spring presses, is making contact with the locating lever. Holding the two levers in this position, move the pickup arm until the needle is $\frac{1}{16}$ " from the first groove of a standard 10-inch record. Now retighten the two set screws shown in Figure 5.

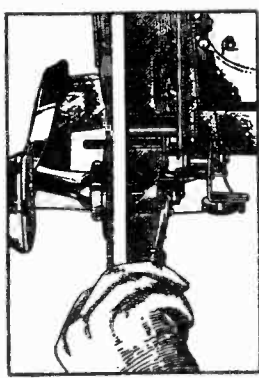


Figure 5—Adjusting position of tone arm



Figure 6—Adjusting tone arm locating screw

- (b) Improper adjustment of tone arm locating screw. This adjustment, shown in Figure 6, can be used to make a substitute adjustment for that described in (a), when the mechanism is out of the cabinet. Make the adjustment so that the needle will lower exactly $\frac{1}{16}$ " from the first groove on a standard 10-inch record. Loosen the lock nut on the adjusting screw by means of a No. 4 Spiritite wrench on which the shoulder has been ground sufficiently thin for clearance. Do not attempt to make this adjustment without first loosening the lock nut. Tighten the lock nut when the proper adjustment has been made.

(4) FAILURE OF NEEDLE TO LOWER ONTO RECORD SURFACE

Failure of the needle to lower onto the record surface may be caused by:

- (a) Cable out of pulley. Examine the tone arm cable and ascertain that it is seated in the pulley.
- (b) Shielded pickup wire improperly placed. Examine the shielded lead coming out of the tone arm base and make sure that it is free from the moving parts of the mechanism.
- (c) Incorrect setting of tone arm lowering screw. Check the position of the tone arm as described in Paragraph 5, Page 4.
- (d) Turntable washer not in place. A leather washer is supplied to fit under the turntable. If this part is not in place, the turntable will be too low, and may cause the needle not to lower onto the record.
- (e) Incorrect adjustment of cable tension screw. The cable tension screw shown in Figure 7 should be so adjusted that the needle will lower smoothly onto the record without drooping. When this adjustment is obtained, the cable will be slightly loose when the needle is lowered onto a record. Loosen the lock nuts, turn the screw to the right or left as required and retighten the lock nut. Check the adjustment to make sure that the needle clears the record on the return of the tone arm. The needle should rise $\frac{1}{16}$ " from the record before any horizontal motion takes place.

(5) NEEDLE FAILS TO CLEAR RECORD AFTER PLAYING

Failure of the needle to clear the record surface on the return of the tone arm is caused by loose adjustment of the cable tension. Adjust this tension as described in Section 4, Paragraph 5.

SERVICE DATA

The following Service information will be found useful in making any adjustments or correction of any irregular operation that may be necessary. All the major adjustments are accessible from the rear of the cabinet. For the sake of clearness the illustrations in this text do not show the cabinet background.

No special tools are required other than a small offset screw driver. (Stock No. 2930) A stand consisting of three Stock No. 7203 will be found useful in supporting the mechanism should removal from the cabinet be required.

(1) SPEED VARIATIONS (WOW)

A variation in the speed of the turntable evidenced by distortion on long sustained notes when playing Program Transcription records may be caused by any of the following:

- (a) Improper operation. It is very important when changing the speed shift lever from 78 R.P.M. operation to 33 $\frac{1}{3}$ R.P.M. operation, to place the hand on the turntable and hold it until it is positively engaged by the driving mechanism.



Figure 6—Adjustment of damper pads

- (b) Lack of proper lubrication. It is important that excessive grease on the gear reducing mechanism be avoided and that sufficient oil is present between the ratchet and the surface upon which it rests. Also clean and oil the spindle bearing and wipe off any excess lubricant that may be on the damper pads or the drive gear upon which it rests.
- (c) Improper Adjustment of the Damper Pads. The damping pads with the necessary springs are provided to place a load on the 33 $\frac{1}{3}$ R.P.M. driving gear at all times while it is in operation. Placing such a load on the gear takes up any possible play and reduces the possibility of a "wow" during operation at the slower speed. Adjust these pads by slipping each spring to one side and bend them until they are $\frac{1}{16}$ " beyond the opposite surface upon which they rest. (See Figure 4).
- (d) Washers Not in Place. A metal washer is placed directly under the speed reducing mechanism and a leather washer directly over it, both washers being over the spindle. These washers must be in their proper position. Also if the leather washer has become hard it must be replaced.
- (e) In some cases, removing the speed reducing mechanism and turning it approximately 90° and then replacing it, may eliminate a "wow" caused by improper meshing of the gears.

(2) ADJUSTMENT OF MAGAZINE ROLLER

The magazine roller should be set in such a position that the plane of the roller is 90° to a line drawn from the center of the magazine bearing to the center of the roller. The height should be adjusted so that it will just touch the magazine when it is empty.

MODELS RAE-26, RAE-59,
RE-73, RAE-79,
RAE-84

RCA MFG. CO., INC.

Notes
Part 3

(6) FAILURE OF RECORD TO DEPOSIT ON TURNTABLE

Incorrect lowering of the record onto the turntable may be caused by:

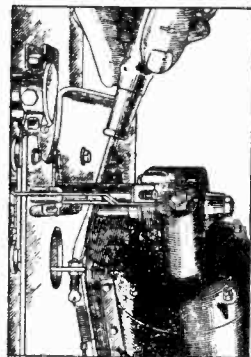


Figure 7—Adjusting tone arm cable tension screw

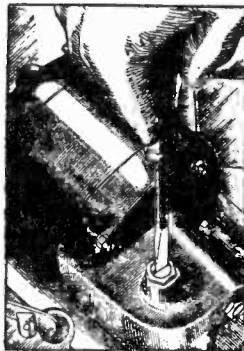


Figure 8—Adjusting spindle height

- (a) Improper turntable spindle height. The height of the turntable spindle nose should be approximately $\frac{1}{4}$ " above the inside bottom surface of the record magazine. Adjustment of this height made by means of the screw at the bottom of the motor. (See Figure 8).
- (b) Improper setting of magazine. The horizontal swing of the magazine should be so adjusted when the mechanism is out of cycle that the outer surface at its nearest point to the nearest side of the turntable spindle is $5\frac{1}{2}$ ". This can be done by loosening the two screws as shown in Figure 9, moving the magazine to its correct position and retightening the screws.
- (c) Improper height of record transfer lever. The small plate on top of the motor board at the left side of the turntable should be so adjusted that it will depress approximately $\frac{1}{2}$ " when the magazine swings over the turntable. When this adjustment is made correctly, the transfer lever will engage the bottom record in the magazine as the latter is swinging back into the playing position. A small adjusting screw and lock nut are provided for this adjustment. See Figure 10.
- (d) Improper Position of Record Transfer Lever. When a ten-inch record is placed so that its edge touches both pins on the record transfer lever, a line drawn from the center of the hole of the lever to the center of the record hole should pass directly over the center of the spindle. See Figure 11. The two record transfer lever mounting screws can be loosened and the lever shifted until this condition exists. Also when a record is on the turntable it should just clear this lever. Unless this adjustment is properly made the record may not center properly over the spindle.

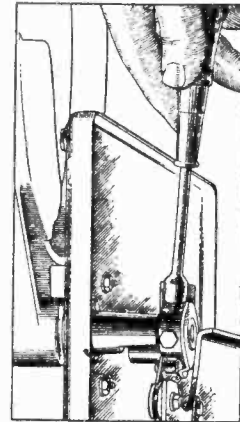


Figure 9—Magazine adjustment

- (e) Weak spring in turntable spindle. The spring inside the turntable spindle which holds up the spindle nose will cause the records to align improperly with the turntable spindle if the spring tension is too weak or if the spindle nose is sticking inside the spindle. Access to the spring for stretching the coils or for replacement can be obtained by removing the turntable.

(7) RECORDS DISCHARGED IMPROPERLY FROM TURNTABLE

Failure of the Record on the turntable to be removed and placed in the magazine can be caused by:

- (a) Improper horizontal adjustment of elevator pads. The elevator pads Figure 16, should be so adjusted that the inside of the pad flange is $4\frac{1}{16}$ " from the nearest side of the turntable spindle. See Figure 3. Loosen the screw on top of the elevator shaft, move the pad to its correct position, holding both the pad and the elevator shaft in position and tighten the screw. Care should be observed that the ridge in the elevator shaft is not turned against the slot in the elevator shaft actuating lever so as to cut the latter. Grip the shaft with padded pliers while this adjustment is being made in order to prevent the shaft from turning. If for any reason the elevator pads have been removed, always place the one with the rubber surface toward the front of the mechanism when replacements are being made.

- (b) Improper adjustment of elevator shaft. The elevator shafts should rise to such a height as to give $\frac{1}{8}$ " clearance between the lowest surface of the elevator pad bottom and the top of the empty magazine. This adjustment can be made by means of the screw and the lock nut as shown in Figure 12.

(8) FAILURE TO TRIP ON ECCENTRIC GROOVE

Failure of the mechanism to change records when the eccentric groove is reached may be caused by:



Figure 11—Method of checking transfer lever lateral adjustment

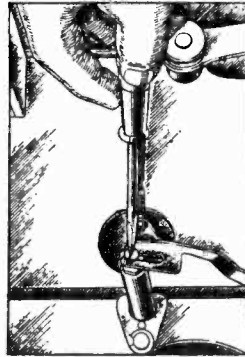


Figure 12—Adjusting height of elevator shaft

- (a) Improper setting of the latch plate. Adjust the latch plate, Figure 17, by means of a small offset screw driver such as Stock No. 2930, until it makes proper contact with the latch trip when the eccentric groove is reached.
- (b) Weak spring on trip lever. A weak spring on the latch trip lever will be a cause of failure to trip.

(9) INABILITY TO SET FOR MANUAL OPERATION

The manual operation lever should set in its back position so as to free the tone arm and prevent the mechanism from tripping. This change from automatic to manual operation should be made only when the mechanism is out of its cycle, otherwise the mechanism will reject continuously. The back position of the lever should be such that the end of the lever causes the latch trip to clear the latch plate by $\frac{1}{2}$ ". An incorrect setting of the latch plate may cause the trip lever to clear the plate at one position of the tone arm, but to make contact with the plate at some other position of the tone arm. Check this point when adjusting the latch plate.

(10) FAILURE TO STOP

Failure of the mechanism to stop after the "off" button has been pressed, and the mechanism has completed its cycle is caused by improper setting of the secondary stop switch. See Figure 17. The switch body should be so mounted that the contacts will open $\frac{1}{2}$ " when the cycle is completed, but will close as soon as the mechanism has tripped.

(11) CONTINUED TRIPPING OF MECHANISM

This condition may be caused by:

- (a) Manual operation lever set for non-automatic operation during cycle.
- (b) Improper setting of latch plate.
- (c) Improper timing of gears and associated parts. See Section 13 for the correct method of retiming.

(12) CLUTCH SLIPPING

Slipping of the clutch when the mechanism is passing through the cycle causing a loud clicking noise, may be caused by:

- (a) Weak spring on pawl carrier. Remove the pawl spring Figure 17, and increase its tension by removing two or three coils.

MODELS RAE-26, RAE-59,
RE-73, RAE-79,
RAE-84

RCA MFG. CO., INC.

Notes
Part 4

- (b) Turntable spindle shaft too low. This condition will cause binding between the pawl carrier and the clutch wheel. Raise the spindle as shown in Figure 8.
- (c) Binding in any of the moving parts. Such binding may be in the slide, the magazine, the elevator shaft or the gears. The slide rollers at the left are mounted on eccentric shafts for adjustment of play. These may be so regulated as to cause excessive binding of the slide. Examine all of these parts carefully, and take any necessary steps to relieve the binding.

(13) RETIMING THE MECHANISM

Should it be necessary to retune the mechanism after replacing parts, or because of continued tripping proceed in the following manner:

- (a) Allow the mechanism to operate until the slide Figure 17 is in its extreme forwarding position. When this setting is reached the straight side of the cam, Figure 17, will be parallel with the side of the slide.
- (b) Check the position of the trip lever and roller at this time to see that they are approximately as shown in Figure 13. If the various parts are not in their proper relation, the mechanism should be retimed.

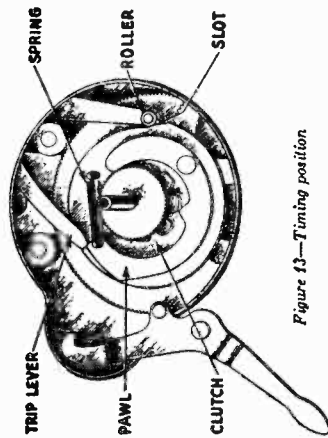


Figure 13—Timing position

- (b) Loosen the set screw in the clutch wheel and lift the wheel from the turntable spindle.
- (c) Lower the pawl carrier until it disengages from the gear.
- (d) Lower the pawl carrier into mesh with the gears so that the trip lever is touching the end of the pawl as shown in Figure 13, when the cable lever roller is engaged in the slot on the side of the pawl carrier as shown.
- (e) Recheck to see that the straight side of the cam is parallel with the slide.
- (f) Replace the clutch wheel and retighten the set screw, making sure that the set screw fits into the spot on the turntable spindle.

(14) REMOVING MOTOR BOARD

Should it be necessary to remove the motor board from the mechanism for replacement of any of the parts, the following procedure should be used:

- (a) Remove nuts and washers from the bolts which hold the motor board to the cabinet, and disconnect the pickup leads and power wiring to the mechanism. Then lift the mechanism from the cabinet.
- (b) Loosen the two set screws and remove the magazine lever Figure 9.
- (c) Lift out magazine.
- (d) Unhook tone arm cable from spring.
- (e) Loosen the two set screws in the tone arm lever.
- (f) Remove the three small screws in the tone arm base, taking care not to lose the lock nuts.
- (g) Disengage the tone arm lever from the tone arm shaft and carefully lift the tone arm from the motor board, bringing the tone arm lever and the shielded cable up through the tone arm base hole in the motor board.
- (h) Remove the screw and lock nuts in the bottom of the elevator shaft.
- (i) Lift elevator shaft from mechanism.
- (j) Unfasten wires from motor board.
- (k) Remove the four motor board screws which support the bottom plate.
- (l) Carefully lift the motor board from the mechanism.

Access can now be had to all the parts on the bottom plate. The parts can be assembled in the reverse order from that given above. It will then be necessary to make various adjustments after the parts have been reassembled.

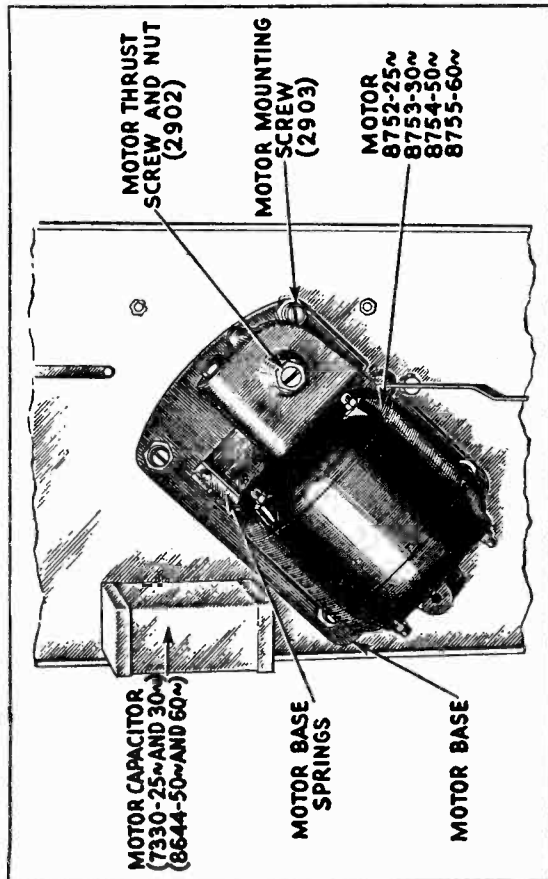


Figure 14—Motor parts

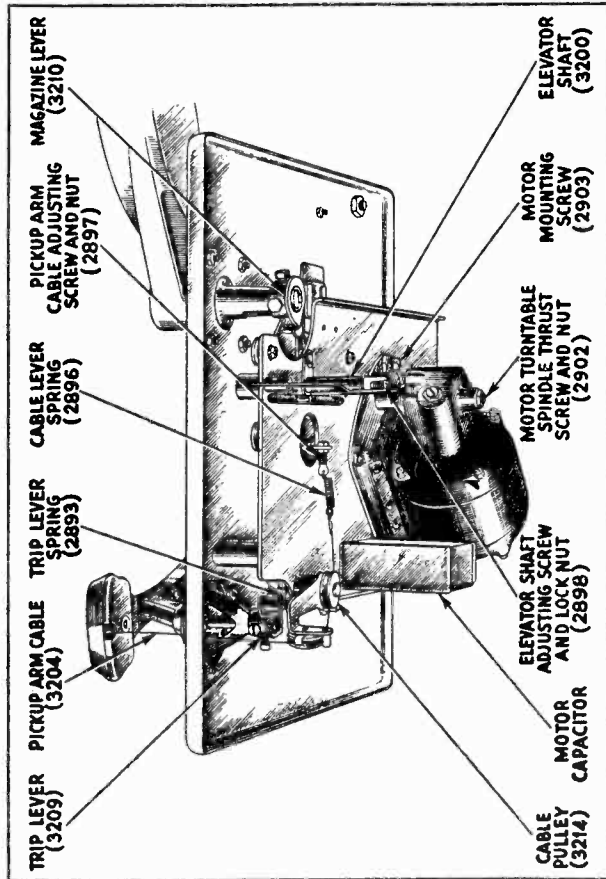
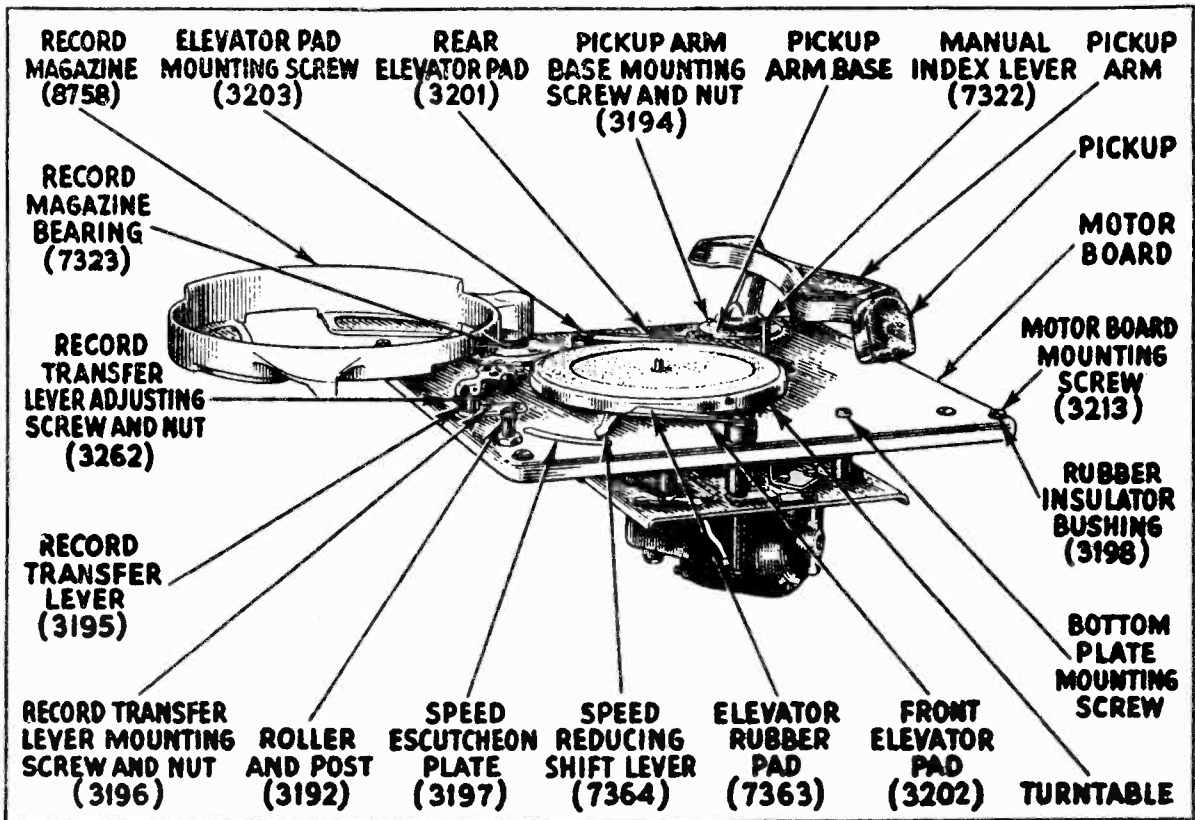
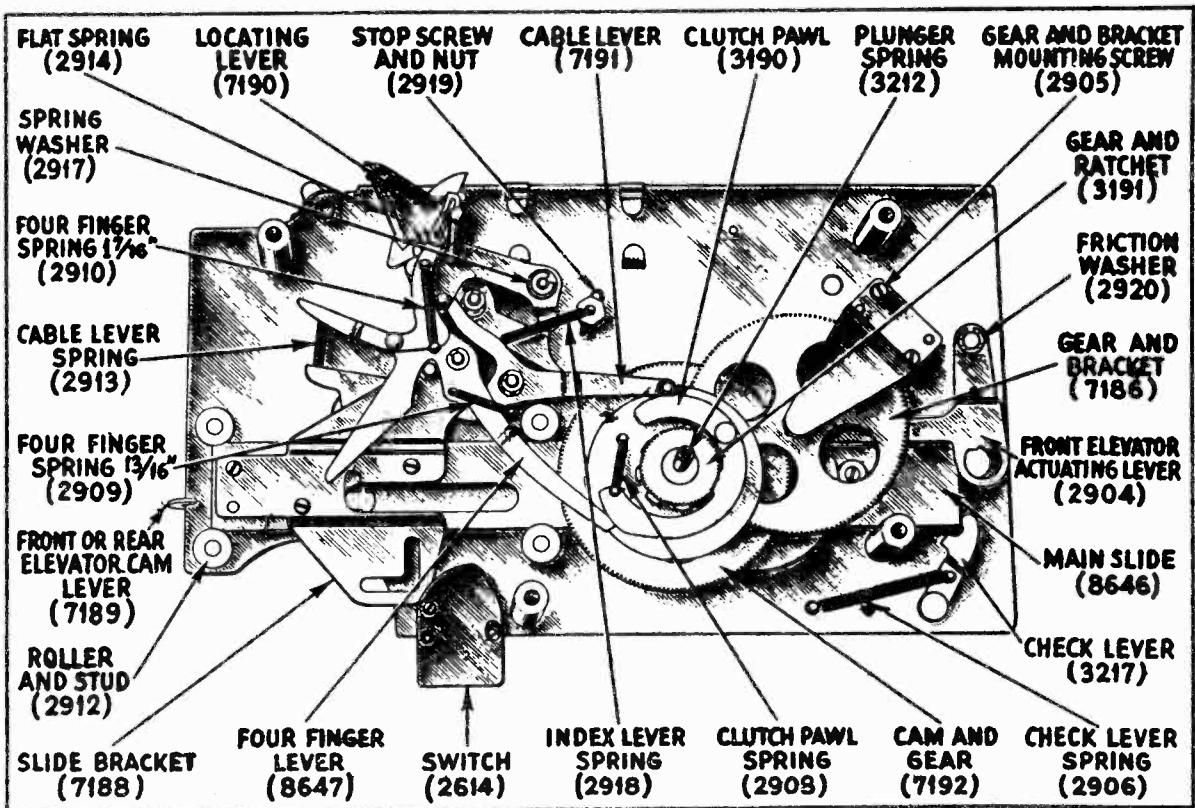


Figure 15—Bottom view of mechanism showing parts

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Top view of mechanism showing parts

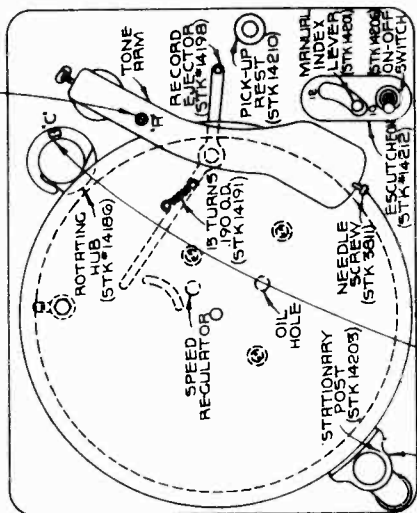


Top view of mechanism with plate removed

ADJUST THE LOWERMOST REST POSITION OF THE TONE ARM SO THAT THE POINT RESTS IN A PLANE $1/16$ " BELOW THE PLANE OF THE TOP OF THE TURNABLE BY MEANS OF SCREW "F".

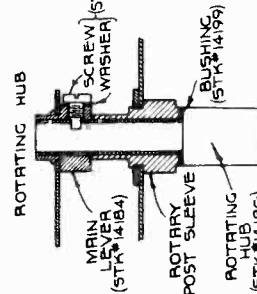
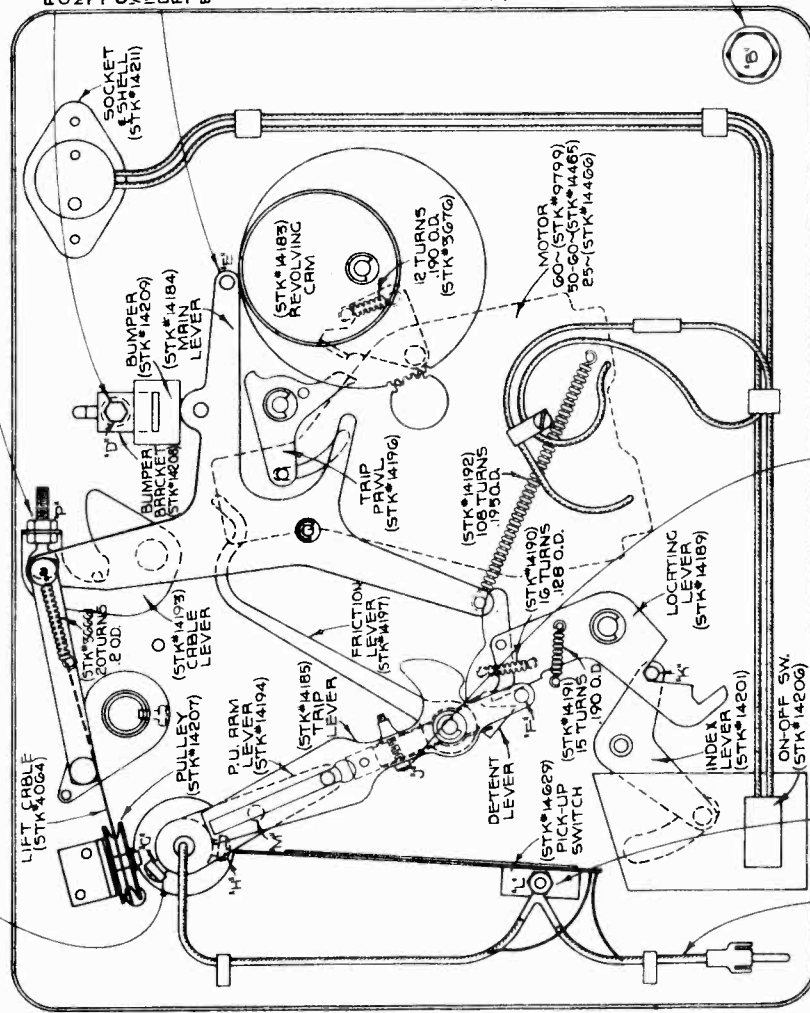
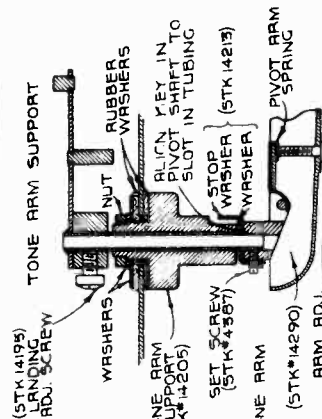
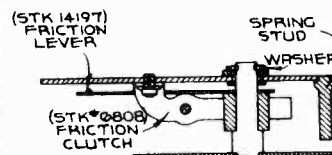
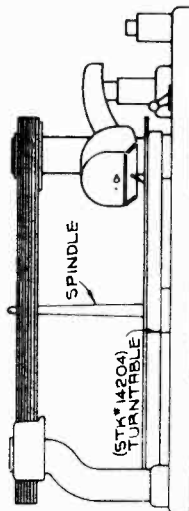
ADJUST THE RISE OF THE TONE ARM SO THAT THE NEEDLE POINT RISES $5/16$ " ABOVE THE TOP OF THE TURNABLE DURING CYCLE. THIS ADJUSTMENT IS MADE BY MEANS OF THE SCREW AND LOCK NUTS "P" (STK#4563) ON THE CABLE LEVER.

TO ADJUST THE LANDING POSITION OF THE NEEDLE FIRST LOCATE NEEDLE $4 1/2$ " FROM CENTER OF THE TURNABLE SPINDLE. THEN WITH THE LOCATING LEVER AGAINST THE STOP PIN "K" AND THE PIN "J" ON THE TRIP LEVER CONTACTING THE LOCATING LEVER SUPPORT AND BLUNT SCREW "G" ON TONE ARM TIGHTEN AND RUN DEVICE THROUGH CYCLE AS A CHECK WHEN CORRECT ADJUSTMENT IS OBTAINED TIGHTEN SCREW "H" (STK#14195) ON TONE ARM SUPPORT.



ADJUST THE REST POSITION OF THE MAIN LEVER BY MEANS OF THE NUT "D" ON THE BUMPER BRACKET SO THAT THE CRAM ROLLER "E" CLEARS THE REVOLVING CRAM $1/16$ " IN THE NEAREST POSITION. ALSO NOTE THAT THE DETENT LEVER "C" CLEARS THE ABOVE CONDITIONS EXIST.

TO ADJUST RECORD POSTS: PLACE RECORD IN POSITION OVER SPINDLE SO THAT IT RESTS ON THE LOWER SHELF OF THE ROT. HUB. MOVE STATIONARY RECORD POST TO A POSITION WHERE IT IS CONCENTRICALLY MOUNTED WITH THE TURNABLE AND THE SHELF FROM UNDER UNDER THE RECORD BOARD. THEN TURN THE LOWER SHELF OF ROTATING HUB ADJUST SCREW "C" (STK#14088) SO THAT THE BEVELED TONGUE ON THE SEPARATING CRAM CLEARS THE RECORD BY $1/8$ ". THESE ADJUSTMENTS SHOULD BE MADE ONLY WHEN THE COMPLETE UNIT IS RESTING ON THE FOUR MOTOR BOARD BUSHINGS.



ADJUST TRIP LEVER SCREW "J" (STK#4059) UNTIL FRICTION WILL JUST FORCE FRICTION LEVER TO MOVE TRIP PAWL.

TO ADJUST PICK-UP NEEDLE CENTER SET PICK-UP NEEDLE FROM CENTER OF SPINDLE ADJUST NUT "L" SO THAT THE BLADE ON SWITCH IS JUST CONTACTING PIN "M"

Figure 7—Automatic Record Changer Adjustments

(Model R-97) ©RCA MFG. CO., INC. T-70827-C

MODELS R-97, U-103,
U-105

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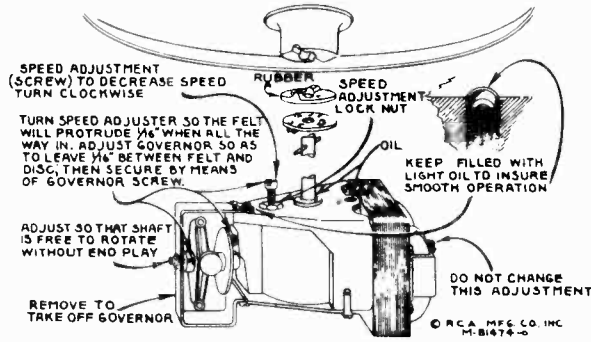
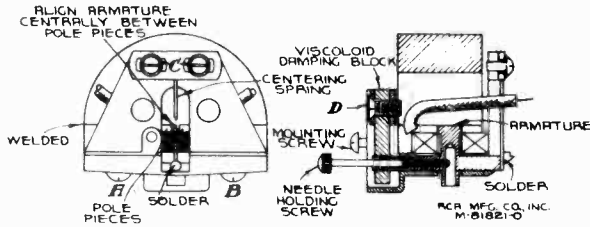


Figure 1—Details of Motor



Magnetic Pickup

The pickup used in the phonograph unit is of an improved design. The horseshoe magnet is rigidly welded to the pole pieces and is irremovable. There is a centering spring attached to the armature to maintain proper adjustment and to provide a limiting effect on the movement of the armature. The frequency response is substantially uniform over a wide range. Service operations which may be necessary on the pickup are as follows.

Centering Armature

Refer to figure 15 showing the pickup inner structure. The armature is shown in its proper relation to the magnet pole pieces, i.e., exactly centered. Whenever this centering adjustment has been disturbed, the screws A, B, and C should be loosened and the armature clamp adjusted to the point where the vertical axis of the armature is at right angles to the horizontal axis of the pole pieces, and centered between them. This centering operation may be facilitated by inserting a small rod or nail into the armature needle hole, using it as a lever to test the angular movement of the armature. The limitations of the movement in each direction will be caused by the armature striking the pole pieces. The proper adjustment is obtained when there is equal angular displacement of the armature and adjustment rod or nail to each side of the vertical axis of the magnet and coil assembly. The screws A and B should then be secured, observing care not to disturb the adjustment of the armature clamp. Then place the pickup in a vise and secure the centering spring-clamp by means of the screw C, allowing the centering spring to remain in the position at which the armature is exactly centered between the pole pieces. With a little practice, the

correct adjustment of the armature may be readily obtained. The air gap between the pole pieces and the armature should be kept free from dust, filings, and other such foreign materials which would obstruct the movement of the pickup armature.

Damping Block

The viscoloid block which is attached to the back end of the armature shank serves as a mechanical filter to eliminate undesirable resonances and to cause the frequency response to be uniform. Should it be necessary to replace this damping block, it may be done by removing screw D and the cover support bracket from the mechanism and taking off the old viscoloid block. The surface of the armature which is in contact with the viscoloid should be thoroughly cleaned with fine emery cloth. Then insert the new block so that it occupies the same position at it did originally. Make certain that the block is in correct vertical alignment with the armature. The hole in the new viscoloid block is somewhat smaller than the diameter of the armature in order to permit a snug fit. With the viscoloid aligned on the armature, screw D and the cover support bracket should then be replaced. Heat should be applied to the armature (viscoloid side) so that the viscoloid block will fuse at the point of contact and become rigidly attached to the armature. A special-tip soldering iron constructed as shown in figure 16 will be found very useful in performing this operation. The iron should be applied only long enough to slightly melt the block and cause a small bulge on both sides.

Replacing Coil

Whenever there is defective operation due to an open or shorted pickup coil, this coil should be replaced. The method of replacement will be obvious upon inspection of the pickup assembly and by study

Remove the pickup mechanism and terminal board as described above. Remove screws A and B and the magnet assembly. Remove the bakelite coil support (with coil attached) and insert the new coil support assembly in its place, after which replace the magnet assembly and center the armature as described above, then re-assemble the remainder of the unit.

MODEL R-96 uses a single record phono turntable only

MODEL R-97 uses early "drop" type automatic record changer

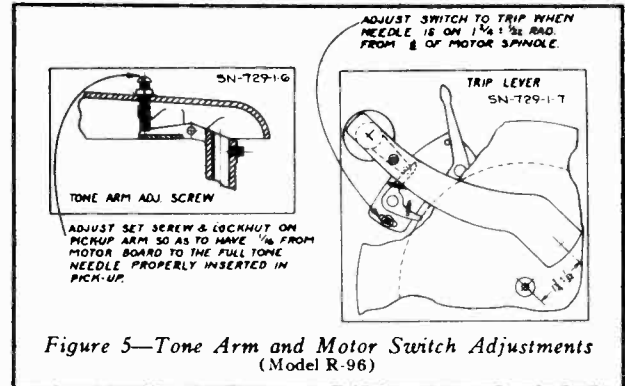


Figure 5—Tone Arm and Motor Switch Adjustments (Model R-96)

of the cut-a-way illustrations. Make sure that the new coil is properly centered with the hole in the support strip and glued securely in that position. It is important to re-adjust the armature as previously explained after re-assembly of the mechanism. Only rosin core solder should be used for soldering the coil leads in the pickup. This same type of solder should be used when necessary for soldering the centering spring to the armature.

Magnetizing

Loss of magnetization will not usually occur when the pickup has received normal care because the magnet and pole pieces are one unit and the magnetic circuit remains practically closed at all times. When the pickup has been mishandled, subjected to a strong a-c field, jolted, or dropped, there may be an appreciable loss of magnetic strength, in which case it will be necessary to re-magnetize the entire structure. To do this, it will be necessary to first remove the pickup mechanism from the tone arm, and then remove the magnet assembly. Place the magnet assembly on the poles of a standard pickup magnetizer such as the RCA Stock No. 9549 Pickup Magnetizer and charging the magnet in accordance with the instructions accompanying the magnetizer. It is preferable to check the polarity of the pickup magnet and to re-magnetize it so that the same polarity is maintained.

Automatic Record Ejector

The record changing mechanism is designed to be simple and fool-proof. Under normal operating conditions, service difficulties should be negligible. Occasionally, however, certain adjustments may be required. These adjustments are illustrated and explained in figure 13.

It is important when servicing the automatic mechanism, to have it placed on a level support. It is also important to refrain from forcing the mechanism if there is a tendency to bind or jam, since bent levers and possibly broken parts may result.

The tip of the record ejector is adjustable in relation to the turntable spindle, the two being exactly coaxial when properly adjusted. To align the tip, remove the rubber silencer of the ejector assembly, loosen ejector tip retaining nut and slide the tip assembly to the position where it is in true-line with the axis of the turntable spindle. This adjustment may be simplified by placing several records on the turntable, depressing the spindle through the top record hole and lining up the ejector tip in the spindle hole of the record.

To insure that the ejector tip rotates freely, apply a slight amount of oil to the shank of the tip at the point where it is in contact with the ball bearing.

The record changing mechanism is designed to be simple and fool-proof. Under normal operating conditions, service difficulties should be negligible. Occasionally, however, certain adjustments may be required. It is important to refrain from forcing the mechanism if there is a tendency to bind or jam, since bent levers and possibly broken parts may result.

Record Changer Adjustments

Mount motor-board on a level support. Remove turntable and cover at right of turntable. Adjustment locations are designated on figure 9 as A, B, etc. The adjustments are explained under corresponding symbols below. Perform adjustments in the following order:

A.—Trip rod "A" should be engaged in "Switch Lever" slot. Adjust trip rod "A" to obtain about $\frac{1}{8}$ of an inch clearance from motor-board.

B.—Adjust "B" to the position shown.

C.—With "Index Lever" in "Manual" position, "Pickup Arm" rotated to extreme left, and switch tripped to open contacts "C," adjust contact points "C" by bending the stiff contact arm until points are opened 10 to 30 thousandths of an inch.

D.—With "Index Lever" in "Manual" position, release set screw "D" and force "Manual Index Finger" as far as it will go towards "Trip Pawl Stop Pin." Tighten set screw.

E.—Adjust at "E" to provide approximately $\frac{1}{32}$ of an inch between outer end of "Link Slot" and screw when rubber "Bumper" is in contact with stop bracket.

F. and G.—Remove rubber silencer at "F" and adjust "F" and "G" so ejector tip "F" is in line with "Spindle." Longitudinal movement, with respect to "Ejector Arm," may be effected by loosening hex. head at "F." Lateral movement of "Ejector Arm" may be effected by adjustment "G."

H.—Adjust "H" so under side of pickup head can be raised $2\frac{1}{2}$ inches above motor-board.

J.—Adjust screw "J" until friction will just force "Trip Finger" to move "Trip Pawl" when "Index Lever" is in "12" inch position.

N.—Adjust needle pressure by turning screw under center of "Pickup Arm" so that a force of 72 grams (2.5 ounces) is required to lift needle from record. Hook scale under needle screw to measure force.

K.—Adjustment "N" must be performed prior to this adjustment. With a 12-inch record on turntable, turn on "Motor Switch," place "Index Lever" to "12" position and adjust "K" so that "Cable" tension will allow needle to lower slowly on start of record at completion of eject cycle. Turn "Motor Switch" off after eject cycle is completed and check to see that "Cable" is slightly loose when "Pickup Arm" is moved against "Spindle." Replace turntable and put a needle in "Pickup."

L.—Adjust "L" so needle will drop into center of smooth portion at the start of a 12-inch record when "Index Lever" is in "12" inch position and "Pickup Arm" is to extreme right.

M.—Loosen three screws "M" and rotate "Spacer" until pointer on "Spacer" is in line with screw to right of "Pickup Arm."

P.—Adjust turntable height by insertion or removal of thrust washers at "P" so ejector tip "F" will not eject bottom 12-inch record but will eject second from bottom record.

Q.—Adjust position of shorting switch at "Q" so switch closes when needle is just outside a 12-inch record.

R.—Adjust screw "R" upward just enough so that with one record on turntable and ejector tip "F" resting on record surface, there is $\frac{1}{32}$ of an inch clearance between screw "R" and "Ejector Arm."

Record Changer Service Hints

- 1.—"Ejector Arm" goes through normal cycle but does not eject records. Adjust "F" and "G." See that "Spindle" slides freely.

- 2.—Ejects bottom record. Lower turntable by removing thrust washers at "P."
- 3.—Ejects records properly down to second from bottom of pile. Raise turntable by placing thrust washers at "P."
- 4.—Eject cycle does not start after needle reaches eccentric groove. Adjust "J" (turn screw clockwise).
- 5.—Eject cycle starts before eccentric record groove is reached. Adjust "J" (turn screw counter-clockwise). Set "Index Lever" to "12" inch or "10" inch position after starting to play record. Do not jar motor-board during automatic operation.
- 6.—Lateral movement of "Pickup Arm" has no control over starting and stopping. Adjust clearance of rod "A." See that rod "A" engages in slot of "Switch Lever."
- 7.—Fails to eject top record of a pile because "Ejector Arm" strikes record in returning to center at end of eject cycle. Adjust screw "R" upward to provide greater incline so that roller in "Ejector Arm" will roll back during cycle.
- 8.—Pickup strikes record during eject cycle. Adjust "K" and "H."
- 9.—Starts playing record several grooves in from beginning or needle misses record entirely. Adjust "L."
- 10.—Needle falls on smooth portion at start of record but does not move into playing groove. Adjust "M." Check to see that motor-board is level.
- 11.—Automatic stop does not operate after needle reaches eccentric groove. Adjust "B" and "C."
- 12.—Motor does not re-start when "Pickup" is returned to rest position. Adjust "C." See that switch mechanism parts move freely and springs are functioning.
- 13.—Starts eject cycle although set for "Manual" operation. Adjust "D."
- 14.—Noise in loudspeaker while changing needles. Clean "Shorting Contact" and adjust "Q."
- 15.—"Wow" in record reproduction.—Instrument should be warmed to about 65° F. Ejector tip should be centered and free to rotate (adjustments "F" and "G"). There should be no solid particles on gear teeth or in grease; no tendency to bind. Turntable plate should be in dynamic balance and "Spindle" should be straight. Proper lubrication is important.

Lubrication.—Clean motor gear-box thoroughly before re-greasing. Apply less than a tablespoonful of a grease, such as "Cities Service No. 7035-A1" or "Koolmotor Universal Trojan No. 1," directly on gears taking care to get none in rotor bearings. Put medium motor oil (S.A.E. No. 30) in the oil holes. Cover main gear and cam of automatic mechanism with a light grease such as "Socony-Vacuum No. 2." Any good house-hold oil, such as "3-IN-ONE" is suitable for the ejector-tip "F" bearing.

Pickup

An adjustment is provided to compensate for reduced sensitivity of the crystal pickup with age. Adjustment requires the use of a 1,000-ohm-per-volt a-c voltmeter (rectifier type, 10-volt range) and a frequency record. With the voltmeter connected across the loudspeaker voice coil, "Phonograph Volume" and "Fidelity" controls turned extreme clockwise, "Dynamic Amplifier" control turned counter-clockwise, and "Exp.-Off Switch Cable" plug pulled out from apron of dynamic amplifier (see figure 10), adjust R101 (end of compensator unit) until an RCA Victor Technical Purpose Record Cat. No. 84519-A or 84505-B gives a voltmeter reading of 5 volts on 400 cycles. Adjustment of R101 will be facilitated by removing the compensator unit from the phonograph control panel, after removing control knobs and shaft bushing nuts. R101 should also be adjusted if pickup is replaced.

MODEL U-109

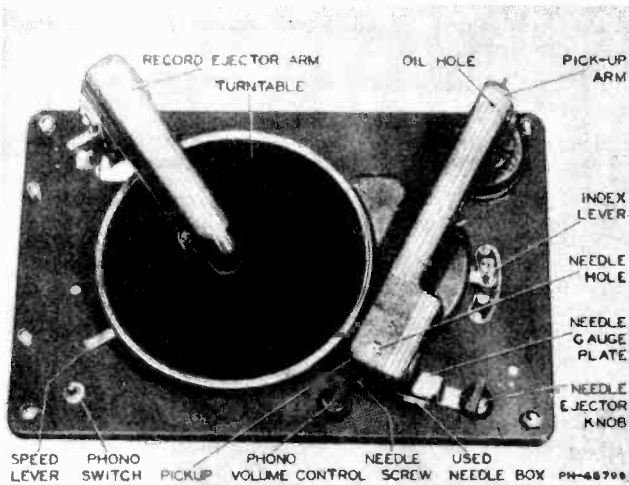


Illustration of Phonograph Board

The phonograph mechanism is designed to play a series of eight 10-inch or seven 12-inch records automatically, repeating on the last record. Either 10-inch or 12-inch records may be played singly (manual operation). A speed-shift lever permits playing either the standard 78 r.p.m. records, or the long-playing $33\frac{1}{3}$ r.p.m. records.

For automatic record-changing operation, or for automatic repeating of one record, the records must have the eccentric or spiral groove in the center. For self-stopping on manual operation, the records must have the eccentric stopping groove.

"Eject Cycle"

Before operating the phonograph, be sure that the pickup arm and the ejector arm are down at playing level and can be moved easily by hand. If not, the index lever will be in position "10" or "12" and an eject cycle must be completed to bring the arms down. To do this, turn on the phono switch so that the turntable will revolve and the motion of the pickup arm will be resumed; when the pickup and ejector arms come down, turn off the phono switch.

CAUTION: Never use force to start or stop the motion of the record-changing mechanism or the pickup or ejector arms.

Automatic Operation

Proceed EXACTLY as follows:

1. See that the index lever is set at "manual," otherwise the pickup can not be moved out beyond the edge of the record. (See "eject cycle" above.)
2. Place the pickup over the needle gauge plate, with pickup arm resting on the two stud supports. Loosen needle screw, insert needle in needle hole in top of pickup, so that it drops all the way down against the needle gauge plate, then tighten screw.
3. Raise ejector arm and load records on turntable, not higher than spindle. Lower ejector arm onto spindle.
4. Turn phono switch "on." After turntable has picked up speed, lift the pickup arm and lower onto record, so that needle is in outer groove.
5. Move index lever carefully to position "10" or "12," according to the size of records on the turntable.
6. Adjust the phono volume control.
7. To eject a record being played and start another one, lift the pickup arm, move it to center of turntable, and hold lightly until it is moved from your hand by the automatic mechanism.
8. To reload the turntable wait until both arms are down in normal position at end of "eject cycle," and then

MODEL MI-6720 Series

turn off the phono switch. Move index lever to "manual" and place pickup over needle gauge plate. Do not change this order. Then proceed as outlined in paragraphs 3, 4, 5, and 6 above.

9. The last record will repeat until the phono switch is turned off, or the index lever placed at "manual." In the latter case, the turntable will stop automatically if the record has the eccentric stopping groove in the center; otherwise it will continue to revolve. To discontinue operation, turn off the phono switch.
10. To change needle, place pickup over needle gauge plate with pickup arm resting on stud supports, loosen needle screw, and turn needle ejector knob to right to drop needle into the used needle box. Replace with new needle as described in paragraph 2 above.

Manual Operation

1. A single record, either 10-inch or 12-inch may be played. If pickup and ejector arms are not down so that they can be moved freely by hand, complete the eject cycle as described previously. Move index lever to "manual."
2. Place pickup on needle gauge plate, and record on turntable.
3. Turn phono switch "on."
4. When turntable has picked up speed, lift the pickup arm and lower onto record so that the needle is in outer groove.
5. Adjust the phono volume control.
6. When record is finished, the turntable will stop automatically if the record has an eccentric stopping groove. To discontinue operation, turn the phono switch "off."

Needles

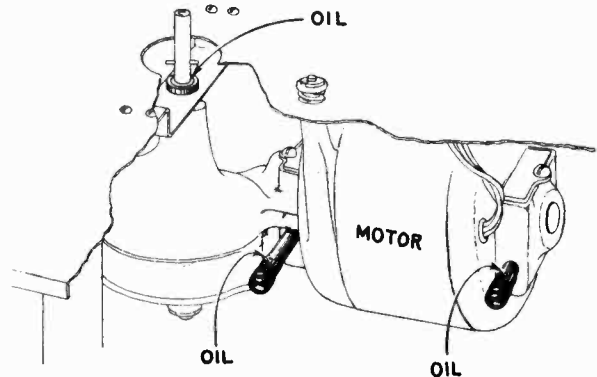
The Green-Shank Chromium Needle is recommended for general purposes. As alternatives, either the Orange-Shank Chromium Needle, or the Tungstone Needle (Full Tone) may be used.

Never insert a used Chromium or Tungstone needle in the pickup, as damage to the record will result.

Transparent-faced (illustrated) and Victrolac records should never be played with Tungstone needles.

Leveling

When a record has been played, the pickup moves out, the played record is ejected, and the needle is automatically placed in the starting groove of the next record. If the needle fails to enter the starting groove, raise the right-hand side of the cabinet by inserting thin spacers under that side of the cabinet. If the needle slides over a few grooves, raise the left-hand side of the cabinet.



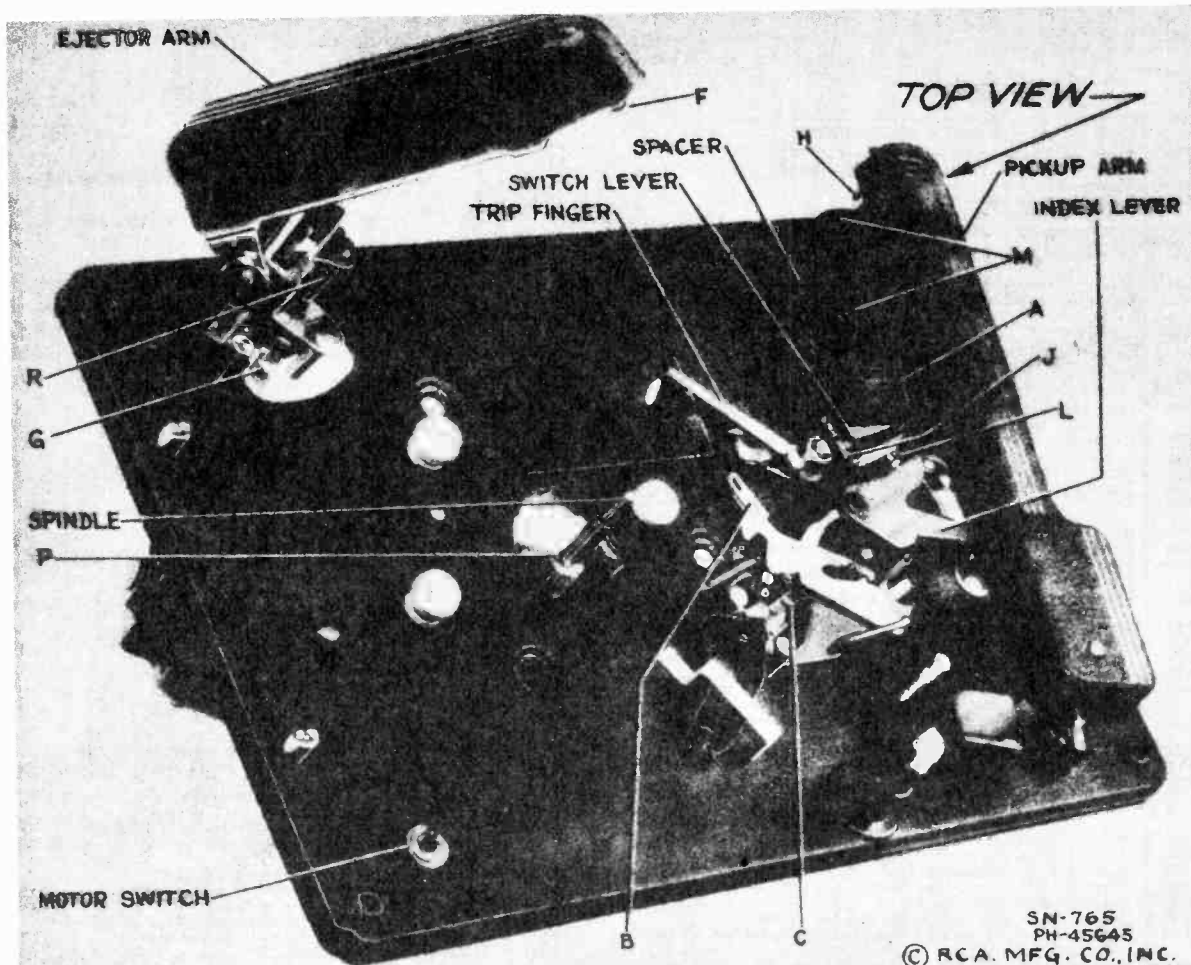
Phonograph Oiling Points

Every six months apply a few drops of good quality light machine oil at the points shown above.

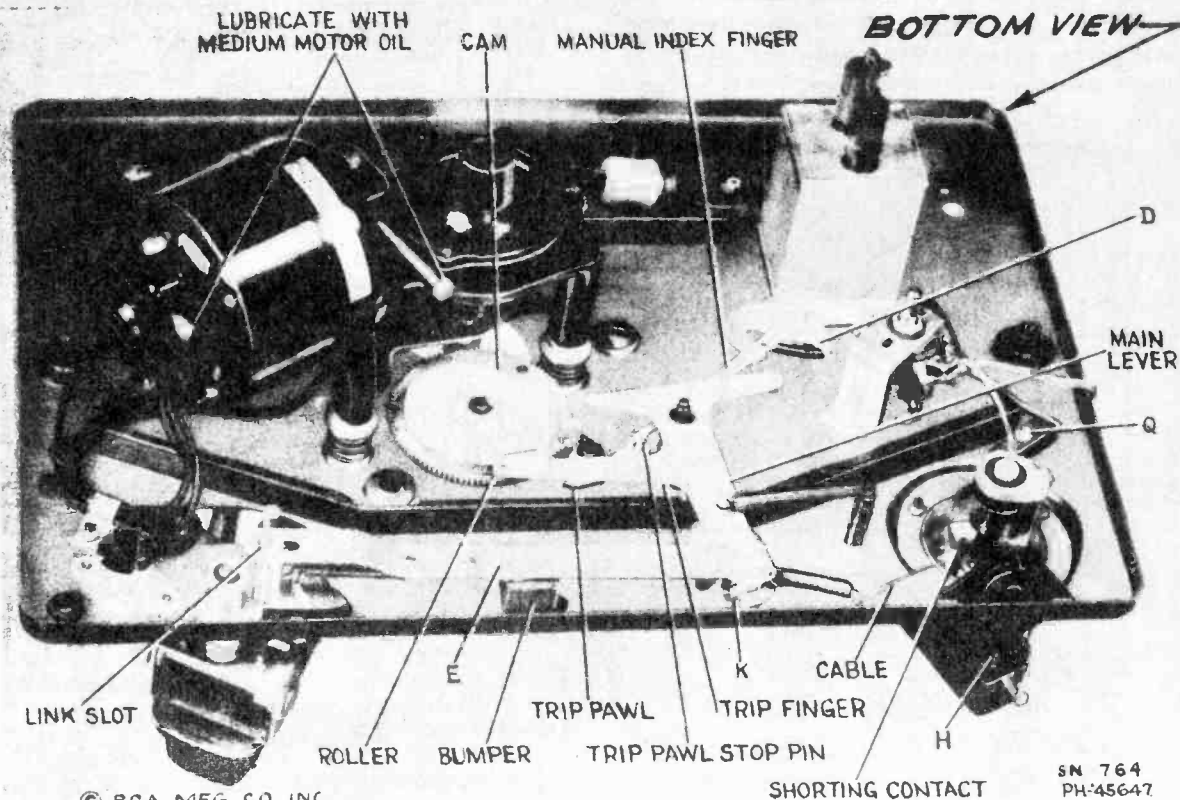
MODEL MI-6720 Series

RCA MFG. CO., INC.

MODEL U-109



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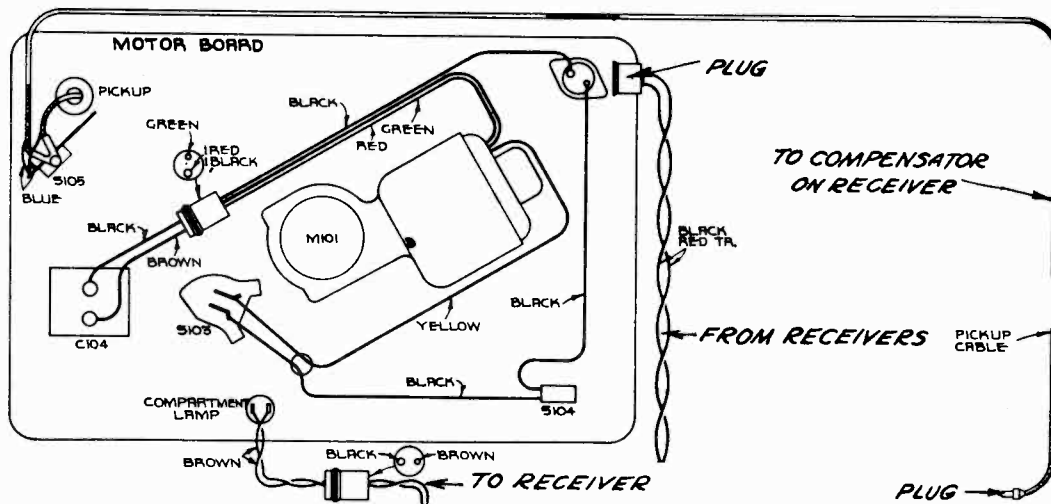


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SN 764
PH-45647

REPLACEMENT PARTS

STOCK No.	DESCRIPTION	
MOTOR ASSEMBLIES		
9735	Motor—105-125 volts—25 cycles (M101)	
9651	Motor—105-125 volts—50 cycles (M101)	
9650	Motor—105-125 volts—80 cycles (M101)	
12050	Suspension Spring—Motor mounting spring, washer and stud assembly—comprising six springs, six cup washers, three spring washers and three studs	
MOTOR BOARD ASSEMBLIES		
11881	Base—Phonograph compartment lamp socket and base	
14819	Cable—Shielded pickup cable—connects shorting switch to compensator pack	
12051	Capacitor—2 Mfd., complete with 2-contact male connector for use with motor, Stock Nos. 9650 or 9651 only (C104)	
13101	Capacitor—4 Mfd., complete with 2-contact male connector for use with motor Stock No. 9735 only (C104)	
4874	Connector—2-contact male connector for Stock Nos. 12051, 13101 or phono compartment lamp leads	
4577	Connector—2-contact male connector for motor cable	
11488	Connector—2-contact female connector for motor leads	
14760	Cup—Used-needle cup	
14762	Damper—Turntable damper	
11553	Escutcheon—Index escutcheon engraved "Manual—12—10"	
14688	Knob—Needle rest knob	
4340	Lamp—Phonograph compartment lamp—6.3 volts	
3764	Nut—Cap nut for motor board suspension	
14761	Rest—Pickup rest	
14826	Roller—Pickup arm cable guide roller—comprising bracket, roller and guide pin	
11711	Shade—Phonograph compartment lamp shade	
14758	Spacer—Pickup arm mounting spacer	
14270	Spring—Retaining spring for knob, Stock No. 14758	
4566	Spring—Tension spring for needle rest	
3763	Suspension Spring—Suspension spring, washer and bolt assembly for motor board—comprising one bolt, two cup washers, two springs, two "C" washers, and one cap nut	
80157	Switch—Pickup shorting switch (S105)	
4871	Switch—Operating switch—toggle switch (S104)	
14759	Turntable, complete	
EJECT ARM ASSEMBLIES		
14753	Arm—Eject arm, complete	
11536	Ball—1/16-inch diameter steel ball	
10129	Ball—3/16-inch diameter steel ball	
11529	Bearing—Ejector tip bearing and nut	
11538	Bracket—Eject arm bracket	
11537	Collar—Eject arm shaft collar and set screw	
11536	Cushion—Counter balance roller cushion—located inside of eject arm	
4055	Post—Vertical adjustment post—located on eject arm bracket	
3729	Roller—Eject arm counter balance roller—located inside of eject arm	
4580	Screw—No. 6—32-3/16-inch square head set screw for eject arm collar	
11534	Screw—No. 8—36-7/32-inch special screw for eject arm	
11535	tip center adjustment Shaft and Collar—Eject arm vertical action shaft and collar assembly	
11528	Silencer—Ejector tip silencer	
4087	Spring—Ejector arm bracket spring	
11531	Spring—Ejector tip spring	
11530	Tip—Ejector tip with tip center, adjusting screw and cap	
11539	Yoke—Eject arm yoke assembly	
PICKUP AND ARM ASSEMBLIES		
10941	Ball—Steel ball for pivot shaft bearing	
3204	Cable—Pickup lift cable	
30101	Cable—Shielded pickup cable—connects pickup unit to shorting switch	
12850	Damper—Pickup arm pivot shaft damper—comprising one upper rubber damper and bearing, one lower rubber damper and one lower bearing	
14820	Mechanism—Pickup mechanism, complete with needle screw	
14818	Pickup and arm, complete	
12546	Plug—Pivot shaft bearing plug	
14823	Rod—Pickup arm brake trip rod	
14822	Screw—Needle screw	
14824	Screw—Pickup mechanism terminal	
14913	Spring—Pickup arm tension spring	
14821	Support—Pickup mechanism support	
OPERATING MECHANISM		
14754	Cam—Cam and gear assembly	
6808	Clutch—Trip lever friction clutch	
14756	Cover—Metal cover for trip lever and friction finger assembly	
6809	Finger—Manual index lever finger assembly	
3870	Finger—Friction finger assembly	
11554	Lever—Manual index lever—less pin	
14755	Lever—Main lever and link assembly	
14814	Lever—Pickup lift cable lever	
11555	Lever—Trip lever and friction clutch assembly	
6503	Pawl—Trip pawl assembly	
3872	Pin—Manual index lever pin	
13835	Plate—Eject arm actuating plate assembly	
4584	Screw—Manual index lever finger set screw	
4059	Screw—Trip lever clutch tension adjustment screw	
4566	Screw—Special screw used to fasten main lever and link assembly bushing	
13837	Spacer—Pickup arm mounting spacer	
13838	Spring—Actuating spring	
4565	Spring—Manual index lever finger tension spring	
4061	Spring—Main spring lever tension spring or pickup lift cable spring	
2893	Spring—Trip lever latch plate tension	
3876	Spring—Cam and gear pawl tension spring	
14916	Spring—Pickup lift lever spring	
4125	Spring—Eject arm horizontal action tension spring	
13836	Stud—Pickup arm lift cable stud and nut	
2917	Washer—Spring washer—"U" type	
AUTOMATIC SWITCH ASSEMBLIES		
3994	Cover—Motor switch cover	
10184	Plate—Automatic brake latch plate	
10174	Springs—Automatic brake springs	
6805	Switch Assembly—Automatic switch, complete	
3322	Switch—Motor switch (S103)	



UNDERSIDE VIEW OF MOTORBOARD. ELECTRICAL CONNECTIONS.

Type..... Automatic Record Ejector
 Record Capacity..... Eight 10-inch or seven 12-inch
 Turntable Speed..... 78 r.p.m.
 Type of Pickup..... Crystal
 Pickup Impedance..... 80,000 ohms at 1,000 cycles

MODELS RP-152 Series, MI-4831 Portable

The RP-139-A and RP-145 automatic record changers are very similar in design and construction. Most of the parts and adjustments are identical on both. The RP-139-A turntable is driven through a worm gear in the motor housing while the RP-145 turntable is driven through a friction drive disc mounted on the turntable spindle.

On Model RP-145 it is important that the drive motor spindle, and rubber tires on main driving disc and idler pulley be kept clean and free from oil, grease, dirt, or any foreign matter at all times. Any quick-drying naphtha is satisfactory for cleaning these parts. The RP-145 drive motor bearing is lubricated from an oil well filled and sealed at the factory. It should not require lubrication in the field.

The RP-145 turntable is not removable from the spindle. However, the rubber tired driving disc is fastened to the spindle by means of a tapered pin "24." If necessary to remove these parts the tapered pin should first be removed. The driving disc can then be removed from the spindle and the turntable and spindle assembly lifted upward from the motorboard. If this is done, great care should be taken not to bend the spindle. At the same time the spindle bearing should be oiled and the cup and ball thrust bearing oiled and checked for proper position.

Before servicing the automatic record changer, inspect the assembly to see that all levers, parts, gears, springs, etc., are in good order and are correctly assembled.

A bind or jam in the mechanism can usually be relieved by rotating the turntable in the reverse direction.

The changer can be conveniently rotated through its change cycle by pushing the index lever to "Reject" and revolving the turntable by hand. Six turntable revolutions are required for one change cycle.

If the record changer or cabinet is not perfectly level, normal operation is likely to be affected.

The 10 and 12 inch records must be absolutely flat for smooth operation.

A pickup shorting switch, located under the motorboard, operates when the pickup is moved outward to the pickup rest.

MISCELLANEOUS SERVICE HINTS

Incorrect adjustment of a particular mechanism of the changer is generally exhibited in a specific mode of improper operation. The following relations between effects on opera-

RCA MFG. CO., INC.

MODELS RP-139A, RP-140, RP-145, RP-145E

tion and the usual misadjustments will enable ready adjustment in most cases.

1. For any irregularity of operation, the adjustment of the main lever "15" should be checked first as in "A."
2. Needle does not land properly on both 10 and 12 inch records—Make complete adjustments "D" and "E."
3. Needle does not land properly on 12 inch record but correct on 10 inch—Effect adjustment "E."
4. Failure to trip at end of record—Increase clutch "5" friction by means of screw "B." Also, see that levers "7" and "12" are free to move without touching each other.
5. Pickup strikes lower record of stack or drags across top record on turntable—Adjust lift cable per adjustment "C."
6. Needle does not track after landing—Friction clutch "5" adjustment "B" may be too tight; bind in tone arm vertical bearing; levers "7" and "12" fouled; or pickup output cable twisted.
7. Cycle commences before record is complete—Record is defective, or adjustment "B" of friction clutch "5" is too tight.
8. Wow in record reproduction—Record is defective; or instrument is not being operated at normal room temperature; on Model RP-145 oil, grease, dirt, or other foreign matter on motor spindle, main driving disc or idler pulley rubber tire. Clean with any quick drying naphtha. Also, on RP-145 the motor support bracket "N" should be moved in its mounting holes until the motor spindle is parallel to the turntable spindle and exactly at right angles to the main driving disc "29." The bracket mounting nuts should then be securely tightened.
9. Record knives strike edge of records—Records warped; record edges are rough; or knife adjustments "F" and "G" are incorrect.
10. Record not released properly—Adjust record shelf assemblies in respect to shaft by means of adjustment "H."
11. When playing both types of records mixed and needle either lands in 10 inch position on 12 inch record or misses record entirely—Increase tension of mixed record discriminating lever spring "M."

INSTALLATION

The Automatic Record Changer is supplied ready for mounting on a cabinet rail. This rail must be drilled in accordance with the information and dimensions shown on page 3. All necessary parts are included in your purchase.

To install the RCA Automatic Record Changer:

1. Place the Motorboard Unit in position on the cabinet rail with the upper mounting springs in place as shown on page 3.
2. Secure Motorboard in position using the screws and lower mounting springs as shown on page 3. Tighten up the four motorboard mounting screws to compress all eight mounting springs to the dimensions shown. *Make sure that the Motorboard Assembly is level in the cabinet.*
3. On the Stock ~~RP-139-A~~ the turntable, rubber spindle piece and washer are in a separate package, see page 4. Raise and swing out the record holder shelves, place metal washer over spindle so that the grooved extension fits over the pin in the spindle, place rubber spindle piece securely down over spindle and turntable securely down over rubber spindle piece. The turntable is attached in place on the ~~RP-145~~.

The pickup and needle box are held by a Z-shaped bracket attached to the motorboard with a screw. Loosen the screw, remove the bracket and replace the screw to cover the hole.

Leveling

When a record has been played the pickup moves out, another record is dropped down, and the needle is fed automatically into the starting groove of this record. If the needle fails to enter the starting groove, raise the right-hand side of the cabinet by inserting thin spacers under the feet on that side. If the needle slides over a few grooves, raise the left-hand side of the cabinet in a similar manner.

Lubrication

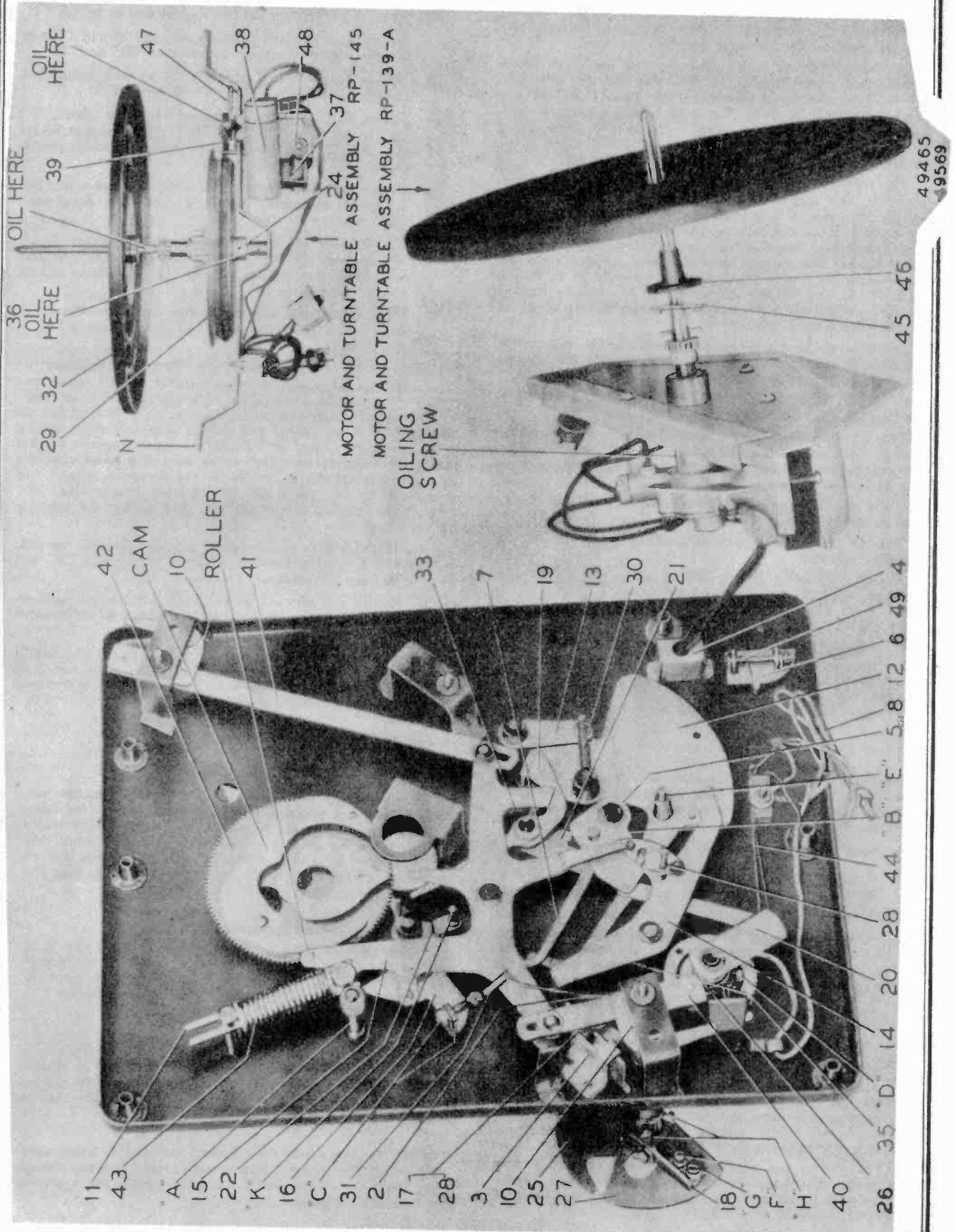
A few drops of good quality light machine oil should be applied about once every six months at the base of the spindle under the turntable. On the Stock No. 9865 the turntable may be lifted and the oil applied below the metal washer.

Either of these Record Changers will automatically play a series of eight 10- or seven 12-inch records of the 78 revolutions-per-minute type, or, if you so desire, you may change records, of any size up to 12 inches, manually. Records of

the last few years with the standard eccentric or spiral stopping groove will operate the automatic mechanism and change your records for you. The Record Changer is for operation on 110 volts, 60 cycles.

MODELS RP-139A, RP-140,
RP-145, RP-145E
MI-4831 Portable

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MODELS RP-152 Series,
MI-4831 Portable

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MODELS RP-139A, RP-140,
RP-145, RP-145E

ADJUSTMENTS

A. Main Lever.—This lever is basically important in that it interlinks the various individual mechanisms which control needle landing, tripping, record separation, etc. Rotate the turntable until the changer is out-of-cycle; and check rubber bumper bracket (A). The roller should clear the nose of the cam plate by approximately 1/16 inch.

B. Friction Clutch.—The motion of the tone arm toward the center of the record is transmitted to the trip pawl "22" by the trip lever "7" through a friction clutch "5." If the motion of the pickup is abruptly accelerated or becomes irregular due to swinging in the eccentric groove, the trip finger "7" moves the trip pawl "22" into engagement with the pawl on the main gear, and the change cycle is started. Proper adjustment of the friction clutch "5" occurs when movement of the tone arm causes positive movement of the trip pawl "22" without tendency of the clutch to slip. The friction should be just enough to prevent slippage, and is adjustable by means of screw "B." If adjustment is too tight, the needle will repeat grooves; if too loose, tripping will not occur at the end of the record.

C. Pickup Lift Cable Screw.—During the record change cycle, lever "16" is actuated by the main lever "15" so as to raise the tone arm clear of the record by means of the pickup lift cable. To adjust pickup for proper elevation, stop the changer "in-cycle" at the point where pickup is raised to the maximum height above turntable plate, and has not moved outward; at this point adjust locknuts "C" to obtain 1 inch spacing between needle point and turntable top surface.

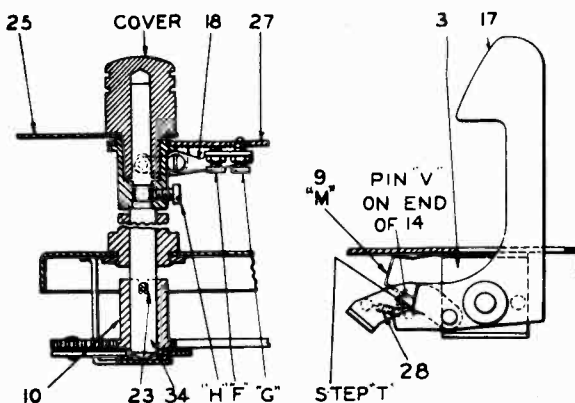
D. & E. Needle Landing on Record.—The relation of coupling between the tone arm vertical shaft and lever "20" determines the landing position of the needle on a 10 inch record. Position of eccentric stud "E" governs the landing of the needle on a 12 inch record; this, however, is dependent on the proper 10 inch adjustment.

To adjust for needle landing, place 10 inch record on turntable; push index lever to reject position and return to the 10 inch position; see that pickup locating lever "17" is tilted fully toward turntable; rotate mechanism through cycle until needle is just ready to land on the record; then see that pin "V" on lever "14" is in contact with "Step T" on lever "17." The correct point of landing is $4\frac{3}{8}$ inches from the nearest side of the turntable spindle; loosen the two screws "D" and adjust horizontal position of tone arm to proper dimension, being careful not to disturb levers "14" and "17." Leave approximately 1/32 inch end play between hub of lever "20" and pickup base bearing, and tighten the blunt nose screw "D"; run mechanism through several cycles as a check, then tighten cone pointed screw "D."

After adjusting for needle landing on a 10 inch record, place 12 inch record on turntable; push index lever to reject and return to 12 inch position; rotate mechanism through cycle until needle is just ready to land on the record; the correct point of landing is $5\frac{3}{8}$ inches from nearest side of spindle. If the landing is incorrect, turn stud "E" until the eccentric end adjusts lever "14" to give correct needle landing. The eccentric end of the stud must always be toward the rear of the motorboard, otherwise incorrect landing may occur with 10 inch records.

F. & G. Record Separating Knife.—The upper plate (knife) "25" on each of the record posts serves to separate the lower record from the stack and to support the remaining records during the change cycle. It is essential that the spacing between the knife and the rotating record shelf "27" be accurately maintained. The spacing for the 10 inch record is nominally .055 inch, and for the 12 inch record is .075 inch.

To adjust, rotate the knife to the point of minimum vertical separation from the record shelf and turn screw and locknut "F" to give .052—.058 inch separation. Screw "G" must not be depressed during this adjustment. After setting screw "F," adjust screw "G" so that when its tip is depressed flush with top of record shelf, the vertical spacing between the knife, in its lowest rotational position, and the shelf, is .072—.078 inch.



Details of Record Shelf Posts and Mixed Record Discriminating Lever

H. Record Support Shelf.—The record shelf revolves during the change cycle to allow the lower record to drop onto the turntable. Both posts are rotated simultaneously by a gear and rack coupled to the main lever "15," and it is necessary that adjustment be such that the record is released from both shelves at the same instant. To adjust, place a 12 inch record on the turntable, rotate mechanism into cycle to the point where both separating knives have turned clockwise as far as the mechanism will turn them; lift record upward until it is in contact with both separating knives. Then loosen screws "H" and shift record shelves "27" so that the curved inner edges of the shelves are uniformly spaced approximately 1/16 inch from the record edge. Some backlash will be present in the rotation of these shelves. They should be adjusted so that the backlash permits them to move away from the record but not closer than the approximate 1/16 inch specified above. Tighten the blunt nose screw "H," run mechanism through cycle several times to check action, then tighten cone pointed screw "H."

If record shelves or knives are bent, or not perfectly horizontal, improper operation and jamming of mechanism will occur.

J. Tone Arm Rest Support (not shown).—When the changer is out-of-cycle, the front lower edge of the pickup head should be 5/16 inch above surface of motorboard. This may be adjusted by bending the tone arm support bracket, which is associated with the tone arm mounting base, in the required direction.

K. Trip Pawl Stop Pin.—The position of the trip pawl stop pin "K" in relation to the main lever "15" governs the point at which the roller enters the cam. By bending the pin support either toward or away from trip pawl bearing stud, the roller can be made to enter the cam later or earlier, respectively. This adjustment should be made so that the roller definitely clears the cam outer guide as well as the nose of the cam plate.

Lubrication.—Petrolatum or petroleum jelly should be applied to cam, main gear, spindle pinion gear, and gears of record posts.

Light machine oil should be used in the tone arm vertical bearing, record post bearings, and all other bearings of various levers and pulleys on underside of motorboard. The turntable spindle bearing of RP-145 must be lubricated from the top of the motorboard. Using an oil can with a long spout, reach in between the turntable and motorboard and apply oil directly to the spindle.

On Model RP-139-A apply a few drops of light machine oil (S.A.E.-10) to the motor oil hole adjacent to the spindle bearing after each 1,000 hours of operation. The oil hole has a screw plug.

Do not allow oil or grease to come in contact with rubber mounting of tone arm base, rubber bumper, rubber spindle cap, or rubber parts of friction drive mechanism of Model RP-145.

MODELS RP-139A, RP-140,
RP-145, RP-145E

RCA MFG. CO., INC.

MODELS RP-152 Series,
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Before operating the phonograph, either automatically or manually, be sure that the pickup is down and can be moved by hand. If not, a "cycle" must be completed to bring it down. To do this, throw Turntable Switch "on." The turntable will start to revolve and the cycle of motion of the pickup arm will be resumed. When the pickup arm comes down, turn off the Turntable Switch.

Cautions

1. Never use force to start or stop the motor or any part of the record-changing mechanism or pickup arm.
2. The use of records which have become warped or damaged through improper care may cause the mechanism to jam and damage the instrument. In addition, records which have become warped will slide on one another when playing, resulting in unsatisfactory reproduction.
3. This instrument is **NOT RECOMMENDED** for playing 10-inch and 12-inch records in mixed sequence. If the user desires this service he must be positive that all records are perfectly flat and free from warp. The Index and Record Reject Lever must be set at "10" and after playing the last selection the pickup will come down in position for a 10-inch record and repeat the playing of the record on a 10-inch diameter unless the Turntable Switch is turned off. Any jamming of the mechanism under these conditions indicates that the records used are not perfectly flat or that their edges are not sufficiently smooth to permit normal operation of the separators in dropping each record in sequence onto the turntable.
4. Do not leave records on the record holder posts, as they are liable to warp, particularly so in warmer climates. Keep your records in a record file (album or cabinet) when not in use. If any records should become warped, place them on a flat surface with a flat heavy article, such as a large book, on top and leave them in this position for a few days.

Controls and Moving Mechanism

Index and Record Reject Lever.—This lever is located near the right front corner of the motorboard with its index plate marked for four positions—"MANUAL," "12," "10," and "REJECT." When you desire to change record selections manually, this lever should be set in the "MANUAL" position. With the lever in the "12" position, the mechanism is set to play a series of 12-inch records automatically. To play either a series of 10-inch records, or 10- and 12-inch records mixed, the lever should be set at the "10" position.

To reject a record being played, or to start the record-changing cycle in case the record just played does not have the standard eccentric or spiral stopping groove, simply push the lever to the "REJECT" position and let go. The pickup will raise up and swing outwards and the next record will drop down. Upon releasing the lever, it will automatically return to the "10" position. If you are playing a series of 12-inch records, the lever should be returned to the "12" position after rejecting a record. Keep the lever in its "MANUAL" position when not actually playing records automatically.

Turntable Switch.—The switch located just in front of the Index and Record Reject Lever controls the current to the turntable motor. To start the turntable, set the switch to the "ON" position. To stop the turntable, set the switch to the "OFF" position.

Pickup and Top-Loading Needle Socket.—The pickup is the new crystal type, with a hole in the top for insertion of needles. When not playing records, the pickup arm should be moved out to the right beyond the turntable and placed at rest on the support with the edge of the pickup arm just beyond the vertical lug on the corner of the used needle box and the pickup over the needle gauge plate. The pickup must be in this position to change needles.

To insert a needle initially, loosen the needle screw on the front of the pickup, place needle in hole at top so that it drops down against the needle gauge plate and then tighten up the needle screw.

Needle Ejector.—The extending tab on the needle gauge plate of the needle box operates the needle ejector. To change a needle, place pickup in rest position, loosen needle screw and press the extending tab on the needle gauge plate to drop the used needle into the box below. Release tab, allowing the needle gauge plate to swing back, and then insert a new needle in the pickup as described above.

The used needle box may be taken out and emptied by first lifting the pickup off its rest and allowing it to float between the rest and the turntable. Then tilt the box upwards at the front and lift out. To replace the box, tilt it upwards at front and lower it into the hole with the lug on the back of the box in the slot in the motorboard. Slide the lug under the motorboard and push the box in place. Replace the pickup on its rest.

Record Holder Shelves.—To place a record on the turntable or to remove records, raise the record holder shelves by lifting the knobs, and swing clear of outer edge of record. Also push back vertical lever adjacent to the rear record holder post. You now have clear access to the turntable. Before loading the magazine for Automatic Operation swing the record holder shelves back into position.

Automatic Operation

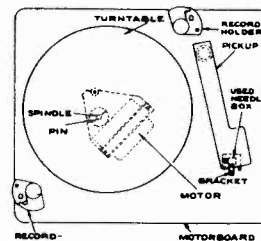
1. See that pickup is over needle gauge plate with needle properly in place. If not, complete a "cycle" as explained in the first paragraph under "OPERATION."
 2. With Index and Record Reject Lever at "MANUAL," place the first of the series of records on the turntable and the remainder of the series (up to seven 10-inch or six 12-inch records) on the record holder posts (as shown below). The records should be arranged in the desired order with the desired selection face up and the last selection on top.
 3. Set the Index and Record Reject Lever to the proper position. (See CONTROLS:—INDEX AND RECORD REJECT LEVER.)
 4. Throw Turntable Switch to the left—"ON"—turntable should commence to revolve.
 5. When turntable has attained speed, lift pickup and lower gently onto the record so that the needle point enters the outside groove.
 6. Close the lid of the cabinet to eliminate mechanical reproduction of sound by the needle.
- The whole series of records will now play without further attention, and the last record will repeat until the Turntable Switch is turned off. Allow the record-changing mechanism to complete its cycle before the turntable is stopped. Then lift the pickup, swing the arm to the right beyond the edge of the record and lower it onto the pickup rest with pickup over needle gauge plate. The record player is then ready for reloading, or for manual operation.

Manual Operation

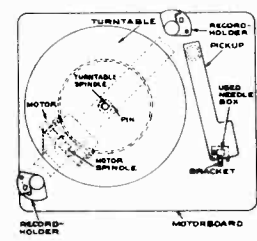
To play records manually:

1. Proceed as in step 1, under "AUTOMATIC OPERATION."
2. Place record on turntable with desired selection upwards.
3. Set Index and Record Reject Lever to "MANUAL" position.
4. Proceed as in steps 4, 5 and 6 under "AUTOMATIC OPERATION."

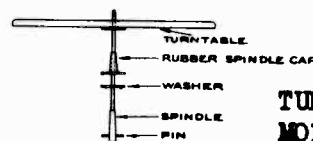
When you have finished playing, be sure that the turntable has stopped and the pickup is in the rest position over needle gauge plate. Never leave pickup with needle resting on a record or on the turntable.



MODEL RP-139A



MODEL RP-145

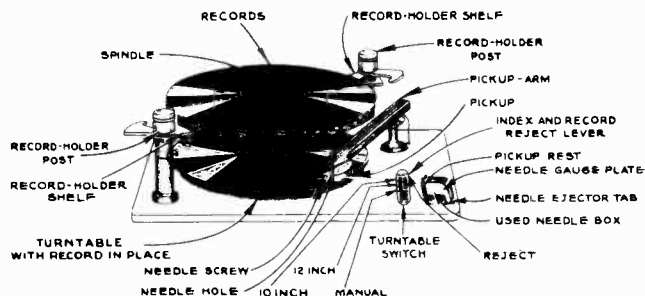


TURNTABLE ON
MODEL RP-139A

MODELS RP-152 Series,
MI-4831 Portable

RCA MFG. CO., INC.

MODELS RP-139A, RP-140,
RP-145, RP-145E



These record changers are available for operation on voltages and frequencies as follows:

RP-139-A	105-125 volts, 60 cycles, 21 watts
RP-139-A	105-125 volts, 50 cycles, 21 watts
RP-139-A	105-125 volts, 25 cycles, 22 watts
RP-145	105-125 volts, 60 cycles, 15 watts
RP-145	105-125 volts, 50 cycles, 15 watts

Replacement Parts

Insist on genuine factory-tested parts, which are readily identified and may be purchased from authorized dealers.

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
PICKUP ARM ASSEMBLIES			OPERATING MECHANISM		
33906	Arm—Pickup arm shell	.45	10129	Ball—Steel ball for turntable bearing (Model RP-145)	.02
33977	Cable—Pickup shielded cable (8)	.50	33984	Bracket—Record discriminating lever mounting bracket (3)	.20
33905	Crystal—Pickup cartridge and needle screw (RP-139-A only)	4.25	33987	Cam—Cam and drive gear (42)	2.00
35171	Crystal—Pickup cartridge and needle screw (RP-145 only)	xx	6808	Clutch—Trip lever clutch (5)	.35
33976	Pin—Used to fasten pivot arm in pickup arm shell	.03	34369	Cup—Turntable bearing cup (Model RP-145) (36)	.20
33974	Screw—Needle screw	.15	32883	Damper—Rubber drive sleeve and damper plate for motor spindle (Model RP-139A) (45, 46)	.30
33975	Shaft—Pickup pivot shaft and pivot arm	1.40	34367	Disc—Turntable drive disc and tire (Model RP-145) (29)	2.25
MOTOR ASSEMBLIES (Model RP-139A)			31116	Finger—Trip lever friction finger (7)	.45
32956	Coil—Field coil and laminations for 25 cycle motor	7.15	32879	Gear—Long arm and rack gear (41)	.60
32955	Coil—Field coil and laminations for 50 cycle motor	5.90	31121	Gear—Record separator shaft gear (10)	.90
32954	Coil—Field coil and laminations for 60 cycle motor	5.35	32880	Gear—Short arm and rack gear (40)	.55
32960	Gear—Motor spindle gear and pin	.75	34368	Grommet—Rubber grommet for motor mounting (Model RP-145) (48)	.08
32873	Motor—Motor complete, 25 cycle, 110 volt AC	15.95	31151	Guide—Lift cable guide spring (2)	.10
32872	Motor—Motor complete, 50 cycle, 110 volt AC	13.75	33982	Guide—Main spring guide (11)	.10
32871	Motor—Motor complete, 60 cycle, 110 volt AC	13.25	34370	Idler—Turntable idler wheel and arm (Model RP-145) (39)	.60
30870	Plug—2-prong male plug—used on motor leads	.35	33986	Lever—Index lever (12)	.60
32959	Spindle—Turntable spindle complete with metal pinion and fibre gear for 25 cycle motor	2.90	31138	Lever—Locating lever and pawl (14)	.70
32958	Spindle—Turntable spindle complete with metal pinion and fibre gear for 50 cycle motor	2.90	33985	Lever—Main lever (15)	1.05
32957	Spindle—Turntable spindle complete with metal pinion and fibre gear for 60 cycle motor	2.90	33993	Lever—10-inch and 12-inch record discriminating lever (17)	.85
32875	Switch—Motor control switch (4)	.30	31140	Lever—Pickup lift cable lever and spring (16)	.55
MOTOR ASSEMBLIES (Model RP-145)			31130	Lever—Record separator elevating lever with adjustment screws (18)	.80
34513	Armature—Complete armature and shaft for 60 cycle motor	xx	31132	Lever—Trip detaining lever (19)	.30
34512	Cap—Bakelite cap for motor	xx	34874	Lever—Trip lever assembly (20)	1.85
34365	Capacitor—1.25 mfd., for 60 cycle motor (38)	1.75	31131	Lever—Trip regulator lever (21)	.25
34364	Motor—105/125 volts, 60 cycle, complete with capacitor (37)	6.75	33992	Link—Index lever setting link and button	.20
30870	Plug—2-prong male plug for motor leads	.35	31137	Pawl—Index lever pawl (13)	.30
MOTORBOARD ASSEMBLIES (Model RP-139A)			31133	Pawl—Trip pawl assembly (22)	.80
33981	Base—Pickup arm mounting base	.60	31535	Pin—Drive pin for turntable drive disc (Model RP-145) (24)	.03
33978	Board—Motorboard complete with bearings and posts less operating mechanism	6.50	31124	Pin—Pin to fasten gear on record separator shaft (23)	.04
33909	Cup—Used needle cup, lid, and pickup arm rest (6)	1.00	31118	Screw—Cone pointed set screw for record separator shelf ("H")	.06
33979	Escutcheon—Index escutcheon	.50	14195	Screw—No. 10-32 cone pointed set screw for trip lever hub ("D")	.05
31150	Mounting—Pickup arm base rubber mounting complete	.45	33983	Screw—Record separator elevating lever pivot screw	.15
31155	Spring—Used needle cup lid spring (49)	.04	31117	Screw—Special to adjust friction clutch	.03
MOTORBOARD ASSEMBLIES (Model RP-145)			33990	Separator—Record separator knife (25)	1.85
33981	Base—Pickup arm mounting base	.60	33988	Shaft—Record separator shaft (34)	.70
34363	Board—Motorboard complete with bearings and posts—less operating mechanisms	6.70	33989	Shelf—Record separator shelf (27)	1.25
33909	Cup—Used cup, lid, and pickup arm rest (6)	1.00	3676	Spring—Cam gear pawl spring	.04
33979	Escutcheon—Index escutcheon	.50	31136	Spring—Index lever pawl spring (30)	.05
31150	Mounting—Pickup arm base rubber mounting complete	.45	3666	Spring—Lift cable spring (31)	.04
31155	Spring—Used needle cup lid spring (49)	.04	32438	Spring—Locating lever spring (35)	.05
32875	Switch—Motor switch (4)	.30	32882	Spring—Main lever tension spring (43)	.05
			34876	Spring—Pickup arm starting spring (26)	.10
			14190	Spring—Record discriminating lever pawl spring or locating lever pawl spring (28)	.08
			33994	Spring—Record discriminating lever spring (flat) (9)	.05
			14191	Spring—Trip detaining lever spring (33)	.04
			34372	Spring—Turntable idler wheel spring (Model RP-145) (47)	.10
			34371	Support—Turntable drive and motor support (Model RP-145)	.70
			34875	Switch—Pickup shorting switch (44)	.45
			33991	Turntable—(Model RP-139A)	3.00
			34366	Turntable and Spindle Shaft—(Model RP-145) (32)	3.35
			34373	Washer—"C" washer for mounting idler wheel and arm (Model RP-145)	.03

xx Price upon application to your RCA Victor Parts Distributor.

ALL PRICES ARE SUBJECT TO CHANGE OR WITHDRAWAL WITHOUT NOTICE.

MODEL RP-139B

RCA MFG. CO., INC.

PHONOGRAPH	MODEL U-126	MODEL U-128
Type	Manual	Automatic—Manual
Record Capacity	one 10-inch or one 12-inch	Seven ten or twelve inch
Turntable Speed	78 R.P.M. (Adjustable)	78 R.P.M. (Adjustable)
Type Pickup	Crystal	Crystal
Pickup Impedance	80,000 ohms at 1,000 cycles	80,000 ohms at 1,000 cycles

Turntable Switch.—The switch located just in front of the Index and Record Reject Lever controls the current to the turntable motor. To start the turntable, set the switch to the "ON" position. To stop the turntable, set the switch to the "OFF" position.

Pickup and Top-Loading Needle Socket.—The pickup is the new crystal type, with a hole in the top for insertion of needles. When not playing records, the pickup arm should be moved out to the right beyond the turntable and placed at rest on the support with the edge of the pickup arm in the groove and the pickup over the needle gauge plate. The pickup must be in this position to change needles.

To insert a needle initially, loosen the needle screw on the front of the pickup, place needle in hole at top so that it drops down against the needle gauge plate and then tighten up the needle screw.

Needle Ejector.—The extending tab on the needle gauge plate of the needle box operates the needle ejector. To change a needle, place pickup in rest position, loosen needle screw and press the extending tab on the needle gauge plate to drop the used needle into the box below. Release tab, allowing the needle gauge plate to swing back, and then insert a new needle in the pickup as described above.

The used needle box may be taken out and emptied by first lifting the pickup off its rest and allowing it to float between the rest and the turntable. Then tilt the box upwards at the front and lift out. To replace the box, tilt it upwards at front and lower it into the hole with the lug on the back of the box in the slot in the motorboard. Slide the lug under the motorboard and the box drops in place. Replace the pickup on its rest.

Record Holder Shelves.—To place a record on the turntable or to remove records, raise the record holder shelves, by lifting with the fingers under the shelf, and swing clear of outer edge of record. Also push back vertical lever adjacent to the rear record holder post. You now have clear access to the turntable. Before loading the magazine for Automatic Operation swing the record holder shelves back into position.

Cautions

1. Never use force to start or stop the motor or any part of the record-changing mechanism or pickup arm.
2. The use of records which have become warped or damaged through improper care may cause the mechanism to jam and damage the instrument. In addition, records which have become warped will slide on one another when playing, resulting in unsatisfactory reproduction.
3. This instrument is NOT RECOMMENDED for playing 10-inch and 12-inch records in mixed sequence. If the user desires this service he must be positive that all records are perfectly flat and free from warp. The Index and Record Reject Lever must be set at "10" and after playing the last selection the pickup will come down in position for a 10-inch record and repeat the playing of the record on a 10-inch diameter unless the Turntable Switch is turned off. Any jamming of the mechanism under these conditions indicates that the records used are not perfectly flat or that their edges are not sufficiently smooth to permit normal operation of the separators in dropping each record in sequence onto the turntable.

(ENTIRE RP-139 SERIES ARE SIMILAR)

Automatic Operation

1. See that pickup is over needle gauge plate with needle properly in place. If not, complete a "cycle" as explained in the first paragraph under "OPERATION."

2. With Index and Record Reject Lever at "MANUAL," place the first of the series of records on the turntable and the remainder of the series (up to seven 10-inch or six 12-inch records) on the record holder posts (as shown below.) The records should be arranged in the desired order with the desired selection face up and the last selection on top.

3. Set the Index and Record Reject Lever to the proper position. (See CONTROLS:—INDEX AND RECORD REJECT LEVER.)

4. Throw Turntable Switch to the left—"ON"—turntable should commence to revolve.

5. When turntable has attained speed, lift pickup and lower gently on to the record so that the needle point enters the outside groove.

6. Close the lid of the cabinet to eliminate mechanical reproduction of sound by the needle.

The whole series of records will now play without further attention, and the last record will repeat until the Turntable Switch is turned off. Allow the record-changing mechanism to complete its cycle before the turntable is stopped. Then lift the pickup, swing the arm to the right beyond the edge of the record and lower it onto the pickup rest with pickup over needle gauge plate. The record player is then ready for reloading, or for manual operation.

Manual Operation

To play records manually:

1. Proceed as in step 1, under "AUTOMATIC OPERATION."

2. Place record on turntable with desired selection upwards.

3. Set Index and Record Reject Lever to "MANUAL" position.

4. Proceed as in steps 4, 5 and 6 under "AUTOMATIC OPERATION."

When you have finished playing, be sure that the turntable has stopped and the pickup is in the rest position over needle gauge plate. Never leave pickup with needle resting on a record or on the turntable.

Controls and Moving Mechanism

Index and Record Reject Lever.—This lever is located near the right front corner of the motorboard with its index plate marked for four positions—"MANUAL," "12," "10," and "REJECT." When you desire to change record selections manually, this lever should be set in the "MANUAL" position. With the lever in the "12" position, the mechanism is set to play a series of 12-inch records automatically. To play either a series of 10-inch records, or 10- and 12-inch records mixed, the lever should be set at the "10" position.

To reject a record being played, or to start the record-changing cycle in case the record just played does not have the standard eccentric or spiral stopping groove, simply push the lever to the "REJECT" position and let go. The pickup will raise up and swing outwards and the next record will drop down. Upon releasing the lever, it will automatically return to the "10" position. If you are playing a series of 12-inch records, the lever should be returned to the "12" position after rejecting a record. Keep the lever in its "MANUAL" position when not actually playing records automatically.

RCA MFG. CO., INC.

MODEL RP-139B

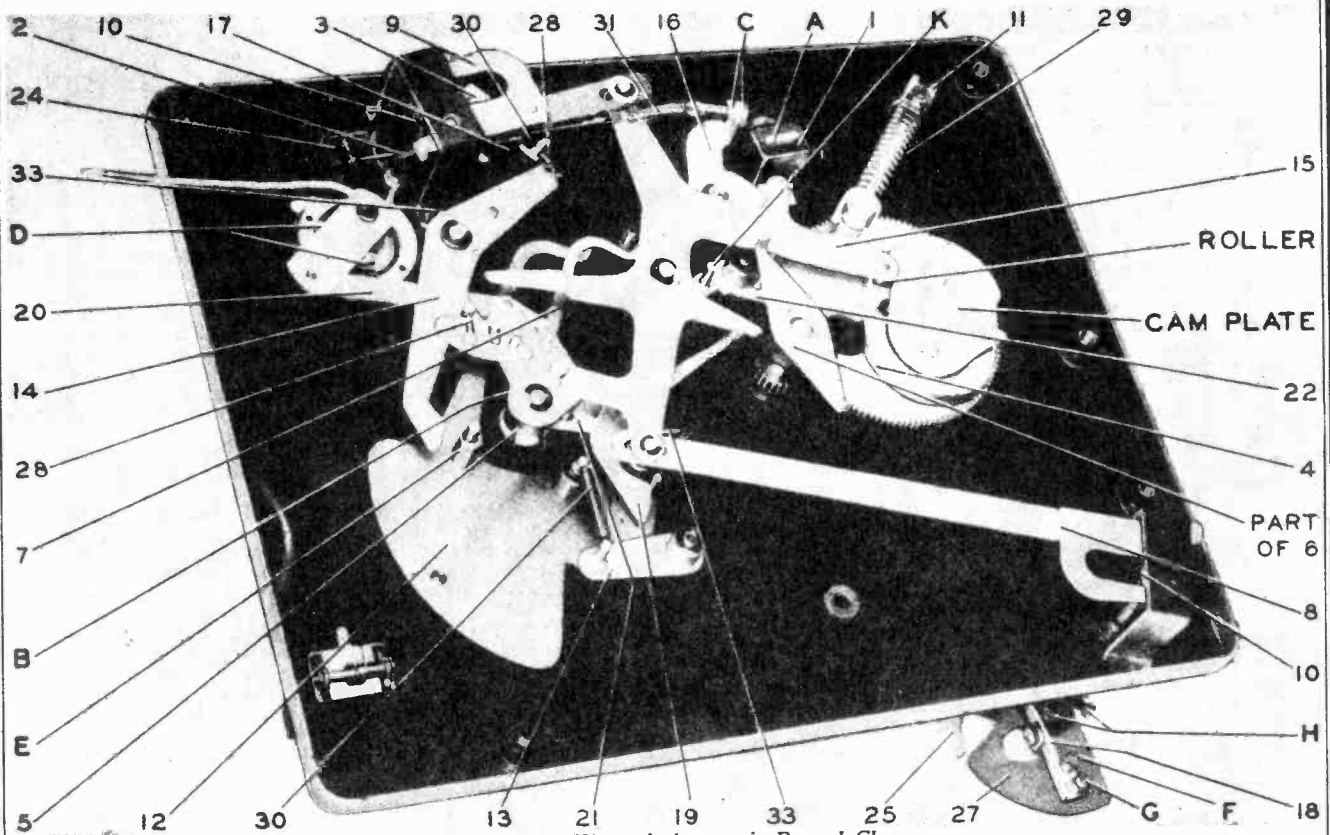


Figure 10—Bottom View of Automatic Record Changer

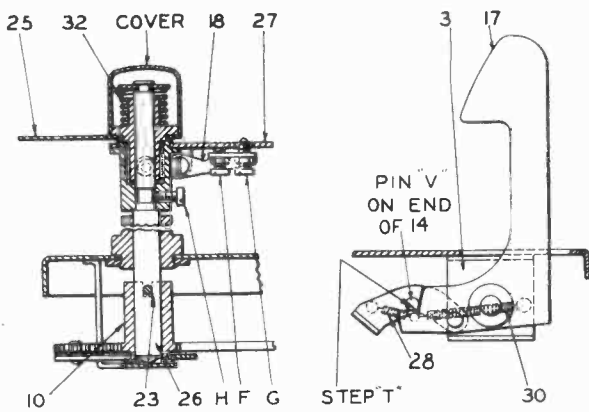


Figure 11—Details of Record Shelf Posts, and Locating Lever Assemblies

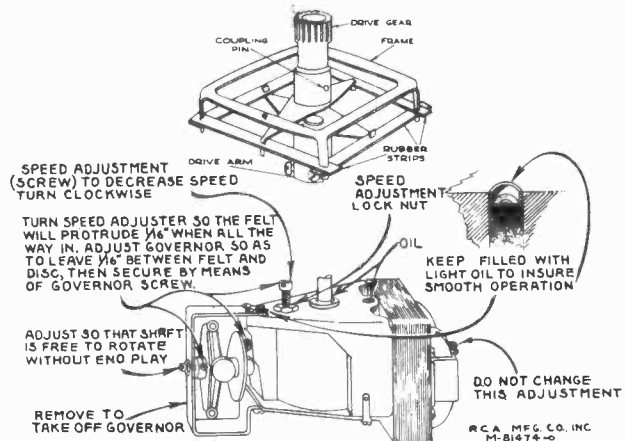


Figure 12—Motor Data and Coupling

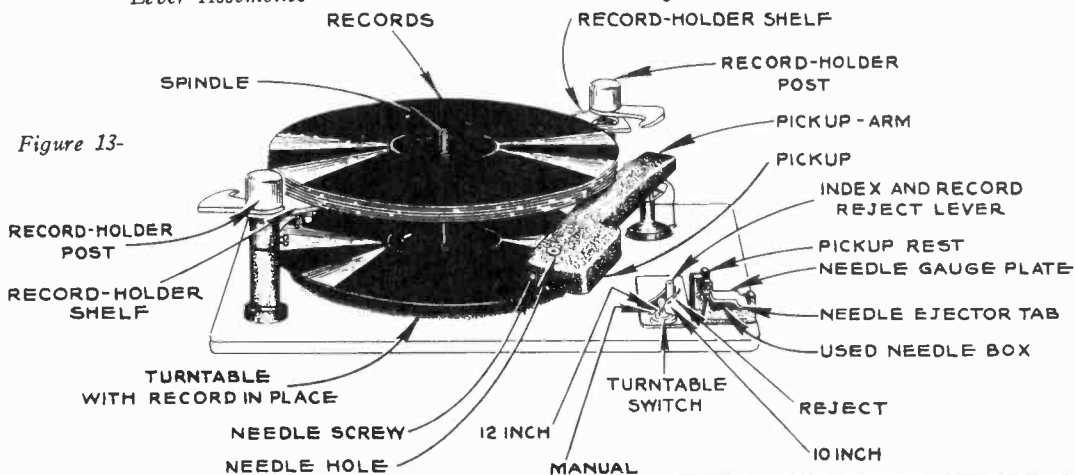


Figure 13-

GENERAL INFORMATION

Before servicing the automatic record changer, inspect the assembly to see that all levers, parts, gears, springs, etc. are in good order and are correctly assembled.

A bind or jam in the mechanism can usually be relieved by rotating the turntable in the reverse direction.

The changer can be conveniently rotated through its change cycle by pushing the index lever to "Reject" and revolving the turntable by hand. Six turntable revolutions are required for one change cycle.

The turntable, spindle, and pinion gear are assembled by means of a 3/32 inch straight pin. This pin may be removed by gently driving with a standard pin punch.

If the record changer or cabinet is not perfectly level, normal operation is likely to be affected.

The 10 and 12 inch records must be absolutely flat for smooth operation when using a mixture of the two sizes.

A shorting switch, located in the pickup head, operates due to pressure when the pickup is placed on the pickup rest.

ADJUSTMENTS

A. Main Lever.—This lever is basically important in that it interlinks the various individual mechanisms which control needle landing, tripping, record separation, etc. One adjustment is provided for the main lever. Rotate the turntable until the changer is out-of-cycle; and adjust rubber bumper bracket (A) so that the roller clears the nose of the cam plate by 1/16 inch.

B. Friction Clutch.—The motion of the tone arm toward the center of the record is transmitted to the trip pawl "22" by the trip lever "7" through a friction clutch "5." If the motion of the pickup is abruptly accelerated or becomes irregular due to swinging in the eccentric groove, the trip finger "7" moves the trip pawl "22" into engagement with the pawl on the main gear, and the change cycle is started. Proper adjustment of the friction clutch "5" occurs when movement of the tone arm causes positive movement of the trip pawl "22" without tendency of the clutch to slip. The friction should be just enough to prevent slippage, and is adjustable by means of screw "B." If adjustment is too tight, the needle will repeat grooves; if too loose, tripping will not occur at the end of the record.

C. Pickup Lift Cable Screw.—During the record change cycle, lever "16" is actuated by the main lever "15" so as to raise the tone arm clear of the record by means of the pickup lift cable. To adjust pickup for proper elevation, stop the changer "in-cycle" at the point where pickup is raised to the maximum height above turntable plate, and has not moved outward; at this point adjust locknuts "C" to obtain 1 inch spacing between needle point and turntable top surface.

D. & E. Needle Landing on Record.—The relation of coupling between the tone arm vertical shaft and lever "20" determines the landing position of the needle on a 10 inch record. Position of eccentric stud "E" governs the landing of the needle on a 12 inch record; this, however, is dependent on the proper 10 inch adjustment.

To adjust for needle landing, place 10 inch record on turntable; push index lever to reject position and return to the 10 inch position; see that pickup locating lever "17" is tilted fully toward turntable; rotate mechanism through cycle until needle is just ready to land on the record; then see that pin "V" on lever "14" is in contact with "Step T" on lever "17." The correct point of landing is 4-11/16 inches from the nearest side of the turntable spindle; loosen the two screws "D" and adjust horizontal position of tone arm to proper dimension, being careful not to disturb levers "14" and "17." Leave approximately 1/32 inch end play between hub of lever "20" and pickup base bearing, and tighten the blunt nose screw "D"; run mechanism through several cycles as a check, then tighten cone pointed screw "D".

After adjusting for needle landing on a 10 inch record, place 12 inch record on turntable; push index lever to reject and return to 12 inch position; rotate mechanism through cycle until needle is just ready to land on the record; the correct point of landing is 5-11/16 inches from nearest side of spindle. If the landing is incorrect, turn stud "E" until the eccentric end adjusts lever "14" to give correct needle landing. The eccentric end of the stud must always be toward the rear of the motor board, otherwise incorrect landing may occur with 10 inch records.

F. & G. Record Separating Knife.—The upper plate (knife) "25" on each of the record posts serves to separate the lower record from the stack and to support the remaining records during the change cycle. It is essential that the spacing between the knife and the rotating record shelf "27" be accurately maintained. The spacing for the 10 inch record is nominally .055 inch, and for the 12 inch record is .075 inch.

To adjust, rotate the knife to the point of minimum

vertical separation from the record shelf and turn screw and locknut "F" to give .052—.058 inch separation. Screw "G" must not be depressed during this adjustment. After setting screw "F" adjust screw "G" so that when its tip is depressed flush with top of record shelf, the vertical spacing between the knife, in its lowest rotational position, and the shelf, is .072—.078 inch.

H. Record Support Shelf.—The record shelf revolves during the change cycle to allow the lower record to drop onto the turntable. Both posts are rotated simultaneously by a gear and rack coupled to the main lever "15," and it is necessary that adjustments be such that the record is released from both shelves at the same instant. To adjust, place a 12 inch record on the turntable, rotate mechanism into cycle to the point where tone arm is at maximum distance outward from turntable; lift record upward until it is in contact with both separating knives, then loosen screws "H" and shift record shelves so that the curved inner edges of the shelves are uniformly spaced at least 1/16 inch from record edge. Tighten the blunt nose screw "H," run mechanism through cycle several times to check action, then tighten cone pointed screw "H".

If record shelves or knives are bent, or not perfectly horizontal, improper operation and jamming of mechanism will occur.

J. Tone Arm Rest Support (not shown).—When the changer is out-of-cycle, the front lower edge of the pickup head should be 5/16 inch above surface of motor board. This may be adjusted by bending the tone arm support bracket, which is associated with the tone arm mounting base, in the required direction.

K. Trip Pawl Stop Pin.—The position of the trip pawl stop pin "K" in relation to the main lever "15" governs the point at which the roller enters the cam. By bending the pin support either toward or away from trip pawl bearing stud, the roller can be made to enter the cam later or earlier, respectively. This adjustment should be made so that the roller definitely clears the cam outer guide as well as the nose of the cam plate.

Lubrication.—Petrolatum or petroleum jelly should be applied to cam, main gear, spindle pinion gear, and gears of record posts.

Light machine oil should be used in the tone arm vertical bearing, record post bearings, and all other bearings of various levers on underside of motor board.

The felt washer between the turntable and spindle bearing should be soaked in light engine oil whenever the turntable is removed, or as required for proper operation.

Do not allow oil or grease to come in contact with, rubber mounting of tone arm base, rubber bumper, or flexible coupling of drive motor.

MISCELLANEOUS SERVICE HINTS

Incorrect adjustment of a particular mechanism of the changer is generally exhibited in a specific mode of improper operation. The following relations between effects on operation and the usual mis-adjustments will enable ready adjustment in most cases.

1. For any irregularity of operation, the adjustment of the main lever "15" should be checked first as in "A".
2. Needle does not land properly on both 10 and 12 inch records—Make complete adjustments "D" and "E".
3. Needle does not land properly on 12 inch record but correct on 10 inch—Effect adjustment "E".
4. Failure to trip at end of record—Increase clutch "5" friction by means of screw "B". Also, see that levers "7" and "12" are free to move without touching each other.
5. Pickup strikes lower record of stack or drags across top record on turntable—Adjust lift cable per adjustment "C".
6. Needle does not track after landing—Friction clutch "5" adjustment "B" may be too tight; bind in tone arm vertical bearing; levers "7" and "12" fouled; or pickup output cable twisted.
7. Cycle commences before record is complete—Record is defective, or adjustment "B" of friction clutch "5" is too tight.
8. Wow in record reproduction—Record is defective; flexible coupling between motor and changer mechanism not correctly assembled; or instrument is not being operated at normal room temperature (65° F).
9. Record knives strike edge of records—Records warped; record edges are rough; or knife adjustments "F" and "G" are incorrect.
10. Record not released properly—Adjust record shelf assemblies in respect to shaft by means of adjustment "H".
11. Needle lands in 10 inch position on 12 inch record or misses record when playing both types mixed—Increase tension of pickup locating lever spring "30".

RCA MFG. CO., INC.

Turntable Mechanism Model U-126

The crystal unit of the pickup is sealed in a metal case against extremes of climate. The offset mounting of the crystal unit in the pickup arm insures ideal tracking between needle and record grooves. If failure should occur due to a defective crystal, no attempt should be made to repair the crystal, but a new replacement crystal unit should be installed.

The turntable drive is a self-starting, variable-speed, governor-type, induction motor. The motor speed adjusting screw is located under the turntable, and may be adjusted by inserting a screwdriver thru one of the holes in the turntable, after the hole has been lined up with the screw. The flexible motor drive arrangement is similar to the U-128. The motor speed should be 78 r.p.m., and may be checked by placing a piece of paper between a record and the turntable, with the paper protruding beyond the edge of the record, and then counting the number of revolutions of the turntable per minute. The motor is designed to be simple and fool-proof in operation. Occasionally, however, certain adjustments and lubrication may be required. These are illustrated and explained in figure 12. In addition, an application of oil to the felt pad, which rubs against the governor disc, will insure smooth operation.

The turntable is started by pushing to the rear the motor starting lever, which appears to the right of the turntable. The adjustment on the automatic motor stopping switch should be made so that the switch will snap to the "off" position when the needle in the pickup head is 1/4 inches away from the center of the turntable. The locking screw and details of the switch mechanism are shown in figure 14. The locking screw and nut may be reached, from underneath the motor board, or, by an open end wrench, under the turntable.

ADJUST SWITCH TO TRIP WHEN NEEDLE IS ON 1/4" RADIUS FROM C. OF MOTOR SPINDLE

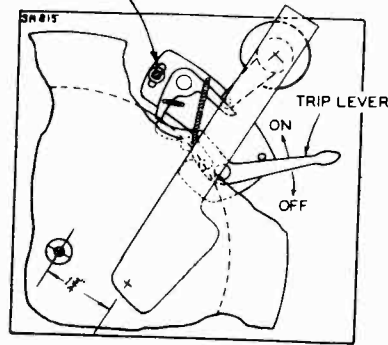


Figure 14—Adjustment of Automatic Stop Switch

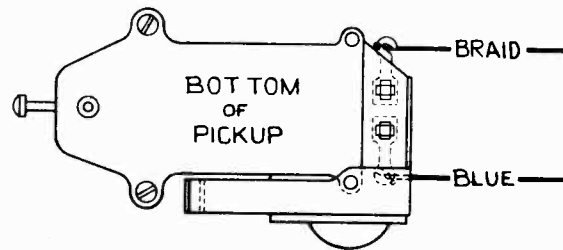


Figure 15—Pickup Connections

REPLACEMENT PARTS

STOCK No.	DESCRIPTION	Unit List Price			
MOTORBOARD ASSEMBLIES Model U-126					
31536	Coupling—Flexible motor coupling complete..	2.10			
9848	Cup—Used needle cup and lid complete..	.75			
31465	Mounting—Pickup arm base rubber mounting..	.10			
31535	Pin—Drive pin to fasten flexible coupling to turntable shaft..	.03			
30870	Plug—2-contact male plug for automatic switch leads..	.35			
14195	Screw—Set screw for flexible coupling..	.05			
30100	Springs—1 set of springs for automatic switch..	.08			
31155	Spring—Used needle cup cover tension spring..	.04			
31147	Strip—Complete set of rubber strips for flexible couplings..	.40			
31534	Switch—Automatic switch and lever complete..	2.75			
31467	Switch—Switch only for automatic switch (S7)..	.35			
31533	Turntable—Turntable with spindle shaft and nose complete..	4.95			
31537	Washers—Turntable bearing and shim washers..	.06			
MOTORBOARD ASSEMBLIES Model U-128					
31149	Base—Tone arm mounting base..	.35			
31152	Board—Record changer base complete with all welded and riveted posts and bearings—less all operating parts..	7.90			
14209	Bumper—Main lever rubber bumper (1)..	.08			
9848	Cup—Used needle cup, rest, and lid complete..	.75			
31148	Escutcheon—Index escutcheon..	.40			
31151	Guide—Pickup lift cable guide (coil spring, 80T 2-in. large) (2)..	.10			
31150	Mounting—Pickup arm base rubber mounting complete..	.45			
31155	Spring—Needle cup lid tension spring..	.04			
OPERATING MECHANISM Model U-128					
31134	Bracket—Pickup locating lever mounting bracket (3)..	.30			
31144	Cam—Cam and gear assembly (4)..	2.80			
6808	Clutch—Trip lever friction clutch assembly (5)..	.35			
31146	Coupling—Motor coupling complete with turntable drive gear, rubber strips, motor coupling, and drive arm (6)..	1.80			
31129	Cover—Cap for top of record post..	.45			
31116	Finger—Trip lever friction finger assembly (7)..	.45			
31119	Gear—Long arm and rack gear for front left-hand record post (8)..	.60			
31120	Gear—Short arm and rack gear for rear right-hand record post (9)..	.55			
31121	Gear—Record post gear (10)..	.90			
31123	Guide—Main lever spring guide (11)..	.40			
31114	Lever—Index lever assembly (12)..	.75			
31137	Lever—Index lever tension spring lever (13)..	.30			
31138	Lever—Locating lever and pawl assembly (14)..	.70			
31113	Lever—Main lever assembly (15)..	1.35			
31140	Lever—Pickup lift cable lever and spring assembly (16)..	.55			
31135	Lever—Pickup locating lever assembly (17)..	.85			
31130	Lever—Record separator elevating lever complete with adjustment screws (18)..	.80			
31132	Lever—Trip detaining lever (19)..	.30			
31115	Lever—Trip lever assembly (20)..	1.85			
31131	Lever—Trip regulator lever (21)..	.25			
31133	Pawl—Trip pawl assembly (22)..	.80			
31124	Pin—Record post drive pin (23)..	.04			
14207	Roller—Pickup lift cable roller and bracket assembly (24)..	.55			
31118	Screw—Cone pointed set screw for trip lever hub or record post shelf..	.06			
4563	Screw—Pickup lift cable screw and nuts..	.04			
14195	Screw—Set screw for flexible coupling..	.05			
31117	Screw—Special screw to adjust friction clutch tension..	.03			
31126	Separator—Record separator knife (25)..	.75			
31122	Shaft—Record separator post shaft (26)..	.40			
31125	Shelf—Record post shelf assembly (27)..	1.25			
31141	Spindle—Turntable spindle shaft and spring..	1.40			
3676	Spring—Cam pawl tension spring on main gear (12 turns, 190-in. O.D., 43/64-in. lg.)..	.04			
14190	Spring—Pickup locating lever short spring or locating lever pawl tension spring (28) (16 turns, 180-in. O.D., 19/32-in. lg.)..	.08			
31145	Spring—Main lever tension spring (29) (18 turns, 9/16-in. O.D., 3-in. lg.)..	.05			
31136	Spring—Pickup locating lever long spring or index lever tension spring (30) (25 turns, 190-in. O.D., 15/16-in. lg.)..	.05			
3666	Spring—Pickup lift cable tension spring (31) (20 turns, 195-in. O.D., 1-in. lg.)..	.04			
31127	Spring—Record separator pressure spring (32) (8 turns, 1/2-in. O.D., 1/2-in. lg.)..	.02			
14191	Spring—Trip detaining lever or locating lever tension spring (33) (15 turns, 190-in. O.D., 1/2-in. lg.)..	.04			
31142	Spring—Turntable spindle spring..	.03			
31147	Strip—Complete set of rubber strips for flexible coupling..	.40			
31139	Turntable Assembly—less spindle..	3.35			
31128	Washer—"C" washer for top of record post..	.04			
31143	Washers—Turntable thrust washers (1 steel, 1 bronze, 1 felt)..	.15			

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

RP-140
MI-4831

RCA MFG. CO., INC.

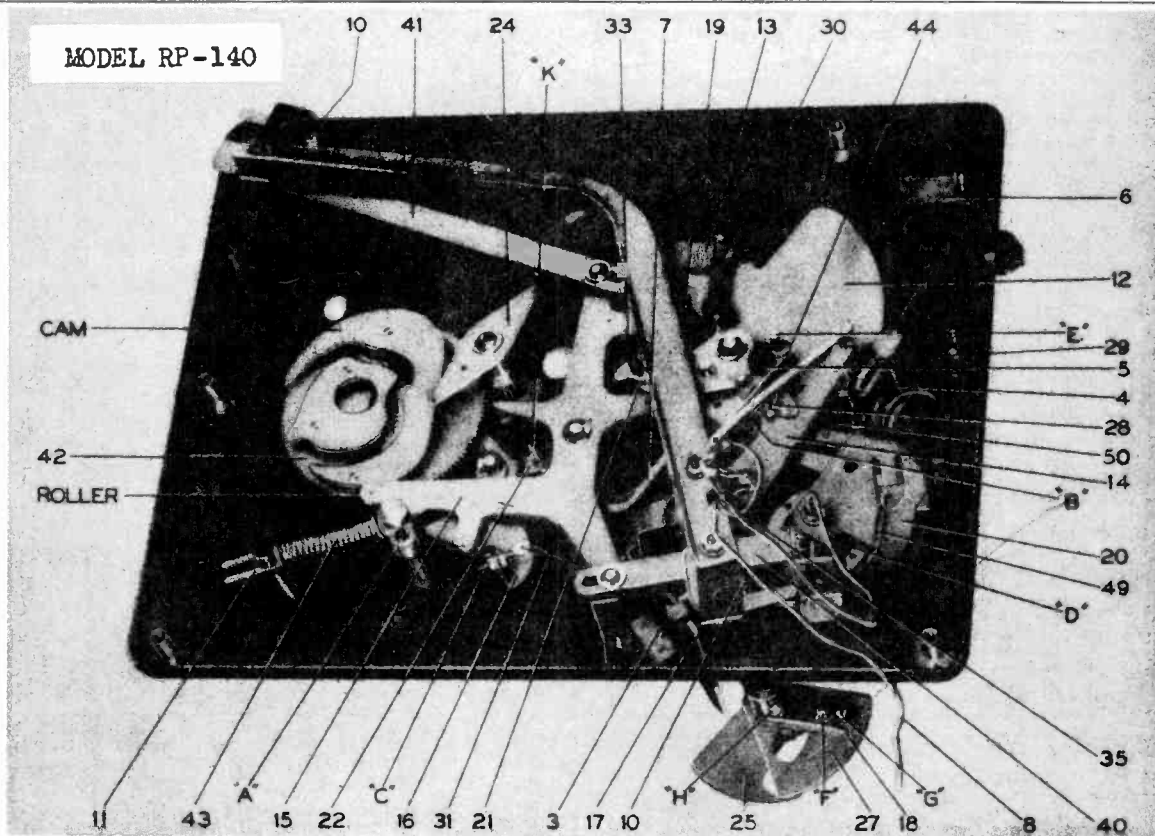
General Description

The MI-4831 Portable Automatic Turntable has been designed for use in those applications when it is desired to play either manually or automatically a series of either eight 10- or seven 12-inch records such as in schools, recreational centers, dance halls, etc. It operates from 115 V. A. C. 60-cycle power source and has an integral volume control. An output cable with telephone type plug is also supplied with the equipment.

FOR OPERATION AND SERVICING
DATA SEE MODEL RP-139A

MI-4831

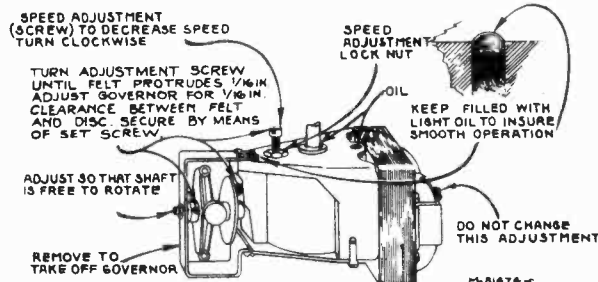
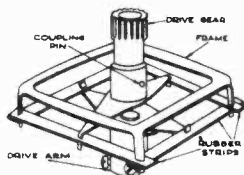
Height (with cover)	9 1/4 inches
Length	20 inches
Depth	15 inches
Weight (net)	25 pounds



Bottom View of Automatic Record Changer

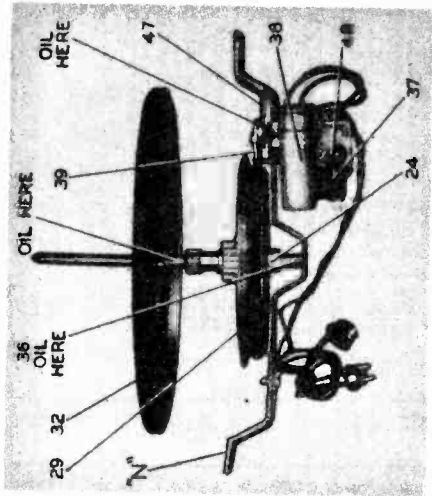
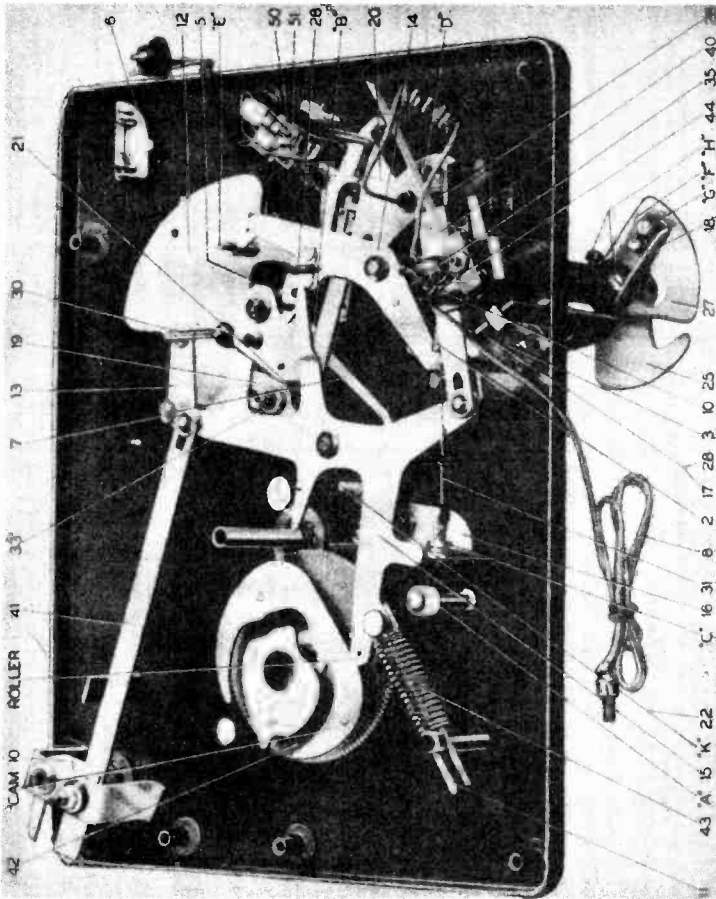
NOTE: Numbers refer to parts—letters refer to adjustments.

THIS DATA FOR MODEL RP-140 ONLY. FOR OPERATION AND SERVICING SEE MODEL RP-139A



Motor Data and Coupling

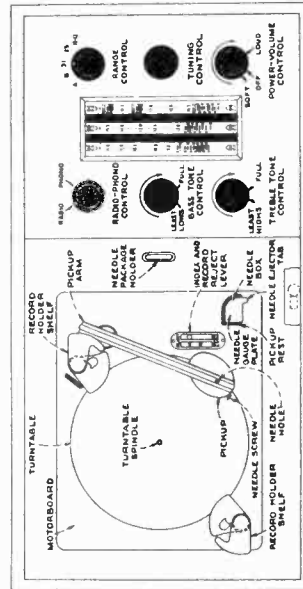
RCA MFG. CO., INC.



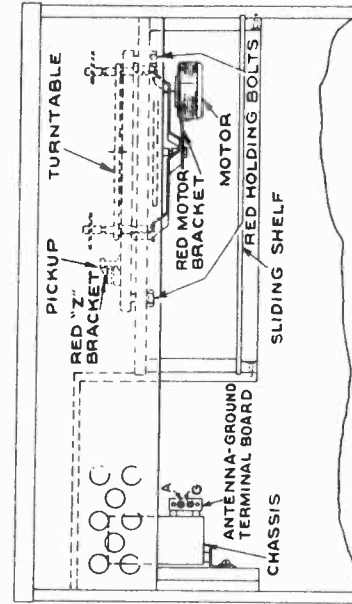
Motor and Turntable Assembly

Bottom View of Operating Mechanism
 Note: Numbers refer to parts—Letters to adjustments.

- PHONOGRAPH Type (RP145E)..... Automatic
- Record Capacity..... Eight 10-inch or seven 12-inch
- Turntable Speed..... 78 r.p.m.
- Type Pickup..... Crystal
- Pickup Impedance..... 100,000 ohms at 1,000 cycles
- Motor..... Self-starting, constant-speed, induction type.



Motorboard and Controls



Position of "Holding Bolts"

RP-140, RP-145E

RCA MFG. CO., INC.

STOCK No.	DESCRIPTION	Unit List Price
MODEL RP-145E		
34011	Arm-Pickup arm shell only	1.80
33905	Crystal-Pickup unit crystal cartridge	4.25
33629	Screw-Needle screw	1.10
34012	Shaft-Pickup pivot arm and shaft	1.30
MOTOR ASSEMBLIES		
38607	Armature-Complete motor armature and shaft for 80 cycle motor	3.75
34513	Armature-Complete armature and shaft for 80 cycle motor	3.55
34512	Capacitor-125 mfd., for 80 cycle and 80 cycle motor	.50
34506	Capacitor-25 mfd., for 80 cycle and 80 cycle motor	1.75
38114	Motor-105-125 volts, 50 cycle motor complete with capacitor (37)	8.00
34364	Motor-105-125 volts, 80 cycle complete with capacitor (37)	6.75
MOTORBOARD ASSEMBLIES		
33998	Base-Pickup arm mounting base	.40
38647	Bearing-Turntable bearing (36)	1.00
38112	Board-Motorboard complete with bearings and post-less operating mechanism	8.70
33999	Cup-Used needle cup, lid, and pickup arm rest (8)	1.00
33997	Escutcheon-Index escutcheon	.56
31150	Mounting-Pickup arm base rubber mounting complete	.45
31155	Spring-Used needle cup lid spring	.04
OPERATING MECHANISM		
10129	Ball-Steel ball for turntable bearing	.02
33984	Bracket-Record discriminating lever mounting	.75
32954	Bracket (3)	.20
33987	Cable-Pickup arm shielded cable (8)	2.00
33986	Cam-Cam and drive gear (42)	.35
6808	Clutch-Trip lever clutch (5)	.20
34589	Cup-Turntable bearing cup (38)	2.25
34587	Disc-Turntable drive disc and tire (39)	.45
31116	Finger-Trip lever friction finger (7)	.60
32879	Gear-Long arm and rack gear (41)	.55
32880	Gear-Short arm and rack gear (40)	.90
31121	Gear-Record separator shaft gear (10)	.08
34588	Grommet-Rubber grommet for motor mounting (48)	.10
31151	Guide-Lift cable guide spring (2)	.80
33982	Guide-Main spring guide (11)	.60
34570	Idler-Turntable idler wheel and arm (39)	.70
34000	Lever-Index lever (18)	1.05
33985	Lever-Mounting lever (15)	.50
34007	Lever-Mercury switch actuating lever (51)	.85
34002	Lever-10 inch and 13 inch record discriminating lever (17)	.85
31140	Lever-Pickup lift cable lever and spring (16)	.50
31130	Lever-Record separator elevating lever with adjustment screws (18)	.80
31132	Lever-Trip lever (19)	.30
36115	Lever-Trip lever and cam complete (20)	2.00
31131	Lever-Trip regulator lever (21)	.25
34086	Link-Index lever setting link and button	.20
31137	Pin-Index pin (13)	.30
31135	Pin-Trip pawl assembly (22)	.80
31133	Pin-Drive pin for turntable drive disc (24)	.03
31124	Pin-Pin to fasten gear on record separator shaft (23)	.04
31118	Screw-Complete set screw for record separator shaft ("H" and "D")	.08
33983	Screw-Record separator elevating lever pivot screw	1.15
31117	Screw-Special to adjust friction clutch ("B")	.03
34001	Screw-Record separator elevating lever ball point	.15
33990	Separator-Record separator knife (25)	1.85
33988	Shaft-Record separator shaft (27)	.70
3676	Spring-Cam gear pawl spring	1.85
31136	Spring-Index lever pawl spring (30)	.04
33994	Spring-Lift cable spring (31)	.04
33993	Spring-Locating lever spring (46)	.05
33992	Spring-Main spring (35)	.05
34876	Spring-Pickup arm starting spring (26)	.10
14190	Spring-Record discriminating lever pawl spring or locating lever pawl spring (flat)	.08
33994	Spring-Record discriminating lever spring (44)	.05
14191	Spring-Trip detaining lever spring (33)	.04
34372	Spring-Turntable idler wheel spring (47)	.10
34371	Support-Turntable drive and motor support ("N")	.70
32886	Switch-Mercury tube with leads (50) (S7)	1.75
34875	Switch-Pickup shorting switch (44)	.45
30113	Turntable-Turntable and spindle shaft (32)	3.00
34373	Washer-"C" washer for mounting idler wheel and arm	.08
31140	Lever-Pickup lift cable lever and spring assembly (16)	.50
31130	Lever-Record separator elevating lever complete with adjusting screws (18)	.80
34002	Lever-10 inch and 13 inch record discriminating lever (17)	.85
31132	Lever-Trip lever and cam complete (20)	2.00
34086	Link-Index lever setting link	.20
31137	Pin-Index pin (13)	.30
31135	Pin-Trip pawl assembly (22)	.80
31133	Pin-Drive pin for turntable drive disc (24)	.03
31124	Pin-Pin to fasten gear on record separator shaft (23)	.04
31118	Screw-Complete set screw for record separator shaft ("H" and "D")	.08
33983	Screw-Record separator shaft elevating lever screw	1.15
14190	Spring-Record separator elevating lever ball point	.10
34001	Screw-Record separator elevating lever ball point adjusting screw	.15
33983	Screw-Record separator shaft elevating lever screw set for flexible coupling	.05
14191	Spring-Trip lever and cam adjusting screw	.05
33990	Separator-Record separator knife (25)	1.85
33988	Shaft-Record separator shaft (27)	.70
33989	Shaft-Record post shaft assembly (37)	1.25
31141	Spindle-Turntable spindle	1.40
3676	Spring-Cam pawl tension spring	.04
31136	Spring-Index lever pawl spring (30)	.05
32436	Spring-Locating lever and pawl spring (39)	.05
33882	Spring-Main lever tension spring (43)	.05
33886	Spring-Mercury switch cam spring (49)	.05
34005	Spring-Trip lever cam spring (33)	.05
3666	Spring-Pickup lift cable lever spring (31)	.04
14190	Spring-Pickup locating lever pawl spring (28)	.05
33994	Spring-Trip detaining lever spring (9)	.05
14191	Spring-Trip lever cam tension spring (33)	.04
33867	Support-Mercury switch support bracket and terminal board	.05
34005	Switch-Mercury switch (4)	.40
33866	Turntable-Turntable	1.75
34003	Washer-Turntable shim washers	3.85
31143	Motor Model U46	1.70
31617	Bracket-Governor and bearing bracket	.30
31636	Coil-Field coil and laminations for 110 volts, 25 cycles motor	9.30
31619	Coil-Field coil and laminations for 110 volts, 80/60 cycles motor	7.80
31624	Governor-Complete for 110 volts, 25 cycles motor	3.05
11703	Governor-Complete for 110 volts, 80/60 cycles motor	3.05
31448	Motor-Motor 110 volts, 25 cycles	23.70
31165	Motor-Motor 110 volts, 50-60 cycles	8.20
30870	Plug-3 prong male plug for motor leads	.35
31615	Screw-Rotor thrust bearing screw and nut	.20
34620	Screw-Speed regulator screw and nut	.35
30868	Socket-3 contact female socket for motor leads	.35
31638	Spindle-Motor spindle and gear for 110 volts, 25 cycles motor	1.90
31634	Spindle-Motor spindle and gear for 110 volts, 80 cycles and 110 volts, 80-80 cycles motors	1.70

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Introduction

The RP-151 is an automatic record changer of revolutionary design. It will play a series of fifteen 10-inch or twelve 12-inch records on both sides, or one side, at will. The pickup arm has two light-pressure, sapphire permanent-point, crystal pickups mounted on one arm. One pickup plays the top side of each record; the other pickup plays the bottom side. The turntable rotates in reverse while the bottom side of a record is being played.

The mechanism has two motors. One motor is used solely to rotate the turntable; the cycling motor drives the mechanism during the automatic record-changing cycle.

There are three simple controls.

1. **A Record Support**—Turn it one way to load a stack of 10-inch records, the reverse way to load 12-inch records.

2. **A Control Lever**—Push the lever to load position, then back to the "two-side" position to play both sides of each record; pull it forward to play only the top side of each record.

3. **A "Start-Reject" Button**—Push the button to start the mechanism or to reject a record when the mechanism is operating.

The mechanism uses a low-noise crystal pickup. Objectionable "needle chatter" has been removed by utilizing a low mass wire, suitably damped, to hold the sapphire point.

Service Procedure

To remove the bottom plate assembly from the motorboard:

1. Disconnect pickup leads from terminal board.
2. Remove the motor lead plugs from their sockets.
3. Loosen the set screws "C" and lift the tone arm out. Be careful not to lose the two ball bearings at the top and bottom of the tone arm pivot shaft.
4. Remove the four bottom plate mounting screws.

To remove the tone arm, turn out the slotted-head bearing through the side of the arm. Then simply lift the arm off. When replacing the arm, do not tighten the bearing enough to cause a bind in vertical motion.

Cautions

1. Do not oil the tone arm pivot shaft.
2. Never use force to start or stop the motor or any part of the record-changing mechanism or pickup arm.
3. Warped or damaged records may cause the mechanism to jam.
4. Do not leave records on the record-holder posts as they may warp, particularly in warm climates. Warped records may be flattened by placing them on a flat surface with a flat heavy article placed on top of them for a few days.
5. If for any reason the phonograph stalls, turn off the turntable switch and remove the records from the record holder shelves. Start the turntable and allow the pickup arm to complete its cycle.
6. Packing material and special shipping brackets should be given to the customer at the time of installation. Advice as to their use may save service calls should the customer later move the instrument any considerable distance.
7. Do not interfere with the motion of the tone arm at any time.

Lubrication

1. Apply Houghton Stayput at all bearing surfaces.
2. Apply graphite grease at cam and gear surfaces on the main cam and gear, pinion gear (1), and segment gear, pivot and cam surfaces on the slide, and the spring pin on the counterweight.
3. Apply Lubriplate No. 110 at all other points.
4. The rubber tires must be kept clean and free from oil, grease, dirt, etc., at all times. Any quick-drying naphtha is satisfactory for cleaning the rubber.

Service Hints

Last 10-inch record drops before next to last record is out of the way.

Delay the knife timing by placing a 1/8-inch spacer between the separator lever and the bottom bushing and then making adjustment B.

Separating knife jams on record edge.

Record warped. Irregularities on the record separating knife and shelf teeth impeding the "elevating search" feature of the knife. Spacing washer too thick.

Record on turntable strikes swivel posts.

Tighten the belt drum springs (11) by taking off turns.

Mechanism trips continuously.

Cycle motor leads impeding movement of mercury switch.

Mechanism fails to trip.

Smooth off the end of the cycling switch trip lever and the stud against which it works.

Mechanism jams.

Stud on main cam and stud on star wheel have hit head on. This generally results when operator improperly positions the control lever and leaves it midway between the "One Side" and the "Two-Side" positions.

Sapphire jumps grooves intermittently.

Check dress of pickup cable in motorboard slot, making certain that it is free over the full range of tone arm movement.

Sapphire repeats grooves intermittently.

Feed-in spring is striking the trip lever pawl.

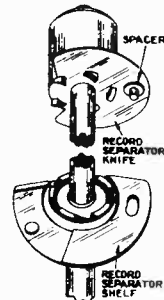
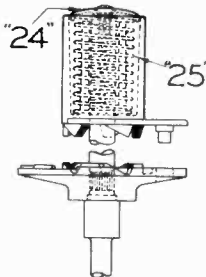
Control Lever can be pushed to only one position.

Check position of index lever with respect to the control lever shaft. When the control lever is in the two-side position, the star wheel lever stud should be at the end of the index lever slot nearest the control lever shaft. A set screw in the index lever hub permits positioning of the index lever.

Unequal output from the two pickups.

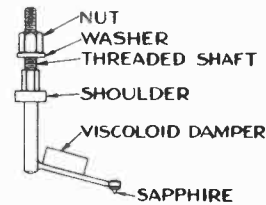
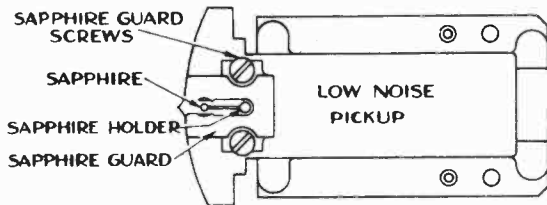
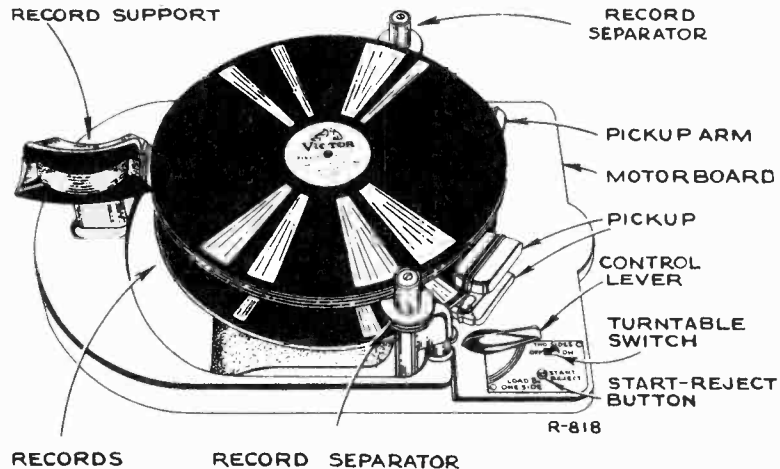
Adjust the trimmer capacitors until the outputs are at the same level. Since there is a slight interaction between the trimmers it may be necessary to repeat the adjustment a second time.

(Trimmer Balance)



MODEL RP-151

RCA MFG. CO., INC.



The Low Noise Pickup

Specifications . . . Output at 400 cycles 0.50 volts
 Impedance at 1,000 cycles . . . 75,000 ohms

Replacement of Complete Unit . . . Simply slide the unit out of the tone arm and insert a new one.

Replacement of Sapphire Caution: Never bend the sapphire support wire. Slide the pickup forward out of the arm.

The nut on the sapphire holder assembly is locked by a light cement (such as Glyptal). Extreme care should be used when loosening the nut so that the twisting motion does not break the crystal.

Remove the two screws holding the sapphire guard in place and take the guard off. Remove the small nut and washer on

the threaded shaft of the sapphire holder and push the shaft through the hole in the viscoloid until the sapphire holder assembly comes free.

Insert threaded shaft of replacement sapphire holder through viscoloid and replace the washer and nut. Make sure that the flat sides of the shaft are firmly in place in the clamp and then tighten the nut very carefully so as not to strip the threads nor break the crystal. Replace the sapphire guard, positioning it by means of the oversize screw slots. Make certain that the sapphire and its supporting wire are centered in the guard. Tighten the guard screws. Before using, check to see that the sapphire projects far enough beyond the guard so that the guard will not strike the record. If necessary, bend the guard a little. Apply a drop of light cement (such as Glyptal) to the sapphire nut holder.

Bend the spring contacts to make good contact with the slides in the tone arm.

Function of Principal Parts

- Record Support** Drives two belts which act to position the record separator posts in unison. This allows for loading 10- or 12-inch records.
- Record Separators** Provide shelves for holding stack of records and provide knives for separating bottom record from stack. Knives also support record stack during change cycle.
- Control Lever Train** Provides selection of two-side or one-side playing. Acts through index lever and star wheel lever to position star wheel.
- Start-Reject Button Train** Acts through button lever, reject lever, ratchet lever, cycling switch trip lever, and cycling switch pivot lever to tilt the mercury cycling switch and begin the automatic cycle.
- Ratchet Lever** Starts the automatic cycle by releasing cycling switch trip lever when acted upon by reject lever or trip lever pawl.
- Main Cam and Gear** Directs and co-ordinates all cycle operations.

- Tone Arm Lever** Directs horizontal movement of tone arm.
- Tone Arm Return Lever** Keeps tone arm moving in with receding tone arm lever and provides proper landing. Provides feed-in spring to push sapphire into music grooves after landing.
- Trip Lever** Its pawl acts on the ratchet lever to trip the mechanism.
- Record Separators' Lever Train (Lever-Links-Cranks)** Directs motion of separator knives and shelves.
- Tone Arm Elevating Control Lever** Directs vertical motion of tone arm through tone arm elevating lever and elevating rod.
- Slide Train** The slide roller lever is directed by the main cam and acts through the slide throw-out lever and the slide control lever to move the slide.
- Slide** Directs tilting of the turntable. Directs motion of record separator lever train. Unlatches reversing switch.
- Reversing Lever** Controls turntable rotation by means of reversing switch.

Two-Side Operation

Slide Cycle

Turn Record Support to 10" or 12" position as desired.

1. Record Separator posts position themselves in unison by means of belt drive.

Place Records on Posts.

Turn Control to "Load" position and return to "Two-Side" position.

1. Star wheel stud is rotated away from slide throw-out lever, thus insuring a "Slide" cycle. Motion is transferred from control to the index lever and the star wheel lever. Star wheel lever stud rides in the index lever slot.

Push "Start-Reject" button.

1. Through button lever the reject lever is made to push on ratchet lever stud.
2. The ratchet lever moves out of the way of the cycling switch trip lever.

3. Switch trip lever moves the cycling switch pivot lever, thus tilting the switch and closing the circuit to the cycle motor.
4. Cycle motor starts.
5. Main cam is driven by cycle motor through a chain of gears.

Tone Arm Rises.

1. The elevating control lever is rotated because its stud rides on the outer guide on the bottom side of the main cam.

2. Elevating control lever closes shorting switch.
3. Elevating control lever pushes reversing lever.
4. Reversing lever rotates.
5. Elevating control lever pushes elevating lever roller.
6. Elevating lever roller moves in allowing elevating lever to rise, thus pushing up on elevating rod and tone arm.

Tone Arm Swings Out.

1. Reversing lever throws reversing switch. Then it latches and holds the switch button in position.
2. Turntable rotates counter-clockwise.

3. Tone arm lever swings outward from motion of its stud against outer guide on top of main cam.

4. It pushes against stud on trip lever.
5. Trip lever moves out and latches to return lever carrying it along.
6. Feed-in spring is depressed.
7. Cycling switch trip lever is reset by protrusion on main cam, and thus moves out of way of ratchet lever stud.
8. Ratchet lever returns to its original position.

Turntable Discards Played Record.

1. Eccentric track on top of main cam moves slide roller lever.
2. Slide roller lever pushes slide throw-out lever.

3. Slide throwout lever moves slide control lever.
4. Slide control lever moves slide.
5. Underneath stud on slide moves along edge of turntable locating lever and finally rotates it.
6. Locating lever releases turntable assembly to control of counterbalance and spring, leaving sector gear free to move.
7. Slide strikes sector gear finger and rotates sector gear.
8. Sector gear rotates segment gear.
9. Segment gear, being fastened to turntable pivot shaft, turns this shaft and tilts the turntable.
10. Reversing lever is unlatched by slide at end of its travel. Turntable motor returns to clockwise rotation.

Record Drops from Stack to Motor-board.

1. Stud on top of slide moves into claw cam of the separator lever.
2. Lever rotates, thus moving link and crank.
3. Crank rotates separator assembly.

4. Record knife separates bottom record from stack.
5. Shelf rotates out from under bottom record and allows it to drop to motorboard.

Turntable picks up next record.

1. Slide reverses direction of travel.
2. Shelf and knife return to original position as top stud on slide releases separator lever.

3. Spring and counterbalance return turntable past its original position as slide recedes from sector gear finger.
4. Turntable spindle finds hole in record and picks record up.
5. Underneath stud on slide finally rotates locating lever

6. Locating lever takes control and returns turntable to exact original position.
7. Turntable drive wheel again contacts drive disc and rotates it.
8. Off-center stud on the main cam and gear pushes star wheel stud.
9. Star wheel rotates 90°.
10. Stud on star wheel unlatches slide throw-out lever.

Tone Arm Returns.

1. Main cam allows tone arm lever to recede.

carrying trip lever along.

3. Return lever stops when its index finger reaches rear separator shaft.

4. Thus the trip lever and tone arm are stopped at the correct landing position.

Tone Arm Lowers.

1. Lower outside face on main cam recedes.

2. Elevating control lever returns to original position.

3. Reversing lever reaches original position.

4. Elevating lever is lowered, elevating rod follows and tone arm lowers.

5. Elevating control lever releases shorting switch.

6. Release stud on the tone arm lever pushes back the latch on the return lever.

7. Release of the latch frees the return lever from the trip lever and the tone arm.

8. Cycling switch pivot lever drops off the end of the main cam face.

9. Cycling switch returns to original position.

10. Cycle motor stops.

Sapphire is pushed into music grooves.

1. Feed-in spring returns to original position pushing stud on trip lever.
2. Trip lever carries tone arm slightly in.

Top side of Record Plays.

Non-Slide Cycle

Sapphire Reaches Eccentric Groove. Mechanism Trips.

1. Trip lever receives backward motion from tone arm.
2. Trip pawl pushes ratchet lever.
3. Ratchet lever stud moves away from cycling switch trip lever.

4. Cycling switch trip lever moves cycling switch pivot lever. Switch tilts, closing circuit.

5. Cycle motor starts.

Tone Arm Rises and Swings Out.

Same as previous cycle.

Turntable Remains in Playing Position and Turntable Rotation Reverses.

1. Eccentric track on top of main cam moves the slide roller lever.

2. Slide throw-out lever is not picked up by star wheel since this lever was unlatched during previous cycle.

3. Thus the slide does not move, the reversing lever remains latched and the turntable motor continues to revolve counterclockwise.

4. Off-center stud on main cam pushes stud on star wheel.

5. Star wheel rotates 90°.

6. Star wheel latches slide throw-out lever.

Tone Arm Returns.

Same as previous cycle.

Tone Arm Lowers.

Same as previous cycle except: 1. Reversing lever remains latched and does not return.

Bottom Side of Record Plays.

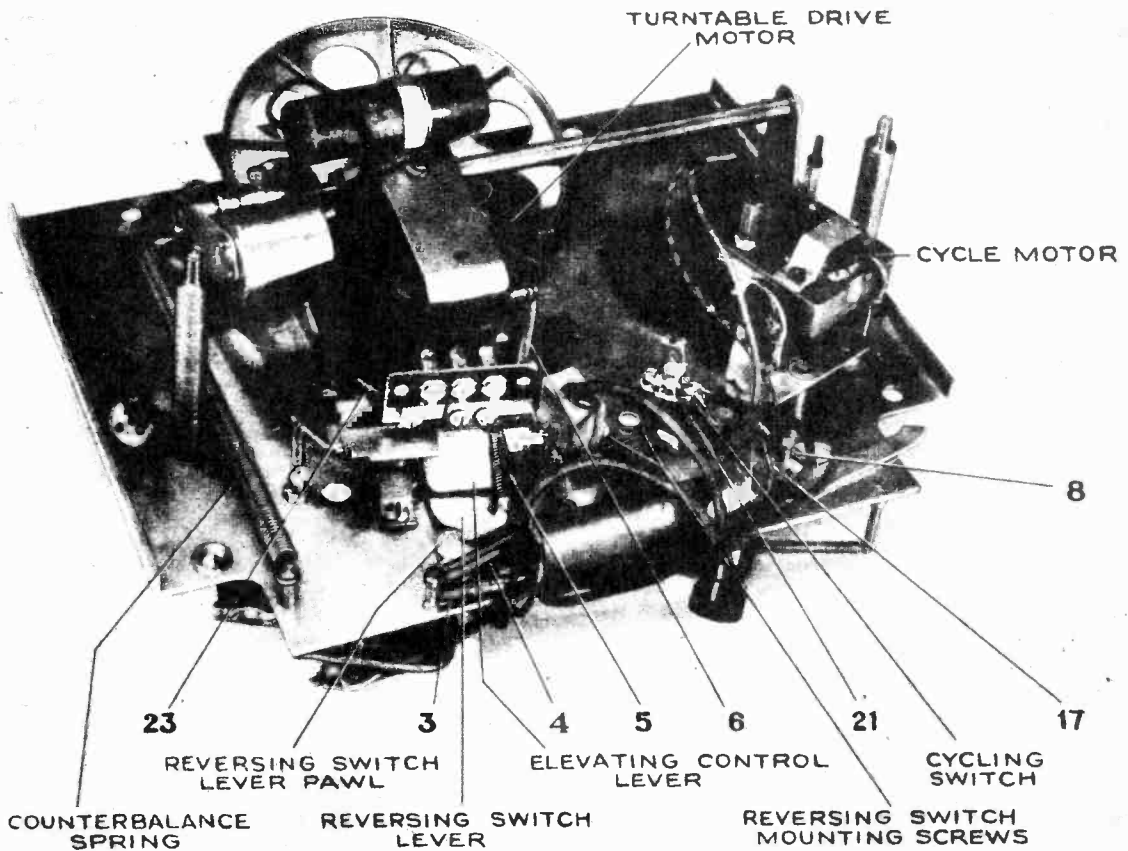
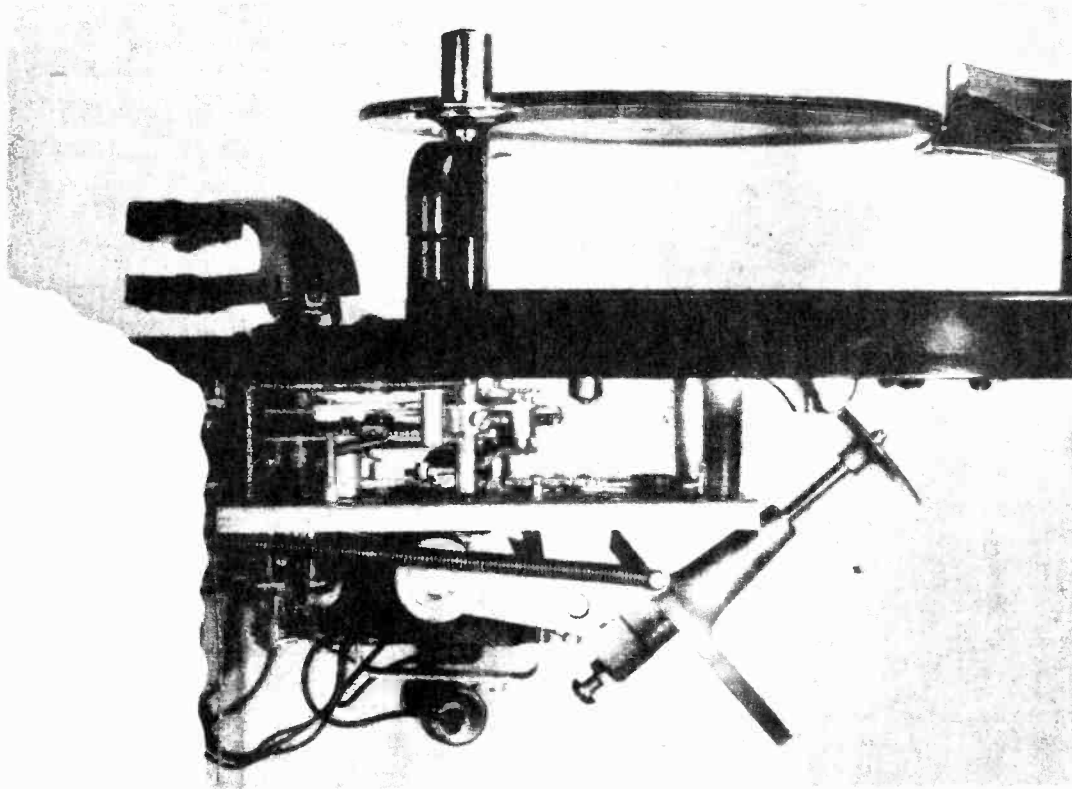
Slide and non-slide cycles continue alternately until entire stack of records has been played.

After last record is played, mechanism trips, goes through cycle, and tone arm comes to rest on "Stop" button, thus opening the a.c. circuit.

In the "One-Side" position, the star wheel is pushed out of the path of the main cam stud and all cycles are slide cycles.

MODEL RP-151

RCA MFG. CO., INC.



MAIN CAM AND GEAR

TURNTABLE

SLIDE THROWOUT LEVER

15

SLIDE

SLIDE CONTROL LEVER

SLIDE ROLLER LEVER

SECTOR LEVER

NOTE--TURNTABLE LOCATING LEVER IS UNDERNEATH SLIDE

TONE ARM RETURN LEVER

16

14

ELEVATING LEVER ROLLER

RETURN LEVER LATCH

12

13

TONE ARM LEVER

RATCHET LEVER

"B"

"C"

ELEVATING ROD

"F"

ELEVATING LEVER

"E"

"D"

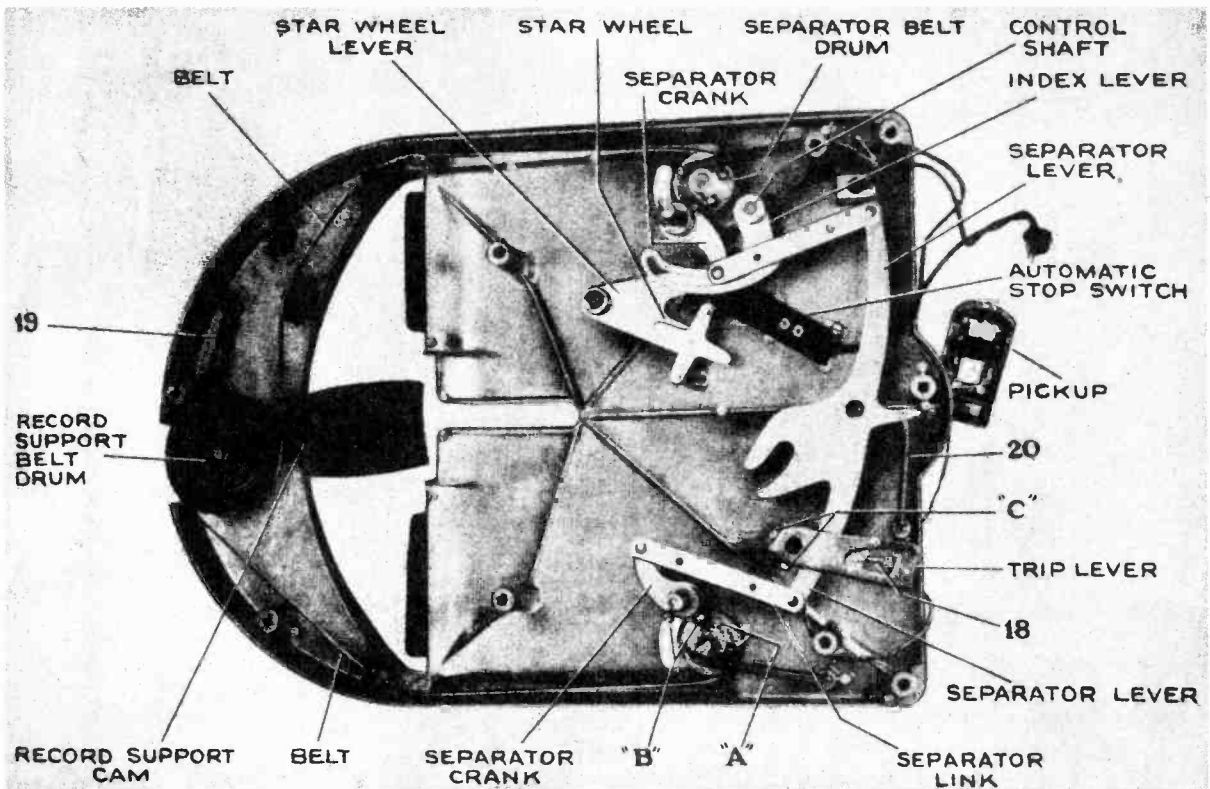
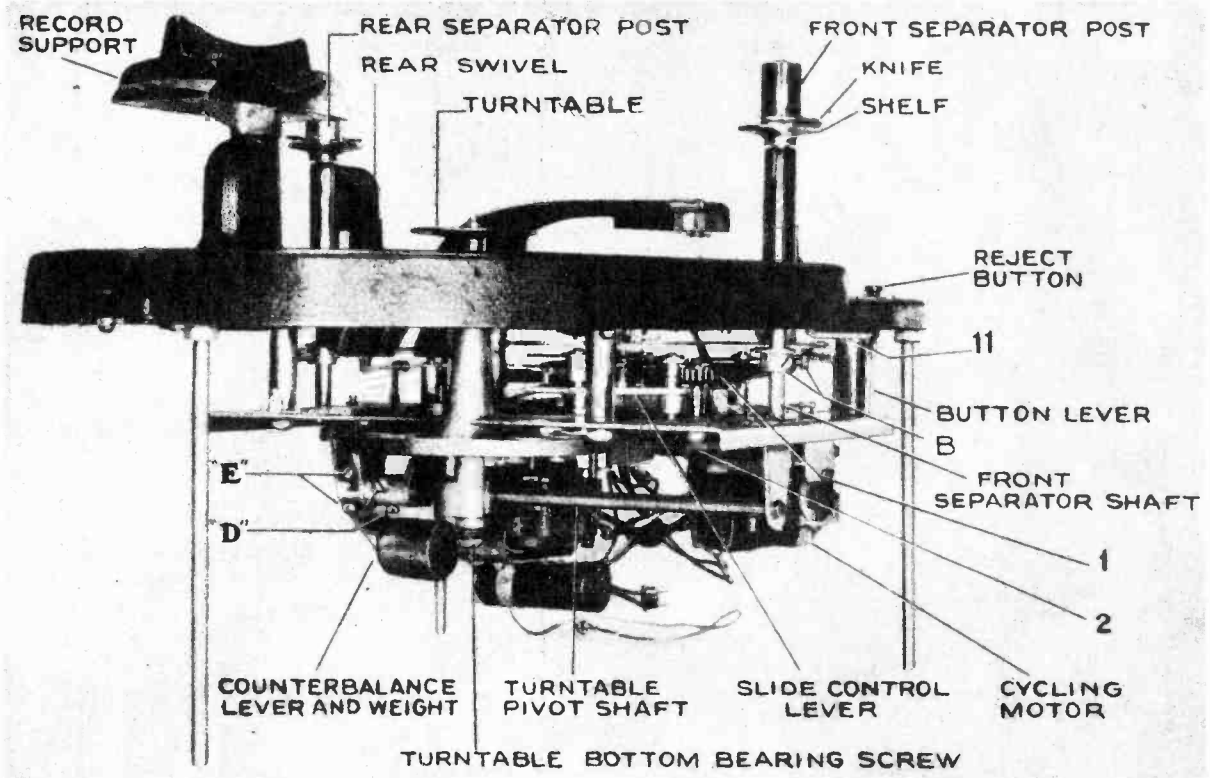
COUNTERBALANCE LEVER AND WEIGHT

SEGMENT LEVER GEAR

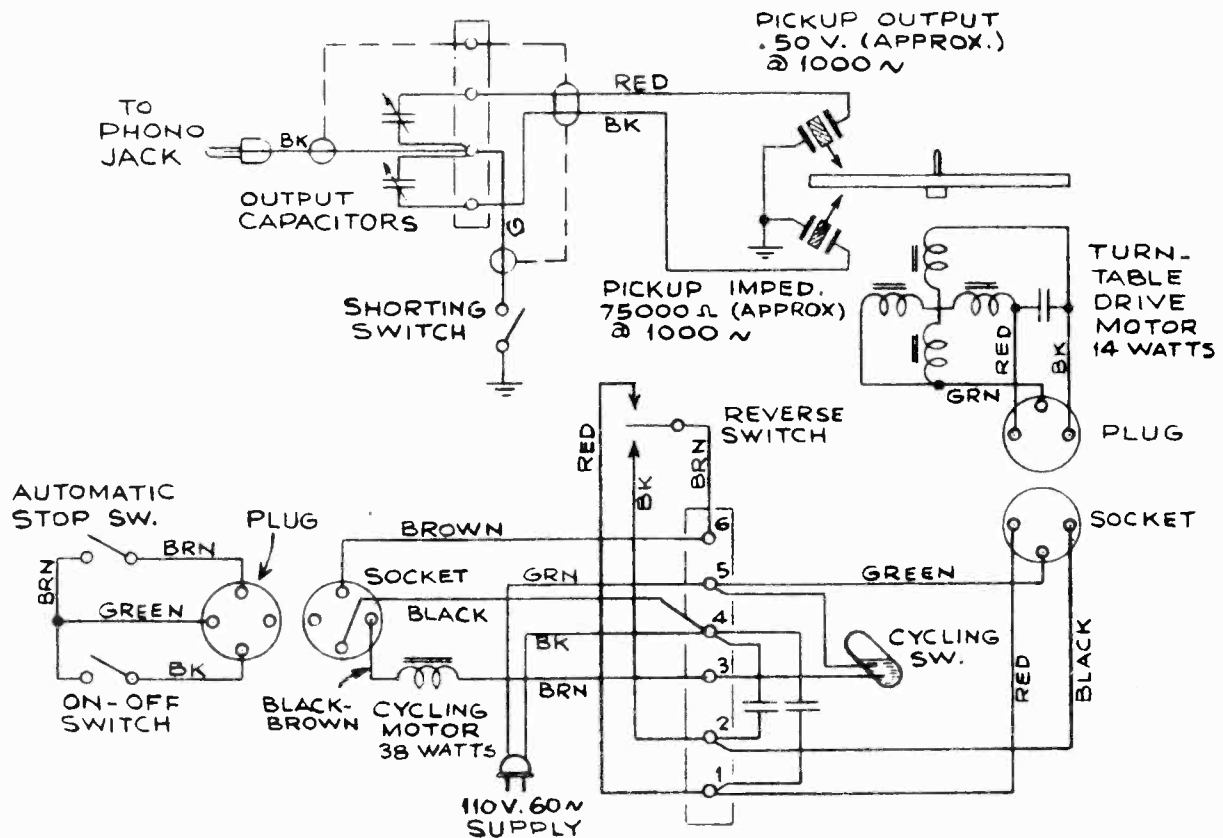
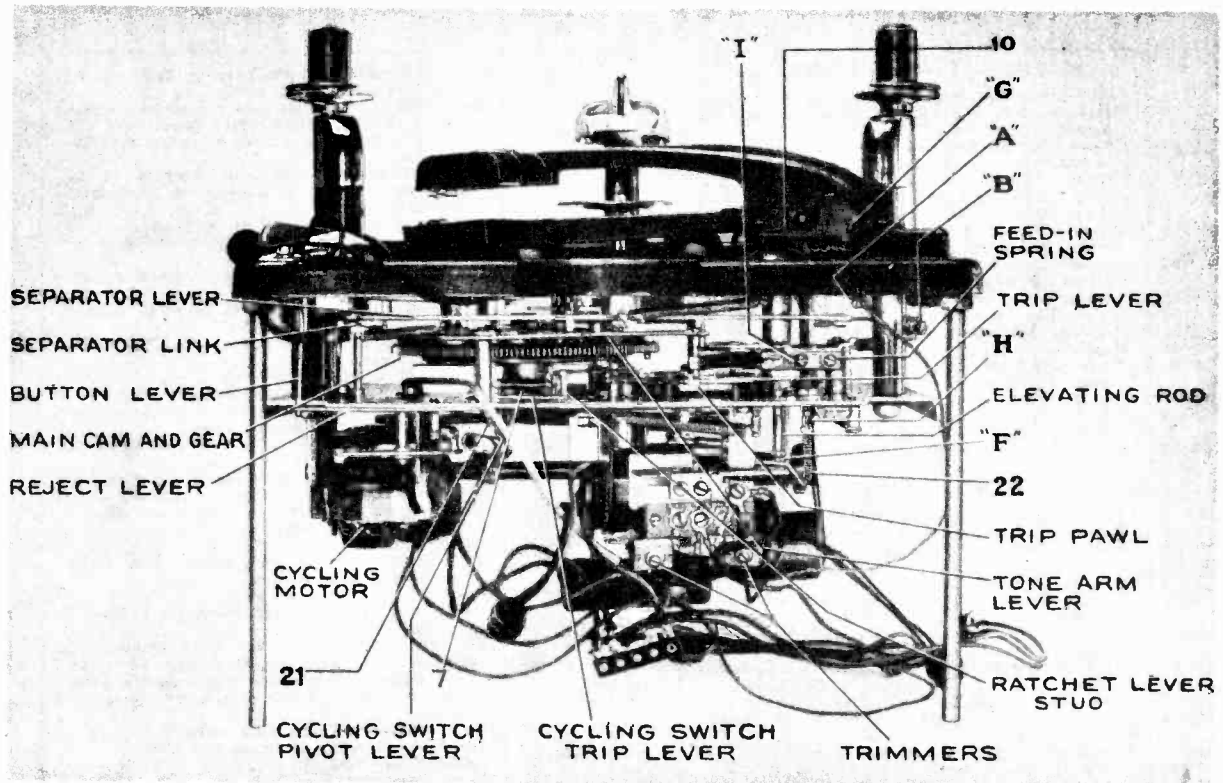
TURNTABLE PIVOT

MODEL RP-151

RCA MFG. CO., INC.



RCA MFG. CO., INC.



MODEL RP-151

RCA MFG. CO., INC.

Replacement Parts

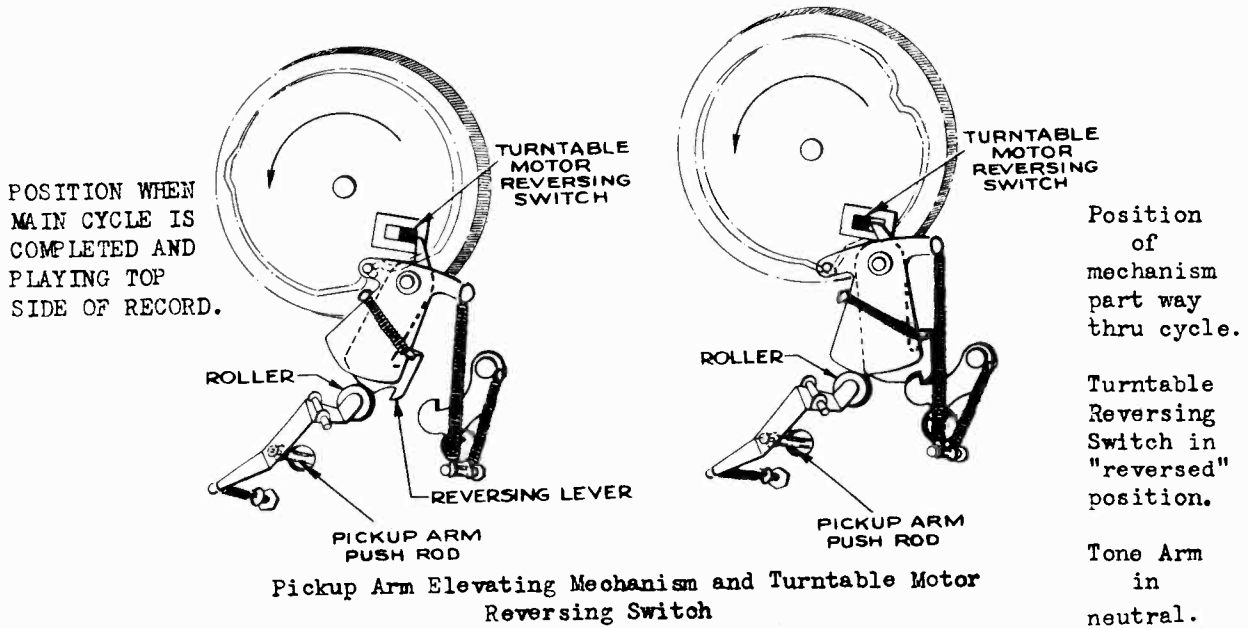
STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
PICKUP AND ARM ASSEMBLIES					
38456	Arm—Upper and lower pickup arms only	3.75	38533	Disc—Turntable bottom bearing discs (1 felt and 1 laminated)	.15
38459	Bracket—Pivot arm spring tension bracket and screw	.10	38496	Gear—Fibre drive gear and set screw—engages pinion on rubber-tired motor drive wheel (2)	.90
38457	Cable—Shielded pickup cable—connects pickup crystals to shorting switch	.75	38495	Gear—Pinion gear and shaft—engages cam gear (1)	.35
	Note: Before ordering a replacement crystal pickup, inspect the used pickup. Order the stock number stamped on its case.		38505	Gear—Sector gear and lever mounted on bottom plate—engages segment on turntable—motor pivot shaft	.50
38598	Crystal—Pickup crystal and holder with sapphire and holder (bottom unit)	6.50	38526	Gear—Turntable pivot shaft segment	.35
38453	Crystal—Pickup crystal and holder with sapphire and holder (top unit)	6.50	38538	Grommet—Rubber grommet for mounting cycling motor	.05
38451	Damper—Viscoloid damper for sapphire holder	.10	34368	Grommet—Rubber grommet for turntable motor mounting (2 required)	.08
38452	Guard—Sapphire guard	.06	38493	Lever—Cycling switch pivot lever or follower arm	.20
38450	Nut—Special nut and washer for sapphire holder	.30	38494	Lever—Cycling switch trip lever	.20
38458	Nut—Speed nut to hold cable in pickup arm	.05	38512	Lever—Reject lever	.15
38454	Pivot—Pivot arm and shaft assembly—less spring and adjusting screw	.80	38497	Lever—Slide roller lever—engages cam	.35
38449	Sapphire—Sapphire and holder—less nut	3.50	38498	Lever—Slide control lever—engages slide	.50
37763	Screw—No. 2-56 x 1/8 screw to mount sapphire guard (2 required)	.04	38504	Lever—Turntable locating lever—engages sector gear and lever on bottom plate	.15
38455	Spring—Pivot arm spring (10)	.10	38544	Lever—Reversing lever, operates motor reversing switch	.15
TOP PLATE ASSEMBLY					
38461	Belt—Record separator belt (steel) (2 used)	.35	38543	Lever—Elevating control lever, operates tone arm elevating lever and pickup shorting switch	.35
38484	Button—Pickup stop switch button (rubber)	.20	38549	Lever—Tone arm elevating lever—less roller	.30
38485	Button—Reject button	.90	38518	Lever—Tone arm lever	.55
38473	Cam—Record support cam—less pin	.45	38506	Lever—Tone arm ratchet lever	.45
38470	Cap—Record separator cap (24)	.50	38500	Lever—Tone arm return lever—less feed-in spring and damper	.50
38491	Crank—Record separator crank with set screws—less connecting lever (2 used)	.45	38474	Lever—Slide throw-out lever	.30
38489	Cushion—Rubber cushion for records (round) (under felt)	.10	38552	Pin—Drive pin to fasten turntable bracket to spindle shaft	.06
38441	Decalcomania—"RCA Victrola—His Master's Voice"	.15	38492	Pin—Pivot pin for tone arm elevating lever	.05
38462	Drum—Record support belt drum (1 required)	.65	38498	Plate—Bottom plate complete with all riveted and welded brackets and studs, cycling switch trip lever, and cycling switch pivot lever and bracket	4.50
38463	Drum—Record separator belt drum—less screws (2 required)	.40	38502	Roller—Cam roller for slide roller lever	.10
38476	Escutcheon—Index escutcheon	.70	38508	Roller—Slide roller, stud and nut (16)	.35
38486	Felt—Top plate felt	2.75	38510	Roller—Tone arm elevating lever roller	.10
38467	Knife—Record separator knife	1.10	38527	Screw—No. 10-24 x 7/16 cone point set screw for turntable pivot shaft segment	.05
38477	Lever—Control of selection lever and shaft	1.10	38528	Screw—No. 10-24 x 7/16 set screw for turntable pivot shaft segment	.05
38481	Lever—Index lever	.45	31118	Screw—No. 10-32 x 5/16 fillister head, cone point set screw for fibre drive gear and counter weight	.06
38490	Lever—Record separator lever—less links	.80	32869	Screw—No. 10-32 x 5/16 set screw for counterweight (E)	.01
38483	Lever—Button lever and bracket	.20	38532	Screw—5/16—18 x 3/4 screw and nut for turntable spindle bottom bearing	.05
38478	Lever—Star wheel lever and bushing—less star wheel and spring	.40	38553	Screw—Special screw to hold tone arm elevating lever spring	.05
38474	Pin—Drive pin for record support cam	.06	38520	Shaft—Motor and turntable pivot shaft	.45
38460	Plate—Finished top plate (cast) only, with pins and studs—less operating parts	18.00	38503	Slide—Slide plate and studs assembly	1.00
38469	Screw—No. 6-32 oval head screw for record separator cap	.08	38537	Spring—Cycling motor idler arm spring—4-in. long (18 turns) (17)	.05
31118	Screw—No. 10-32 x 5/16 fillister head cone point set screw for record separator belt drum, record separator crank, or index lever	.06	38540	Spring—Cycling switch pivot lever spring—13/16-in. long (34 turns) (21)	.05
32869	Screw—No. 10-32 x 5/16 fillister head set screw for record separator belt drum and record separator crank	.01	38507	Spring—Tone arm feed-in spring and damper	.55
38466	Shelf—Record separator shelf and shaft—less top knife, cap, and spring	.85	38513	Spring—Reject lever spring (8)	.05
38471	Spacer—Spacing washer for record separator knife	.04	38501	Spring—Slide throw-out lever spring (15)	.10
38468	Spring—Record separator spiral spring (25)	.20	38546	Spring—Spiral spring for motor reversing switch lever (5)	.05
38488	Spring—Spiral spring for record separator belt drum (11)	.10	38519	Spring—Spiral spring for cycling switch trip lever (7)	.06
38475	Spring—Spiral spring for record separator lever (20)	.10	38545	Spring—Spiral spring for elevating control lever (4)	.10
38487	Spring—Spiral spring for record support belt drum (19)	.15	38514	Spring—Spiral spring for motor reversing switch lever pawl (3)	.06
38480	Spring—Spiral spring for star wheel	.15	38508	Spring—Spiral spring for pickup return lever (14)	.05
38472	Support—Record support and shaft (1 required)	4.50	38518	Spring—Spiral spring for ratchet lever	.06
33900	Switch—"Off-On" main switch	.30	38554	Spring—Spiral spring for tone arm elevating lever (22)	.05
38482	Switch—Stop switch—operated by pickup	.65	38515	Spring—Spiral spring for tone arm return lever pawl (12)	.05
38464	Swivel—Support and swivel for front record separator	3.25	38510	Spring—Tone arm lever spring (13)	.06
38465	Swivel—Support and swivel for rear record separator	3.25	38524	Spring—Turntable drive motor idler arm spring (23)	.05
2917	Washer—"C" washer for star wheel, record separator link and lever, record support belt drum, star wheel lever, and reject button	.03	38531	Spring—Turntable drive motor tension spring (6)	.05
8078	Washer—Spring washer for star wheel lever	.06	38530	Spring—Turntable pivot shaft counterbalance spring	.15
38479	Wheel—Star wheel	.25	38521	Support—Turntable support bracket and spindle bearing—less bearing screw and nut	.75
BOTTOM PLATE ASSEMBLY					
38536	Arm—Cycling motor idler arm—less wheel	.25	38541	Switch—Mercury tube with leads (cycling)	1.75
38525	Arm—Turntable drive motor arm—less wheel	.25	38844	Switch—Pickup shorting switch	.45
38547	Board—Pickup shorting switch terminal board—less mounting bracket, pickup elevating lever, and trimmer condensers	.80	38542	Switch—Turntable motor reversing switch and bracket	.75
38539	Bracket—Cycling motor mounting bracket	.20	38534	Turntable—Turntable, spindle shaft, and drive disc assembled	2.50
38551	Bracket—Tone arm elevating lever and bracket—less lever	.20	2917	Washer—"C" washer for slide control levers, tone arm lever, tone arm return lever, main cam, or slide throw-out lever	.03
38523	Bracket—Turntable drive motor mounting bracket	.80	20165	Washer—"C" washer for tone arm elevating lever roller, elevating lever pin, cycling motor idler wheel, cycling motor drive wheel, and tone arm ratchet lever	.05
38845	Cable—Shielded output cable—connects to shorting switch	.50			
38511	Cam—Cam, gear, and bearing assembly	1.50			
38548	Condenser—Trimmer condenser (2 required)	.35			

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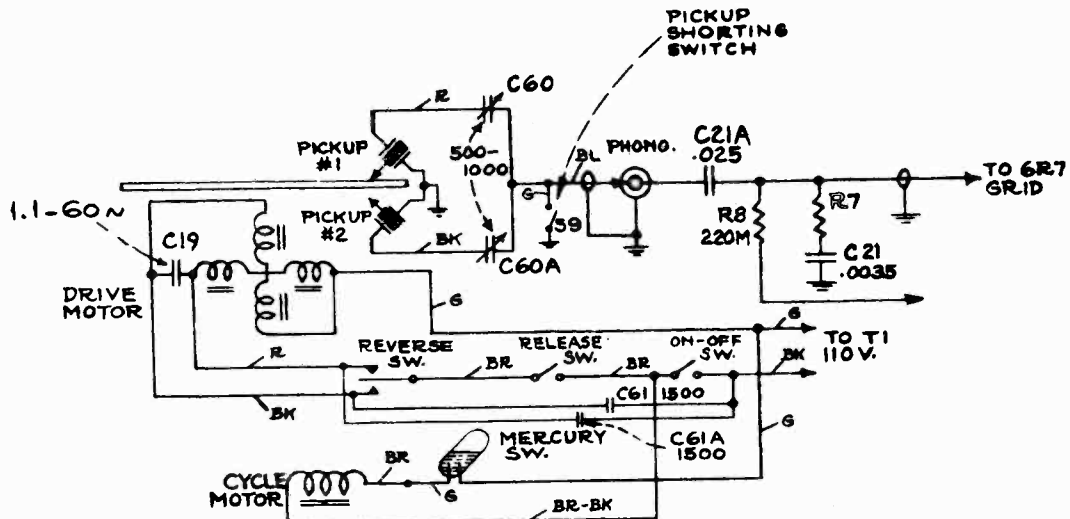
Replacement Parts

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
33726	Washer—"C" washer for turntable drive wheel or idler wheel	.02	10941	MISCELLANEOUS ASSEMBLIES	
34373	Washer—"C" washer for turntable idler wheel arm	.03	38565	Ball—1/8 diameter steel ball for pickup arm, or trip lever bearing	.02
38529	Weight—Turntable pivot shaft counterweight and arm	1.25	13762	Cable—Output cable and plug—connects shorting switch to amplifier	.85
38535	Wheel—Cycling motor rubber-tired drive wheel and pinion gear	.85	38561	Capacitor—1,500 mmfd.	.50
36274	Wheel—Rubber-tired turntable drive wheel or idler wheel	.55	30870	Lever—Pickup arm trip lever—less spring	.75
	CYCLING MOTOR		31572	Plug—2-prong male for power supply cable	.35
38556	Motor—105-125 volts, 60 cycles	4.00	31572	Plug—3-contact female for motor cable	.15
	TURNTABLE DRIVE MOTOR		31567	Plug—3-prong male for turntable motor leads	.25
36952	Cap—Bakelite top cover for motor	.50	35352	Plug—4-contact female for motor cable	.25
36955	Capacitor—1.1 mfd., 200 volts for 60 or 50 cycle motors	1.50	35384	Plug—4-prong male for power switch cable	.25
38557	Motor—Motor and capacitor, 105-125 volts, 60 cycles	8.75	38563	Rod—Pickup arm elevating rod—less adjusting screw	.25
38558	Rotor—Rotor and shaft for 60 cycle motor	3.25	38564	Screw—No. 4-40 x 5/16 hex. head screw and nut for pickup arm elevating rod	.04
38848	Sleeve—Motor spindle sleeve for 50 cycle conversion	.25	31118	Screw—No. 10-32 x 5/16 cone point set screw for trip lever	.06
			32869	Screw—No. 10-32 x 5/16 set screw for trip lever unit to top plate	.01
			38559	Screw—5/16—18 x 1/2 screw to mount lower unit to top plate	.04
			38562	Spring—Spiral spring for trip lever latch (18)	.10
			38560	Washer—Felt washer for pickup arm pivot shaft bearing	.04

ALL PRICES ARE SUBJECT TO CHANGE OR WITHDRAWAL WITHOUT NOTICE.



Pickup Arm Elevating Mechanism and Turntable Motor Reversing Switch

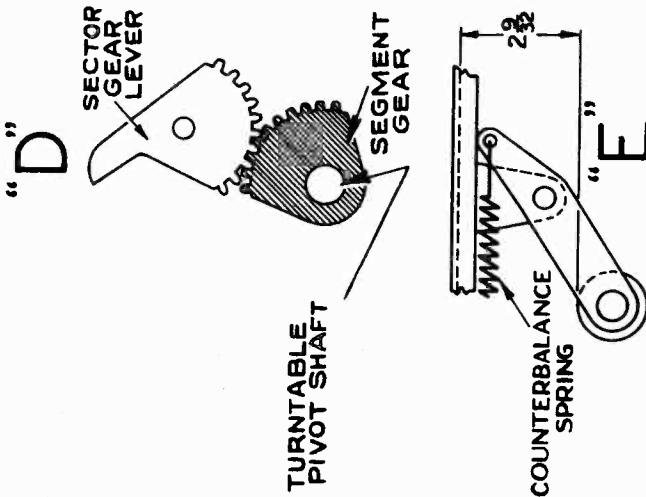
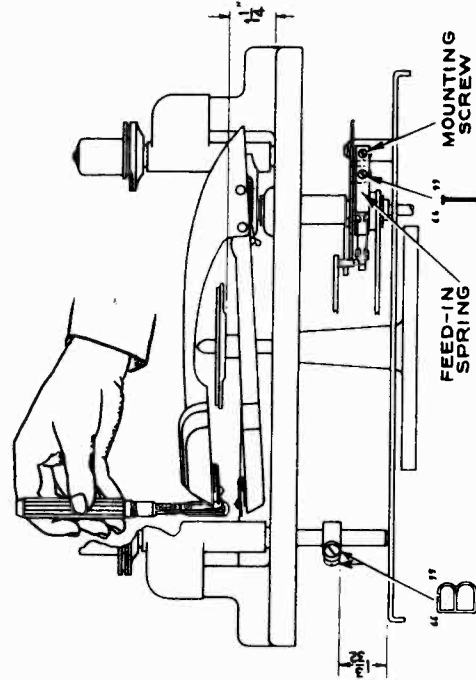


Electrical Schematic Diagram

Adjustment of Pickup Arm Feed-in Spring

A bronze feed-in spring damped by a piece of Viscoloid is fastened to the pickup arm return lever. Its purpose is to move the pickup over into the first music groove after the pickup has landed on the record. This spring is mounted with one mounting screw which is always drawn up tight and in addition has an adjusting screw marked "I". Greater pressure is required from this feed-in spring to move the bottom pickup into the first music groove than is required to move the top pickup into the first music groove. Consequently, the adjustment of this spring will be a compromise between the two where sufficient force is exerted to move the bottom pickup into the first music groove and at the same time not enough force is exerted to cause the top pickup to jump several grooves when it moves inward. Due to the damping action of the Viscoloid on the springs, several seconds will frequently elapse between the time that the bottom pickup touches the record at the time that the bottom pickup is actually moved into the first music groove.

TO MEASURE PRESSURE AT THE SAPPHIRE POINT USE POSTAL SCALE AS SHOWN

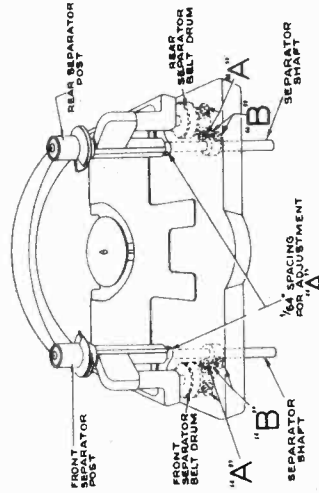
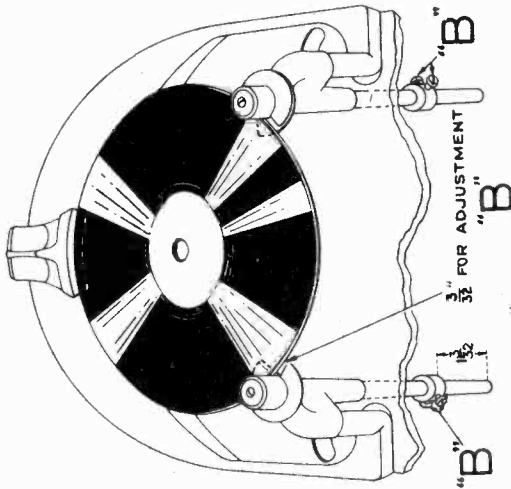


Turntable Adjustment

The sector gear lever is properly meshed at the factory with the segment gear and unless they have been tampered with, there will never be any occasion to change the mesh of these gears. Be sure that the mechanism is out of cycle and then remove the long spring from the counter balance lever. Loosen set screws "E" and "D". The long turntable pivot rod can now be moved forward or backward as necessary to exactly center the turntable spindle from front to back. This is most easily checked by holding a record against the record support posts and noting whether or not the center of the spindle is centered from front to back in the hole in the record. The turntable should then be moved from side to side as necessary so that it is exactly level. Hold it in this position and move the segment gear snugly against the pivot shaft bearing and tighten the zinc plated set screw "D". Now move the counter balance lever snugly against the turntable pivot bearing allowing just sufficient clearance so that there will be no binding and move the counter balance lever until the top of the counter balance weight is $2 \frac{9}{32}$ inches below the main bottom plate. Tighten zinc plated set screw "E". Replace long spring on counter balance lever and run mechanism through cycle several times to be sure it functions properly. Then tighten copper plated set screws "D" and "E".

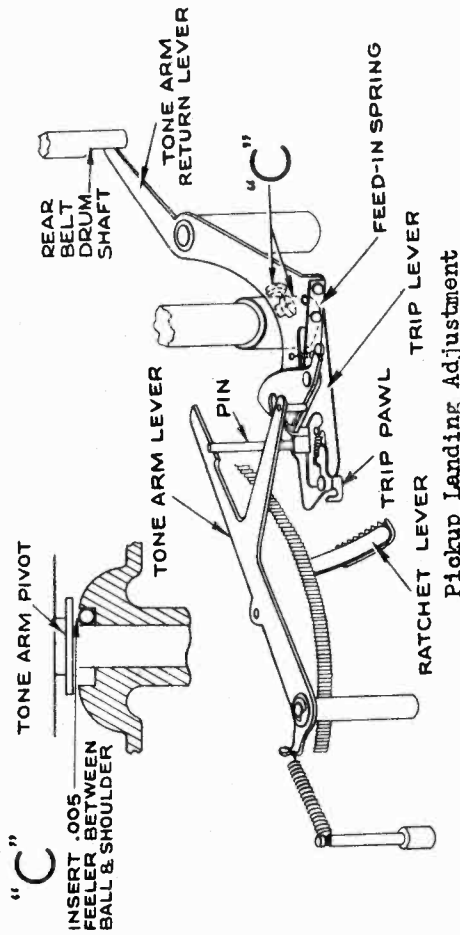
Record Post Separator Knife Adjustment

Turn the main record support to the 10" position, be sure the mechanism is out of cycle, and place a 10" record on the shelves pushed over snugly against the front and rear record separator posts. Loosen set screws "B" on the front record separator shaft and turn this shaft until the record separating knife is $\frac{3}{32}$ nd of an inch away from the edge of the record. Be sure that the bottom of the set screw collar is $1\frac{3}{32}$ nd inch above the bottom plate. Tighten the zinc plated screw, run the mechanism through cycles several times as a check, then tighten the copper plated screw. Repeat this adjustment on the rear record separating post.



Records will not fit properly on the three record posts.
(Record Post Spacing)

Turn the record support to the 10-inch position. Loosen the set screws "A." Move the front record separator post until its shaft is $\frac{1}{64}$ from the end of the motorboard slot. Turn the belt drum to take up the slack in the belt and tighten the zinc-plated screw being certain to maintain the $\frac{1}{64}$ -inch spacing. Repeat the adjustment on the rear separator post. Check by placing a 10-inch record on the shelves posts and then tighten the copper-plated screws. Care should be taken to leave a small vertical clearance between the belt drum and the motorboard. The 12-inch position is automatically main-



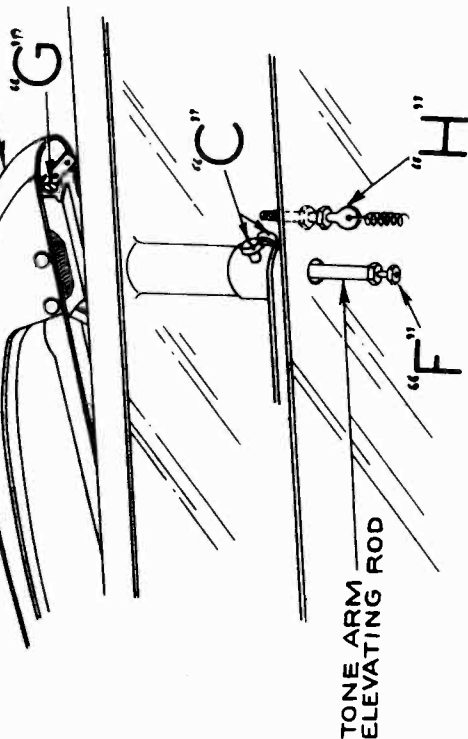
Pickup Landing Adjustment

When properly adjusted the sapphire point should land on the smooth outer edge of the record just outside of the music grooves after which the feed-in spring will move the sapphire over into the first music groove. This condition is brought about by the proper relationship between the pickup arm position with respect to the trip lever. Place a 10" record on the turntable and rotate the changer through cycle until the sapphire is just ready to land and has not quite touched the record. Be sure that the pickup arm return lever is against the rear belt drum shaft and that the pin in the trip lever is still latched securely in the pickup arm return lever. Loosen both set screws "C" and place a .005 inch feeler between the shoulder on the pickup arm pivot shaft and its ball bearing as shown. Move the pickup arm to the point of proper landing, be sure that the set screw collar is up against the pickup arm pivot shaft bushing, and tighten the zinc plated screw. Remove feeler and run through cycle several times as a check and then tighten the copper plated screw. The 12" landing will then be correct also.

Correct Mesh of Sector Gear and Segment Gear

This shows the correct mesh of the sector gear with the segment gear. This mesh is set correctly at the factory and unless it has been tampered with, it will never require adjustment in the field. This is the gear mesh which was referred to in the previous slide.

TONE ARM

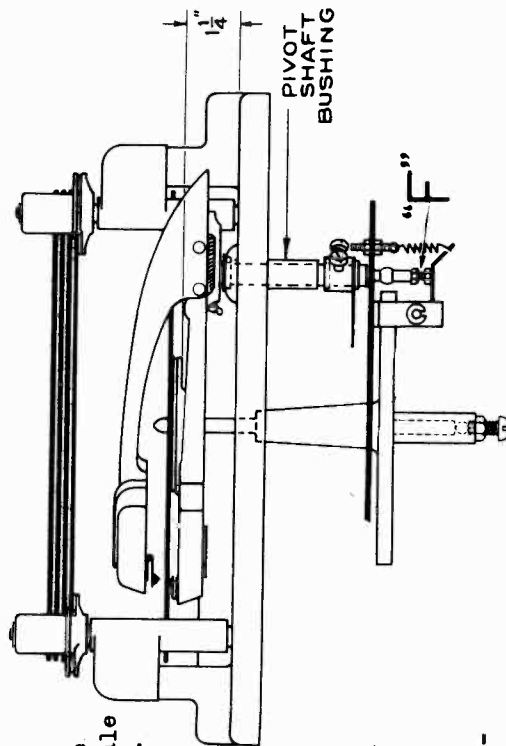
Turntable and Pickup Arm Height Adjustment

Adjust the screw, as necessary, on the bottom bearing of the turntable housing until the bottom of the turntable is $1\frac{1}{4}$ inches above the top of the main motor board. Then start mechanism through cycle until pickup arm has reached its neutral position where neither sapphire point touches a flat record placed on the turntable. The top and bottom sapphires should now be equally distant above and below the records. If they are not, the screw and lock nut "F" in the bottom of the pickup arm push rod should be adjusted until the sapphires are equally distant above and below the record.

Pickup Pressure Adjustment

Run the mechanism through cycle so that it is in position to play the top side of a record. Use a small postal scale which can be very readily obtained from almost any stationery store at a very nominal cost and measure the downward pressure exerted by the top sapphire when the tray of the scale is held level with the top side of a record if one were lying on the turntable. Adjustment screw "G" should now be turned until the pressure is between one ounce and one and one-quarter ounces.

Run the mechanism through cycle again until it is in position to play the bottom side of a record. Now adjust the two lock nuts on screw "H" until the upward pressure exerted by the bottom sapphire is between one ounce and one and one-quarter ounces. This measurement must likewise be taken when the sapphire is raised up to a position where its point is level with the bottom side of a record if one were placed on the turntable. Suitable weights can be used for making this measurement or the postal scale just referred to can have its zero adjustment changed until it shows a reading of two ounces and it can then be pressed down on the pickup and the adjustment made so that the scale reading will be between three-quarters of an ounce and one ounce. It is important to make the adjustment for pressure of the top pickup before the adjustment is made for pressure of the bottom pickup.

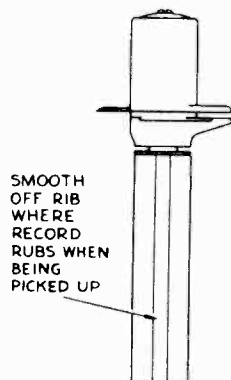


RCA-MFG. CO., INC.

MODEL RP-151
ADJUSTMENTS

Illustrated Hints for RCA RP-151 Record Changer

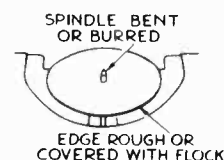
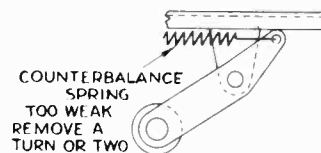
Caution: Do Not Handle The Tone Arm While The Mechanism Is Operating



Fails To Pick Up Record or 12-Inch Record Rubs Tone Arm

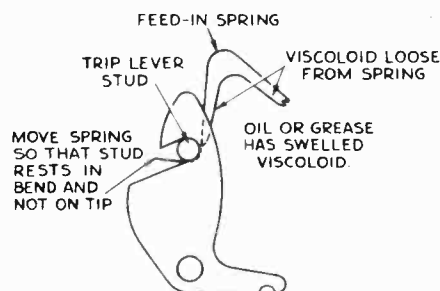
Check to see that turntable returns to level position. If necessary make Adjustments "D" and "E." Check turntable height.

Edge of hole in record is raised.



Incorrect Feed-In

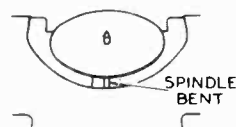
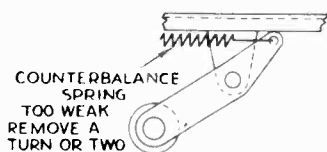
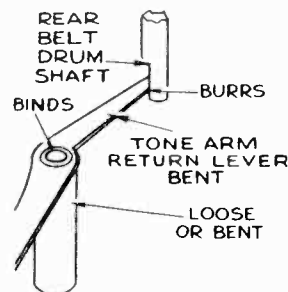
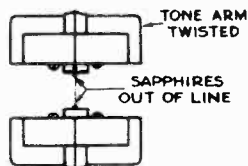
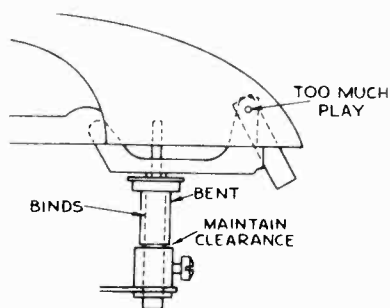
The feed-in spring has no effect until just after the pickup has landed. It then springs back to its original position, pushing on the trip lever stud and moving the pickup toward the music grooves. When feeding in on the top side of a record the feed-in spring is assisted by the rotational force of the record; on bottom side feed-in this force opposes the feed-in spring's action. Adjustment "I" should be made so that the sapphire does not jump grooves on top side feed-in and still accomplishes bottom side feed-in in less than ten seconds. Instrument is not level. Pickup cable binds.



Lands Incorrectly

First check Adjustment "C." Make certain that turntable returns to level position making Adjustment "D" and "E"

if necessary. Be sure that sapphire clears record on turntable making Adjustment "F" if necessary. Pickup cable binds.



MODEL RP-151
ADJUSTMENTS

RCA- MFG. CO., INC.

Repeats Grooves

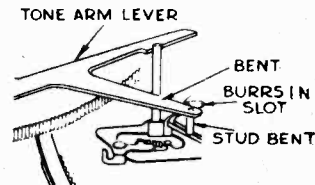
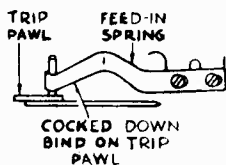
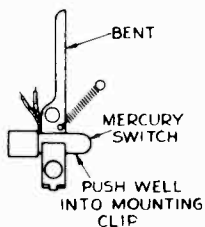
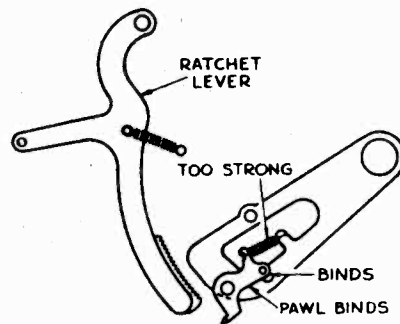
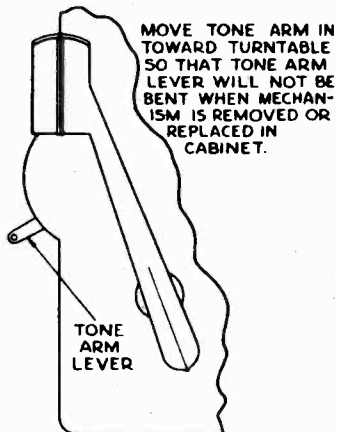
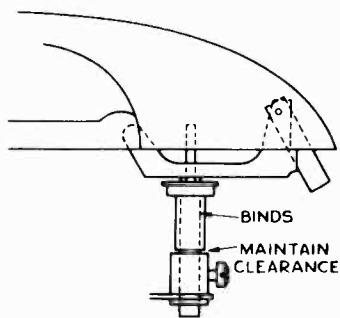
The mercury switch is operated to break the a.c. supply to the cycling motor a few moments before all the cycling operations are completed. The "coast" of the mechanism should then bring the tone arm lever stud against the return lever latch and disconnect the return lever from the trip lever. If excessive friction anywhere in the cycling motor or its gear train reduces this "coast" the pickup will land and repeat

grooves near the beginning of the record. Other causes for the repeating of grooves are shown below.

Check pickup pressure Adjustments "G" and "H."

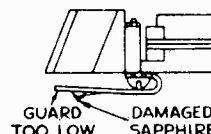
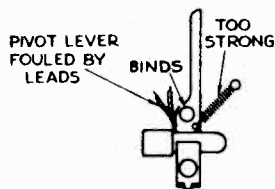
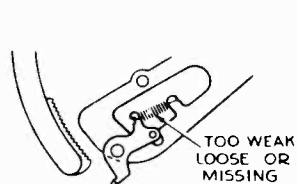
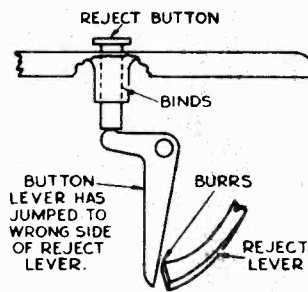
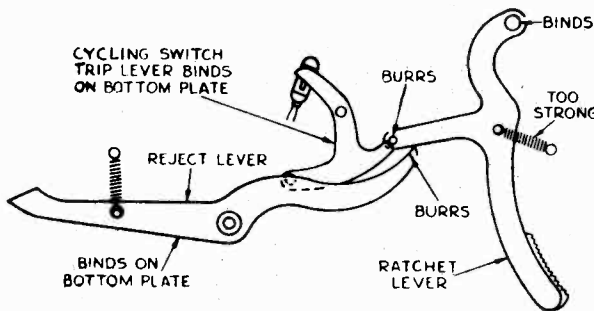
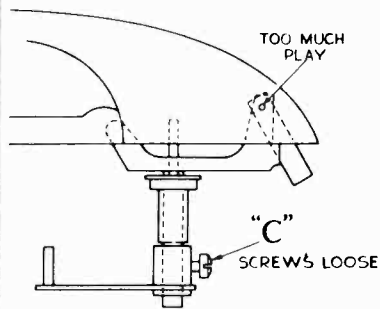
Groove wall in record is broken.

Pickup cable binds.



Fails To Trip (or Fails to Cycle)

Eccentric groove on record is too shallow or discontinuous. Defective mercury switch, circuit, or motor.



Record Drops Too Soon

Check Adjustments "B" and "A" setting the knife spacing greater than 3/32 inches if necessary.

Adjustment Screws Slip

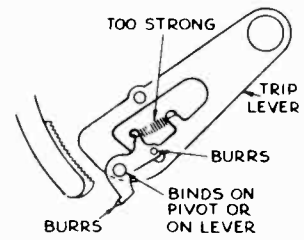
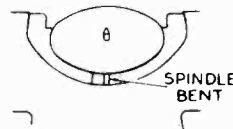
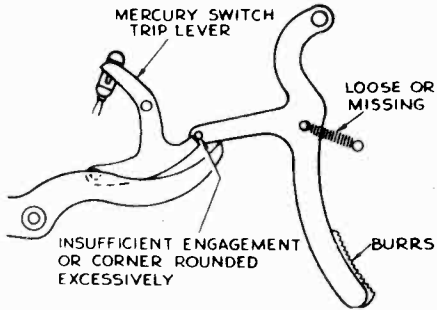
Two cone-pointed set screws Stock No. 31118 may be used if Adjustment "D" fails to hold. Similarly on Adjustment "E" two cone-pointed screws Stock No. 38527 may be used.

RCA MFG. CO., INC.

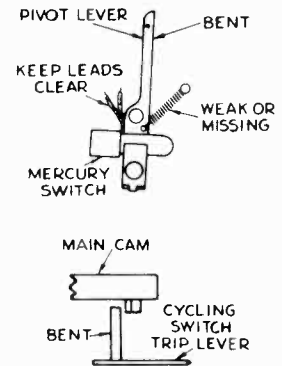
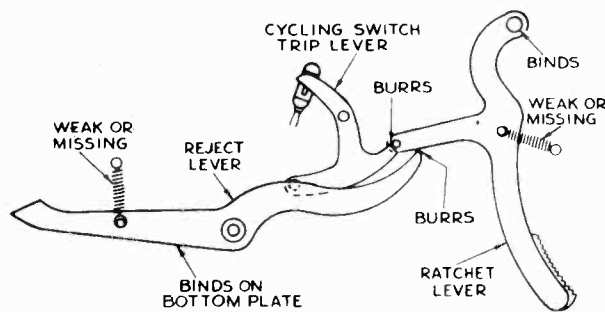
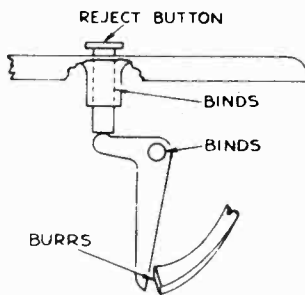
MODEL RP-151
ADJUSTMENTS

Trips Early

Off-center record.
Trip pawl not aligned with ratchet lever teeth.

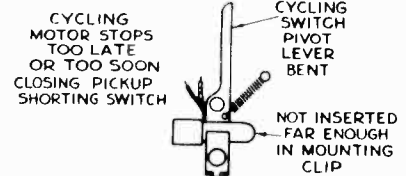
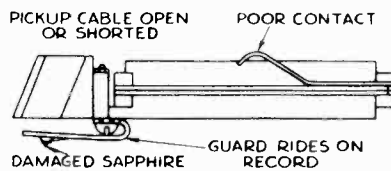
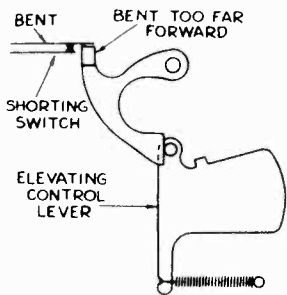


Trips Continuously



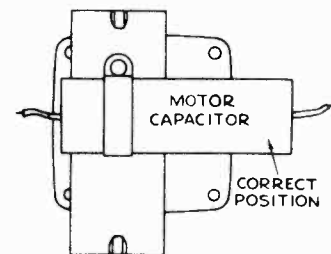
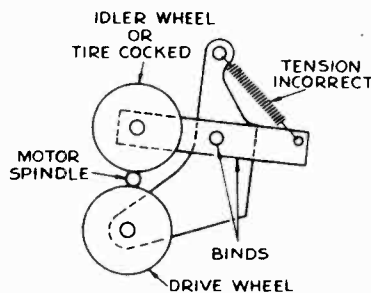
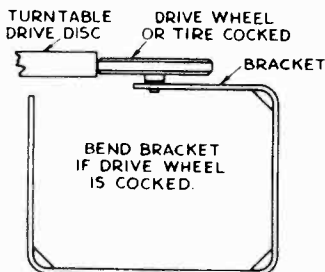
No—Low—Distorted Output

Defective crystal. Shield over terminal board is shorting to cable lugs. Sapphire strikes guard. Nut on sapphire holder shaft is loose.



Slow or Varying Speed

Motor support spring tension is incorrect.

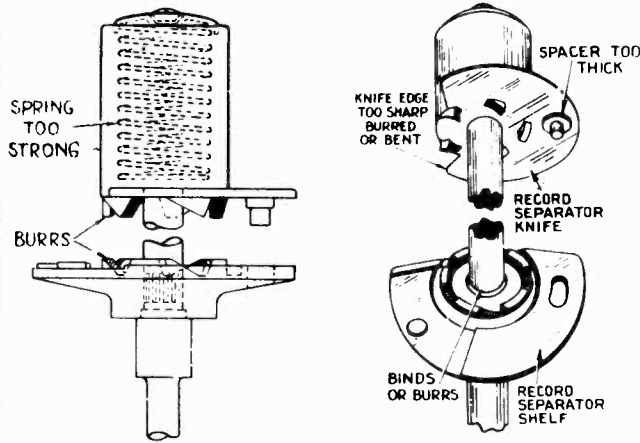


**MODEL RP-151
ADJUSTMENTS**

RCA- MFG. CO., INC.

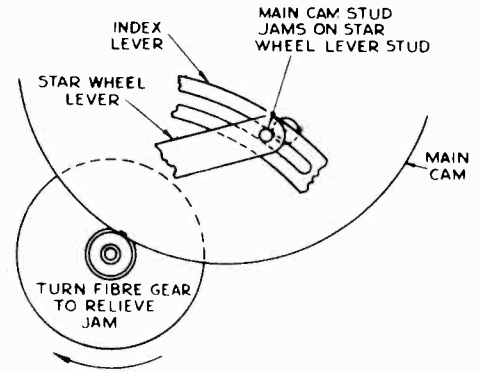
Record Jams

Record too thick, too thin, or warped. Separator knife shaft binds in its bushing.

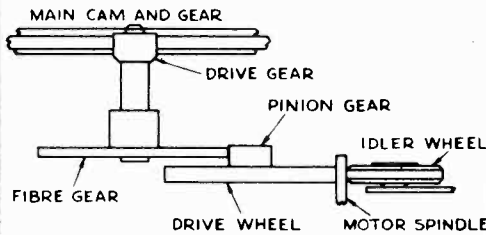


Mechanism Jams

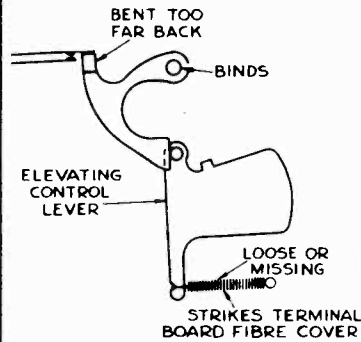
JAM CAUSED BY OPERATOR LEAVING CONTROL LEVER IN MID-POSITION



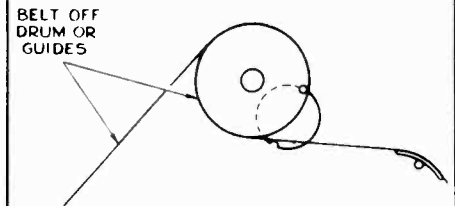
Cycling Drive System



Reproduced Noise During Cycle



Record Posts Fail to Move



Turntable Stops While Playing Record or Fails to Reverse Rotation

First make certain that sapphires are equi-distant from the record on the turntable when the tone arm has been raised or lowered to its "in-cycle" position. Check Adjustment "F" if necessary.

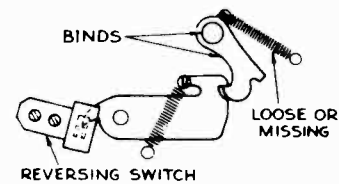
See that turntable is level making Adjustments "D" and "E" if necessary.

Check reversing switch adjustment.

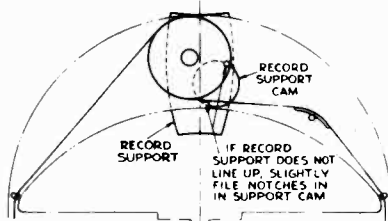
Check turntable height adjustment.

Warped record strikes automatic stop switch.

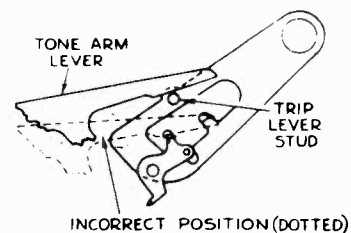
Automatic stop switch button binds on motorboard and fails to rise.



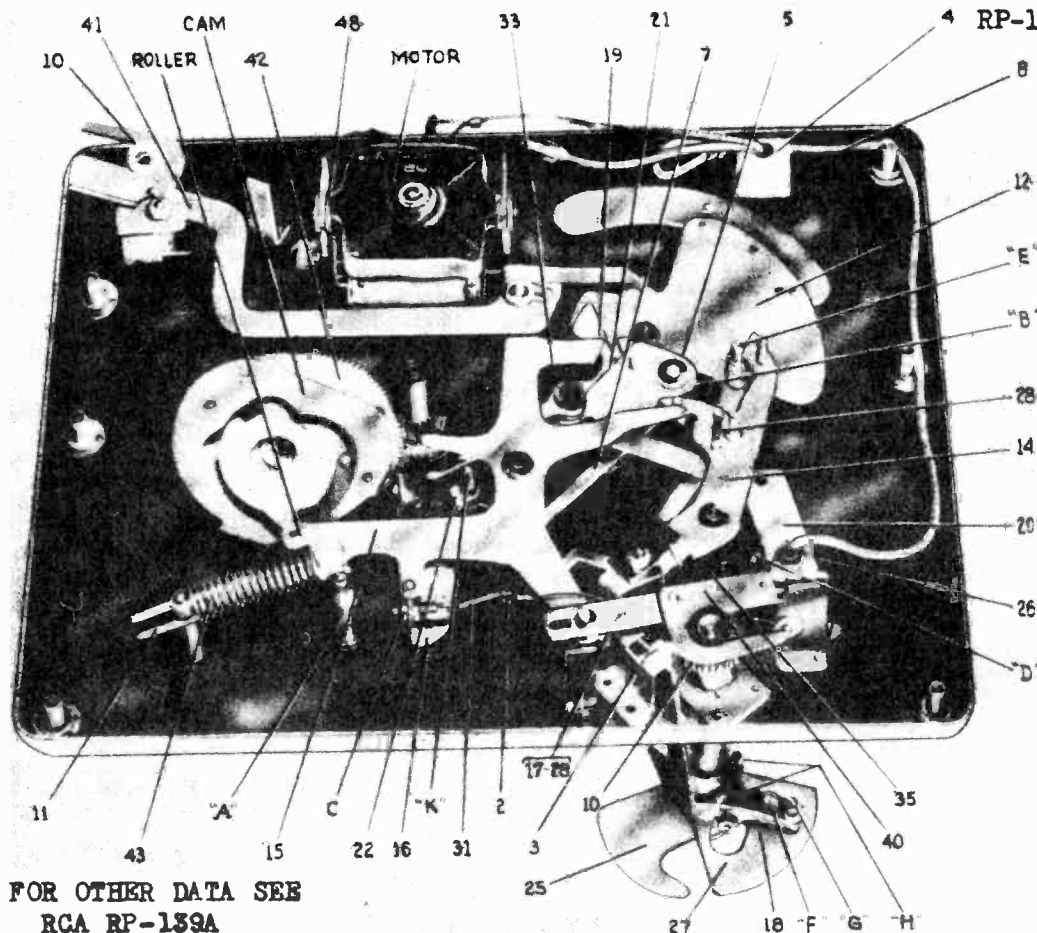
Record Support Misaligned



Tone Arm Action Erratic



RCA MFG. CO., INC.

MODELS RP-152, -A, -B,
-C, -D, -J;
RP-153

FOR OTHER DATA SEE
RCA RP-139A

Bottom View of RP-152, -A, -B, -C, -J Automatic Record Changer
RP-153 mechanisms are similar to above but have flexible coupling turntable drive, and automatic switch.
RP-152-D mechanisms are similar to above but include automatic switch.

Note: Numbers refer to parts—letters refer to adjustments.

Names of Mechanism Parts

- | | | |
|----|-----------|--|
| 2 | Guide | —Pickup-lift-cable guide. |
| 3 | Bracket | —Record-discriminating-lever bracket. |
| 4 | Switch | —Turntable motor switch. |
| 5 | Clutch | —Trip-lever friction clutch. |
| 7 | Finger | —Trip-lever friction finger. |
| 8 | Cable | —Pickup shielded cable. |
| 9 | Spring | —Record-discriminating-lever spring (flat). |
| 10 | Gear | —Record-separator-shaft gear. |
| 11 | Guide | —Main-lever-spring guide. |
| 12 | Lever | —Index lever. |
| 14 | Lever | —Locating lever and pawl. |
| 15 | Lever | —Main lever. |
| 16 | Lever | —Pickup lift-cable lever. |
| 17 | Lever | —Record-discriminating lever and pawl. |
| 18 | Lever | —Record-separator elevating lever. |
| 19 | Lever | —Trip-detaining lever. |
| 20 | Lever | —Trip lever. |
| 21 | Lever | —Trip-regulator lever. |
| 22 | Pawl | —Trip pawl. |
| 23 | Pin | —Separator-shaft pin (engages gear) |
| 25 | Separator | —Record-separator knife. |
| 26 | Spring | —Pickup-arm starting spring. |
| 27 | Shelf | —Record-support shelf. |
| 28 | Spring | —Record-discriminating-lever pawl spring, or locating-lever pawl spring. |
| 31 | Spring | —Pickup lift-cable spring. |
| 34 | Shaft | —Record separator shaft. |
| 35 | Spring | —Locating-lever spring. |
| 40 | Gear | —Short arm and rack gear. |
| 41 | Gear | —Long arm and rack gear. |
| 42 | Cam | —Cam and drive gear assembly. |
| 43 | Spring | —Main-lever spring. |

Names of Mechanism Adjustments

- "A" Rubber Bumper. —Maintains $\frac{1}{16}$ -inch clearance between roller (on end of main lever) and cam plate.
- "B" Friction Clutch Adjustment.—Regulates tripping of record-changing cycle when pickup swings in eccentric groove.
- "C" Pickup Lift-Cable Adjustment.—Regulates height that pickup arm is lifted during record-changing cycle.
- "D" Needle Landing Position for 10-inch Records.—The relation between pickup shaft and trip lever "20," which are fastened by set screws "D," determines needle landing position for 10-inch records.
- "E" Needle Landing Position for 12-inch Records.—Eccentric stud "E" adjusts position of lever "14" which determines landing position for 12-inch records.
- "F" Record separator knife adjustment for 10-inch records, adjusts spacing of knife with relation to record shelf so knife will accurately slice in between the bottom 10-inch record and the rest of the stack.
- "G" Record separator knife adjustment for 12-inch records, adjusts movement of elevating lever which raises knife to compensate for greater thickness of 12-inch records.
- "H" Record support shelf set screws, to adjust record support self on each record post, so the shelves move out from under the bottom record at the same instant, permitting record to drop properly.
- "K" Trip-pawl stop pin, regulates point at which the roller on main lever enters the cam.

**RP-152 SERIES,
RP-153**

RCA MFG. CO., INC.

The RP-152 and RP-153 automatic record changers are very similar in design and construction. Most of the parts and adjustments are identical on both. The RP-153 turntable is driven through a worm gear in the motor housing while the RP-152 turntables are driven through a friction drive disc mounted under the turntable.

On Models RP-152 it is important that the drive motor spindle, and rubber tires on main driving disc and idler pulley be kept clean and free from oil, grease, dirt, or any foreign matter at all times. Any quick-drying naphtha is satisfactory for cleaning these parts. The drive motor bearing is lubricated from an oil well filled and sealed at the factory. It should not require lubrication in the field.

The rubber-tired drive disc on Models RP-152 is not removable from the spindle. The turntable is fastened to the driving disc by three bolts. If necessary to remove these parts the spindle drive gear set screw should first be removed. The driving disc, turntable and spindle assembly can now be lifted upward from the motorboard. If this is done, great care should be taken not to bend the spindle.

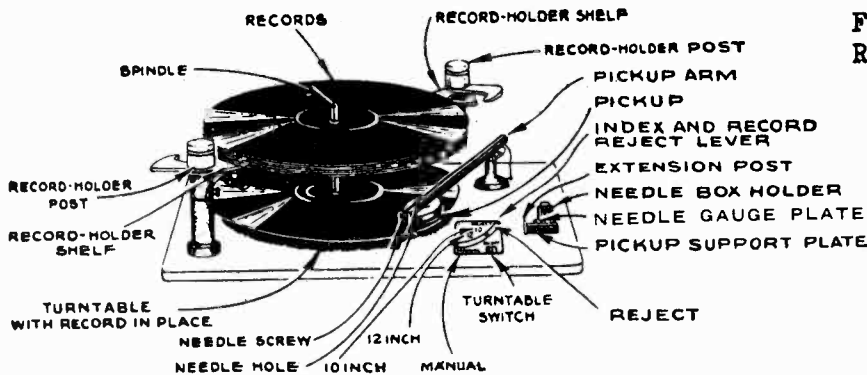
To remove the turntable and spindle on the RP-153 type it is necessary to first remove the tapered pin in the turntable drive arm assembly. The turntable and spindle can then be drawn up through the motorboard bearing.

Before servicing the automatic record changer, inspect the assembly to see that all levers, parts, gears, springs, etc., are in good order and are correctly assembled.

A bind or jam in the mechanism can usually be relieved by rotating the turntable in the reverse direction.

The changer can be conveniently rotated through its change cycle by pushing the index lever to "Reject" and revolving the turntable by hand. Six turntable revolutions are required for one change cycle.

When a record has been played the pickup moves out, another record is dropped down, and the needle is fed automatically into the starting groove of this record. If the needle fails to enter the starting groove, raise the right-hand side of the cabinet by inserting thin spacers under the feet on that side. If the needle slides over a few grooves, raise the left-hand side of the cabinet in a similar manner.



**FOR OTHER DATA SEE
R C A MODEL RP-139A**

When the RP-152-D and RP-153 type record changers are operated in the "manual" position, power to the drive motor is controlled by an automatic starting and stopping switch. The mounting holes on this switch are elongated for adjustment purposes. Proper adjustment is obtained when power is disconnected with the pickup needle 1 3/4 inches from the center of the turntable spindle.

Replacement Parts Model RP-152

Insist on genuine factory-tested parts, which are readily identified and may be purchased from authorized dealers.

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
PICKUP AND ARM ASSEMBLIES (RP-152)			MOTOR ASSEMBLIES (110 volts, 60 cycles) (Motor No. 91708-1) (RP-152 — RP-152-A)		
33906	Arm—Pickup arm only—less crystal, cable, and pivot arm	.45			
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00			
34550	Bushing—Rubber bushing for pickup pivot arm	.05			
32635	Cable—Pickup lift cable	.24			
35694	Cable—Pickup shielded cable (8)	.40			
35171	Crystal—Pickup crystal cartridge and needle screw	4.25			
33529	Screw—Pickup needle screw	.10			
PICKUP AND ARM ASSEMBLIES (RP-152-A)					
36321	Arm—Pickup arm only—less crystal, cable, and pivot arm	.75	37108	Bearing—Bottom bearing and bracket	.40
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00	37107	Bearing—Top bearing and bracket	.40
34550	Bushing—Rubber bushing for pickup pivot arm	.05	37109	Bracket—Motor mounting bracket	.40
32635	Cable—Pickup lift cable	.24	37111	Coil—Motor field coil assembly	1.50
35694	Cable—Shielded pickup cable (8)	.40	37110	Rotor—Motor rotor complete with fan	1.75
35171	Crystal—Pickup crystal cartridge and needle screw	4.25	37108	Pad—Rotor thrust pad	.05
33974	Screw—Pickup needle screw	.15	MOTOR ASSEMBLIES (Motor No. 91655-1, 2, and 3)		
PICKUP AND ARM ASSEMBLIES (RP-152-B)			36954	Armature—Motor armature and shaft for 25 cycle motor	7.85
36322	Arm—Pickup arm only—less crystal, cable, and pivot arm and shaft	1.80	36953	Armature—Motor armature and shaft for 50 cycle motor	4.00
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00	36255	Armature—Motor armature and shaft for 60 cycle motor	2.75
34550	Bushing—Rubber bushing for pickup pivot arm	.05	36952	Cap—Bakelite cap for motor	.50
32635	Cable—Pickup lift cable	.24	36955	Capacitor—1.1 mfd. for 60 cycle motor	1.50
35694	Cable—Pickup shielded cable	.40	36951	Capacitor—1.25 mfd. for motors (1 required for 50 cycles) (2 required for 25 cycles)	1.75
37158	Crystal—Pickup crystal cartridge and needle screw	4.25	36726	Motor—105-125 volts, 25 cycle, complete with capacitor	10.75
33529	Screw—Pickup needle screw	.10	36725	Motor—105-125 volts, 50 cycle, complete with capacitor	8.00
			36254	Motor—105-125 volts, 60 cycle, complete with capacitor	6.75

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

RCA MFG. CO., INC.

RP-152 SERIES

Replacement Parts Model RP-152 (Continued)

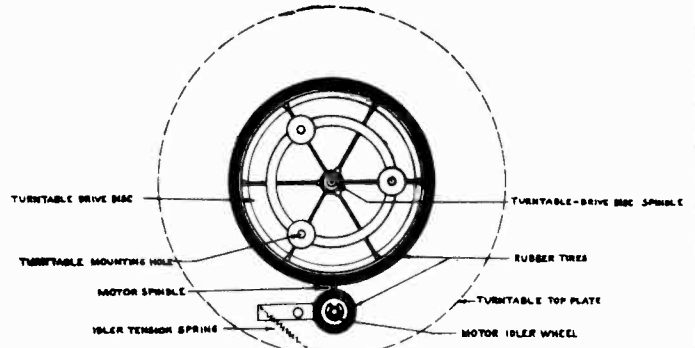
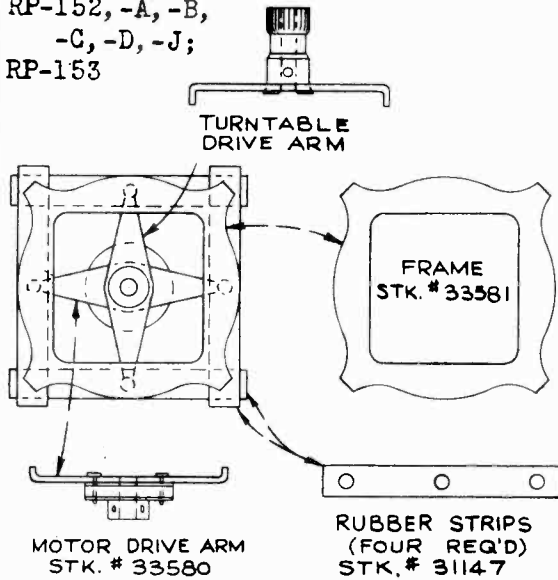
STOCK No.	DESCRIPTION	Unit List Price			
PICKUP AND ARM ASSEMBLIES (RP-152-C)					
36591	Arm—Pickup arm shell only	.75			
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00			
34550	Bushing—Rubber bushing for pickup pivot arm	.05			
32635	Cable—Pickup lift cable	.24			
32556	Cable—Shielded pickup cable	.75			
35171	Crystal—Pickup unit crystal cartridge	4.25			
33974	Screw—Needle screw	.15			
PICKUP AND ARM ASSEMBLIES (RP-152-D)					
37181	Arm—Pickup arm (shell only)	1.80			
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00			
34550	Bushing—Rubber bushing for pivot arm	.05			
32635	Cable—Pickup lift cable	.24			
33905	Crystal—Pickup crystal cartridge	4.25			
33976	Pin—Support pin used to fasten arm shell to pivot arm	.03			
33529	Screw—Needle screw	.10			
PICKUP AND ARM ASSEMBLIES (RP-152-J)					
36322	Arm—Pickup arm (shell only)	1.80			
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00			
34550	Bushing—Rubber bushing for pivot arm	.05			
32635	Cable—Pickup lift cable	.24			
35694	Cable—Shielded pickup cable to shorting switch	.40			
37158	Crystal—Pickup crystal cartridge	4.25			
33976	Pin—Used to attach pickup arm to pivot arm	.03			
33529	Screw—Needle screw	.10			
MOTORBOARD ASSEMBLIES					
36259	Base—Pickup arm mounting base—RP-152 only	.40			
36378	Base—Pickup arm mounting base—RP-152-A, RP-152-B, and RP-152-J only	.40			
36542	Base—Pickup arm mounting base—RP-152-C only	.40			
36811	Base—Pickup arm mounting base—RP-152-D only	.40			
36257	Board—Motorboard complete with bearings and posts—less operating parts—RP-152 only	7.00			
36375	Board—Motorboard complete with bearings and posts—less operating parts—RP-152-A, RP-152-B, and RP-152-J	7.00			
36256	Board—Motorboard complete with bearings and posts—less operating mechanisms—RP-152-C only	7.00			
36813	Board—Motorboard with welded and riveted studs and bearing—less operating parts—RP-152-D only	7.00			
32556	Cable—Shielded pickup cable and plug, connects to shorting switch	.75			
36262	Cup—Used needle (insert only for pickup rest)—RP-152, RP-152-A, RP-152-B, RP-152-C and RP-152-J	.15			
36518	Cup—Used needle cup (insert for pickup rest)—RP-152-D only	.40			
36258	Escutcheon—Index escutcheon—RP-152, RP-152-A, RP-152-B, RP-152-C and RP-152-J	.25			
36377	Escutcheon—Index escutcheon—RP-152-D only	.50			
36260	Gauge—Pickup needle gauge	.15			
34368	Grommet—Rubber grommet for motor mounting	.08			
36263	Plate—Turntable shaft support and spring plate	.40			
30870	Plug—2-contact male for motor leads	.35			
31048	Plug—Plug for pickup leads—RP-152-D only	.15			
36261	Rest—Pickup arm rest—RP-152 only	.35			
36379	Rest—Pickup arm rest—RP-152-A, RP-152-B and RP-152-J	.25			
36812	Rest—Pickup arm rest—RP-152-D only	.35			
36543	Rest—Pickup arm rest—RP-152-C only	.25			
36798	Spring—Index lever spring (riveted to motorboard)	.20			
32875	Switch—Motor switch (4)	.30			
OPERATING MECHANISMS					
36275	Arm—Motor idler wheel arm and studs—less wheel—for use with motor marked No. 91655	.25			
10129	Ball—Steel ball for spindle shaft	.02			
33984	Bracket—Bracket and pin for locating post and lever (3)	.20			
36277	Bumper—Main lever rubber bumper	.10			
33987	Cam—Cam and drive gear complete (42)	2.00			
36531	Cam—Trip lever cam and link—RP-152-D only	.75			
36266	Clutch—Trip lever clutch—less adjusting stud (5)	.25			
36282	Disc—Turntable drive disc, rubber tire, and spindle shaft assembled—less turntable finished plate	2.80			
36265	Finger—Trip lever friction finger (7)	.50			
31121	Gear—Record separator shaft gear (10)	.90			
36280	Gear—Turntable shaft drive gear	.75			
33982	Guide—Main lever spring guide (11)	.10			
31151	Guide—Pickup lift cable guide (spring) (2)	.10			
36264	Lever—Index lever—RP-152 only (12)	.70			
36380	Lever—Index lever—RP-152-A, RP-152-B, and RP-152-J	.70			
36545	Lever—Index lever—RP-152-C only	.70			
36816	Lever—Index lever—RP-152-D only	.70			
36273	Lever—Locating lever and pawl—RP-152, RP-152-A, RP-152-B and RP-152-J	.50			
31138	Lever—Locating lever and pawl—RP-152-C and RP-152-D (14)	.70			
33985	Lever—Main lever (15)	1.05			
31140	Lever—Pickup lift cable lever and spring (16)	.55			
36814	Lever—Pickup discriminating lever and pawl—RP-152-D only	.85			
36272	Lever—Record discriminating lever and pawl—RP-152 only (17)	.85			
36381	Lever—Record discriminating lever and pawl—RP-152-A, RP-152-B, and RP-152-J	.85			
36544	Lever—Record discriminating lever and pawl—RP-152-C only	.85			
36476	Lever—Record separator elevating lever with adjustment screws (18)	.80			
31132	Lever—Trip detaining lever (19)	.30			
36530	Lever—Trip lever—less cam and link—RP-152-D only	1.60			
36284	Lever—Trip lever—less friction finger and clutch—RP-152, RP-152-A, RP-152-B, RP-152-C, and RP-152-J (20)	1.25			
36525	Link—Index link assembly—RP-152-D only	.20			
31133	Pawl—Trip pawl (22)	.80			
36268	Pin—Pin to fasten gear to separator shaft (23)	.05			
36267	Rack—Long arm and gear (41)	.60			
32880	Rack—Short arm and gear (40)	.55			
36281	Ring—Retaining ring for set screw in turntable drive gear	.04			
36477	Screw—No. 6-32 ball point screw for record separator elevating lever	.10			
36276	Screw—No. 6-32 x 1/2 cup point set screw for turntable drive gear	.02			
31118	Screw—No. 10-32 x 5/16 cone pointed set screw for record separator shelf ("H")	.06			
32669	Screw—No. 10-32 x 5/16 machine screw for record separator shelf	.01			
4563	Screw—Pickup lift cable adjusting screw	.04			
33983	Screw—Record separator elevating lever point screw	.15			
36270	Separator—Record separator knife—RP-152 and RP-152-A only	1.85			
33990	Separator—Record separator knife—RP-152-B, RP-152-J and RP-152-D (25)	1.85			
34775	Separator—Record separator knife—RP-152-C only	1.95			
33988	Shaft—Record separator shaft (34)	.70			
36269	Shelf—Record separator rotating shelf—less set screw—RP-152, RP-152-A, and RP-152-C	1.25			
33989	Shelf—Record separator rotating shelf—less set screws—RP-152-B, RP-152-D, and RP-152-J (27)	1.25			
36269	Shelf—Record separator rotating shelf—less set screws—RP-152-C only	1.25			
33994	Spring—Flat spring for record discriminator lever	.05			
32882	Spring—Main lever spring (43)	.05			
36580	Spring—Motor tension spring, for use with motor No. 91706-1—RP-152, RP-152-A, RP-152-B, RP-152-C, and RP-152-J	.08			
36278	Spring—Pickup arm feed spring	.10			
3666	Spring—Pickup lift cable spring (31)	.04			
14190	Spring—Record discriminating lever pawl spring (28)	.08			
3676	Spring—Tension spring for cam pawl	.04			
30585	Spring—Tension spring for idler assembly, for use with motor marked No. 91655	.06			
32436	Spring—Tension spring for locating lever and pawl (35)	.05			
31136	Spring—Tension spring for roller index link—RP-152-D only	.05			
36921	Spring—Tension spring for trip detaining lever	.03			
36279	Spring—Tension spring for trip pawl	.02			
36271	Stud—No. 4-40 hex stud for trip lever clutch adjustment	.08			
36529	Switch—Automatic switch—RP-152-D only	1.10			
34875	Switch—Pickup shorting switch—RP-152, RP-152-A, RP-152-B, RP-152-C, and RP-152-J	.45			
36283	Turntable—Finished top plate only—RP-152, RP-152-A, RP-152-B, RP-152-C, and RP-152-J	1.25			
36815	Turntable—Finished top plate only—RP-152-D only	1.00			
31608	Washer—"C" washer for roller index link—RP-152-D only	.01			
33726	Washer—"C" washer for motor idler—for use with motor marked No. 91655	.02			
8078	Washer—Spring washer for mounting record discriminator lever	.06			
2917	Washer—Spring washer for mounting levers	.03			
36274	Wheel—Motor idler wheel and bearing—less arm—for use with motor marked No. 91655	.55			

PARTS SUBJECT TO CHANGE WITHOUT NOTICE

MODELS

RP-152, -A, -B,
-C, -D, -J;
RP-153

RCA MFG. CO., INC.



Motor Drive Details on RP-152, -A, -B, -C, -D, -J

Motor Coupling Details on RP-153

Replacement Parts Model RP-153

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
PICKUP AND ARM ASSEMBLIES					
36513	Arm—Pickup arm shell only	3.85	31151	Guide—Pickup lift cable guide (spring) (2)	.10
36320	Arm—Pickup support and pivot arm	1.00	36520	Lever—Index lever (12)	.75
34550	Bushing—Rubber bushing for pickup pivot arm	.05	36273	Lever—Locating lever and pawl	.50
32635	Cable—Pickup lift cable	.24	33985	Lever—Main lever (15)	1.05
33905	Crystal—Pickup crystal cartridge and needle screw	4.25	31140	Lever—Pickup lift cable and spring (16)	.55
33976	Pin—Pickup arm shell mounting pin	.03	36522	Lever—Record discriminating lever	1.30
MOTOR ASSEMBLIES					
37300	Armature—Motor armature and worm gear for 50 cycle motor	XX	31132	Lever—Trip detaining lever (19)	.30
37298	Armature—Motor armature and worm gear for 60 cycle motor	XX	36530	Lever—Trip lever less cam and link	1.60
37303	Bearing—Fibre insert for motor spindle bottom bearing	XX	36525	Link—Roller index link	.20
37296	Motor—105-120 volts, 50 cycles	XX	31133	Pawl—Trip pawl (22)	.80
37295	Motor—105-120 volts, 60 cycles	XX	31535	Pin—Drive pin for turntable spindle shaft	.03
37299	Spindle—Motor spindle and fibre gear for 50 cycle motor	32.00	36268	Pin—Pin to fasten gear to separator shaft (23)	.05
37297	Spindle—Motor spindle and fibre gear for 60 cycle motor	XX	36267	Rack—Long arm and gear (41)	.60
37304	Support—Motor mounting support plate	.45	32880	Rack—Short arm and gear (40)	.55
37301	Washer—"C" washer for motor armature shaft (thrust bearing)	XX	33983	Screw—Elevating lever pivot screw	.15
37302	Washer—Felt washer for motor armature shaft (thrust bearing)	XX	36519	Screw—No. 6-32 ball point screw for elevating lever	.30
MOTORBOARD ASSEMBLIES					
36516	Base—Pickup arm mounting base	.40	36477	Screw—No. 6-32 ball point screw for record separator elevating lever	.10
36514	Board—Motorboard complete with bearings and posts—less operating parts	7.00	36526	Screw—No. 10-32x5/16 cup point set screw for record separator	.30
36517	Brace—Motorboard strain brace	.70	32869	Screw—No. 10-32x5/16 screw for record separator	.01
32556	Cable—Shielded pickup cable and plug, connects to shorting switch	.75	31118	Screw—No. 10-32x5/16 set screw for trip lever cam	.06
36518	Cup—Used needle cup	.40	14188	Screw—No. 10-32x7/16 set screw for motor coupling	.06
36377	Escutcheon—Index escutcheon	.50	4563	Screw—Pickup lift cable adjusting screw	.04
36260	Gauge—Pickup needle gauge	.15	36528	Separator—Record separator knife (25)	2.00
30870	Plug—2-contact male for motor leads	.55	33988	Shaft—Record separator shaft (34)	.70
31572	Plug—Female, for switch leads	.15	36527	Shelf—Record separator rotating shelf (27)	1.40
36515	Rest—Tone arm rest and needle cup holder	.85	36524	Spindle—Turntable spindle	1.05
36798	Spring—Index lever spring (riveted to motorboard)	.20	33994	Spring—Flat spring for record discriminator lever	.05
OPERATING MECHANISM					
34009	Arm—Motor coupling arm and gear—turntable end	.70	32882	Spring—Main lever spring (43)	.05
33580	Arm—Motor coupling arm and hub—motor end	.70	36278	Spring—Pickup arm feed spring	.10
33984	Bracket—Bracket and pin for locating post and lever (3)	.20	3666	Spring—Pickup lift cable spring (31)	.04
36277	Bumper—Main lever rubber bumper	.10	14190	Spring—Record discriminating lever pawl spring (28)	.08
33987	Cam—Cam and drive gear complete (42)	2.00	31136	Spring—Tension spring for automatic switch plunger	.05
36531	Cam—Trip lever cam and link—less trip lever	.75	3676	Spring—Tension spring for cam pawl	.04
36266	Clutch—Trip lever clutch—less adjusting stud (5)	.25	32436	Spring—Tension spring for locating lever and pawl (35)	.05
36265	Finger—Trip lever friction finger (7)	.50	36521	Spring—Tension spring for trip lever cam	.05
33581	Frame—Motor coupling frame only	.20	36921	Spring—Tension spring for trip detaining lever	.03
31121	Gear—Record separator shaft gear (10)	.90	36279	Spring—Tension spring for trip pawl	.02
33982	Guide—Main lever spring guide (11)	.10	31147	Strip—Complete set of rubber strips for motor coupling	.40
			36271	Stud—No. 4-40 hex stud for trip lever clutch adjustment	.08
			36529	Switch—Automatic switch	1.10
			34875	Switch—Pickup shorting switch	.45
			36523	Turntable—Turntable less spindle shaft	4.50
			8078	Washer—Spring washer for mounting record discriminating lever	.06
			2917	Washer—Spring washer for mounting levers	.03
			31608	Washer—Spring washer to hold index link	.01
			31143	Washer—Washers for turntable bearing (1 steel, 1 bronze and 1 felt)	.15

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

RCA MFG. CO., INC.

PHONOGRAPH (RP-155)

Type..... Automatic
 Record Capacity..... Eight 10-inch or Seven 12-inch
 Turntable Speed..... 78 r.p.m.
 Drive... Motor drive through idler on inside rim of turntable
 Type Pickup..... Crystal
 Pickup Impedance..... 100,000 ohms at 1,000 cycles
 Average Output... 1½ volts at 1,000 cycles across ½ meg.

RECORDER

Recording Head (cutter)..... Crystal

FOR DATA ON RECORD CHANGER ADJUSTMENTS SEE MODEL RP-139A, AND FOR MECHANICAL DATA ON RECORD CHANGER SEE MODEL RP-152 SERIES.

Recorder Operating Instructions

Preliminary.—

1. See that cutter is functioning correctly as outlined on facing page.
2. Place recording disc on turntable with stud engaged in one hole.
3. Turn on power-bass control, just past the click of the power switch. Turn treble tone control full clockwise. Set radio-phonograph volume control to soft, and microphone volume control fully counter-clockwise.

Radio Recording.—

1. Tune in the desired radio program.
2. Turn service selector to position "3."
3. Turn radio-phonograph volume control so the "Magic Eye" just closes during loudest passages.
4. Push turntable switch "on."
5. Lift the recording arm, move it over so the stylus is about ¼-inch inside the recording disc, and lower gently on the disc.
6. During the recording, listen to the loudspeaker, watch the "Magic Eye," and increase or decrease the radio-phonograph volume control if the broadcast level becomes too low or too high.
7. Use a fine hair brush occasionally to keep the area immediately ahead of the stylus free from chips and threads.
8. Before the cutter reaches its inner limit, lift the cutter head and place on rest. Turn off the turntable switch and remove the cuttings from the disc.
9. The recording may be "played-back" immediately: Turn the service selector to "Victrola," push the turntable switch "on," turn power-bass control fully clockwise, place pickup needle in outer groove of the disc, and adjust the radio-phonograph volume control. Use a new needle for play-back.

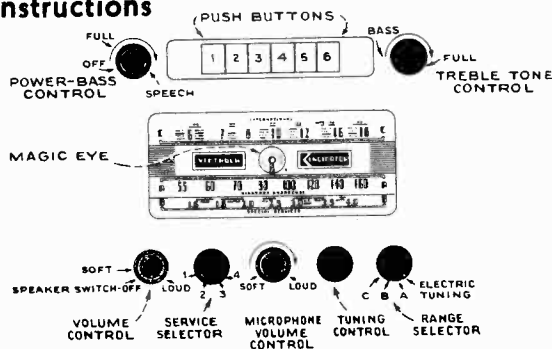
Microphone Recording.—

1. Turn service selector to position "1."
2. Turn radio-phonograph volume control to its "off" position to prevent feed-back and "howl."
3. Turn power-bass control just past the click of the power switch. Turn treble-tone control full clockwise.
4. To obtain an approximate setting of the microphone volume control before making a recording, talk into the microphone (which should be left plugged into its receptacle at all times) and adjust the microphone volume control so the "Magic Eye" just closes. By talking in a fairly level tone, and by maintaining the same distance between the microphone and lips, the microphone volume control will not require continual readjustment.
5. Start the turntable and place cutter on the disc.
6. Talk into the microphone to make the desired recording, and re-adjust the microphone volume control if required, as indicated by the "Magic Eye."
7. Stop the recorder before it reaches its inner limit, turn back the microphone volume control counter-clockwise and play back the recording as described in "9" above.

Re-Recording.—

A record may be re-recorded, or duplicated (that is, a "copy" may be made from an "original") by connecting an RCA Victrola Attachment (record player) to the "re-recording jack" on the rear of the radio chassis. The "original" record is played on the RCA Victrola Attachment, and the "copy" is cut or recorded on the Home Recorder.

Impedance of Cutter at 1,000 cycles..... Approx. 60,000
 Turntable Speed..... 78 r.p.m.
 Grooves Cut per Inch..... Approx. 115
 Inches Cut per Minute..... Approx. 713 inch
 Recording Blank Discs..... Coated metal-base or coated paper-base
 Recording Disc Diameter..... Up to 10 inches
 Drive..... Motor drive through idler on inside rim of turntable; the turntable spindle drives a lead screw which guides the recorder arm from outside of recording blank to inside



Controls on VHR-207 and VHR-407. Model VHR-202 Controls are identical, except "B" Band is omitted.

The procedure is as follows:

1. Turn the service selector to position "1."
2. Connect the RCA Victrola Attachment pickup cable to the jack on rear of the Home Recorder radio chassis.
3. Place the "original" record on the RCA Victrola Attachment, turn its volume control fully clockwise, and place its pickup on the "original" record.
4. Adjust the radio-phonograph volume control so the "Magic Eye" just closes on loudest passages, then lift pickup off the RCA Victrola Attachment.
5. Start the recorder by pushing turntable switch "on," and placing the recorder arm on the recording disc.
6. Put the RCA Victrola Attachment pickup arm on the "original" record. The recorder will cut a duplicate of this record, which may be played-back as described previously.

Mixed Recording.—

The RCA Home Recorders have complete flexibility for mixed recordings of radio, microphone, and phonograph. The various possible combinations are clearly shown in the illustration of the service selector control.

In mixed recordings, the radio-phonograph volume control regulates the recording level for radio, and for the RCA Victrola Attachment.

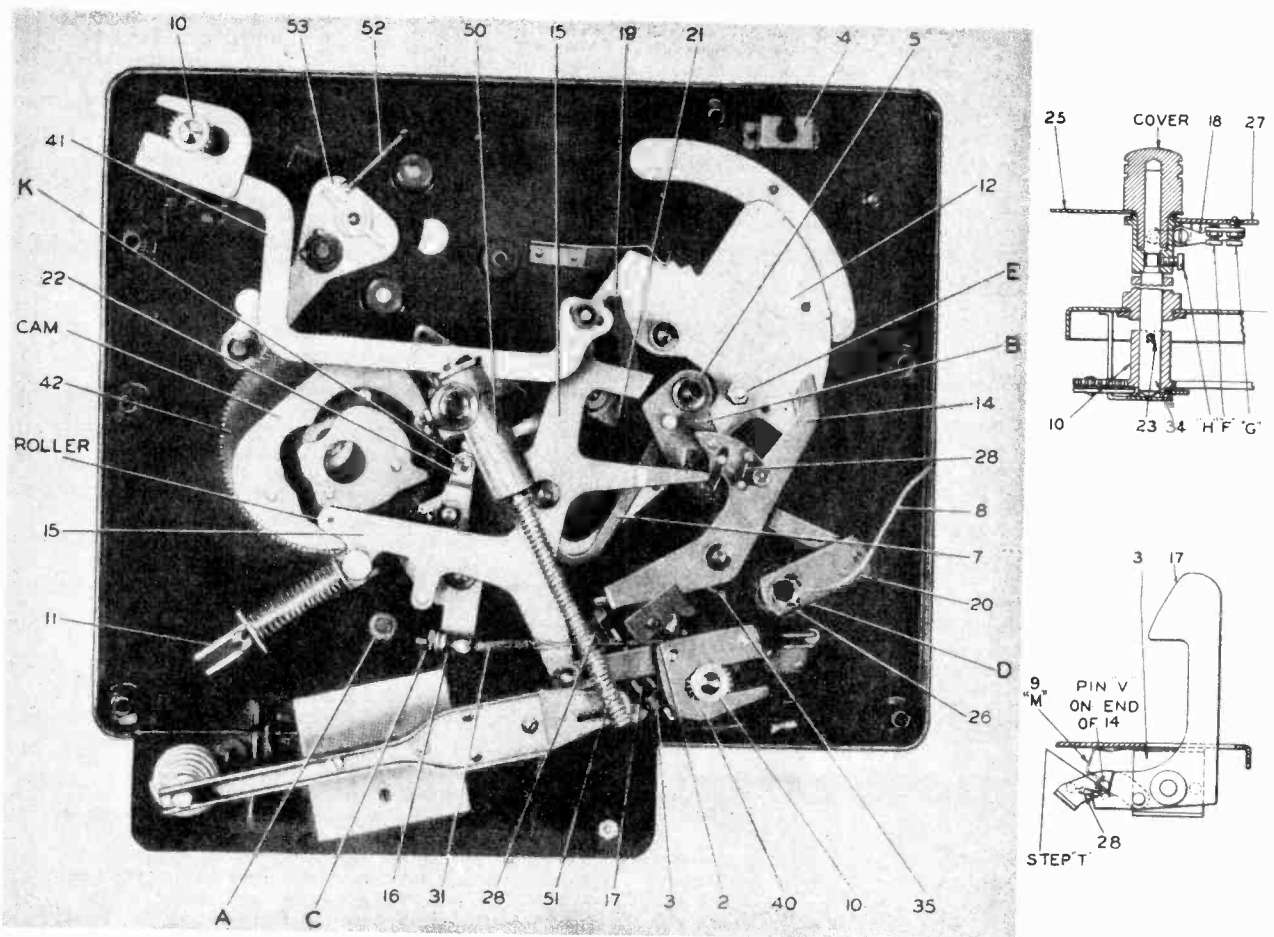
The microphone volume control regulates the recording level of the microphone only. In using the microphone on mixed recordings, or mixed PA, it should be placed as far as possible from the loudspeaker and faced away from the loudspeaker to avoid feed-back howl. (An extension cord may be added if necessary.)

"Rumble".—

1. Excessive cutting pressure will cause rumble. The width of the groove should almost equal, but not exceed, the distance between grooves. Check the groove width each time a new stylus is used, and each time a new disc is used.
2. When recording, use the maximum bass response, by turning the power-bass control to "full" (just past the click of the power switch).
3. On play-back, use the least bass response, by turning the power-bass control to "speech" (full clockwise).
4. Be certain that the motor board and mechanism is "floating" free from the cabinet.

MODEL RP-155

RCA MFG. CO., INC.



Names of Mechanism Parts

- | | | |
|----|-----------|--|
| 2 | Guide | —Pickup-lift-cable guide. |
| 3 | Bracket | —Record-discriminating-lever bracket. |
| 4 | Switch | —Turntable motor switch. |
| 5 | Clutch | —Trip-lever friction clutch. |
| 7 | Finger | —Trip-lever friction finger. |
| 8 | Cable | —Pickup shielded cable. |
| 9 | Spring | —Record-discriminating-lever spring (flat). |
| 10 | Gear | —Record-separator-shaft gear. |
| 11 | Guide | —Main-lever-spring guide. |
| 12 | Lever | —Index lever. |
| 14 | Lever | —Locating lever and pawl. |
| 15 | Lever | —Main lever. |
| 16 | Lever | —Pickup lift-cable lever. |
| 17 | Lever | —Record-discriminating lever and pawl. |
| 18 | Lever | —Record-separator elevating lever. |
| 19 | Lever | —Trip-detaining lever. |
| 20 | Lever | —Trip lever. |
| 21 | Lever | —Trip-regulator lever. |
| 22 | Pawl | —Trip pawl. |
| 23 | Pin | —Separator-shaft pin (engages gear). |
| 25 | Separator | —Record-separator knife. |
| 26 | Spring | —Pickup-arm starting spring. |
| 27 | Shelf | —Record-support shelf. |
| 28 | Spring | —Record-discriminating-lever pawl spring, or locating-lever pawl spring. |
| 31 | Spring | —Pickup lift-cable spring. |
| 34 | Shaft | —Record separator shaft. |
| 35 | Spring | —Locating-lever spring. |
| 40 | Gear | —Short arm and rack gear. |
| 41 | Gear | —Long arm and rack gear. |
| 42 | Cam | —Cam and drive gear assembly. |
| 43 | Spring | —Main-lever spring. |
| 50 | Casting | —Casting and bearing for spindle and lead screw. |
| 51 | Screw | —Lead screw and pinion gear for recorder drive. |
| 52 | Spring | —Tension spring for motor idler pulley arm. |
| 53 | Arm | —Motor drive disc arm. |

Names of Mechanism Adjustments

"A" Rubber Bumper.—Maintains $\frac{1}{16}$ -inch clearance between roller (on end of main lever) and cam plate.

"B" Friction Clutch Adjustment.—Regulates tripping of record-changing cycle when pickup swings in eccentric groove.

"C" Pickup Lift-Cable Adjustment.—Regulates height that pickup arm is lifted during record-changing cycle.

"D" Needle Landing Position for 10-inch Records.—The relation between pickup shaft and trip lever "20," which are fastened by set screws "D," determines needle landing position for 10-inch records.

"E" Needle Landing Position for 12-inch Records.—Eccentric stud "E" adjusts position of lever "14" which determines landing position for 12-inch records.

"F" Record separator knife adjustment for 10-inch records, adjusts spacing of knife with relation to record shelf so knife will accurately slice in between the bottom 10-inch record and the rest of the stack.

"G" Record separator knife adjustment for 12-inch records, adjusts movement of elevating lever which raises knife to compensate for greater thickness of 12-inch records.

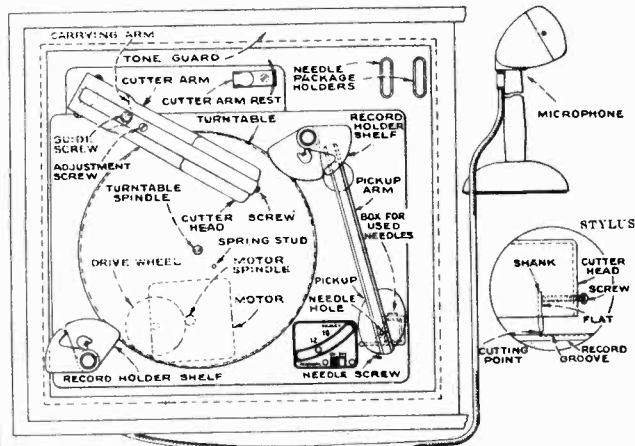
"H" Record support shelf set screws, to adjust record support shelf on each record post, so the shelves move out from under the bottom record at the same instant, permitting record to drop properly.

"K" Trip-pawl stop pin, regulates point at which the roller on main lever enters the cam.

RCA MFG. CO., INC.

Recorder Cutting Adjustments

MODEL RP-155



IMPORTANT

The cutting point of the stylus must be in perfect condition in order to make good recordings.

The condition of the stylus point can not be determined by ordinary visual inspection. If the recordings are noisy or poor in quality, first try a new stylus.

The stylus cutting point can be ruined by dropping the cutter on the record, by cutting into the base metal of the recording blank, or by cutting into the paper label on the blank.

Always stop the recorder before it reaches its inner limit as it will repeat in the last groove and may wear into the base metal, thereby ruining the stylus point.

To insert or change a stylus, lift the recorder arm, loosen the stylus screw, and insert the stylus as far as it will go in the hole at bottom of cutter head, with the flat on the shank of the stylus toward the screw. Tighten the screw against the flat on the shank. **Retighten the screw before making each recording.** Do not use pliers or wrench.

To adjust the stylus pressure for the correct depth and width of cut, the best procedure is to cut some "blank" grooves in a recording disc of the type that will be used: The stylus pressure can be regulated, by means of the adjustment screw on top of the cutter arm, to produce the correct thickness of the hair-like cuttings. The procedure is as follows:

1. See that the phonograph pickup is on its rest, the turntable cleared of records, the record-holder shelves rotated back away from the turntable, index lever at "manual," a perfect stylus correctly inserted in the cutter head, and the stylus screw firmly tightened.

2. Place the blank recording disc on the turntable, with the spring stud that protrudes from the turntable engaged with one of the three holes at inside of the disc. This prevents the disc from slipping during recording.

3. Turn on power-bass control and turntable switch. Turn radio-phonograph and microphone volume controls fully counterclockwise.

4. Lift the cutter arm well up and move it over so the stylus is about 1/4-inch inside the recording disc and lower GENTLY on to the disc.

5. The stylus will begin to cut, and the cuttings should collect toward the center of the recording disc. If they collect toward the outside, the stylus is not correctly inserted, and

must be adjusted by removal and reinsertion. If the threads continue to collect toward the outside, use a new stylus.

6. When the stylus is correctly inserted, with the cuttings collecting toward the center of the disc, lift the cutter, place it on the cutter rest, and stop the turntable. Then examine the cuttings and the grooves in the disc.

The cuttings should be even, thin, hair-like threads about three-thousandths of an inch across or approximately the diameter of a human hair.

The groove width should almost equal, but not exceed, the distance between grooves. A magnifying glass is helpful in examining the grooves. If the grooves are too shallow, the phonograph needle will slide over them on play-back. If the grooves are cut too deep, rumble will be excessive.

After examining the cuttings and the groove width, adjust the cutter pressure as required by means of the adjustment screw on top of the cutter arm. Turn this clockwise to increase pressure and increase size of cuttings. Turn counterclockwise to decrease pressure and decrease size of cuttings.

Check the new adjustment by running more blank grooves.

Check the cuttings and groove width each time a new stylus is inserted, and whenever a different type of recording disc is used.

The stylus pressure, when adjusted for correct cutting, is approximately 1 3/4 ounces, measured at the end of the stylus screw.

Always lift the cutter-arm well up while moving it into cutting position, and while moving it back to the rest. Failure to do this will cause the follower-arm guide to drag across the lead screw under the motorboard.

Recorder Mechanism Adjustments

"N" Recorder Arm Stop.—An extension on the cross-bracket under the motorboard limits the inward movement of the follower arm. In this stop position, the stylus screw should be 1 1/2 inches from the spindle.

The correct distance can be obtained by loosening set screws "N," moving the recorder arm in the required direction, and tightening the set screws.

"O" Follower-Arm Guide Adjustment.—When the recorder arm is lifted, the follower-arm rises up so that the follower-guide will clear the lead screw and permit the recording arm to be moved inward or outward.

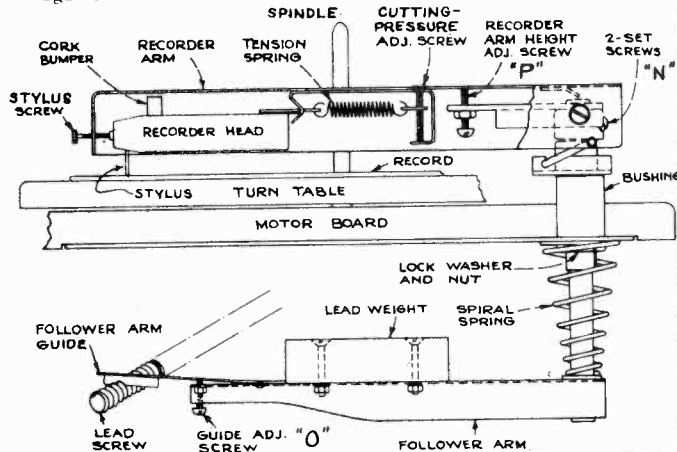
Adjust the set screw and locknut "O" so that the guide clears the lead screw when the bottom-front edge of recorder arm is 3 inches above record.

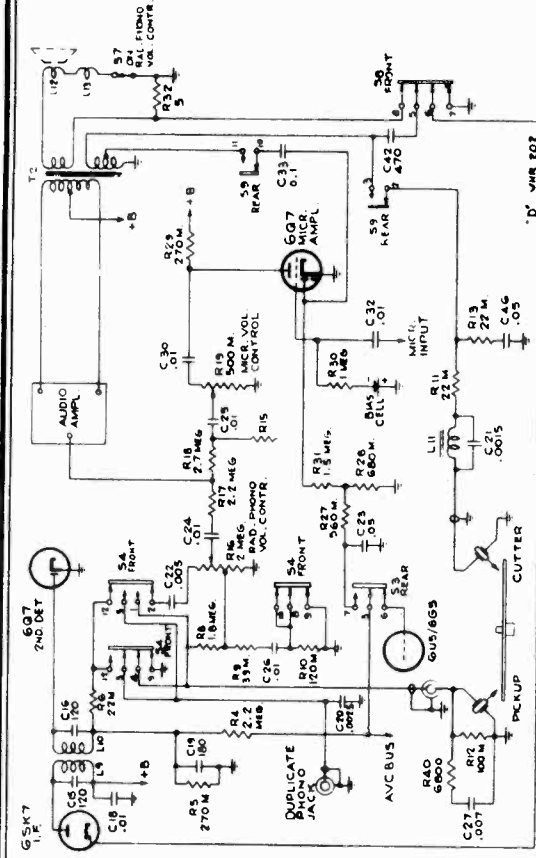
"P" Recorder-Arm Height Adjustment.—With the recording stylus resting on a metal-base recording disc, and adjusted for correct cutting pressure, the stylus screw should be approximately in the center of the hole in the recorder arm, and the cutter head should be free to move up and down. Adjust the recorder-arm height adjustment screw and locknut "P" to obtain these conditions.

If the arm is too low, the cork bumper on top of the cutter head will hit the inner top of recorder arm.

If the arm is too high, the stylus screw will hit the lower edge of the screw hole.

Also check to see that the stylus screw does not scrape against the side of the screw hole.



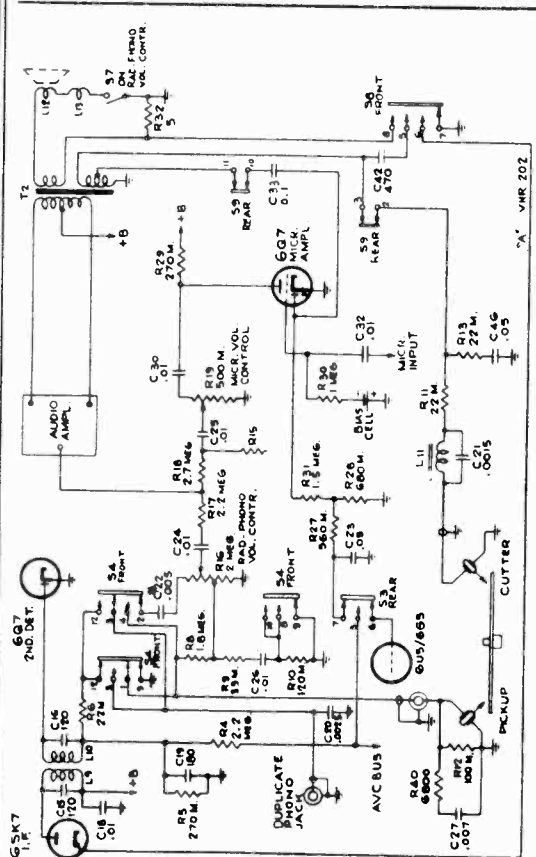


1—"Recording"

RECORDING:
 1. CUTTING RECORDS OF VOICE OR MUSIC THROUGH MICROPHONE
 2. CUTTING RECORDS OF MUSIC THROUGH PHONOGRAM RECORDS
 3. CUTTING RECORDS OF MUSIC THROUGH PHONOGRAM RECORDS MIXED WITH VOICE OR MUSIC BY MICROPHONE

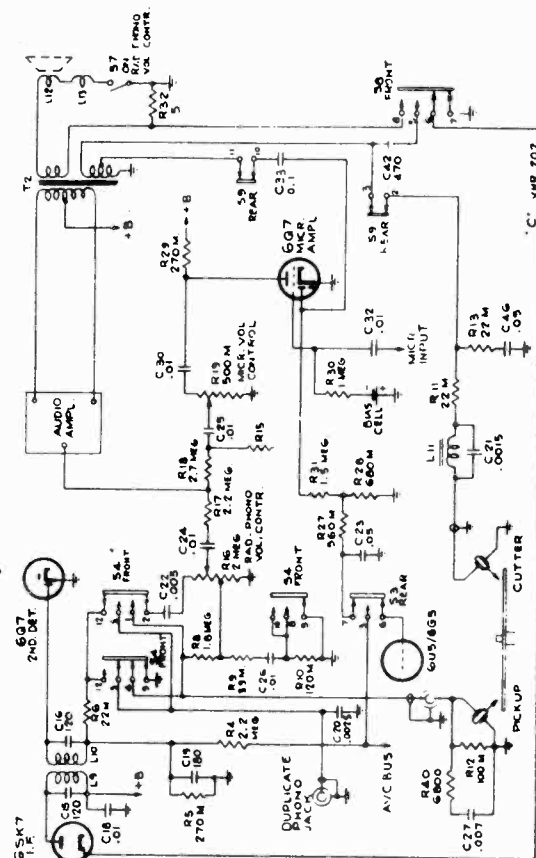
VICTROLA:
 1. PHONOGRAM RECORD SELECTIONS
 2. PHONOGRAM SELECTIONS MIXED WITH VOICE OR MUSIC BY MICROPHONE ONLY (RA)

Model VHR-202 Service Selector Circuits

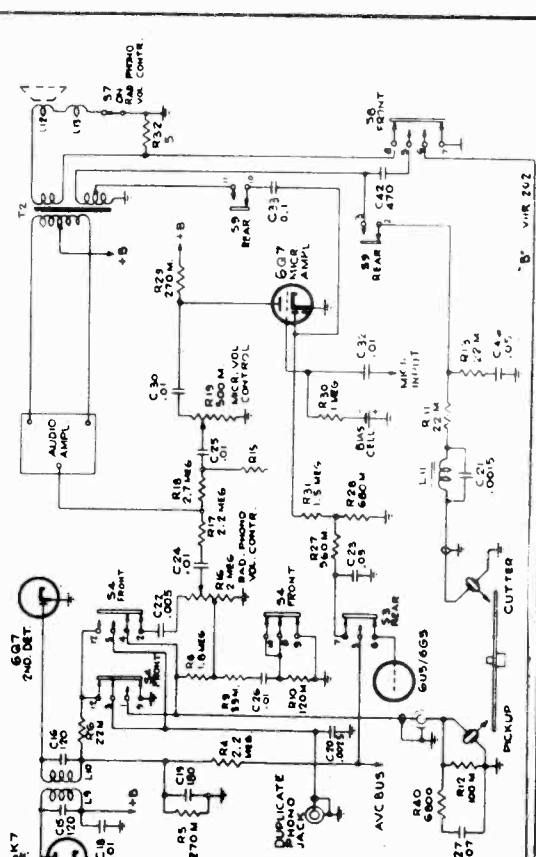


2—"Victrola"

RADIO RECORDING:
 1. RADIO PROGRAMS MIXED WITH VOICE OR MUSIC BY MICROPHONE
 2. CUTTING RECORDS OF RADIO PROGRAMS WITH VOICE OR MUSIC MIXED IN THROUGH MICROPHONE



3—"Radio Recording"



4—"Radio"

4—"Radio"

SERVICE SELECTOR

1—"Re-Recording"

2—"Victrola"

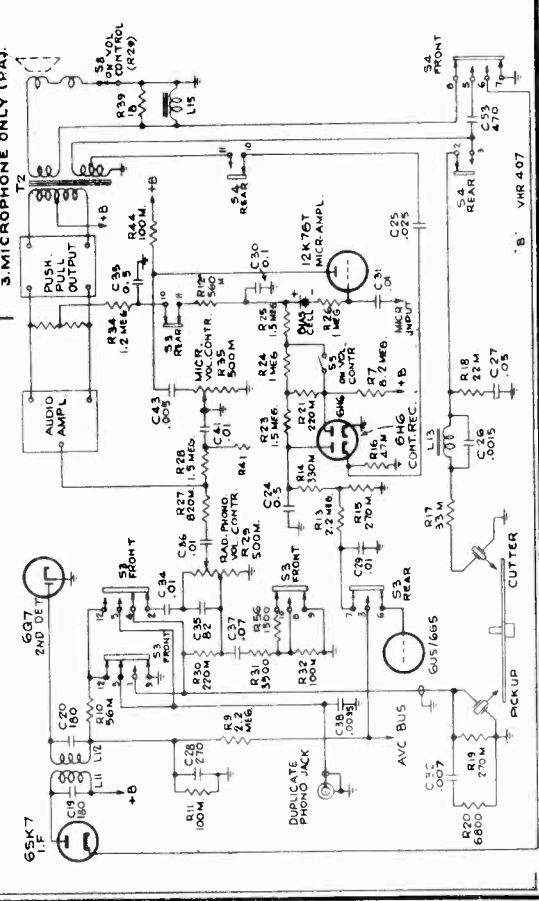
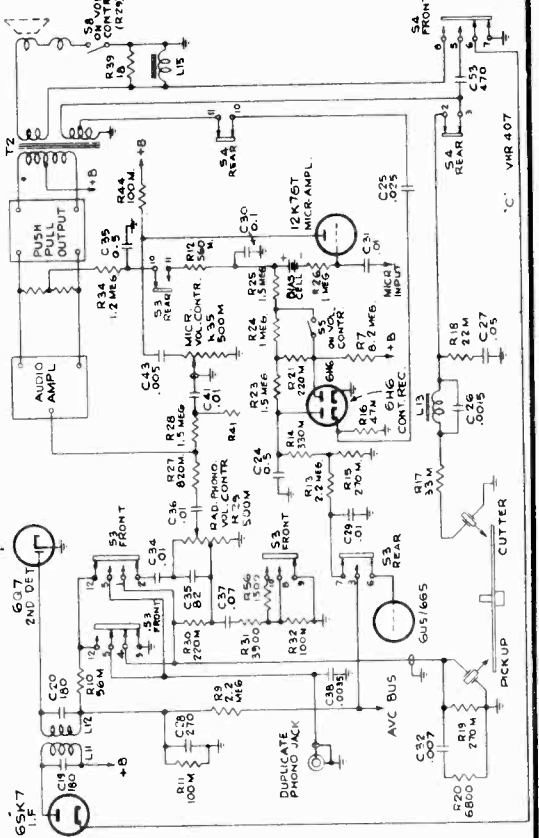
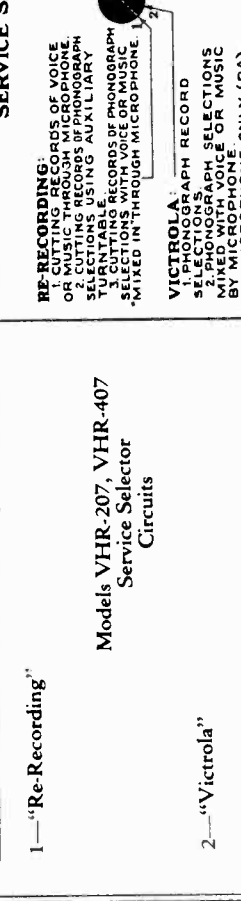
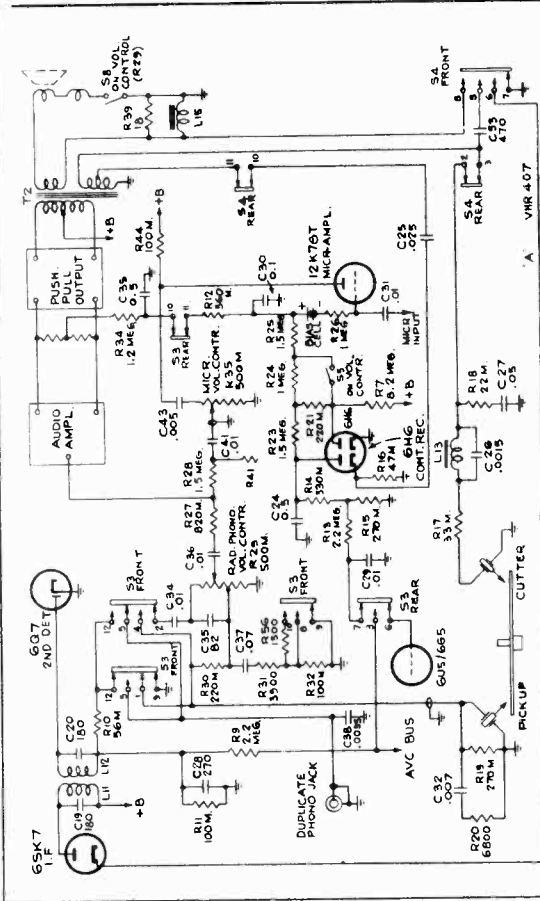
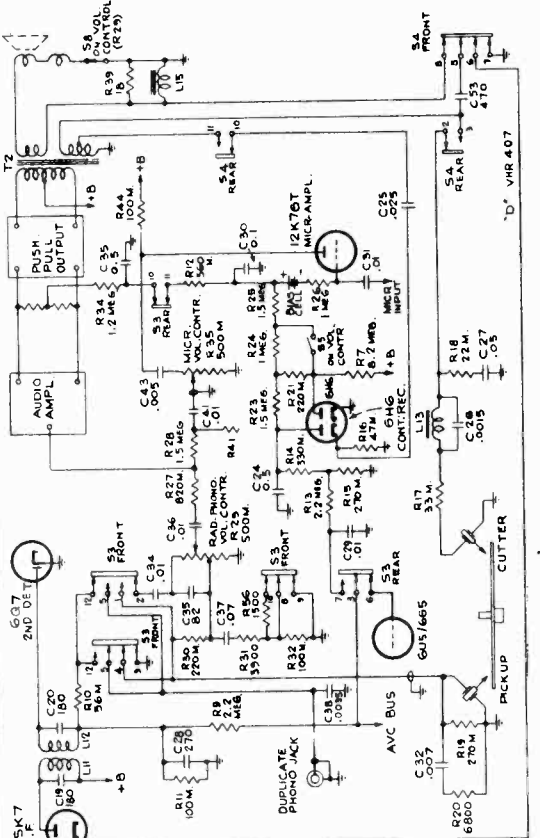
In some production, the wording on the Service Selector plate is like that shown for Model VHR-202.

RADIO:
1. RADIO PROGRAMS MIXED WITH RECORDING OR MUSIC BY MICROPHONE.

RE-RECORDING:
1. RECORDING RECORDS OF VOICE OR MUSIC THROUGH MICROPHONE.
2. CUTTING RECORDS OF PHONOGRAPH RECORDS USING AUXILIARY TUBES.
3. CUTTING RECORDS OF PHONOGRAPH SELECTIONS WITH VOICE OR MUSIC MIXED IN THROUGH MICROPHONE.

VICTROLA:
1. GRAPH RECORD SELECTIONS.
2. PHONOGRAPH SELECTIONS MIXED WITH VOICE OR MUSIC.
3. MICROPHONE ONLY (PA).

RECORDING:
1. CUTTING RECORDS OF RADIO PROGRAMS.
2. CUTTING RECORDS OF MUSIC MIXED WITH VOICE OR MUSIC "MIXED IN" THROUGH MICROPHONE.



Automatic Record Changer Mechanism Cycle of Operation

In automatic operation (index lever set to "10" or "12"), when the pickup needle enters the eccentric or spiral groove at the inside of the record, the pickup arm swings in the groove, and this motion acts through a friction clutch to "trip" or start the cycle of the automatic record changer mechanism which:

1. Lifts up the pickup arm and swings it out clear of the records.
2. Turns the two record-holder posts, each of which has a "knife" and a "shelf": The knives enter between the bottom record and the rest of the stack. Continuing to turn, the shelves move from under the bottom record and it drops on the turntable, while the rest of the stack of records are supported by the "knives."
3. The pickup arm is then moved to correct position and lowered on the record, while—
4. The record-holder posts are turning back to their original positions, so that the records rest on the shelves, and the knives are in correct position to separate the next record from the stack.

The cycle is completed when the pickup comes down on the record. The pickup arm should not be moved while "in cycle."

Record-Separating Knives. 12-inch records are thicker than 10-inch records: To accommodate this difference, the "knife" or record-separating lever on each record post is raised slightly when a 12-inch record presses down against the ball-point screw that projects through a hole in the record-holder shelf on each post. (10-inch records do not rest on these screws, and the knife clearance is then correct for a 10-inch record.)

"Record Discriminating Lever." In playing a mixed group of 10-inch and 12-inch records, the index lever is set at "10." When the pickup arm moves out during the cycle of operation, the record discriminating lever (at left of the rear record-holder post) is moved to its forward position, toward the spindle, and sets the correct landing position of the pickup needle for a 10-inch record. If a 12-inch record drops down, it pushes the record discriminating lever back, and sets the correct landing position for the 12-inch record.

Manual Phonograph Operation

Inserting Needles.—To insert a needle, place pickup on its rest, loosen needle screw on the front of the pickup, place needle in hole at top of pickup so that it drops down against the polished gauge plate, press firmly on top of pickup so it sits squarely on the pickup rest, and then tighten the needle screw. This procedure ensures that the needle will project the correct distance from the pickup.

1. See that the recording arm is in its rest position at rear of turntable.
2. Turn power-bass control on, turn service selector to "Victrola," and turn microphone volume control fully counter-clockwise.
3. See that pickup is on the pickup rest.

4. Push index lever to "manual," lift the knobs on the top of the record holder posts, and rotate the shelves back, away from the turntable. Push back the vertical lever at left of the rear record post.

5. Place record on turntable.

6. Push turntable switch "on" and when turntable has attained speed, lift the pickup and lower it gently on the record so that the needle point enters the outside groove.

7. Adjust the radio-phonograph volume control for the desired volume, and adjust the tone controls for best reproduction.

8. To stop, place pickup on its rest and turn off the turntable switch.

Automatic Phonograph Operation

1. See that the recording arm is in its rest position at rear of turntable.

2. Turn power-bass control on, turn service selector to "Victrola," and turn microphone volume control fully counter-clockwise.

3. See that the pickup is on the pickup rest. If it is not, complete a cycle of operation as described previously.

4. Push index lever to "manual," lift the knobs on the top of the record-holder posts and rotate the shelves back, away from the turntable. Push back the vertical lever at left of the rear record post.

5. Select a series of eight 10-inch records, or seven 12-inch records, and place the first one on the turntable. Swing the record-post shelves into position and place the remainder of the series of records on the shelves as shown in the illustration.

6. Push the index lever to "10" for a series of 10-inch records, or to "12" for a series of 12-inch records.

7. Push turntable switch "on" and when turntable has attained speed, lift the pickup and lower it gently on the record, so that the needle point enters the outside groove.

8. Adjust the radio-phonograph volume control for the desired volume, and adjust the tone controls for best reproduction.

9. Close the lid of the cabinet to eliminate mechanical sound. The whole series of records will play without further

attention, and the last record will repeat until the turntable switch or the power-bass control is turned off.

To reject a record being played, or to start the record-changing cycle in case the record just played does not have the standard eccentric or spiral stopping groove, simply push the index lever to the "reject" position and let go. The pickup will raise up and swing outwards and the next record will drop down. Upon releasing the index lever, it will automatically return to the "10" position. If playing a series of 12-inch records, the lever should be returned to the "12" position after rejecting a record. Keep the lever in at "manual" when not actually playing records automatically.

To stop the mechanism while a record is being played, push the index lever to "manual," place the pickup on its rest, and turn off the turntable switch.

To stop the mechanism at the completion of a record, first allow the pickup to complete its cycle (the cycle is completed when the pickup comes down on the record). Then push the index lever to "manual," place the pickup on its rest, and turn off the turntable switch.

When discontinuing operation, turn off both the turntable switch and power-bass control.

To remove a record from the turntable, lift the knobs on top of the record-holder posts, swing the shelves back clear of the records, and push back the vertical lever at left of the rear record post.

RECORD CHANGER SERVICE DATA

Before servicing the automatic record changer, inspect the assembly to see that all levers, parts, gears, springs, etc., are in good order and are correctly assembled.

The changer can be rotated through its change cycle by pushing the index lever to "Reject" and revolving the turntable by hand. Six turntable revolutions are required for one change cycle.

A bind or jam in the mechanism can usually be relieved by rotating the turntable in the reverse direction. The 10- and 12-inch records must be absolutely flat for smooth operation.

A pickup shorting switch, located under the motorboard, operates when the pickup is moved outward to the pickup rest.

The turntable in RP-155 can be removed by tapping smartly on the top of the spindle while pulling upward on opposite sides of the turntable.

Lubrication.—Petrolatum or petroleum jelly should be applied to cam, main gear, spindle pinion gear, lead screw and gears of record posts.

Light machine oil should be used in the tone arm vertical bearing, motor bearing, record post bearings, and all other bearings of various levers and pulleys on underside of motorboard and underneath turntable.

Do not allow oil or grease to come in contact with rubber idler wheel, bumper or rubber parts of the mechanism. Use quick drying naphtha to clean the rubber parts.

RCA MFG. CO., INC.

MODEL RP-155

RP-155 Recorder and Automatic Record-Changer Phonograph Mechanism

Insist on genuine factory-tested parts, which are readily identified and may be purchased from authorized dealers.

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
PICKUP AND ARM ASSEMBLIES					
36322	Arm—Pickup arm only—less crystal, cable and pivot arm and shaft	1.80	36838	Casting—Casting and bearing for turntable spindle and lead screw (50)	1.90
36320	Arm—Pickup pivot arm and shaft—less lift cable and rubber bushings	1.00	30340	Clip—Motor drive disc retaining clip	.02
34550	Bushing—Rubber bushing for pickup pivot arm	.05	36266	Clutch—Trip lever clutch (5)	.25
32635	Cable—Pickup lift cable	.24	36831	Disc—Motor drive disc and rubber tire	.75
35694	Cable—Pickup shielded cable (8)	.40	36265	Finger—Trip lever friction finger (7)	.50
33905	Crystal—Pickup crystal cartridge and needle screw	4.25	36267	Gear—Long arm and rack gear (41)	.60
33529	Screw—Pickup needle screw	.10	36839	Gear—Pinion gear for turntable spindle	.40
MOTOR ASSEMBLIES					
37039	Bearing—Bottom bearing and bracket assembled	.40	31121	Gear—Record separator shaft gear (10)	.90
37038	Field—Motor field complete	5.15	32880	Gear—Short arm and rack gear (40)	.55
36820	Motor—105-120 volts, 60 cycle	13.75	33982	Guide—Main lever spring guide (11)	.10
37037	Pulley—Motor shaft pulley	.20	36830	Guide—Pickup lift cable guide (2)	.10
37040	Ring—Motor pulley support ring	.03	36380	Lever—Index lever (12)	.70
37036	Rotor—Motor armature complete	2.90	36273	Lever—Locating lever and pawl (14)	1.05
MOTORBOARD ASSEMBLIES					
36824	Base—Pickup arm mounting base	.40	33985	Lever—Main lever (15)	.50
36821	Board—Motorboard with riveted and welded bearings and studs less operating mechanism	7.50	31140	Lever—Pickup lift cable lever (16)	.55
36822	Brace—Motorboard brace	.85	36381	Lever—Record discriminating lever (17)	.85
32556	Cable—Shielded pickup cable and plug	.75	36476	Lever—Record elevating lever and screws (18)	.80
36262	Cup—Used needle cup—insert only for pickup arm rest	.15	31132	Lever—Trip detaining lever (19)	.30
36258	Escutcheon—Index escutcheon	.26	36284	Lever—Trip lever less friction finger and clutch (20)	1.25
36260	Gauge—Pickup needle gauge	.15	31133	Pawl—Trip pawl assembly (22)	.80
36823	Mounting—Motor mounting screw, spacer, rubber cushion and washer (3 required)	.10	36268	Pin—Drive pin to engage gear to record separator shaft (23)	.05
30870	Plug—2-contact male plug for motor leads	.35	36834	Pin—Pin for turntable to hold disc while recording	.15
36379	Rest—Pickup arm rest—less needle cup	.25	36477	Screw—Ball point screw for record elevating lever "G"	.10
36798	Spring—Index lever spring (riveted to motorboard)	.20	31118	Screw—Cone pointed set screw for record separator shelf "H"	.08
37348	Weight—Lead weight for motor	2.25	36837	Screw—Lead screw and pinion gear for recorder drive (51)	1.90
HOME RECORDING ASSEMBLIES					
36829	Arm—Follower arm and post assembly	.80	33983	Screw—Record elevating lever pivot screw	.15
37041	Arm—Recorder arm less Recorder head	4.80	33990	Separator—Record separator knife (25)	1.85
36827	Bushing—Recorder arm pivot post bushing	.90	33988	Shaft—Record separator rotating shaft (34)	.70
37044	Nut—Special hex nut for recorder arm pivot bushing	.08	33989	Shelf—Record separator shelf (27)	1.25
36826	Plate—Straddle plate for recorder arm pivot post	.30	36838	Spindle—Turntable spindle	2.25
33166	Plug—2-contact male for recorder head leads	.20	3676	Spring—Cam pawl spring	.04
37042	Recorder—Recorder head only—less arm	11.50	3676	Spring—Discriminating lever pawl spring (28)	.08
36825	Rest—Recorder arm rest	.40	14190	Spring—Tension spring for motor idler pulley arm (52)	.05
37045	Screw—Recorder head needle screw	.10	36835	Spring—Flat spring for turntable recording disc pin	.08
36828	Spring—Recorder arm pivot post compressing spring (spiral)	.15	32436	Spring—Locating lever spring (35)	.05
37043	Spring—Recorder head tension spring	.10	32882	Spring—Main lever spring (43)	.05
37349	Weight—Lead weight for recorder head	1.00	3666	Spring—Pickup lift cable spring (31)	.04
OPERATING MECHANISM					
36832	Arm—Motor drive disc arm (53)	.25	33994	Spring—Record discriminating lever spring (flat) (9)	.05
36277	Bumper—Rubber bumper "A"	.10	36921	Spring—Trip detaining lever spring (33)	.03
33987	Cam—Cam and drive gear assembly (42)	2.00	36279	Spring—Trip pawl spring	.02
			36271	Stud—Trip lever clutch adjustment stud "E"	.08
			32875	Switch—Motor switch (4)	.30
			34875	Switch—Pickup shorting switch	.45
			36833	Turntable—Turntable assembly complete	4.00
			2917	Washer—"C" washer used to mount all levers except trip detaining lever	.03
			8078	Washer—"C" washer for mounting record discriminating lever	.06
			37046	Washer—Rubber washer for turntable drive wheel arm	.03
			20165	Washer—Spring washer to mount rack gears and trip detaining lever	.05

ALL PRICES ARE SUBJECT TO CHANGE OR WITHDRAWAL WITHOUT NOTICE.

Public Address

The microphone, amplifier, and loudspeaker in the Home Recorder forms a public address (PA) system, and may be mixed with the phonograph or radio.

The various combinations are shown in the illustration of the service selector control.

Microphone Volume "Contractor"

Models VHR-207 and 407 incorporate a "contractor" or sound leveller in the input circuit of the microphone pre-amplifier. This tends to prevent over-recording and distortion. Thus when shouting into the microphone, the contractor will lower the recorded sound sufficiently to make a good record yet preserve good contrast.

* The cuttings of discs with coatings of cellulose nitrate or other inflammable materials, which does not include the RCA paper-base discs, should be disposed of with special care. The threadlike cuttings or shavings must be carefully removed immediately after the record is made, and destroyed in a safe manner, as they are very inflammable.

** Approximate life is 15 minutes.

Blank Recording Discs*

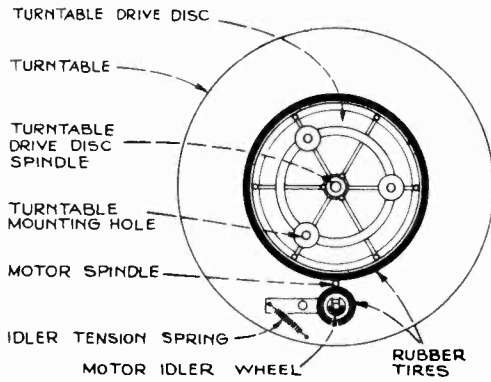
Type	Size	Unit pkg.	Part Number	List Price
"Phonogram"				
(Paper base)	6 1/2"	seven	none	\$1.05
Deluxe Metal Base				
(Aluminum base)	6 "	one	801-4	.40
	8 "	one	802-4	.55
	10 "	one	803-5	.80
Standard Metal Base				
(Steel Base)	6 "	one	801-9	.25
	8 "	one	802-9	.40

Styli (Cutting Needles) for Recording

Steel**	six	MI-4879A	2.00
Sapphire	one	MI-4878A	6.00

MODEL RP-158

RCA MFG. CO., INC.



Operation

The RP-158 is a record changing mechanism designed for the automatic playing of records. It will play twelve 10-inch or ten 12-inch records at a single loading.

To Operate:

1. Turn the record support located at the left front corner to the 10-inch or 12-inch position as desired.
2. Place the records on the record support and record separator posts.

Cycle of Operation

The changer can be conveniently rotated through the change cycle by pushing the reject button and revolving the

3. Push the turntable switch to the "On" position.
4. Press the "Start-Reject" button. The entire series of records will now play without further attention and the pickup will swing to its rest position at the end of the last record. (For completely automatic operation all records must have the standard eccentric tripping groove. Otherwise it may be necessary to press the "Start-Reject" button to change the record).
5. When the last record has been played, push the turntable switch to stop the turntable. The mechanism is now ready for another loading.
6. To reject a record being played, press the "Start-Reject" button.

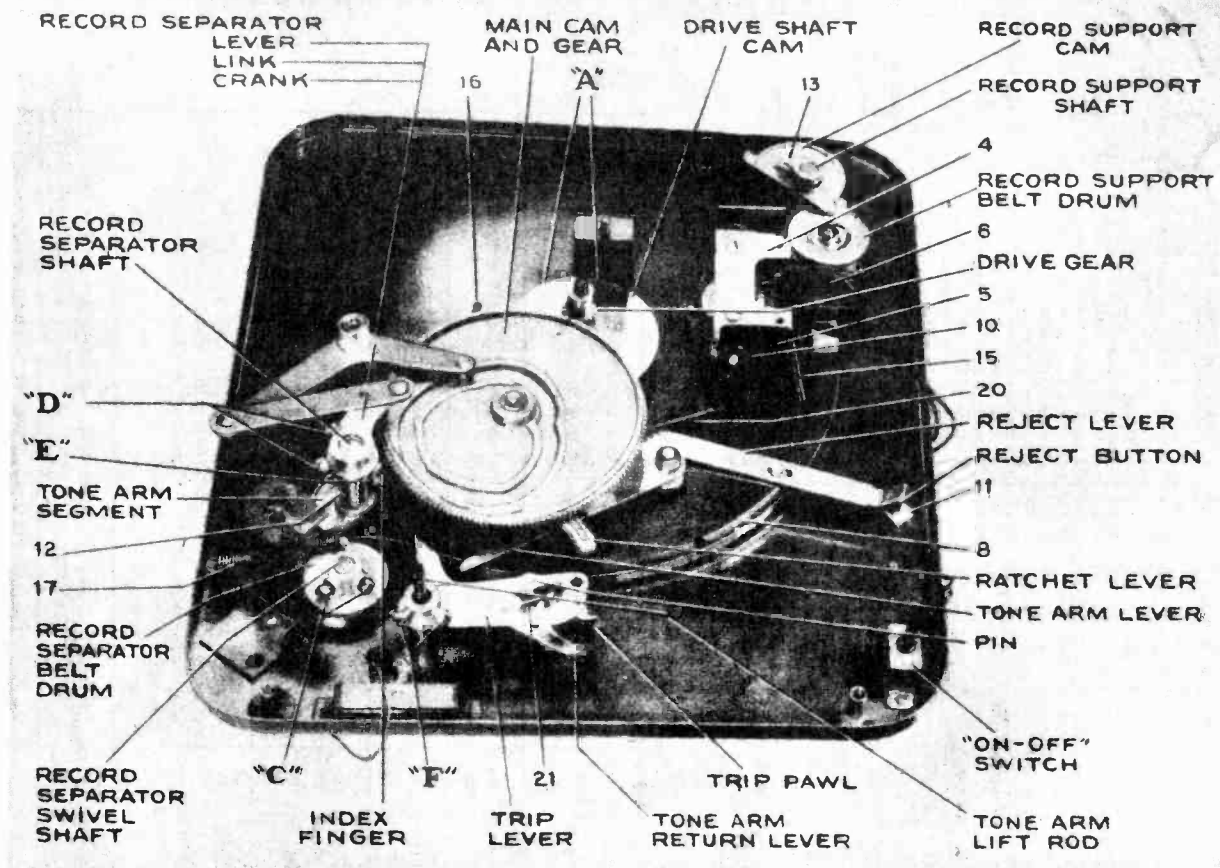
Lubrication

The RP-158 turntables are driven by a drive disc screwed to the turntable. It is important that the drive motor spindle and the rubber tire on the friction drive disc as well as that on the idler wheel be kept clean and free from oil, grease, dirt, or any foreign material at all times. Any quick drying naphtha is satisfactory for cleaning these parts. The drive motor bearing is lubricated from felt washers at the bottom and top. A light machine oil should be used at these points.

On all bearing surfaces except the motor bearings Hough-ton Stayput No. 320 should be used. On all other surfaces Lubriplate No. 110 is recommended.

turntable by hand. Eight turntable revolutions are required for one change cycle.

	Function	Explanation
Operator	Turn Record Support to 10" or 12" Position as Desired	1. Separator post positions itself by means of belt drive.
	Place Records on Posts	1. Separator shaft is pushed down against its spring and carries segment out of path of index finger.
	Press Start Button	1. Reject lever moves in and pushes ratchet lever. 2. Ratchet lever is pushed out of eccentric step on main gear shaft and releases drive cam pawl. 3. Drive cam pawl engages toothed wheel and it revolves carrying drive gear with it.
Automatic Cycle	Tone Arm Rises	1. Main cam and gear revolves with drive gear. 2. Stud on tone arm lever rides in top track on main cam and directs movement of the lever. 3. Tone arm elevating lever rides up on ridge on main cam and pushes tone arm up by means of elevating rod.
	Tone Arm Moves Out	1. Tone arm lever pushes on trip lever stud. 2. Trip lever moves out. 3. Tone arm return lever is carried along by trip lever stud, and by stud on main cam top track.
	Record Knife Separates Bottom Record from Stack after Gauging Thickness of Record	1. Stud on separator lever follows main cam bottom track and directs the motion of the lever. 2. Through the separator link and crank, the separator lever turns the separator shaft. 3. Knife turns with shaft and strikes edge of bottom record. 4. Separator shaft continues to revolve and teeth on inner circumference of knife ride up on shelf teeth until knife is carried high enough against the action of spring 19 to move in over top of record.
	Record Drops to Turntable	1. Separator shaft continues to turn until knife supports stack of records and shelf moves out from under bottom record.
	Tone Arm Moves In	1. Separator shaft reverses rotation. 2. Tone arm lever moves away from trip lever stud. 3. Tone arm return lever pushes on trip lever stud. 4. Trip lever moves in.
	Tone Arm Lowers Sapphire on to Record	1. Index finger on tone arm return lever moves against separator shaft to insure proper landing position. 2. Tone arm elevating lever rides down on main cam ridge thus lowering the elevating rod and the tone arm. 3. Separator shaft returns knife to original position and allows stack of records to rest on shelf.
	Sapphire Moves In to Music Groove Record Begins to Play	1. Feed-in spring on tone arm return lever pushes against stud on trip lever. 1. Ratchet lever rides down into eccentric step on main gear shaft and blocks drive cam pawl. 2. Pawl is disengaged from drive cam wheel. 3. Drive gear and main gear stop.



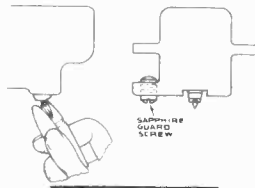
Function of Principal Levers

Main Cam and Gear	Directs and coordinates all cycle operations.	Tone Arm Elevating Lever	Directs vertical motion of tone arm.
Tone Arm Lever	Directs horizontal motion of tone arm.	Tone Arm Elevating Rod	Transfers motion of elevating lever to tone arm.
Tone Arm Return Lever	Keeps tone arm moving in with receding tone arm lever and provides proper landing.	Reject Lever	Starts automatic cycle at will of operator.
Trip Lever	Its latch acts on ratchet lever to start the automatic cycle.	Separator Knife	Separates record from stack and supports stack during cycle.
Record Separator Lever Train (Lever-Link-Crank)	Directs motion of separator knife and shelf.	Separator Shelf Drive Gear	Supports stack during playing time.
Ratchet Lever	Transfers motion from trip lever or reject lever to start automatic cycle.	Drive Cam Pawl and Wheel	Transfers motion of turntable to main cam and gear.
			Engage to connect turntable spindle to drive gear during cycle.

ALSO SAME FOR MODEL RP - 162

As an additional precaution against rough handling, the top of the sapphire is dipped in a rubber cement (such as Goodrich "Plastic") before being inserted in the pickup. To remove the sapphire, grasp it firmly with a pair of tweezers, give it a few turns to loosen the cement and then pull it out. Much easier handling of the sapphire will result if the tweezers are

Replacement of Sapphire



notched with a file as shown. Naphtha may be used as a thinner should difficulty with the rubber cement be experienced.

Before inserting the new sapphire it should be dipped in the rubber cement previously thinned with naphtha. After insertion clean the point with naphtha if there is any doubt as to the presence of cement.

To Remove the Turntable.—

To remove the turntable, loosen set screws "A" and lift the turntable up.

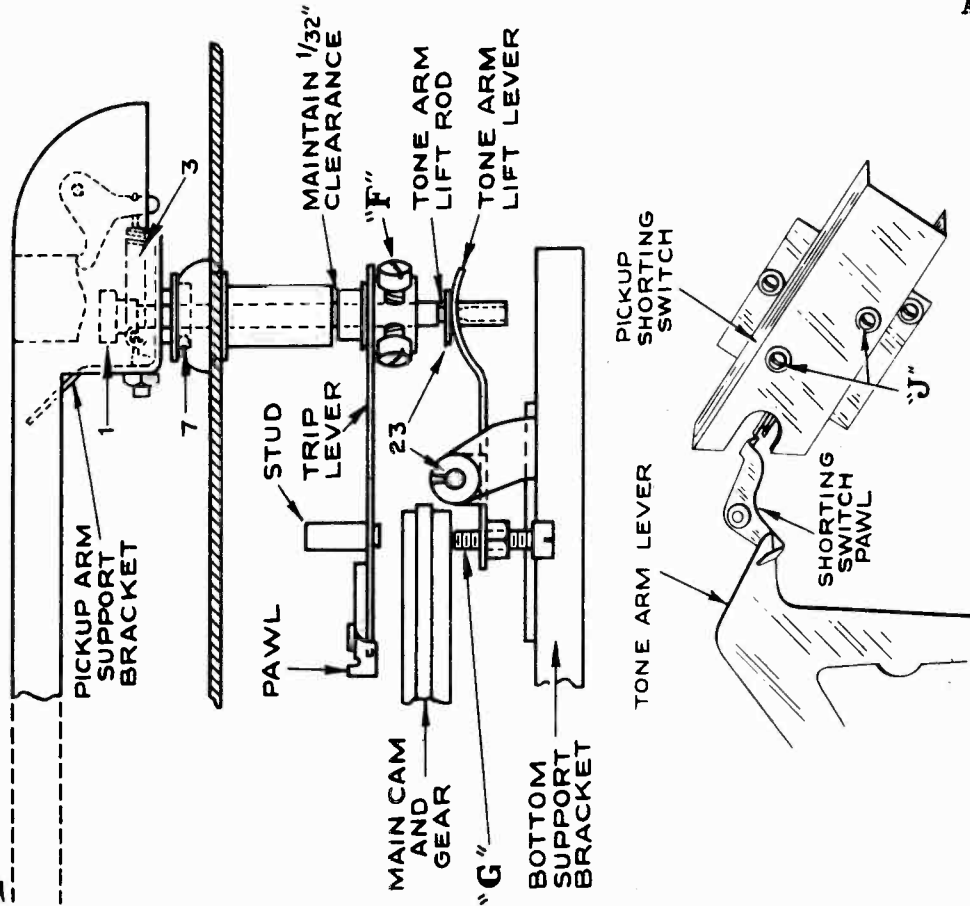
To Remove Pickup Arm.—

One of the tone arm bearings has a slotted head and can be turned out to facilitate removal of the tone arm. Raise the tone arm and loosen the bearing set screw. Turn the bearing partly out through the hole in the side of the tone arm and lift the arm off.

RCA MFG. CO., INC.

MODELS RP-158,
RP-160 Series
Adjustments

SAPPHIRE MUST CLEAR TURNTABLE AT LEAST $1\frac{3}{16}$ INCHES WHEN PICKUP ARM IS RAISED.



Details of Pick-Up Arm

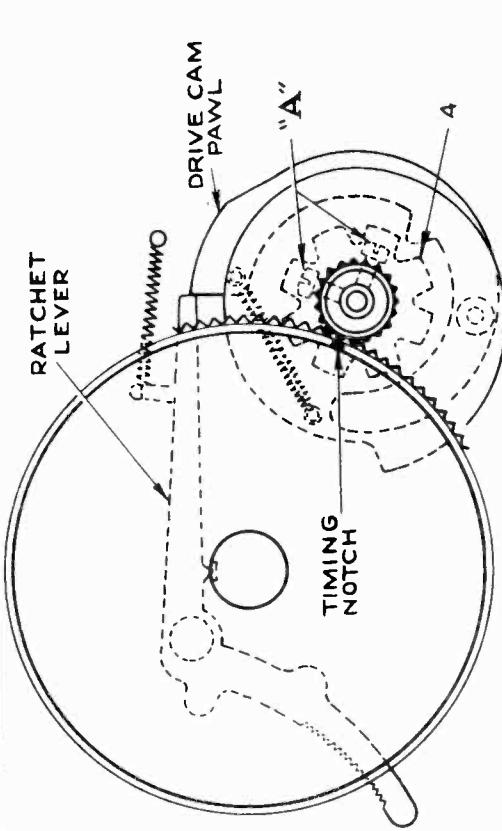
In this view we see very clearly the lever system which rides against the bottom face of the main cam and gear at the outer edge which exerts pressure on the pickup arm lift rod in order to lift the pickup up clear of the record at the proper time during cycle. Rotate the changer through cycle until the pickup arm has risen to its maximum height above the turntable but has not begun the move out. At this point, adjust the screw "C" until the distance between the turntable and the sapphire is not less than one and three-sixteenths of an inch. Setting this adjustment so that the pickup rises somewhat higher than this dimension usually will do no harm. However, a check should always be made that the top of the pickup does not strike against the bottom of a stack of ten 12" records loaded on the mechanism. Also, if the pickup arm is adjusted to rise too high when the mechanism shuts off at the completion of playing the last record there is a possibility that the pickup may not remain down on the stop switch but that it may come down, hit the switch, and then jump off. Make sure that the lock nut is securely tightened after this adjustment has been made.

In this view we also see the rubber button marked "I". When the pickup arm lift rod is holding the pickup up above the record this button provides sufficient friction so that an appreciable amount of force is required to swing the pickup arm inward over the record. Because of this the feed-in spring (mounted on the pickup arm return lever) will be compressed while the return lever is moving the pickup arm inward to the playing position and will not be released until the sapphire point touches the record at which time the spring will push the pickup into the music groove. The feed-in spring should be bent so that it always pushes the pickup into the music groove but does not push inward hard enough to make the pickup jump the first few grooves.

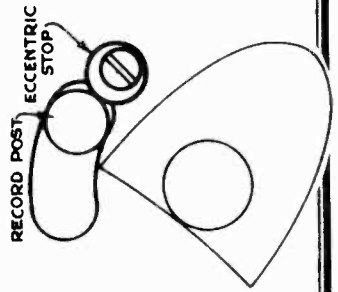
The two set screws marked "J" in this view should be loosened and the shorting switch moved sufficiently in its housing so that the shorting switch contact points are closed while the mechanism is in cycle and are opened approximately $1/16$ " when the mechanism is out of cycle. Shorting the pickup during cycle in this manner is necessary due to the high amount of audio gain employed in order to prevent vibration noises caused by the changer going through cycle from being heard in the loudspeaker.

MODELS RP-158,
RP-160 Series
Adjustments

RCA MFG. CO., INC.

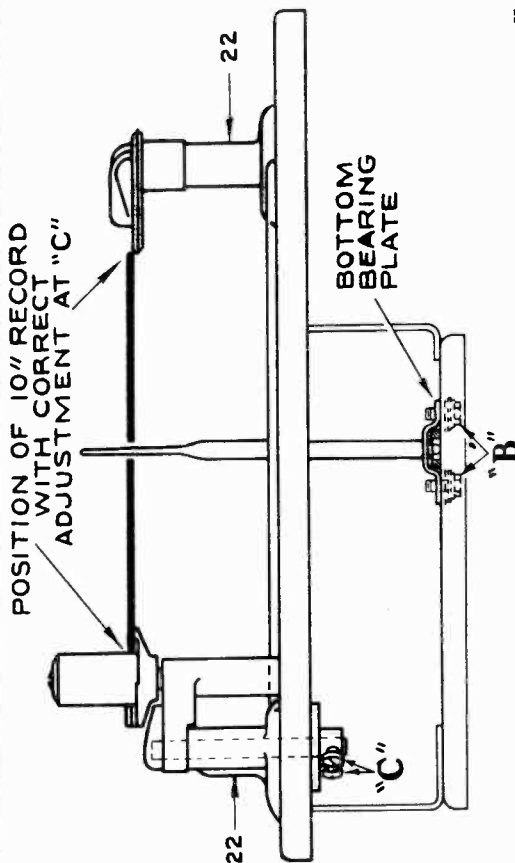


Here we see the correct timing position of the mechanism. This, of course, refers to the proper mesh of the gear teeth on the drive cam and gear with the main cam and gear. For convenience in setting this timing, a notch is marked in the main cam and gear which should be turned to the position shown in this view when the drive cam and gear are likewise in the position shown in this view. This adjustment is set properly at the factory and unless it has been changed in the field there will never be any occasion to retime the mechanism. However, if it has been changed, all that is necessary is to slip the gears out of mesh and put them in the positions shown in this view and then slip them back into mesh again. When tightening the two set screws marked "A" in this figure which fasten the star wheel to the turntable spindle, care must be taken to leave sufficient vertical clearance so that there will be no binding and that the turntable can rotate freely.



FOR MODEL 160, ONLY

The twelve-inch position is adjusted after that of the 10" record, by changing the support post to take the 12" record, and turning the eccentric stop until the edge of the record is halfway up on the record support bevel while the other edge is against the record separator post.



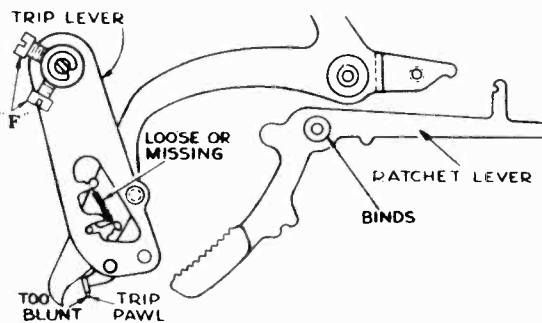
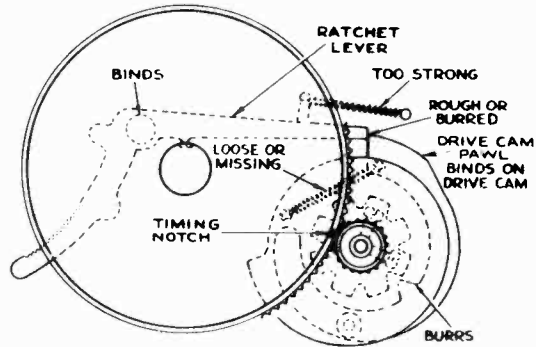
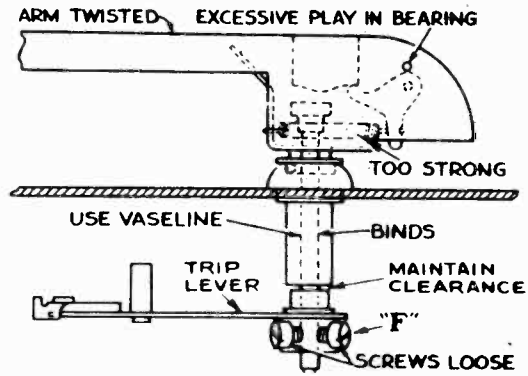
The turntable spindle rotates in two bearings which must be perfectly lined up. One is permanently fastened to the motor board and the other is fastened by means of set screws through clearance holes marked "B" in this figure to the bottom plate. In making this adjustment, the screws marked "B" should be loosened and the bottom bearing plate moved from side to side as necessary until the turntable can rotate with maximum freedom. When this is properly done, a check can easily be made by applying power to the mechanism so that the turntable is rotating at normal speed and then shutting off the power. After this shut-off, the turntable should coast for approximately twelve complete revolutions before coming to a stop.

Next the position of the record separator post should be checked. To do this, turn the main record support post to the 10" position and loosen the set screws marked "C", hold the separator post against the end of its slot in the motor board and turn the belt drum to take up any slack in the belt. Tighten the zinc plated blunt nose screw and check to see that a 10" record fits the post properly. Then tighten the copper plated cone pointed set screw.

On Model 158, only, the twelve inch position is automatically maintained.

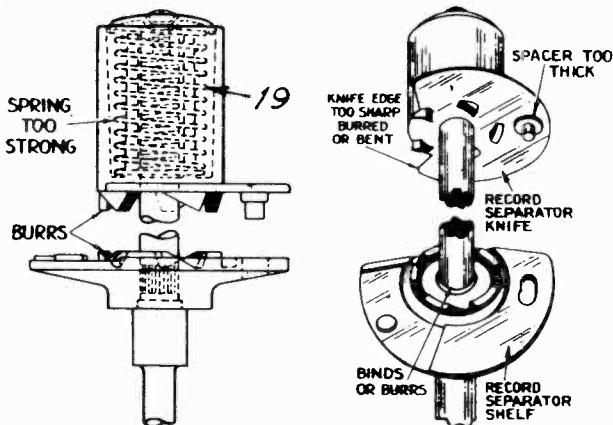
Fails to Trip:

First check adjustment "F" Do not tighten screws "F" too tightly or the hollow pivot shaft will be distorted.



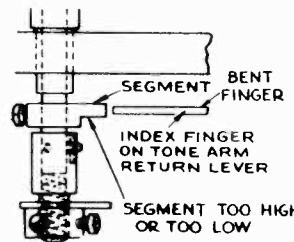
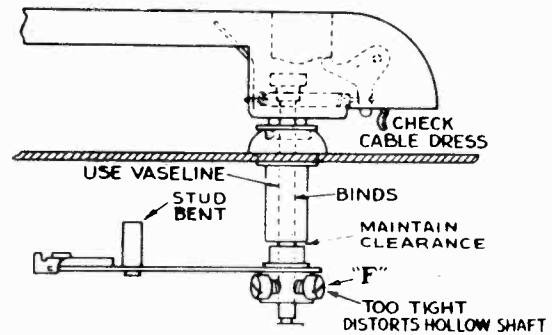
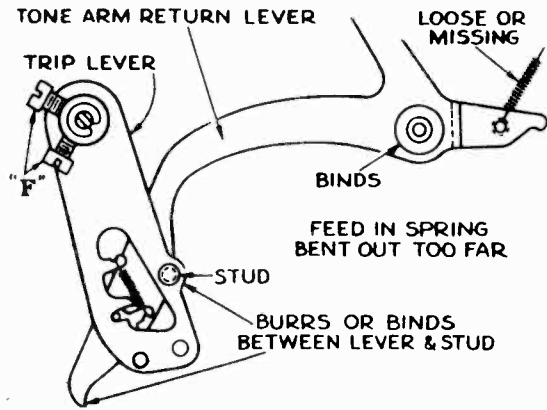
Jams Records:

Record too thick, too thin, warped, or has rough edge.

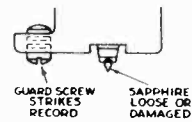


Lands Incorrectly:

First check adjustments "F", "C", "M", "E".

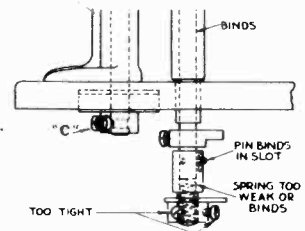


Fails to Track or Distorts:



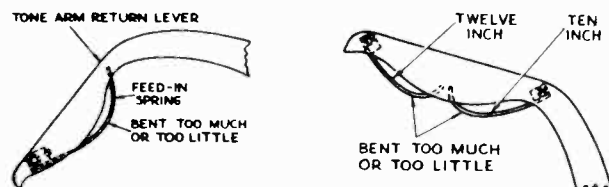
Repeats Playing of Last Record:

First check adjustment "E".



Incorrect Feed-in:

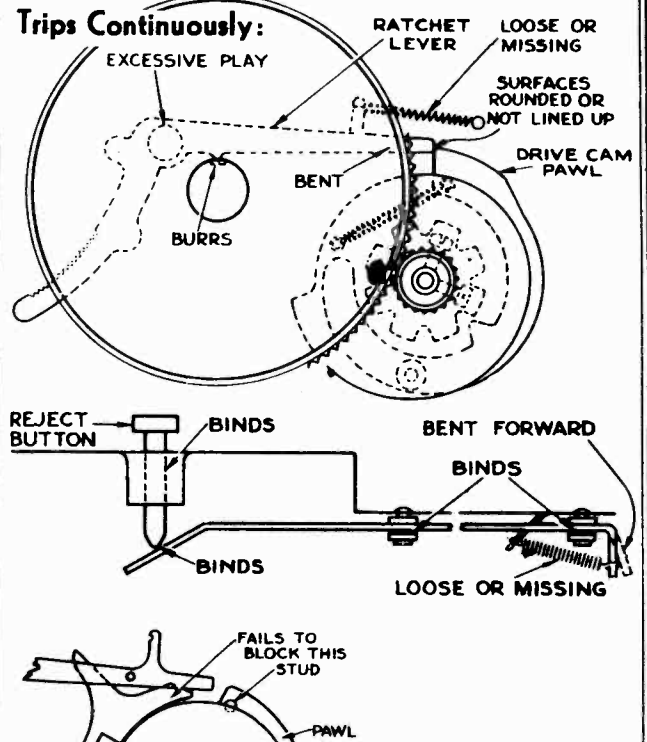
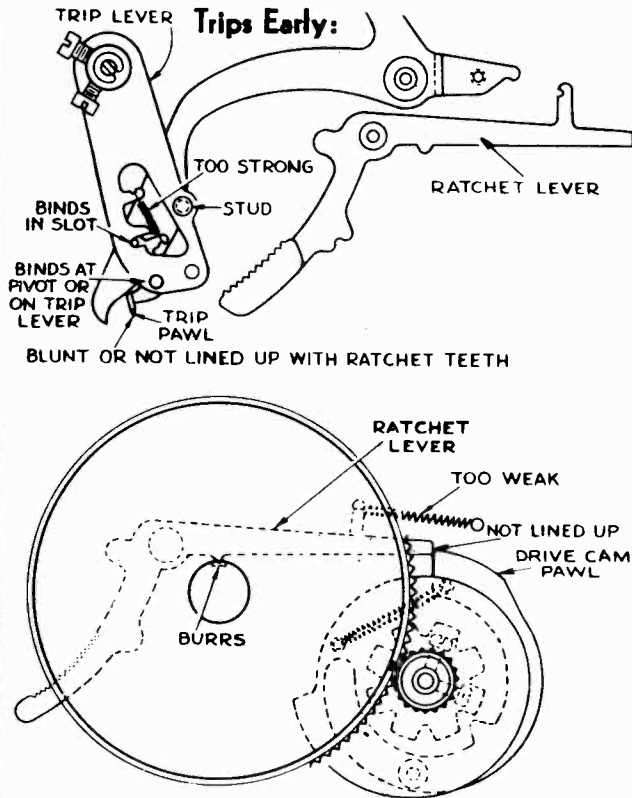
The feed-in spring does not have any effect until just after the pickup has landed on the record. It then springs back to its original shape pushing against the trip lever stud and moving the pickup toward the music grooves.



MODELS RP-158, RP-160
Series, RP-162

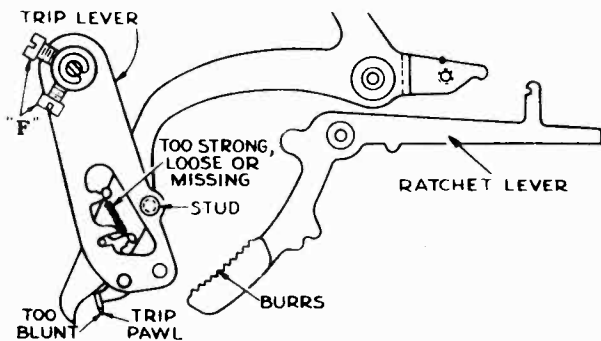
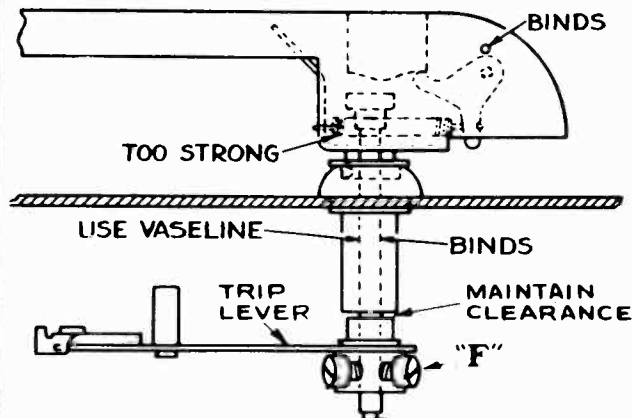
RCA MFG. CO., INC.

Illustrated Hints



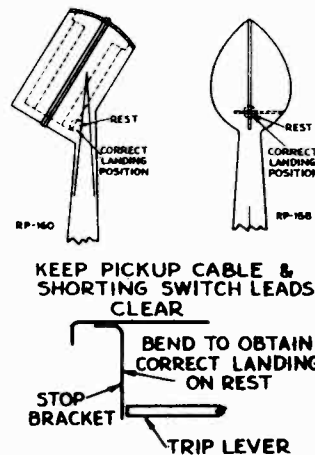
Repeats Grooves:

First check adjustment "G".

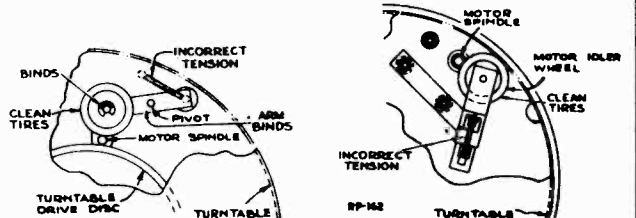


A replacement sapphire for the RP-158 and RP-162 crystal pickup is available as Stock No. 39564, list price \$2.00.

Incorrect Landing on Rest:

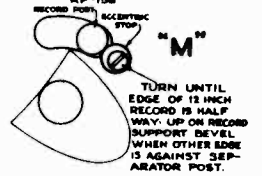


Slow Speed: Turntable spindle binds on bottom bearing.
Incorrect tension on motor support spring.

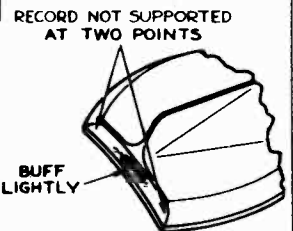


12-Inch Record Post Spacing:

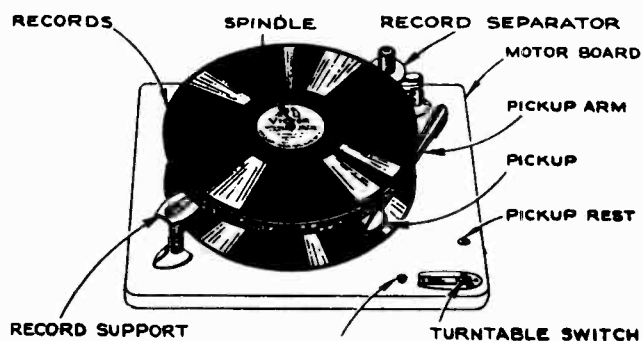
THIS ADJUSTMENT HAS BEEN ADDED ON LATE PRODUCTION RP-158



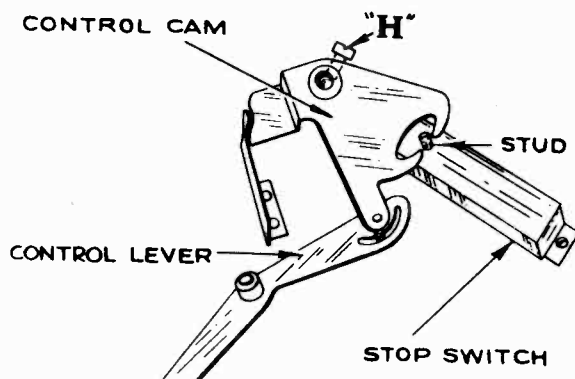
Record Stack Unsteady:



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MODELS RP-158, RP-160
Series, RP-162

Perspective view of top of record changer. Models: RP-158, RP-162



ADJUSTMENTS FOR MODELS RP-158, 160

Control Cam and Stop Switch

The relationship between the start-reject lever on top of the motor board and the control cam shown in this view is governed by the rotation of the control cam with respect to the shaft coming down through the motor board from the start-reject lever. The control cam should be turned so that the stud on the stop switch is centrally spaced between the control cam jaws as shown in this view when the start-reject lever is turned to its middle or "AUTOMATIC" position. Sufficient vertical clearance must be allowed so that there will be no binding and then the set screw "H" should be securely tightened.

FOR MODEL RP-162 only

Cabinet Leveling.—

If the sapphire fails to enter the starting groove, raise the right-hand side of the cabinet by inserting thin spacers under the legs. If the pickup slides over a few grooves, raise the left-hand side of the cabinet.

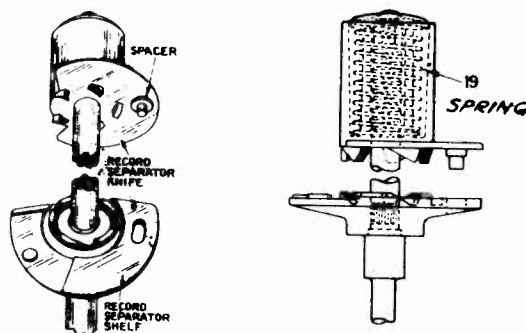
Sapphire Pressure.—

In these mechanisms, the correct pressure is approximately 4 ounces, measured at the sapphire. Adjust the spring (3) in the tone-arm base if necessary.

FOR MODELS: RP-158, 160 series, 162

Before servicing the automatic changer, inspect the assembly to see that all gears, cams, springs, levers, etc., are correctly assembled and in good working order.

1. Never use force to start or stop the motor or any part of the record changing mechanism.
2. Warped or damaged records may cause the mechanism to jam.
3. A cracked or chipped record may damage the sapphire.
4. Warped records may slide on one another while playing and result in unsatisfactory reproduction.
5. Do not leave the records on the record posts or on the turntable as they may warp, particularly in warm climates. Warped records may be flattened by placing them on a flat surface with a heavy flat article placed on top of them for a few days.
6. If, for any reason, the mechanism stalls, turn off the turntable switch and remove the records from the posts. Start the turntable by turning the switch on and allow the pickup arm to complete its cycle.
7. Do not tighten copper-plated, cone-pointed screws until final adjustment has been made.



Illustrations Show Details of Record Separator
SAME FOR RP-158, 160 series, 162

To Remove the Turntable.—

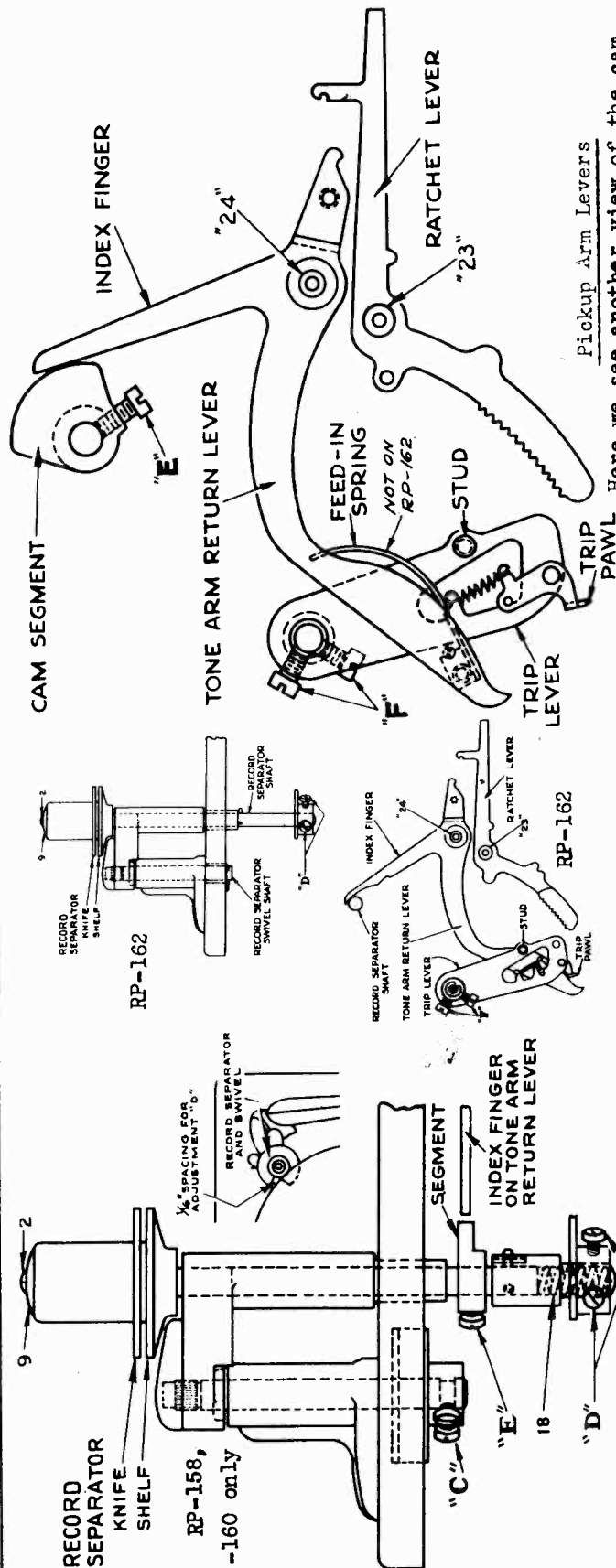
To remove the turntable, loosen set screws "A" and lift the turntable up.

To Remove Pickup Arm.—

One of the tone arm bearings has a slotted head and can be turned out to facilitate removal of the tone arm. Raise the tone arm and loosen the bearing set screw. Turn the bearing partly out through the hole in the side of the tone arm and lift the arm off.

MODELS RP-158, RP-160
Series, RP-162

RCA MFG. CO., INC.



Record Separator Post Adjustment ON ALL

Place a 10" record on the mechanism. Loosen the set screws "D" and turn the record separator shaft until the edge of the record separating knife is 1/16" away from the edge of the record as shown in this view. When making this adjustment, the teeth on the bottom of the record separating knife must be down snugly in the bottom of their slot in the shelf. Tighten the zinc plated screw first, run through cycle several times as a check, then tighten the copper plated screw.

Take all records off the post and be sure that the record separator post has moved to its upward position. Loosen the set screw "E". Set the cam segment so that the pickup arm return lever rides on the middle of the segment as shown. Rotate the cam until it is in such a position that the pickup arm return lever will never ride off either end when the post is rotated during cycle. Check and see that the pickup arm return lever rides in over the top of the cam when the record shelf is depressed. Then re-tighten the set screw "E".

The space between the record separator knife and the record separator shelf should be just the thickness of a 10" record. If necessary, use a bit of emery cloth to smooth the edge of the knife so that it is not sharp, since sharpness might cause the knife to chip the edge of a thick record, or one with a rough edge.

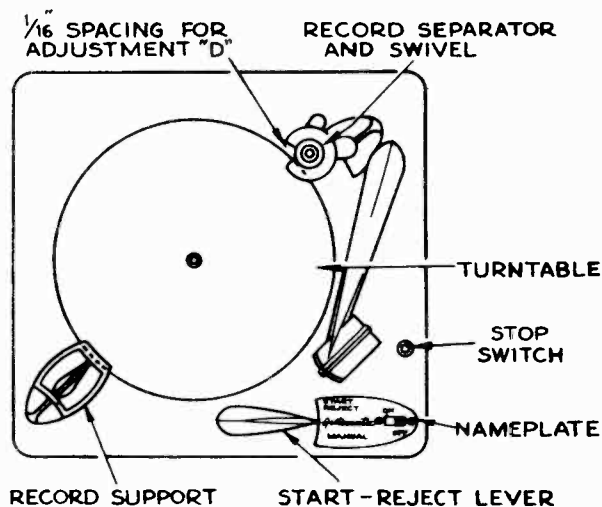
Pickup Arm Levers

Here we see another view of the cam segment covered by adjustment "E" in the slide which was just shown.

Place a 10" record on the turntable and rotate the changer through cycle until the sapphire is just ready to land. Make sure that the pickup arm return lever is against the record separator shaft and that the pickup arm trip lever stud is held firmly against the return lever with the feed-in spring compressed. Loosen set screws "F" and move the pickup arm to the correct landing position. Be sure that there is 1/32" clearance between the pickup arm bearing and the trip lever hub ^{OR SET SCREW COLLAR}. Tighten zinc plated screw, run the changer through cycle several times as a check, then tighten the copper plated screw. The 12" landing position is automatically maintained.

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MODEL RP-160 Series



This mechanism is designed to play a series up to twelve 10-inch, or ten 12-inch records of the 78 r.p.m. type. It will also play single records of any diameter up to 12 inches.

Features Include—

1. Light-pressure sapphire-point plug-in crystal pickup.
2. Positive ratchet trip, actuated by eccentric groove at end of record.
3. Safety clutch, relieves strain on mechanism due to jamming. (The clutch makes a clicking sound if the mechanism jams.)
4. Stop switch, shuts off the motor after the last record is played. This switch is the pickup "rest."
5. Pickup shorting switch, shorts pickup during record-changing cycle to prevent noise.
6. Simplified mechanism.

Manual Operation

1. See that the mechanism is out of cycle, with the pickup on its rest.
2. Set the "start-reject" lever at "manual."
3. Place record on turntable and push turntable switch "on."
4. Lift the pickup and set it down on the record.
5. When the record is finished, the pickup will swing in the eccentric groove, or run in the last groove, until the power is shut off.
6. Lift the pickup and place it on its rest.

Cabinet Leveling.—

If the sapphire fails to enter the starting groove, raise the right-hand side of the cabinet by inserting thin spacers under the legs. If the pickup slides over a few grooves, raise the left-hand side of the cabinet.

Tone Arm Feed-in Spring.—

When the sapphire comes down on the record, the feed-in spring (shown in adjustment sketch "E," acts to push the tone arm toward the music grooves. The spring should be adjusted to do this without causing the sapphire to skip grooves. This action is also related to—

Do not oil the record separator shaft.

It is important that the drive motor spindle and the rubber tire on the friction drive disc as well as that on the idler wheel

Automatic Operation

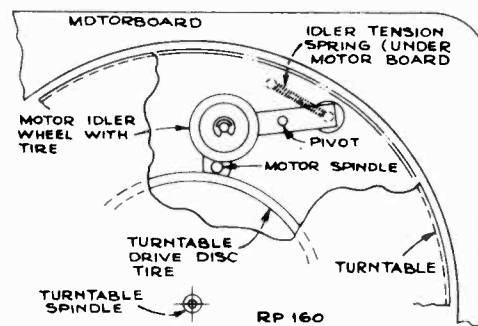
The pickup "rest" is a button on the stop switch that opens the motor circuit when the pickup comes down on the rest after completion of the cycle following the last record. Before starting automatic operation, see that the mechanism is out of cycle and that the pickup is on its rest. If it is not, start the motor and allow to run until the pickup comes down on its rest.

1. Turn the "record support" in front left-hand corner, to its position for 10-inch or 12-inch records as required. Turning the front record support automatically positions the rear support.
2. Load the records on the supports, with required selections upward, the last record to be played on top. **Be sure that the rear record support is pushed down.**
3. Push turntable switch "on."
4. Push the "start-reject" lever towards the back to its "start-reject" position, and let go. The first record drops on turntable, and the pickup moves onto the record.
5. When the last record is finished, the pickup moves out and comes down on its rest. This depresses the rest button and opens the stop switch, thus shutting off the motor.
6. To reject a record being played, push the "start-reject" lever to "start-reject," and let go.
7. For automatic operation, each record must have the standard eccentric groove.

Lubrication

The drive motor bearing is lubricated from felt washers at the bottom and top. A light machine oil should be used at these points.

On all bearing surfaces except the motor bearings Houghton Stayput No. 320 should be used. On all other surfaces Lubriplate No. 110 is recommended.



To Remove the Turntable.—

To remove the turntable, loosen set screws "A" and lift the turntable up.

To Remove Pickup Arm.—

One of the tone arm bearings has a slotted head and can be turned out to facilitate removal of the tone arm. Raise the tone arm and loosen the bearing set screw. Turn the bearing partly out through the hole in the side of the tone arm and lift the arm off.

Sapphire Pressure.—

In these mechanisms, the correct pressure is from 1 to $1\frac{1}{4}$ ounces, measured at the sapphire. Adjust the spring (3) in the tone-arm base if necessary.

be kept clean and free from oil, grease, dirt, or any foreign material at all times. Any quick drying naphtha is satisfactory for cleaning these parts.

MODEL RP-160 Series

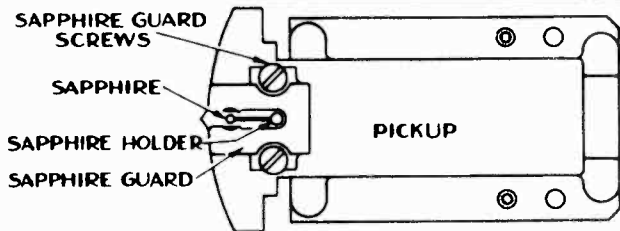
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Cycle of Operation

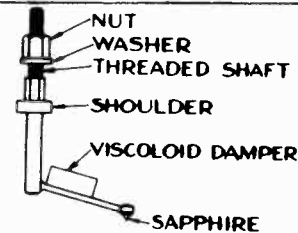
The changer can be conveniently rotated through the change cycle by pushing the reject button and revolving the turntable by hand. Eight turntable revolutions are required

for one change cycle. Block up the motor, so it is disengaged from the drive disc, to permit easier manual rotation of the turntable.

Function	Explanation	
Operator	Turn Record Support to 10" or 12" Position as Desired	1. Separator post positions itself by means of belt drive.
	Place Records on Posts	1. Separator shaft is pushed down against its spring and carries segment-cam out of path of index finger.
	Press Start Button	1. Reject lever moves in and pushes ratchet lever. 2. Ratchet lever is pushed out of eccentric step on main gear shaft and releases drive cam pawl. 3. Drive cam pawl engages cam sprocket and it revolves carrying drive gear with it.
Automatic Cycle	Tone Arm Rises	1. Main cam and gear revolves with drive gear. 2. Stud on tone arm lever rides in top track on main cam and directs movement of the lever. 3. Tone arm elevating lever rides up on ridge on main cam and pushes tone arm up by means of elevating rod.
	Tone Arm Moves Out	1. Tone arm lever pushes on trip lever stud. 2. Trip lever moves out. 3. Tone arm return lever is carried along by trip lever stud, and by stud on main cam top track.
	Record Knife Separates Bottom Record from Stack after Gauging Thickness of Record	1. Stud on separator lever follows main cam bottom track and directs the motion of the lever. 2. Through the separator link and crank, the separator lever turns the separator shaft. 3. Knife turns with shaft and strikes edge of bottom record. 4. Separator shaft continues to revolve and teeth on inner circumference of knife ride up on shelf teeth until knife is carried high enough against the action of spring 19 to move in over top of record.
	Record Drops to Turntable	1. Separator shaft continues to turn until knife supports stack of records and shelf moves out from under bottom record.
	Tone Arm Moves In	1. Separator shaft reverses rotation. 2. Tone arm lever moves away from trip lever stud. 3. Tone arm return lever pushes on trip lever stud. 4. Trip lever moves in.
	Tone Arm Lowers Sapphire on to Record	1. Index finger on tone arm return lever moves against separator shaft to insure proper landing position. 2. Tone arm elevating lever rides down on main cam ridge thus lowering the elevating rod and the tone arm. 3. Separator shaft returns knife to original position and allows stack of records to rest on shelf.
	Sapphire Moves In to Record Groove Record Begins to Play	1. Ratchet lever rides down into eccentric step on main gear shaft and blocks drive cam pawl. 2. Pawl is disengaged from drive cam sprocket. 3. Drive gear and main gear stop. 4. Tone arm lever moves into cam to maintain disengagement.



Replacing Sapphire in Pickup



Specifications Output at 400 cycles 0.50 volts
Impedance at 1,000 cycles 75,000 ohms

Replacement of Complete Unit Simply slide the unit out of the tone arm and insert a new one.

Replacement of Sapphire Caution: Never bend the sapphire support wire. Slide the pickup forward out of the arm.

The nut on the sapphire holder assembly is locked by a light cement (such as Glyptal). Extreme care should be used when loosening the nut so that the twisting motion does not break the crystal.

Remove the two screws holding the sapphire guard in place and take the guard off. Remove the small nut and washer on the threaded shaft of the sapphire holder and push the shaft

through the hole in the viscoloid until the sapphire holder assembly comes free.

Insert threaded shaft of replacement sapphire holder through viscoloid and replace the washer and nut. Make sure that the flat sides of the shaft are firmly in place in the clamp and then tighten the nut very carefully so as not to strip the threads nor break the crystal. Replace the sapphire guard, positioning it by means of the oversize screw slots. Make certain that the sapphire and its supporting wire are centered in the guard. Tighten the guard screws. Before using, check to see that the sapphire projects far enough beyond the guard so that the guard will not strike the record. If necessary, bend the guard a little. Apply a drop of light cement (such as Glyptal) to the sapphire nut holder.

Bend the spring contacts to make good contact with the slides in the tone arm.

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MODEL RP-160 Series

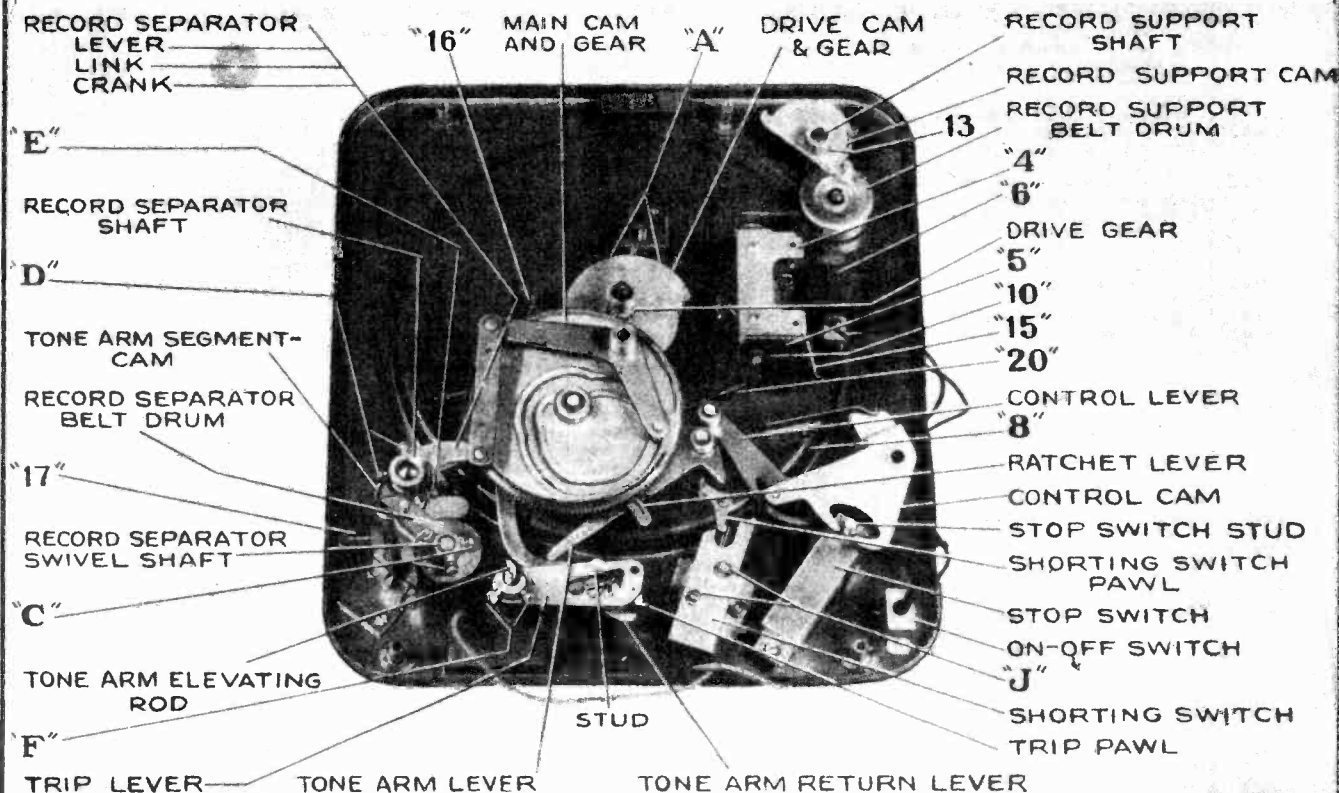
Before servicing the automatic changer, inspect the assembly to see that all gears, cams, springs, levers, etc., are correctly assembled and in good working order.

1. Never use force to start or stop the motor or any part of the record changing mechanism.
2. Warped or damaged records may cause the mechanism to jam. When jamming occurs, the safety clutch slips, causing a clicking sound.
3. A cracked or chipped record may damage the sapphire.
4. Warped records may slide on one another while playing and result in unsatisfactory reproduction.

5. Do not leave the records on the record posts or on the turntable as they may warp, particularly in warm climates. Warped records may be flattened by placing them on a flat surface with a heavy flat article placed on top of them for a few days.

6. If, for any reason, the mechanism stalls, turn off the turntable switch and remove the records from the posts. Start the turntable by turning the switch on and allow the pickup arm to complete its cycle.

7. Do not tighten copper-plated, cone-pointed screws until final adjustment has been made.

**Trip Lever**

When the tone arm swings in the eccentric groove, the trip lever latch acts on the ratchet lever to start the automatic cycle.

Ratchet Lever

Transfers motion from trip lever or control lever to start automatic cycle by allowing pawl to engage with sprocket of safety clutch.

Drive Cam Pawl and Sprocket (This is the "safety clutch")

Engages turntable spindle to drive gear during cycle (see sketch "A").

Drive Gear

Transfers rotation of turntable spindle to main cam and gear when the clutch is engaged.

Main Cam and Gear

Has four "tracks" which control horizontal and vertical motion of tone arm,

Function of Principal Levers

and rotation of record separator knife and shelf. The bushing on this gear governs position of the ratchet lever.

Control Cam and Lever

In "manual" position, it keeps the motor stop switch closed, and disengages the ratchet lever and safety clutch so the mechanism cannot go into cycle.

In "automatic" position, it permits operation of the ratchet lever, safety clutch, and stop switch.

In "start-reject" position, it closes the motor stop switch, and moves the ratchet lever away from the drive cam pawl, permitting the clutch to engage and thus start the change cycle.

*** Shorting Switch Pawl**

Closes the pickup shorting switch when the pickup is outside the 12-inch landing position.

Tone Arm Lever

Directs horizontal motion of tone arm.

Tone Arm Return Lever

Keeps tone arm moving in with receding tone arm lever and provides proper landing.

Tone Arm Elevating Lever

Directs vertical motion of tone arm.

Tone Arm Elevating Rod

Transfers motion of elevating lever to tone arm.

Record Separator Lever Train (Lever-Link-Crank)

Directs motion of separator knife and shelf.

Separator Knife

Separates record from stack and supports stack during cycle.

Separator Shelf

Supports stack during playing time.

Replacement Parts

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
	PICKUP AND ARM (Aluminum Arm) (Aluminum Case Crystal)		38653	Board—Motorboard with all welded or riveted studs, posts, or bearings — less operating mechanism	8.00
38650	Arm—Pickup arm shell (aluminum casting) less crystal, cable, and pivot arm	1.90	38630	Brace—Angle brace, or bottom support bracket and bearing plate	.65
38603	Arm—Pivot arm and shaft for pickup arm—less spring	.95	38620	Bushing—Record separator shaft end bushing	.30
35694	Cable—Shielded pickup cable—connects pickup to shorting switch	.40	38668	Button—Stop switch button	.10
38453	Crystal—Pickup crystal cartridge with sapphire and holder	6.50	39386	Cable—Shielded pickup cable and plug—connects shorting switch to amplifier	.60
38607	Cushion—Rubber cushion (1) for pickup arm push rod	.20	38627	Cam—Drive shaft cam and pawl—less spring	.70
38451	Damper—Viscoloid damper for sapphire holder	.10	38641	Cam—Main cam	1.50
38452	Guard—Needle guard	.06	38646	Cam—Record support shaft cam	.40
38450	Nut—Special nut and washer for sapphire holder	.30	38470	Cap—Record separator cap (9)	.50
38458	Nut—Speed nut to hold cable in pickup arm	.05	38665	Cover—Stop switch cover and stud	.25
38606	Rod—Pickup arm push rod—less cushion	.50	38657	Disc—Turntable drive disc and spindle	2.50
38449	Sapphire—Sapphire and holder—less nut	3.50	38463	Drum—Record separator belt drum	.40
37763	Screw—No. 2-56 x 1/8 screw to mount needle guard (2 required)	.04	38617	Drum—Record support belt drum	.40
38609	Screw—No. 4-40 x 1/4 headless set screw for pickup arm	.05	38660	Escutcheon—Index escutcheon ("Manual," "Automatic," "Start-Reject")	.30
38608	Screw—No. 6-32 x 9/32 headless set screw for pickup arm	.03	34368	Grommet—Rubber grommet for motor mounting (10)	.08
30585	Spring—Pivot arm spring (31 turns) (3)	.06	38487	Knife—Record separator knife	1.10
38604	Stud—Pivot arm spring stud, and nut	.10	39106	Lever—Index control lever and shaft	.95
	PICKUP AND ARM (Zinc Arm) (Aluminum Case Crystal)		38622	Lever—Link and lever assembly—fastens on record separator shaft	.65
	Same as Pickup and Arm (Aluminum Arm) except:		38661	Lever—Manual lever	.35
39671	Arm—Pickup arm shell (zinc casting)—less crystal, cable, and pivot arm	2.50	38656	Lever—Ratchet lever	.60
39672	Arm—Pivot arm and shaft for pickup arm—less spring	.75	38633	Lever—Tone arm lever	.45
39674	Rivet—Rivet to hold pivot arm spring—Pkg. of 5	.02	38631	Lever—Tone arm lift lever	.15
39673	Spring—Pivot arm spring (19-1/2 turns)	.10	38618	Lever—Tone arm return lever	.45
	NOTE: The zinc arm may be identified by the fact that it has a 1/8-in. hole in the back end, for the rivet which holds the pivot arm spring. This hole is not present in the aluminum arm. When replacing an aluminum arm with a zinc arm (Stock No. 39671) it will also be necessary to replace the pivot arm and spring; use Stock No. 39672, Pivot Arm, and Stock No. 39673, Spring.		38619	Lever—Tone arm segment—fastens on record separator shaft—less screws	.50
	MOTOR ASSEMBLIES		38632	Lever—Trip lever—less pawl spring	.65
36954	Armature—Motor armature and shaft for 25 cycle motor	7.85	32943	Nut—Speed nut for stop switch button	.01
36255	Armature—Motor armature and shaft for 60 cycle motor	2.75	38740	Pin—Drive pin for record separator shaft and bushing	.05
37108	Bearing—Bottom bearing and bracket (4)	.40	38474	Pin—Record support shaft cam pin (13)	.06
37107	Bearing—Top bearing and bracket	.40	38663	Plate—Index control lever plate and screw	.45
37109	Bracket—Motor mounting bracket (5)	.40	30868	Plug—Female plug for motor extension cable	.35
36952	Cap—Bakelite cap for motor	.50	30870	Plug—Male plug for motor and switch leads and extension cable	.35
36955	Capacitor—1.1 mfd. for 60 cycle motor	1.50	38624	Ratchet—Ratchet wheel (drive cam sprocket) for turntable spindle (14)	.40
36951	Capacitor—1.25 mfd. for motors (2 required for 25 cycles)	1.75	38469	Screw—Oval head screw for record separator cap (2)	.08
37111	Coil—Motor field coil assembly (6)	1.50	38626	Screw—No. 8-32 x 1/4 in. cone point set screw for ratchet wheel (drive cam sprocket)	.04
36726	Motor—105-125 volts, 25 cycle, complete with capacitor (91655-3 or 8)	10.75	38625	Screw—No. 8-32 x 1/4 in. set screw for ratchet wheel (drive cam sprocket)	.02
36254	Motor—105-125 volts, 60 cycle, complete with capacitor (91655-1 or 3)	6.75	31118	Screw—No. 10-32 x 5/16 in. cone point set screw for index lever plate	.06
38612	Motor—105-125 volts, 60 cycle (91706-1)	6.75	32869	Screw—No. 10-32 x 5/16 in. set screw for drum, tone arm segment, record separator crank, and trip lever	.01
37106	Pad—Rotor thrust pad	.05	38652	Shelf—Record separator shelf and shaft	1.10
37110	Rotor—Motor rotor complete with fan	1.75	38471	Spacer—Record separator spacer (washer)	.04
38847	Sleeve—Motor spindle sleeve for 50 cycle conversion of motor No. 91706-1, Stock No. 38612	.25	38628	Spring—Cam pawl and ratchet lever spring	.10
38848	Sleeve—Motor spindle sleeve for 60 cycle conversion of motor No. 91655-1 or 6, Stock No. 36254	.25	38669	Spring—Index lever plate spring	.20
	MOTORBOARD ASSEMBLIES		30585	Spring—Motor idler arm spring	.06
38640	Arm—Motor idler arm—less wheel	.25	38643	Spring—Motor tension spring (15)	.10
3658	Ball—3/32 steel ball for tone arm bearing (7)	.02	39679	Spring—Ratchet lever spring (16)	.10
10129	Ball—Bearing ball for spindle	.02	38642	Spring—Record separator belt drum spring (17)	.10
38647	Bearing—Turntable spindle bearing	.20	38621	Spring—Record separator shaft bottom spring (18)	.10
38616	Belt—Record support to separator belt (8)	.25	38468	Spring—Record separator spring (19)	.20
			39554	Spring—Reject button spring	.10
			38634	Spring—Tone arm lever spring (20)	.10
			39599	Spring—Tone arm return lever spring	.10
			38667	Spring—Tone arm switch spring	.05
			38562	Spring—Trip level pawl spring	.10
			38668	Stud—Tone arm switch pivot stud	.06
			38645	Support—Record support and shaft	1.70
			39085	Support—Separator support (2 used) (22)	.50
			32875	Switch—"On-Off" switch	.30
			38844	Switch—Pickup shorting switch	.45
			38664	Switch—Stop switch—less leads	1.00
			38615	Swivel—Record separator swivel and shaft	.75
			37873	Tire—Rubber tire only for drive disc	.75
			38623	Turntable—Finished turntable plate	1.10
			33726	Washer—"C" washer for motor idler arm or idler wheel	.02
			20165	Washer—"C" washer for ratchet lever, tone arm lift lever, or tone arm lift rod (23)	.05
			2917	Washer—"C" washer for tone arm lever, tone arm return lever, record support belt drum, link, or cam (24)	.03
			38560	Washer—Felt washer for tone arm bearing	.04
			38629	Washer—Felt washer for turntable spindle bottom bearing	.04
			36274	Wheel—Motor idler wheel	.55

ALL PRICES ARE SUBJECT TO CHANGE OR WITHDRAWAL WITHOUT NOTICE.

RCA MFG. CO., INC.

MODELS RP-160 Series,
RP-162

MODEL RP-160 only Miscellaneous Service Hints

- Mechanism trips continuously.* Check to see that the ratchet lever engages drive cam pawl at end of change cycle. Bend lever if necessary. Check adjustment "H." Bend the control cam flat spring for greater pressure.
- Turntable does not stop automatically.* Check for bind in stop button bushing. Bend the flat bracket that limits outward movement of the trip lever, so that pickup lands on the stop button.
- Turntable fails to start.* Check spacing of stop switch contacts to be certain that weight of stop button does not open them.
- Loud clicking noise resulting from drive cam pawl slipping out of teeth in cam sprocket.* Check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud. Any jam will cause the clutch to slip and produce clicking sound.
- Mechanism jams.*
- Irregular landing on 10 and 12 inch records.* Check adjustment "C." Insufficient tension on belt.
- Tone arm continues to repeat playing top record of the stack.* Check adjustment "E." Record separator shaft, or the spring on which it rests, is binding on the shaft bushing. Pin on record separator shaft is binding in its slot. Shaft spring is too weak. Do not tighten set screws "D" enough to distort the housing of the separator shaft spring. Do not oil the record separator shaft.
- Tone arm continues to come down in rest position.* Check adjustment "E." Record separator shaft or the spring on which it rests is binding on the shaft bushing. Pin on record separator shaft is binding in its slot. Shaft spring is too strong.
- Sapphire strikes motorboard.* Bend the pickup arm support bracket until the sapphire clears the motorboard by approximately 3/32 of an inch.
- Separator knife jams on last record of the stack.* Check the separator knife edge. It should not be sharp enough to dig in the record and carry the record up with it.

MODEL RP-162 only Replacement Parts

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
PICKUP AND ARM ASSEMBLIES					
			4288	Ferrule—Pickup connector ferrule (insert) . . . . .	.03
38602	Arm—Pickup arm shell only	1.00	39039	Grommet—Rubber grommet for motor mounting (1 set) . . . . .	.10
38603	Arm—Pivot arm and shaft—less spring . . . . .	.95	38658	Lever—Ratchet lever . . . . .	.60
38610	Crystal—Pickup crystal cartridge, sapphire and shielded cable	5.00	38637	Lever—Reject lever . . . . .	.25
38607	Cushion—Lift rod cushion (rubber) (1) . . . . .	.20	38633	Lever—Tone arm lever . . . . .	.45
38458	Nut—Speed nut to hold cable in arm . . . . .	.05	38631	Lever—Tone arm lift lever . . . . .	.15
39387	Plate—Bottom plate for pickup arm—less screws . . . . .	.10	38618	Lever—Tone arm return lever . . . . .	.45
38606	Rod—Lift rod—less cushion . . . . .	.50	38632	Lever—Trip lever . . . . .	.65
38609	Screw—No. 4-40 x 1/4-in. headless set screw for pickup arm—Pkg. of 5 . . . . .	.05	39036	Link—Record separator link . . . . .	.80
38605	Screw—No. 4-40 x 1/4-in. screw to mount crystal, Pkg. of 5 . . . . .	.02	33225	Nut—Speed nut for reject button . . . . .	.01
38611	Screw—No. 4-40 x 3/16-in. headless set screw for pickup crystal (oval point)—Pkg. of 5 . . . . .	.10	38740	Pin—Drive pin for record separator shaft . . . . .	.05
39388	Screw—No. 4-40 x 3/16-in. screw for pickup arm bottom plate—Pkg. of 5 . . . . .	.02	30870	Plug—Male plug for motor leads . . . . .	.35
38608	Screw—No. 6-32 x 9/32-in. headless set screw for pickup arm—Pkg. of 5 . . . . .	.03	38624	Ratchet—Ratchet wheel (clutch sprocket) (14) less screws . . . . .	.40
30585	Spring—Pivot arm spring (3) . . . . .	.06	38469	Screw—Record separator cap screw (2) . . . . .	.08
38604	Stud—Pivot arm spring stud and nut . . . . .	.10	38626	Screw—No. 8-32 x 1/4-in. cone point screw for ratchet wheel . . . . .	.04
MOTOR ASSEMBLY					
(No. 91647-5)					
39031	Motor—105-125 volts, 60 cycle	5.25	38625	Screw—No. 8-32 x 1/4-in. screw for ratchet wheel . . . . .	.02
38850	Sleeve—Motor spindle sleeve for 50 cycle conversion . . . . .	.25	38625	Screw—No. 10-32 x 5/16-in. cone point screw for link and trip lever . . . . .	.06
MOTORBOARD ASSEMBLY					
36402	Arm—Idler wheel arm and stud . . . . .	.25	32869	Screw—No. 10-32 x 5/16-in. screw for link and trip lever . . . . .	.01
10129	Ball—3/16-in. dia. steel ball for turntable spindle . . . . .	.02	38467	Separator—Record separator knife only	1.10
3658	Ball—3/32-in. dia. steel ball for pickup arm bearing (7) . . . . .	.02	39035	Shell—Record separator shelf and shaft	1.10
38648	Bearing—Record separator support and bearing . . . . .	.50	38471	Spacer—Record separator shelf to knife spacer . . . . .	.04
38647	Bearing—Turntable spindle bearing . . . . .	.20	38628	Spring—Cam pawl spring . . . . .	.10
39032	Board—Motorboard with all riveted and welded posts, studs, and bearings—less all operating parts	7.50	30685	Spring—Idler wheel arm spring . . . . .	.06
38630	Brace—Motorboard bottom brace and bracket . . . . .	.65	38635	Spring—Ratchet lever spring (16) . . . . .	.10
38638	Button—Reject button . . . . .	.10	38468	Spring—Record separator spring (19) . . . . .	.20
38627	Cam—Cam and pawl . . . . .	.70	38638	Spring—Reject lever spring . . . . .	.10
38641	Cam—Main cam and gear	1.50	38680	Spring—Spring for under reject button . . . . .	.10
38470	Cap—Record separator cap (9) . . . . .	.50	38634	Spring—Tone arm lever spring (20) . . . . .	.10
4288	Connector—Pickup lead connector—less insert . . . . .	.03	39038	Spring—Tone arm return lever spring . . . . .	.10
38639	Escutcheon—Index escutcheon . . . . .	.30	38562	Spring—Trip pawl spring (21) . . . . .	.10
			39033	Support—Record support	1.80
			32875	Switch—"On-OR" switch . . . . .	.30
			39034	Swivel—Record separator swivel	2.75
			39037	Turntable—Record turntable and spindle	2.80
			33726	Washer—"C" washer for idler wheel . . . . .	.02
			20165	Washer—"C" washer for ratchet lever, tone arm lever, or pickup pivot shaft (23) . . . . .	.05
			2917	Washer—"C" washer for tone arm return lever, tone arm lever, link, or cam (24) . . . . .	.03
			38560	Washer—Felt washer for pickup arm bearing . . . . .	.04
			38629	Washer—Felt washer for turntable spindle bottom bearing04
			38274	Wheel—Idler wheel55

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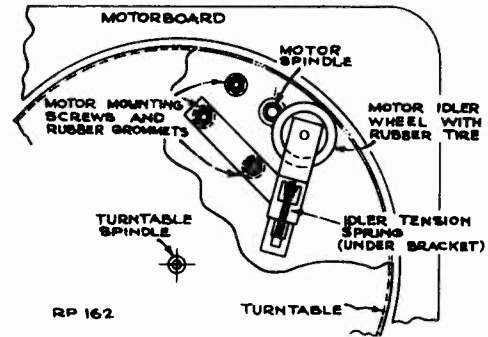
MODEL RP-162

RCA MFG. CO., INC.

Before starting automatic operation, see that the mechanism is out of cycle and that the pickup is on its rest. If it is not, start the motor and allow to run until the pickup comes down to playing level.

This mechanism is designed to play a series up to twelve 10-inch, or ten 12-inch records of the 78 r.p.m. type.

1. Turn the "record support" and "record separator" to position for 10-inch or 12-inch records as required.
2. Load the records on the supports, with required selections upward, the last record to be played on top.
3. Push turntable switch "on."
4. Push the "start-reject" button. The first record drops on turntable, and the pickup moves onto the record.
5. The whole series of records will play without further attention, and the last record will repeat. Turn off the turntable switch as the pickup commences a replaying, lift the pickup and place on rest.
6. To reject a record being played, push the "start-reject" button and let go.
7. For automatic operation, each record must have the standard eccentric groove.



Miscellaneous Service Hints

Mechanism trips continuously.	Check to see that the ratchet lever engages drive cam pawl at end of change cycle. Bend lever if necessary.
Loud clicking noise resulting from drive cam pawl slipping out of teeth in cam sprocket. Mechanism jams.	Check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud. Any jam will cause the clutch to slip and produce clicking sound.
Sapphire strikes motorboard	Bend the pickup arm support bracket until the sapphire clears the motorboard by approximately $\frac{3}{32}$ of an inch.
Separator knife jams on last record of the stack.	Check the separator knife edge. It should not be sharp enough to dig in the record and carry the record up with it.

Cycle of Operation

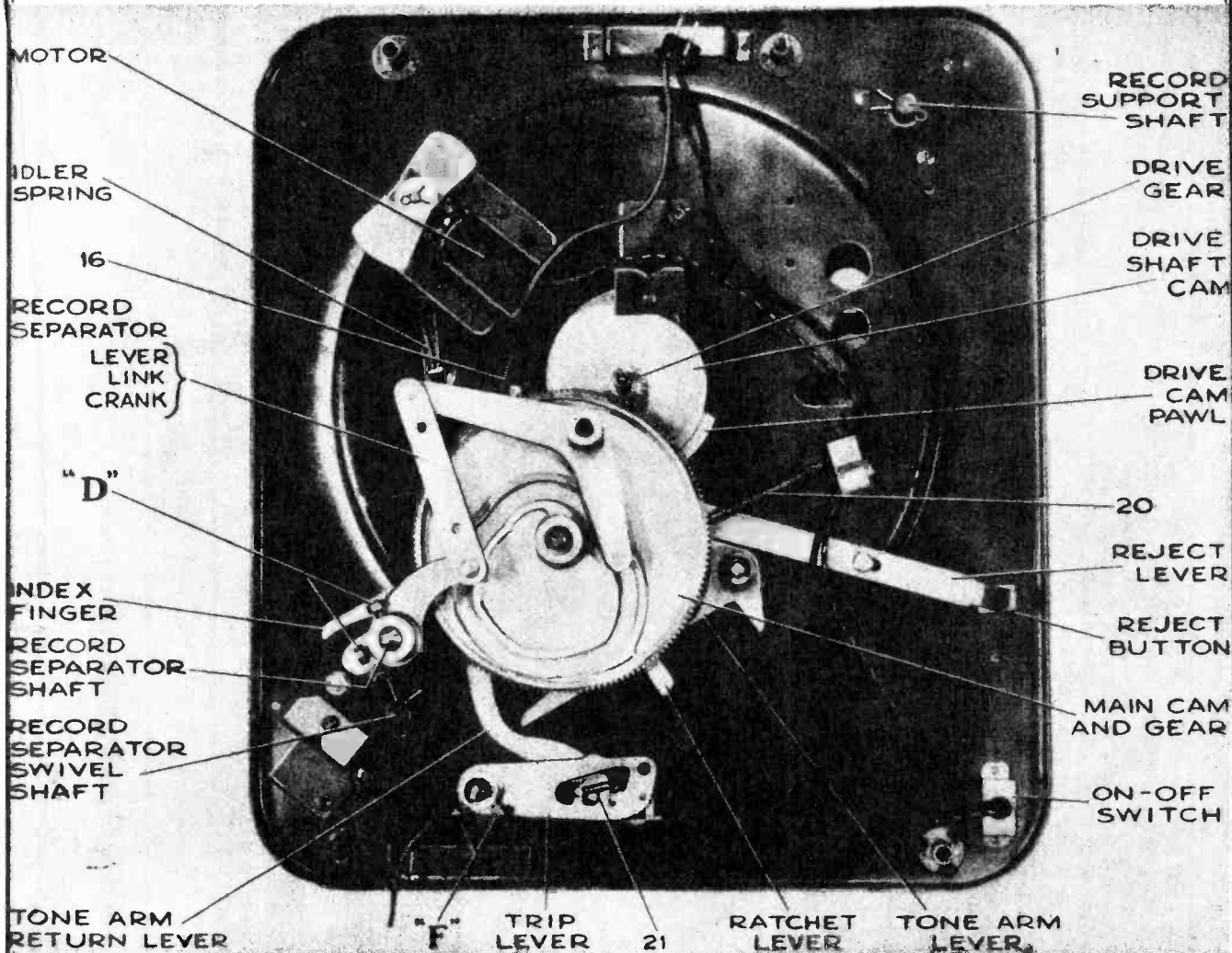
The changer can be conveniently rotated through the change cycle by pushing the reject button and revolving the turntable by hand. Eight turntable revolutions are required

for one change cycle. Hold idler arm back so idler wheel is away from turntable to permit easier manual rotation of the turntable.

Function	Explanation
Press "Start-Reject Button"	<ol style="list-style-type: none"> 1. Reject lever moves in and pushes ratchet lever, thus releasing drive cam pawl. 2. Drive cam pawl engages cam sprocket and it revolves carrying drive gear with it.
Tone Arm Rises	<ol style="list-style-type: none"> 1. Main cam and gear revolves with drive gear. 2. Stud on tone arm lever rides in top track on main cam and directs movement of the lever. 3. Tone arm elevating lift rides up on ridge on main cam and pushes tone arm up by means of lift rod.
Tone Arm Moves Out	<ol style="list-style-type: none"> 1. Tone arm lever pushes on trip lever stud. 2. Trip lever moves out, carrying the tone arm out. 3. Tone arm return lever is carried along by trip lever stud, and by stud on main cam top track.
Record Knife Separates Bottom Record from Stack after Gauging Thickness of Record	<ol style="list-style-type: none"> 1. Stud on separator lever follows main cam bottom track and directs the motion of the lever. 2. Through the separator link and crank, the separator lever turns the separator shaft. 3. Knife turns with shaft and strikes edge of bottom record. 4. Separator shaft continues to revolve and teeth on inner circumference of knife ride up on shelf teeth until knife is carried high enough against the action of spring 19 to move in over top of bottom record.
Record Drops to Turntable	<ol style="list-style-type: none"> 1. Separator shaft continues to turn until knife supports stack of records and shelf moves out from under bottom record, which drops to turntable.
Tone Arm Moves In	<ol style="list-style-type: none"> 1. Separator shaft reverses rotation. 2. Tone arm return lever pushes on trip lever stud. 3. Trip lever moves in, carrying the tone arm in.
Tone Arm Lowers Sapphire on to Record	<ol style="list-style-type: none"> 1. Index finger on tone arm return lever moves against separator shaft to insure proper landing position. 2. Tone arm elevating lever rides down on main cam ridge thus lowering the elevating rod and the tone arm. 3. Separator shaft returns knife to original position and allows stack of records to rest on shelf.
Sapphire Moves In to Record Groove Record Begins to Play	<ol style="list-style-type: none"> 1. Ratchet lever rides down into eccentric step on main gear shaft and blocks drive cam pawl, disengaging the pawl from drive cam socket. 2. Drive gear and main gear stop. 3. Tone arm lever moves into cam to maintain disengagement.

RCA MFG. CO., INC.

MODEL RP-162



Function of Principal Levers

Trip Lever

When the tone arm swings in the eccentric groove, the trip lever latch acts on the ratchet lever to start the automatic cycle.

Ratchet Lever

Transfers motion from trip lever or reject lever to start automatic cycle by allowing pawl to engage with sprocket of safety clutch.

Drive Cam Pawl and Sprocket

(This is the "safety clutch")
Engages turntable spindle to drive gear during cycle (see sketch "A").

Tone Arm Lift Lever

Directs vertical motion of tone arm.

Drive Gear

Transfers rotation of turntable spindle to main cam and gear when the clutch is engaged.

Main Cam and Gear

Has four "tracks" which control horizontal and vertical motion of tone arm, and rotation of record separator knife and shelf. The bushing on this gear governs position of the ratchet lever.

Reject Lever

When the reject button is pushed, the reject lever moves the ratchet lever away from the drive cam pawl, permitting the clutch to engage and thus start the change cycle.

Tone Arm Return Lever

Keeps tone arm moving in with receding tone arm lever and provides proper landing.

Tone Arm Lift Rod

Transfers motion of elevating lever to tone arm.

Record Separator Lever Train (Lever-Link-Crank)

Directs motion of separator knife and shelf.

Separator Knife

Separates record from stack and supports stack during cycle.

Separator Shelf

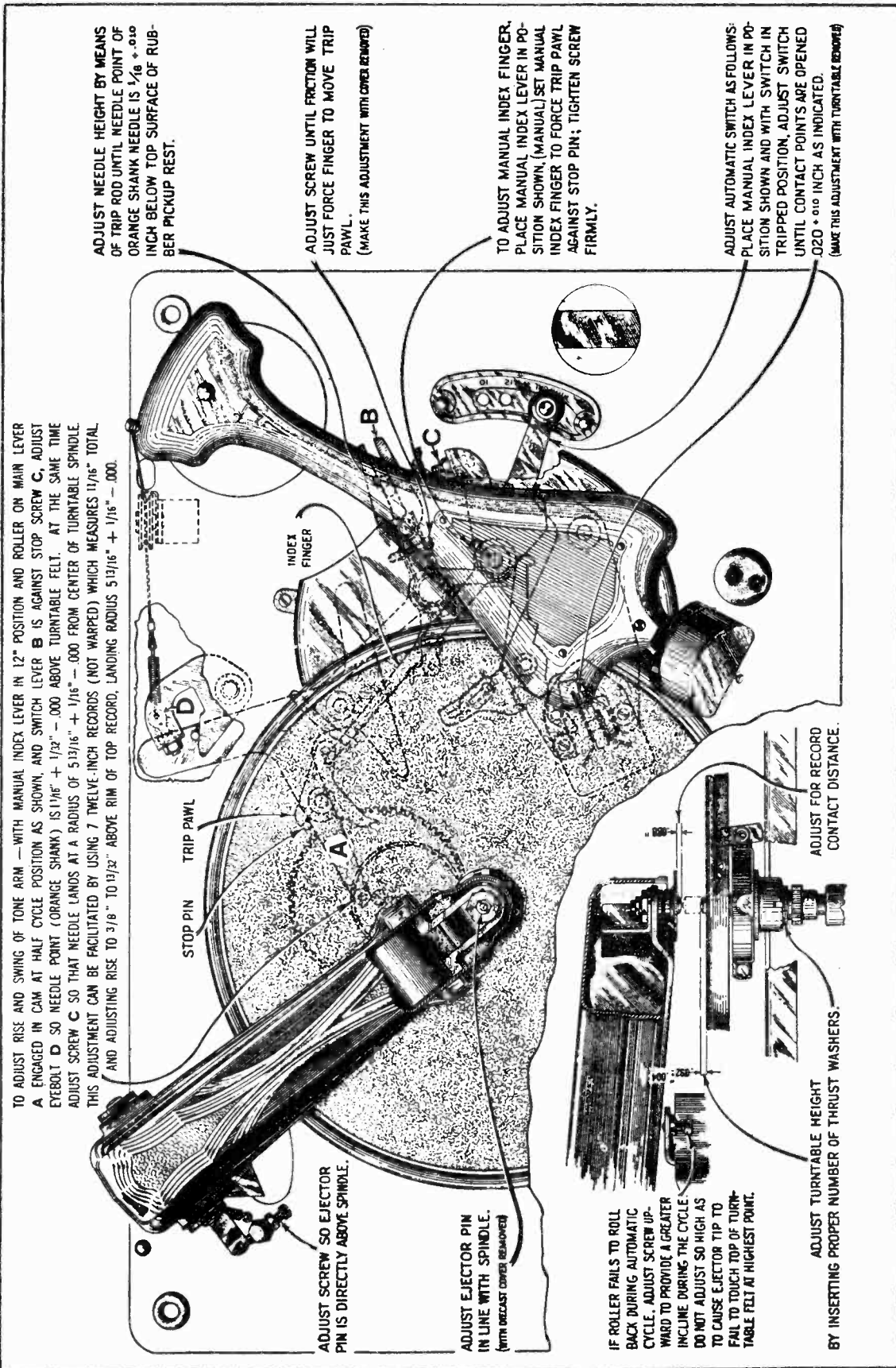
Supports stack during playing time.

Tone Arm Lever

Directs horizontal motion of tone arm.

MODELS 331, 341, 380,
380HR, 381,
MI-6982

RCA MFG. CO., INC.



TO ADJUST RISE AND SWING OF TONE ARM — WITH MANUAL INDEX LEVER IN 12° POSITION AND ROLLER ON MAIN LEVER A ENGAGED IN CAM AT HALF CYCLE POSITION AS SHOWN, AND SWITCH LEVER B IS AGAINST STOP SCREW C, ADJUST EYEBOLT D SO NEEDLE POINT (ORANGE SHANK) IS $1/16"$ + $1/32"$ - $.000$ ABOVE TURNABLE FELT. AT THE SAME TIME ADJUST SCREW C SO THAT NEEDLE LANDS AT A RADIUS OF $5/13/16"$ + $1/16"$ - $.000$ FROM CENTER OF TURNABLE SPINDLE. THIS ADJUSTMENT CAN BE FACILITATED BY USING 7 TWELVE-INCH RECORDS (NOT WARPED) WHICH MEASURES $1/16"$ TOTAL AND ADJUSTING RISE TO $3/8"$ TO $13/32"$ ABOVE RIM OF TOP RECORD, LANDING RADIUS $5/13/16"$ + $1/16"$ - $.000$.

ADJUST NEEDLE HEIGHT BY MEANS OF TRIP ROD UNTIL NEEDLE POINT OF ORANGE SHANK NEEDLE IS $1/16"$ + $.010$ INCH BELOW TOP SURFACE OF RUBBER PICKUP REST.

ADJUST SCREW UNTIL FRICTION WILL JUST FORCE FINGER TO MOVE TRIP PAWL.
(MAKE THIS ADJUSTMENT WITH COVER REMOVED)

TO ADJUST MANUAL INDEX FINGER, PLACE MANUAL INDEX LEVER IN POSITION SHOWN, (MANUAL) SET MANUAL INDEX FINGER TO FORCE TRIP PAWL AGAINST STOP PIN; TIGHTEN SCREW FIRMLY.

ADJUST AUTOMATIC SWITCH AS FOLLOWS: PLACE MANUAL INDEX LEVER IN POSITION SHOWN AND WITH SWITCH IN TRIPPED POSITION, ADJUST SWITCH UNTIL CONTACT POINTS ARE OPENED $.020$ + $.010$ INCH AS INDICATED.
(MAKE THIS ADJUSTMENT WITH TURNABLE REMOVED)

STOP PIN
TRIP PAWL

INDEX FINGER

ADJUST SCREW SO EJECTOR PIN IS DIRECTLY ABOVE SPINDLE.

ADJUST EJECTOR PIN IN LINE WITH SPINDLE.
(WITH DIECAST COVER REMOVED)

IF ROLLER FAILS TO ROLL BACK DURING AUTOMATIC CYCLE, ADJUST SCREW UPWARD TO PROVIDE A GREATER INCLINE DURING THE CYCLE. DO NOT ADJUST SO HIGH AS TO CAUSE EJECTOR TIP TO FAIL TO TOUCH TOP OF TURNABLE FELT AT HIGHEST POINT.

ADJUST TURNABLE HEIGHT BY INSERTING PROPER NUMBER OF THRUST WASHERS.

ADJUST FOR RECORD CONTACT DISTANCE.

Figure E—Automatic Record Changer Adjustments

RCA MFG. CO., INC.

MODELS MI-4814,
MI-4823

Better control of volume is obtained on subject phonograph units if the pick-up wiring is changed to agree with Figure 1 below. This change involves the addition of two 1/2 watt resistors. R-5, 220 ohms stock #5201, and R-6, 120 ohms stock #30189, should be wired to R-1 250 ohms volume control as shown in Figure 1.

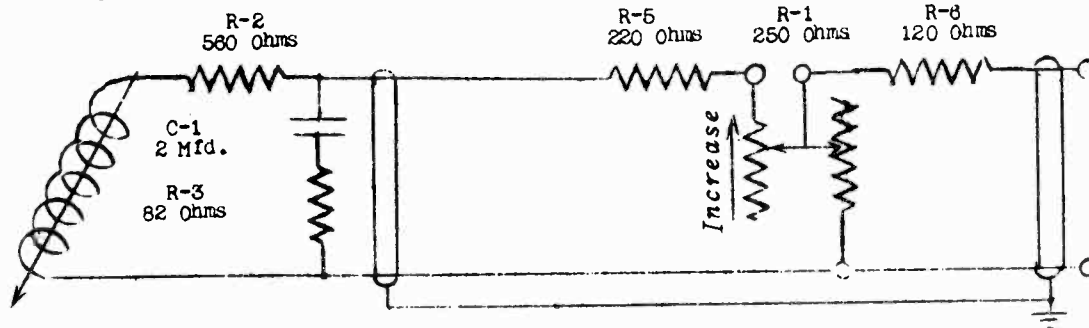


Figure 1 - MI-4814-A Schematic

PARTS LIST FOR MODELS MI-12701, MI-12702

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
20134	MOTORBOARD ASSEMBLY		4340	Lamp—Pilot lamp	.17
32679	Arm—Motor starting switch actuating arm	1.95	32055	Socket—4-contact microphone input socket	.70
10194	Ball—Turntable shaft ball bearing	.02	32804	Socket—Pilot lamp socket, bracket, and jewel	.30 net
32677	Base—Recorder arm base assembly	3.40	32629	Speaker—P.M. dynamic speaker complete	6.45
32683	Bearing—Feed screw bearing complete with eccentric and screw	4.00	17507	Switch—D.P.D.T. Recording-Phonograph switch (S2)	1.60
32590	Jack—Hex head tip jack for recorder cable tip	.10	13462	Switch—S.P.S.T. "On-off" switch (S1)	.85
32648	Knob—Motor starting switch knob	.70	32607	Tone Control—5,000 ohms tone control (R8)	1.00
32516	Meter—Volume level indicator meter	X	32606	Volume Control—500,000 ohms volume control (R6)	1.00
32613	Motor—110 volt, 50 cycle motor	16.60		AMPLIFIER ASSEMBLY	
32612	Motor—110 volt, 60 cycle motor	16.60	12635	Capacitor—1,000 mmfd. (C5)	.50
32744	Mounting—Motor mounting assembly consisting of 2 screws, 4 lockwashers, 5 washers, 4 spacers, 2 grommets and 1 cap nut	.60	4886	Capacitor—.05 mfd. (C3, C7)	.20
33080	Nut—Motor board knurled nut and screw	.40	4839	Capacitor—0.1 mfd. (C2, C4, C6)	.30
32685	Pad—Rubber turntable cover pad	1.00	12484	Capacitor—.25 mfd. (C13)	.30
32647	Plate—Recorder feed plate	.45	32332	Capacitor—10-10 mfd. dual pack (C9, C10)	2.05
32681	Pulley—Turntable drive pulley with vulcanized rubber tip 50 cycle operation	2.25	32331	Capacitor—20-20 mfd. dual pack (C1, C8)	2.80
32680	Pulley—Turntable drive pulley with vulcanized rubber tip 60 cycle operation	2.00	32020	Capacitor—30 mfd. (C11, C12)	4.25
32676	Screw—Feed screw and pinion	4.15	14133	Fuse—1 ampere (F1)	.18
33079	Screw—Motor board mounting "T" nut and thumb screw (1 ea.)	.40	32059	Post—Fuse post	1.00
32678	Spring—Coil spring for recorder arm base assembly	.20	30789	Resistor—33 ohms, 1/2 watt (R16, R17)	.20
32745	Spring—Motor bracket tension spring	.15	32330	Resistor—40 ohms, 2 watts (R15)	1.30
32684	Spring—Recorder head tension spring	.20	30681	Resistor—470 ohms, 1 watt (R14)	.22
32746	Support—Pickup arm support bracket and spring	.65	30731	Resistor—1,200 ohms, 1/2 watt (R9)	.20
14804	Switch—Motor starting switch and flash cap (S3)	.60	30930	Resistor—1,800 ohms, 1/2 watt (R3)	.20
32649	Turntable—Turntable and shaft assembly	12.85	32329	Resistor—1,800 ohms, 5 watts (R21)	1.60
	RECORDER HEAD ASSEMBLY		30730	Resistor—2,700 ohms, 1/2 watt (R20)	.20
32475	Armature—Armature and spring assembly complete	4.10	30225	Resistor—68,000 ohms, 2 watts (R19)	.25
32480	Cable—Lead wire for recorder head	.50	3252	Resistor—100,000 ohms, 1/2 watt (R1, R18)	.20
32476	Coil and sleeve assembly	.75	30180	Resistor—120,000 ohms, 1/2 watt (R12)	.20
32459	Cover—Recorder head cover assembly	2.30	14583	Resistor—220,000 ohms, 1/2 watt (R11)	.20
32477	Damper assembly	.35	30651	Resistor—270,000 ohms, 1/2 watt (R5)	.20
32458	Recorder—Recorder head complete	18.00	30784	Resistor—330,000 ohms, 1/2 watt (R7)	.20
12539	Screw—Needle holding screw	.15	11988	Resistor—390,000 ohms, 1/2 watt (R13)	.20
	PICKUP AND ARM ASSEMBLY		30162	Resistor—1.2 megohms, 1/2 watt (R4, R10)	.20
33053	Arm—Arm complete—less pickup unit	6.75	33084	Socket—Octal base tube socket and speaker socket	.25
33054	Base—Pivot arm and base assembly	.95	7852	Transformer—Output transformer (T2)	2.00
31100	Pickup—Pickup unit only	4.95	31380	Transformer—Power transformer XT-2741C—110-120 volts, 50-60 cycles (Model MI-12701 only) (T3)	4.75
3811	Screw—Needle holding screw	.10	31575	Transformer—Power transformer—110-220 volts, 50-60 cycles (Model MI-12702 only) (T3)	8.35
33095	Spacer—Pickup arm assembly	.30		MICROPHONE ASSEMBLY (MI-6228-C)	
	CONTROL PANEL ASSEMBLY		30842	Adapter—Ball joint, swivel type, microphone stand adapter	.80
32630	Cone—Cone complete with mounting bracket and centering web	1.75	32584	Cable—10 ft. microphone cable with strain relief	1.40
30187	Jack—"Monitor" jack (J1)	.75	31452	Cap—Front cap and screen assembly	.85
30247	Knob—Volume or tone control knob	.25	32054	Plug—4-prong microphone plug	1.00
			30052	Transformer—Microphone transformer XT-2651	4.80
				MISCELLANEOUS ASSEMBLIES	
			16823	Cable—Power cord and plug	1.15 net
			26573	Plug—8-prong speaker plug	.60
			25941	Plug—Power cord plug	.60

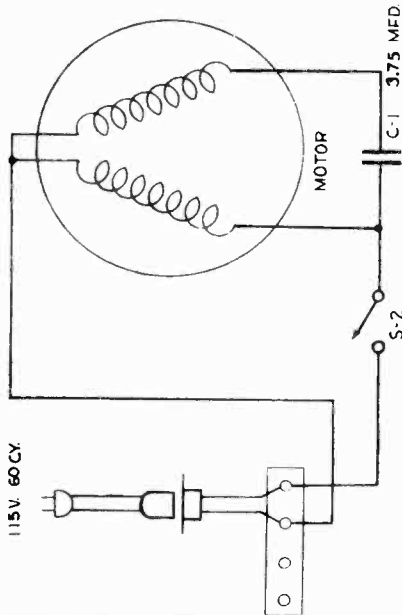
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X Price upon application to local RCA distributor.

MODELS MI-4814,
MI-4823

RCA MFG. CO., INC.

For magnetic pickup and turntable adjustments, see Model MI-12700

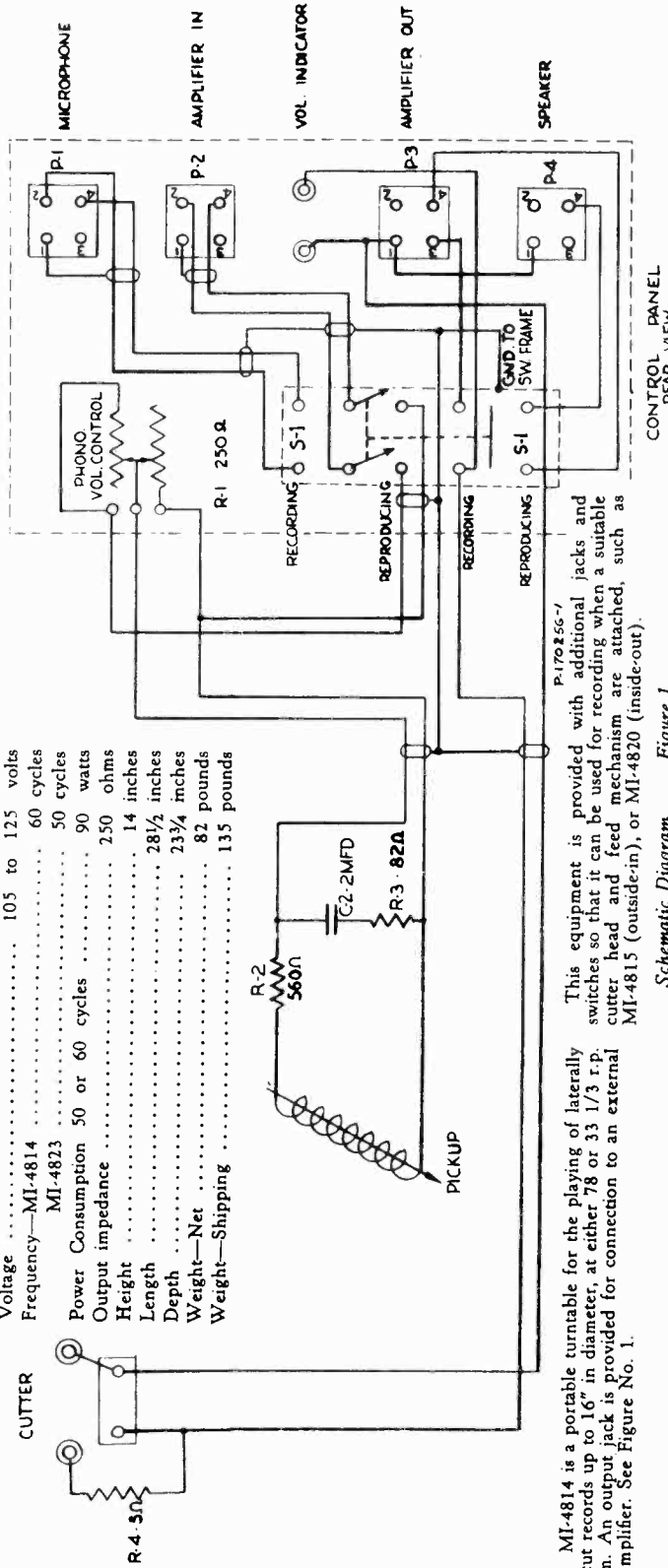


STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
32654	Ball—Turntable shaft ball bearing 1/4 inch	.06	33560	Shaft Assembly	X
33568	Bearing—Assembly	.50	32055	Socket—4 Contact (P. 1, 2, 3, 4)	.70
11782	Box—Needle body and lid	.50	32511	Spring—Eccentric "J" Spring	.75
26714	Bracket—Switch bracket for gang switch	1.50	32862	Spring—Roller tension spring	.25
16823	Cable—Power cord and plug	2.00	32514	Spring—Speed shift coil spring	.40
32608	Capacitor—2 mfd-300 V. (C-2)	6.00	14804	Switch—Motor switch (S-3)	1.60
32335	Connector—3.75 mfd. Motor capacitor (C-1)	6.90	17507	Switch—D. P. D. T. (Part of S-1)	.75
32589	Jack—Pin jack, Hex head tip jack, with nut and insulating washers	.10	32515	Switch—D. P. S. T. (Part of S-1) Turntable	16.80
30075	Knob—Small knob	.50	PICKUP ARM AND UNIT ASSEMBLY		
32249	Motor—110 Volt 60 Cycle	2.50	12540	Armature and spring assembly	2.20
32651	Pad—Attenuator Type L—250 ohm, (R1)	.50	33578	Base assembly—pickup arm base	1.90
32054	Plug—4 prong Microphone—Amplifier and Speaker plug	6.00	32394	Cable—Pickup cable complete with connector block	.70
25941	Pulley—2 contact male	1.00	12541	Coil and Sleeves Assembly	1.05
32512	Pulley—4 later pulley assembly, including tire and bushing	.60	32361	Cover—Back cover for pickup	1.15
32513	Pulley Assembly—Motor pulley assembly	7.75	32360	Cover—Front cover for pickup	1.15
33603	Receptacle—Needle receptacle	5.40	Mechanism—Comprising armature and spring assembly, armature clamp and armature damper		2.30
32333	Resistor—5 ohms, 10 watt (R-4)	1.95	33577	Pickup Arm Assembly	7.55
13961	Resistor—82 ohms, 1/2 watt (R-3)	.20	32357	Pickup Unit Assembly	9.85
5164	Resistor—560 ohms, 1/2 watt (R-2)	.20	33579	Screw—Pickup needle screw	.15
			32359	Spring—Phosphor bronze spring for pickup arm	2.80

X—Price upon application to local RCA Distributor.

ALL PRICES ARE SUBJECT TO CHANGE OR WITHDRAWAL WITHOUT NOTICE.

- Voltage 105 to 125 volts
- Frequency—MI-4814 60 cycles
- MI-4823 50 cycles
- Power Consumption 50 or 60 cycles 90 watts
- Output impedance 250 ohms
- Height 14 inches
- Length 28 1/2 inches
- Depth 2 3/4 inches
- Weight—Net 82 pounds
- Weight—Shipping 135 pounds



MI-4814 is a portable turntable for the playing of laterally cut records up to 16" in diameter, at either 78 or 33 1/3 r.p.m. An output jack is provided for connection to an external amplifier. See Figure No. 1.

Schematic Diagram Figure 1

RCA MFG. CO., INC.

MODELS MI-4815, MI-4819,
MI-4820, MI-4821

IB-24143-1

MI-4819; MI-4821 RECORDER SCREWS

In order to install a new, or reverse, Recorder Screw from that which comes with the equipment, the following procedure is necessary:

1. Loosen set screw "A" (in picture) and remove cone bearing from right end. The entire recorder screw and worm gear can then be removed by manipulating with the hand to disengage the worm gear.
2. Place the new recorder screw and worm gear in place, and shove the cone bearing into the proper position. Adjust the recorder screw by moving the cone bearing inward to remove all loose play; but not so far that the screw will bind. When the proper adjustment is obtained, tighten the set screw "A".

INSTALLATION OF FEED PLATE

To install a new feed plate proceed as follows:

- A. Raise carriage upward to the "rest" position and remove the two nuts and screws holding the feed plate in place.
- B. Insert the new feed plate in place and replace the two screws and nuts.
- C. Before tightening the nuts lower the carriage, in order to make sure that the feed plate engages the threads of the recorder screw, then tighten nuts.

FLOAT STABILIZER

The float stabilizer supplies critical damping to the cutter head and float arm. This critical damping eliminates any vertical oscillation of the cutter head and float arm.

ADJUSTMENTS

Located within the collar of the base casting is the adjusting sleeve, the adjustment of which must be such that it will insure motion of the recorder head cutter parallel to the upper surface of the record. The sleeve is locked in position by means of a set screw "B", which is threaded through the collar of the support casting. It is essential that vertical adjustment of this sleeve be very carefully made in order to insure the same depth of groove throughout the run of the record. There is a tendency for the cutter to cut a deeper groove at the inner section of the record than at the outer section, if the adjusting sleeve is not properly adjusted. The sleeve is adjusted before the mechanism leaves the factory, but at the same time, it may become necessary to readjust it. If the groove is being cut deeper at the outer edge of the record, raise the sleeve, and vice versa. By using a spirit-level, the recording mechanism may be readily adjusted parallel to the record surface.

Depth of the cut should be maintained with fairly close precision. It is best determined by observing the width of the groove in comparison with the width of the remaining wall. A standard feed screw such as the MI-4819 or MI-4821 will cut 112 grooves per inch, and the proper width of groove is equal to but never greater than, the width of remaining wall. This procedure will make the respective width of grooves and walls about .0045" in each. The depth of groove will then be about .0025 inch.

After some practice, the groove-to-wall width ratios can be estimated with fair accuracy by eye, using a small magnifying glass. Of course, a calibrated microscope is much better if it is available.

In order to properly adjust the feed screw member, procedure should be as follows:

Loosen the set screw "A" (which holds the cone bearing for the right end of the feed screw shaft in the housing). Push the cone bearing inward to tighten the shaft; and outward to loosen the shaft. When the proper adjustment has been made, tighten the set screw, thus locking the bearing in place.

LUBRICATION

A clean, high grade, light body grease such as vaseline should be applied to both the worm gear and worm wheel every two or three months.

The feed screw should not be lubricated since it would collect dust. Also, the upper and lower support rods should not be lubricated. Instead, if these items become dusty or dirty, the dust should be wiped off with a clean, dry rag free from lint.

MODELS MI-4815, MI-4819,
MI-4820, MI-4821
IB-24143-1

RCA MFG. CO., INC.

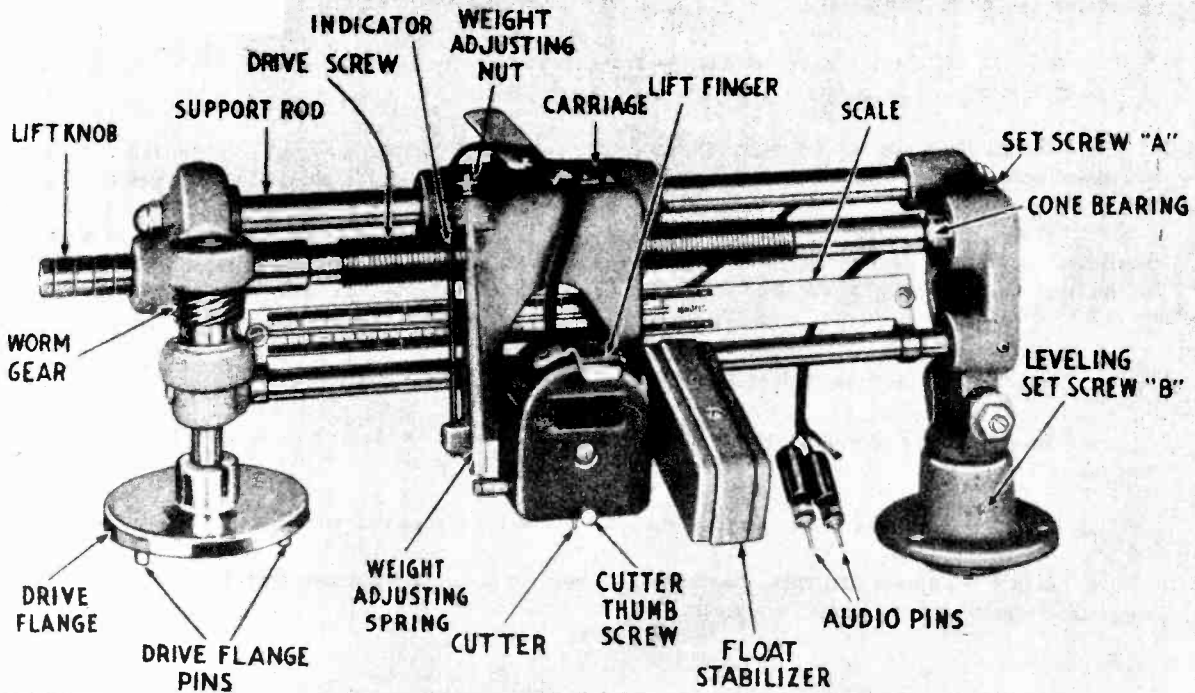


FIGURE 1 - INSTANTANEOUS RECORDING MECHANISM (MI-4815 OR MI-4820)

INSTALLATION

MI-4815; MI-4820 RECORDING ATTACHMENTS

The installation may proceed as follows:

Remove the panel from the back of the cabinet by taking out the screws. Remove the plug button in the motor board (near the base of the pickup arm) by knocking out from the under side; and in its place insert the stud (rest for recorder attachment). The stud is secured from the under side by 1 washer, 1 lockwasher, and 1 nut.

Remove the plate covering the hole for the base assembly. Insert the base assembly and secure by the three bolts, washers, and nuts, provided for that purpose. Check to see that the sleeve for the base assembly is secure in its place.

The recording attachment may then be mounted by inserting the shaft into the sleeve of the base assembly down to the yoke. The above-mentioned sleeve is held in position by the set screw "B" on the collar of the base casting. Thus the sleeve may be raised and clamped by the set screw.

On the end of the lead from the recorder head may be found two audio pins. Insert these pins into the pin jacks provided for same (pin jacks are located near the base of the recording attachment).

TECHNICAL DATA

SOURCE IMPEDANCE	MI-4815 RECORDING ATTACHMENT (OUTSIDE-IN)	PHYSICAL SPECIFICATIONS
	MI-4820 RECORDING ATTACHMENT (INSIDE-OUT)	
	MI-4819 RECORDER SCREW (INSIDE-OUT)	
	MI-4821 RECORDER SCREW (OUTSIDE-IN)	
15 Ohms		
DRIVING SOURCE		Width - 13-3/4 Inches
	1. MI-12700 Instantaneous Recording and Play-Back Equipment	Depth - 8 Inches
	2. MI-4814 Portable Turntable	Height - 5-3/4 Inches
		Weight - 8-1/2 Pounds

MODELS MI-4824-B,
MI-4824-C

RCA MFG. CO., INC.

MODELS MI-4822-B,
MI-4822-C

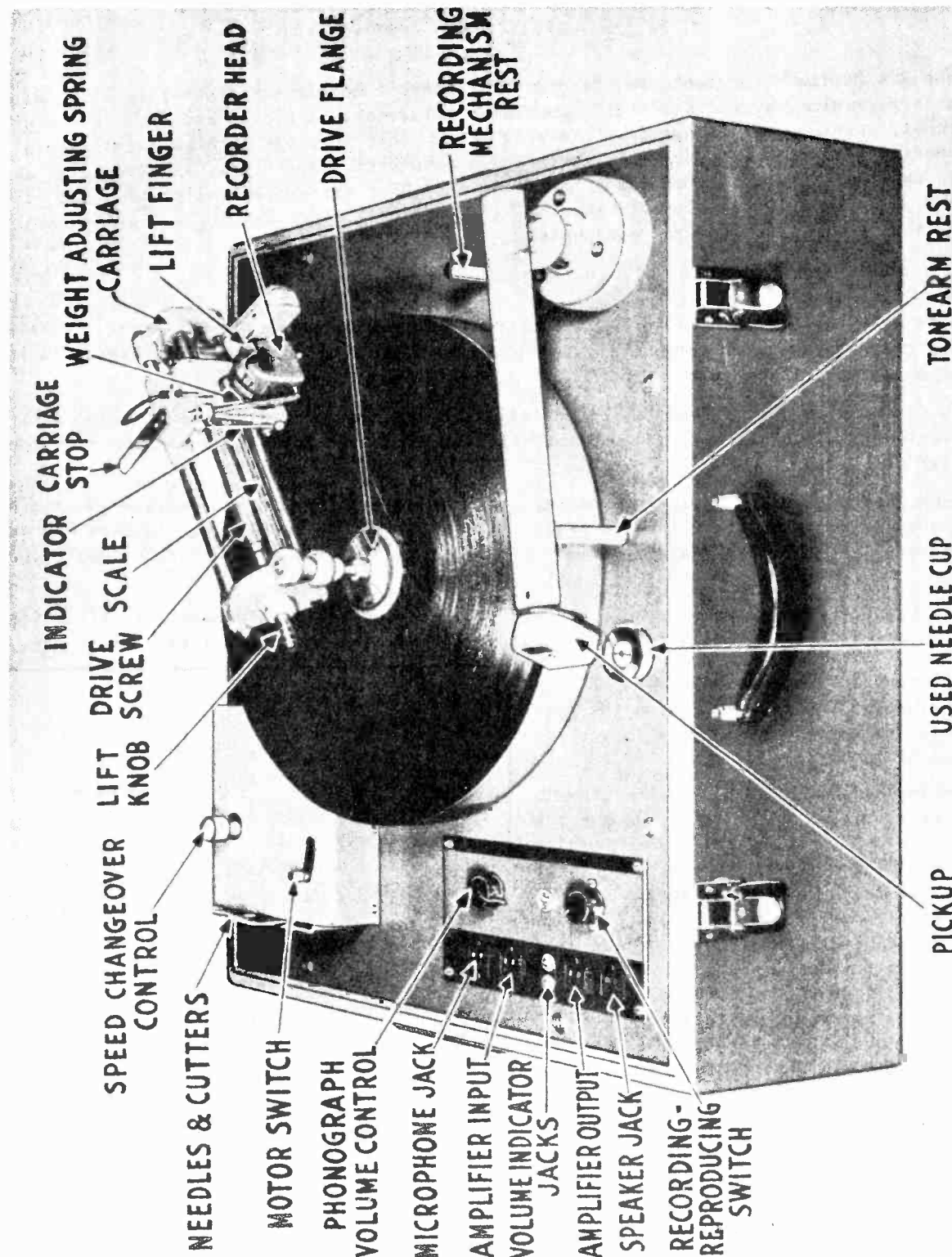


FIGURE 1 - PORTABLE TURNTABLE AND RECORDING ATTACHMENT IN OPERATION.

MODELS MI-4822-B,
MI-4822-C

RCA MFG. CO., INC.

MODELS MI-4824-B,
MI-4824-C

RCA PORTABLE TURNTABLE AND RECORDING ATTACHMENT

(MI-4822-B	OUTSIDE-IN,	60 CYCLES)
(MI-4822-C	INSIDE-OUT,	60 CYCLES)
(MI-4824-B	OUTSIDE-IN,	50 CYCLES)
(MI-4824-C	INSIDE-OUT,	50 CYCLES)

The RCA Portable Turntable and Recording Attachment consists essentially of a motor and drive mechanism, a record plate, a recording attachment, a pickup and arm, and a control panel, mounted in an umber gray carrying case. This Portable Turntable and Recording Attachment may be used with suitable, existing microphones, amplifiers, loudspeakers, etc. thereby making a flexible arrangement for schools, public address installations, and other purposes. The MI-6719 Desk Console and similar equipment, where available, afford a convenient source of amplifier and loudspeaker.

CAUTION:

Lift and remove the cover for this equipment before operating the equipment. Never drop the cover backward or allow the cover to be supported by the hinges, as damage to the cabinet and hinges may result.

It is impossible to give detailed installation instructions as installations will vary with local conditions and with the accessories used. The following general instructions are given as a guide.

Exercise care during unpacking and set-up to prevent injury to the precision mechanism, and to prevent dust and other foreign matter from entering the mechanism. Unpack and install carefully the record plate. Install the additional items, as power cord, needle cup, etc.

The support (table, etc.) should be free from excessive vibration, and a location free from such extraneous noises as automobile horns, the singing of birds, should be chosen.

The four (4) male plugs should be connected as shown in Figure 3, using the type of cables indicated. Insert the plugs in the control panel.

To install the Recording Mechanism (MI-4815 or MI-4820) proceed as follows: Remove the three (3) machine screws and the cover plate at the right-hand rear corner of the motor board. Use these same three screws and install the recorder mechanism base casting, but do not tighten the screws. Place the drive flange on the turntable spindle. By using a spirit level, adjust the drive screw parallel to the record plate (See "CUTTING METHOD AND ADJUSTMENT" on page 6.) At the same time, check to make sure that no binding exists between the record plate and recording mechanism, and then tighten the three screws.

Install a cutting stylus in the recorder head, making sure that the flat at the blunt end of the cutting stylus is toward the set screw. See diagram opposite.

Insert a chromium reproducing needle in the pickup.

Plug in the volume indicator meter.

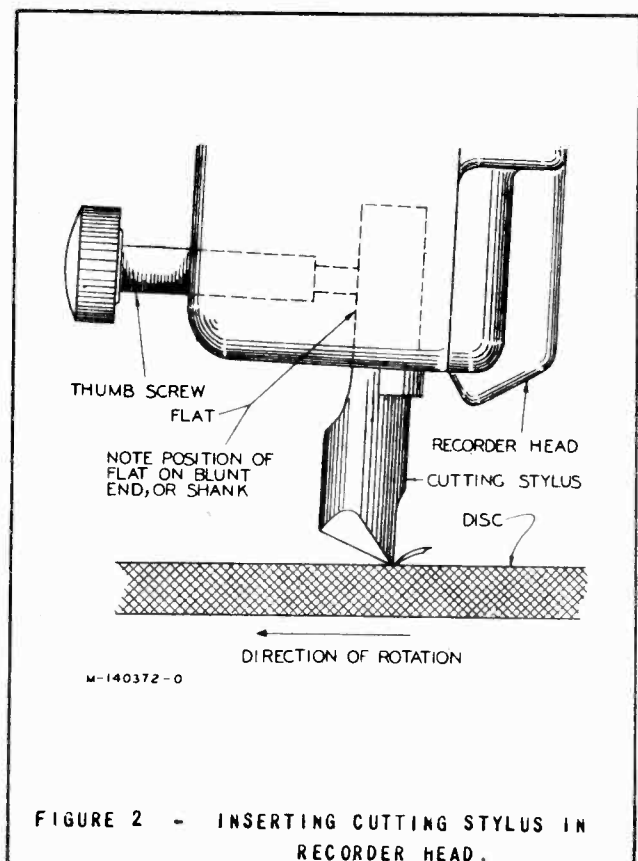
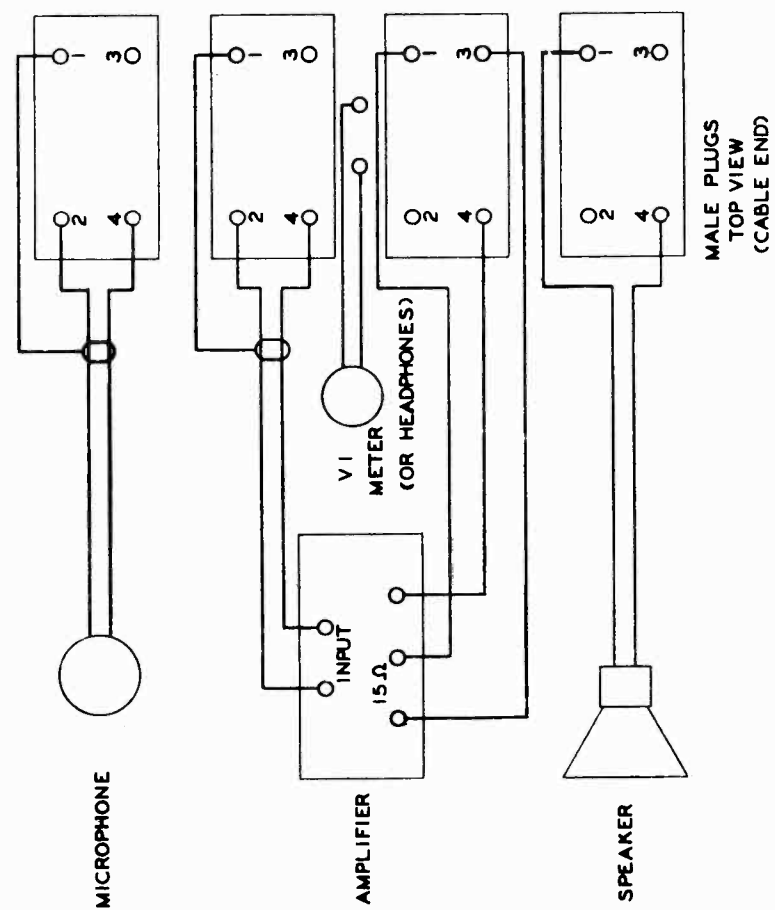
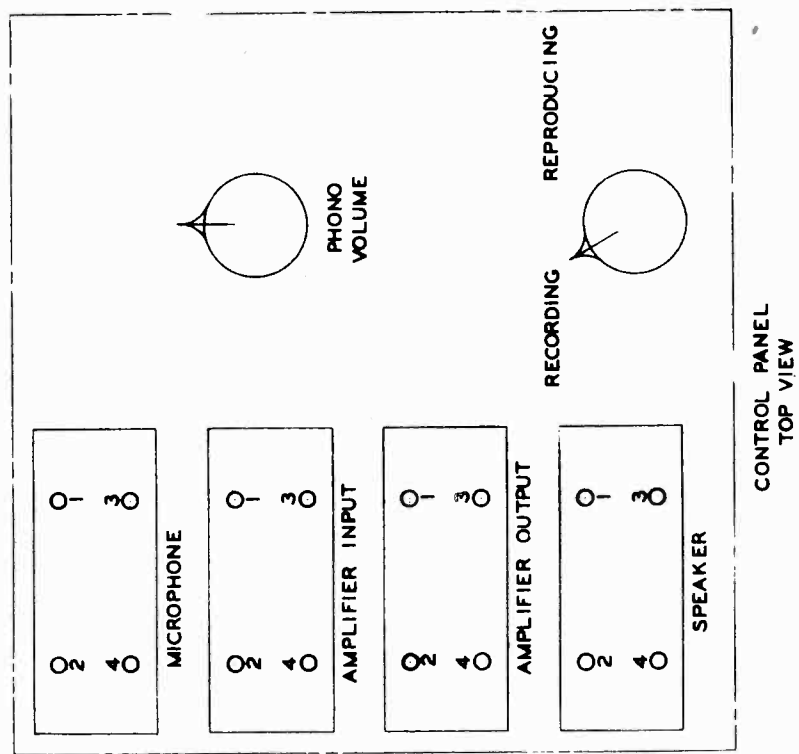


FIGURE 2 - INSERTING CUTTING STYLUS IN RECORDER HEAD.

MODELS MI-4824-B,
MI-4824-C

RCA MFG. CO., INC.

MODELS MI-4822-B,
MI-4822-C



NOTE № 1: THE IMPEDANCE OF THE MICROPHONE SHOULD MATCH THE IMPEDANCE OF THE AMPLIFIER INPUT.

NOTE № 2: THE AMPLIFIER OUTPUT IMPEDANCE (CONNECTED TO TERMINALS № 1 AND № 4 OF THE PLUG), SHOULD MATCH THE SPEAKER IMPEDANCE.

NOTE № 3: THE AMPLIFIER OUTPUT IMPEDANCE (CONNECTED TO TERMINALS № 1 AND № 3 OF THE PLUG), SHOULD MATCH THE CUTTER IMPEDANCE (15 OHMS).

MI-4814-A & MI-4823-A P-170368-2

FIGURE 3 - CONNECTION DIAGRAM.

MODELS MI-4822-B,
MI-4822-C

RCA MFG. CO., INC.

MODELS MI-4824-B,
MI-4824-C

HOW TO MAKE A RECORDING

When the equipment has been set up, connected to an AC power supply, and the groove depth has been checked, (see "PART IV"), recordings may be made as follows:

- (A) On the amplifier, throw the AC power switch to the "OFF" position, turn the volume control to "0", and set the tone control at a position to obtain a maximum of high frequencies.
- (B) Throw the motor switch to the "OFF" position.
- (C) Throw the amplifier power switch to the "ON" position (about thirty seconds are required for the Radiotrons to heat).
- (D) Turn the "RECORDING-REPRODUCING" knob to the "RECORDING" position.
- (E) Place a blank recording disc on the record plate.
- (F) Adjust the speed changeover knob for the desired speed. This knob should be "UP" for 33 1/3 R.P.M., and "DOWN" for 78 R.P.M.

CAUTION: The motor switch must be shut "OFF" when the speed changeover knob is either pushed down or raised.

- (G) With the carriage in the raised (non-recording) position, move the recording mechanism, by means of the lift knob, over the record plate so that the drive flange is directly over the turntable spindle, and then lower the mechanism until the drive flange pins rest on the record.
- (H) Hold the drive flange with the thumb and forefinger, and rotate the turntable by hand until the drive flange pins engage both the record and the turntable. Positive drive is thus obtained between the turntable, the record, and the recording mechanism.
- (I) If possible, test the sound to be recorded, and adjust the amplifier volume control so that the needle of the volume indicator meter will indicate in the section of the meter scale between -3 and +3 during average recording passages. Practice will determine the proper adjustment.

NOTE: If piano recordings are being made, the needle should not reach the section of the scale between -3 and +3, or distortion will occur.

- (J) Start the turntable motor by moving the motor switch to the "ON" position.
- (K) Slide the carriage on the support rod until the cutter is in the approximate position over the record, and then, by means of the lift finger on the recorder head, carefully lower the cutter to the proper position on the record.

CAUTION: Do not record nearer than 1/4 inch to the outer diameter, or nearer than a 2 inch radius to the center of the record.

- (L) The recording may now be made. Enunciation should be clear and distinct.
- (M) When the recording is completed, lift the recorder head from the record before shutting off the motor.
- (N) The cuttings should be removed from the record by moving the fingers, or a small, soft brush, in a gentle, circular motion over the record. Do not scratch the record.

HOW TO PLAY-BACK A RECORDING.

The recording may be played back immediately as follows:

- (a) Lift the recording mechanism, and place it in the "rest" position.
- (b) Turn the amplifier volume control to "0".
- (c) Turn the "RECORDING-REPRODUCING" knob to the "REPRODUCING" position.
- (d) Carefully move the tonearm over the record and lower the needle to the record. Adjust the amplifier volume control for proper volume, and adjust the amplifier tone control to reduce needle scratch and to obtain the desired tone.

MODELS MI-4824-B,
MI-4824-C

RCA MFG. CO., INC.

MODELS MI-4822-B,
MI-4822-C

PART IV - ADJUSTMENTS AND ADDITIONAL INFORMATION

CUTTING METHOD AND ADJUSTMENT

The depth of cut is controlled directly by the weight of the recorder head as it rests on the disc. This weight should be from two to four ounces, and an adjusting spring and a knurled nut are provided to alter the pressure. If the pressure of the cutter on the record is too great, the cut becomes too deep, and the remaining wall between grooves then becomes too thin, causing "cross-talk" or distortion.

The depth of the groove should be accurate over the surface of the record. Located within the collar of the recording mechanism base casting is the adjusting sleeve, the adjustment of which must be such that it will insure motion of the recorder head parallel to the surface of the record. The sleeve is locked in position by means of a set screw which is threaded through the collar of the support casting. It is essential that vertical adjustment of this sleeve be very carefully made to insure constant depth of groove throughout the run of the record. There is a tendency for the cutter to cut a deeper groove at the inner section of the record, if the adjusting sleeve is not properly adjusted. If the groove is being cut deeper at the outer edge of the record, raise the sleeve and vice versa. By using a spirit level, the recording mechanism may be readily adjusted parallel to the record surface.

A good method of determining the depth of cut is to observe the width of the remaining wall by means of a microscope. They should be the same. After some practice, the groove-to-wall width ratios can be estimated by the eye, or with a small magnifier.

Groove depth may vary somewhat depending on the softness or freshness of the record, and it is desirable to recheck frequently the groove dimensions as explained above.

CUTTER ANGLE

The angle between the cutting stylus and the record surface has been adjusted at the Factory for slightly less than 90 degrees. It may be necessary in certain cases, such as when using reground cutters, etc., to readjust the cutter angle as follows: Loosen the two screws at the back of the recorder head. These two screws secure the recorder head to the carriage assembly. If the cutter angle is to be increased, the recorder head should be raised with respect to the mounting bracket; and if the cutter angle is to be decreased, the recorder head should be lowered with respect to the mounting bracket. The recorder head must not be rotated sidewise when the above adjustment is made.

If cutter sing or chatter is experienced, the cutter angle should be changed slightly until proper operation is obtained, and the two mounting screws should then be securely tightened.

THE CUTTING POINT.

A sharp cutting tool is imperative for a smooth groove free from excessive surface noise. Steel cutters are satisfactory for about fifteen minutes of recording. Sapphire cutters are recommended, which last approximately twelve times as long.

A sharp cutting tool will remove the thread quietly and smoothly. The only noise heard should be that of the recorder head itself, which talks audibly during the louder passages. In other words, when test cuts or blank grooves are cut, there should be no tearing or scraping sound. By placing the ear close to the record, the cutting should sound even in character, and have a faint, steady hiss.

The amount of noise heard while cutting a blank groove is a fairly reliable indication of how much surface noise will exist in the finished record. Sapphire cutters cut more smoothly than the steel type, and their increased cost is warranted if maximum quality and minimum surface noise are sought.

MODELS MI-4822-B,
MI-4822-C
CUTTER CHATTER

RCA MFG. CO., INC.

MODELS MI-4824-B,
MI-4824-C

Occasionally a steel cutting tool will be found which chatters or cuts with a whistling sound. If the groove dimensions are correct, the fault is apt to be caused by a defective tool, and a new tool should be tried. Do not attempt to use a steel cutter for over fifteen minutes of recording.

DIRECTION OF FEED.

The RCA Portable Turntable may be used with the proper recording attachment to feed either "inside-out" or "outside-in", that is, from the inside of the record to the outside, or from the outside of the record to the inside.

The following are available for use with this equipment:

- (A) MI-4815 Outside-In Recording Attachment
- (B) MI-4820 Inside-Out Recording Attachment
- (C) MI-4821 Outside-In Recording Drive Screw
- (D) MI-4819 Inside-Out Recording Drive Screw

The threads shrink in size when cut from the record, and therefore tend to lie near the inner diameter of the record. For this reason, there is no difficulty when recording from "inside-out", but when making long recordings from "outside-in", difficulty is sometimes encountered due to the cutter becoming entangled with the shavings. When recording intermittently from "outside-in", opportunity should be taken during pauses in recording to remove the shavings. A fine camel hair brush about 1" wide may be used to free the cutter from the shavings.

RECORD SUPPLY

Since the instantaneous recording discs contain a volatile softener which gradually evaporates, records should be purchased in quantities suited to immediate needs, and should be stored in metal containers sealed with tape until used. Sealed containers prolong the useful life before cutting.

AVAILABILITY OF BLANK RECORDS.

Blank records are available on short notice, and a little planning as to requirements will insure maximum quietness in the completed record.

For the most satisfactory recordings, use RCA Recording Blanks.

REPEATED PLAYING OF RECORDINGS.

Repeated playing does not materially affect the quality of the record up to fifteen or twenty times.

RECORDING FROM RADIOS.

Figure 4 shows two methods of recording from radio receivers. The preferable method, if convenient, is to use the adaptor and plug into the inverter tube socket of the radio.

In case of emergency, a recording may be made from the radio by placing the microphone about two feet from, and at an angle of about 45 degrees from, the radio loudspeaker, but this method is not recommended as standard practice due to the superior results obtained by the above methods.

CORRECT USE OF THE TONE CONTROL

When recording, it is generally preferable to set the amplifier tone control for a maximum amount of high frequencies, and when reproducing to retard the tone control sufficiently to obtain the desired tone and to reduce needle scratch. To secure professional type results, however, the tone control should be adjusted several times during a recording

MODELS MI-4824-B,
MI-4824-C

RCA MFG. CO., INC.

MODELS MI-4822-B,
MI-4822-C

This is because the higher frequencies are considerably more in evidence at the outer diameter of the record. When recording from "inside-out", the tone control should be adjusted for a maximum of high frequencies at the start of the recording, and gradually changed to reduce high frequencies at the outer diameter of the record. When recording from "outside-in", the reverse procedure should be followed. A little practice will make it easy to follow the above procedure and thus secure the best results.

LUBRICATION AND MAINTENANCE.

The motor should be lubricated once every three months by dropping a few drops of high-grade S.A.E. #50 oil in the oil wick at each end of the motor housing. The oil holes are painted red for identification. The upper oil hole is located under the cover plate, and the lower oil hole is reached by removing the motor board.

The worm gear and worm wheel of the recording mechanism should be lubricated every two or three months with a small amount of clean, high grade, light-body grease, such as vaseline. No further lubrication of the recording mechanism is required.

The equipment supplied by the manufacturer is as follows:

- 1 Portable Turntable in carrying case, either,
 - (a) MI-4814-A (105-125 Volts, 60 Cycles)
 - (b) MI-4823-A (105-125 Volts, 50 Cycles)
- 1 Recording Attachment, either
 - (a) MI-4815 Outside-In Attachment, or
 - (b) MI-4820 Inside-Out Attachment
- 6 Steel Cutting Stylus
- 6 Chromium Reproducing Needles
- 4 Male Plugs

The following, not supplied, are required for operation:

- Suitable Microphone
- Suitable Amplifier
- Suitable Loudspeaker
- Blank Recording Discs
- Power Supply of 105 to 125 Volts, and of the proper frequency.

The following accessories, not supplied, may be used:

- 1 Volume Indicator Meter, RCA Drawing No. K-180840 which can be mounted in a suitable case and provided with jack tips by the customer.
- 1 Pair of High-Quality Headphones (for monitoring)
- 1 High Quality Radio (for Radio recording)
- 1 Microscope (10 power or greater, for checking groove depth, etc.)

CONTROLS PROVIDED

- (A) Motor Switch
- (B) Phonograph Volume Control
- (C) Recording-Reproducing Switch
- (D) Speed-Changeover Control

PHYSICAL SPECIFICATIONS

- Width - 27 3/4 Inches
- Depth - 23 Inches
- Height - 14 Inches
- Weight - 82 Pounds

POWER REQUIRED

- 105-125 Volts
(of the proper frequency)

TURNTABLE DIAMETER

16 Inches (For 12", 14" or 16" Records.)

80 Watts

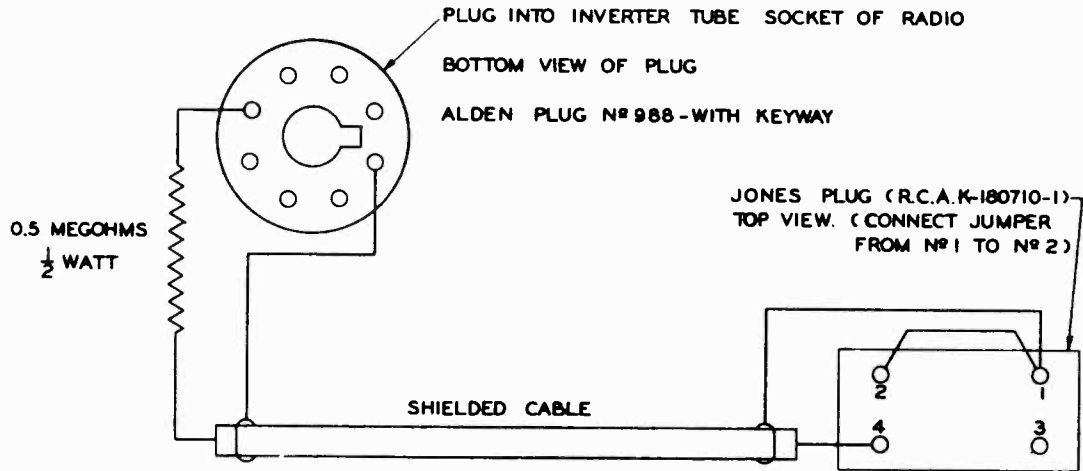
TURNTABLE SPEEDS

78 and 33-1/3 rpm

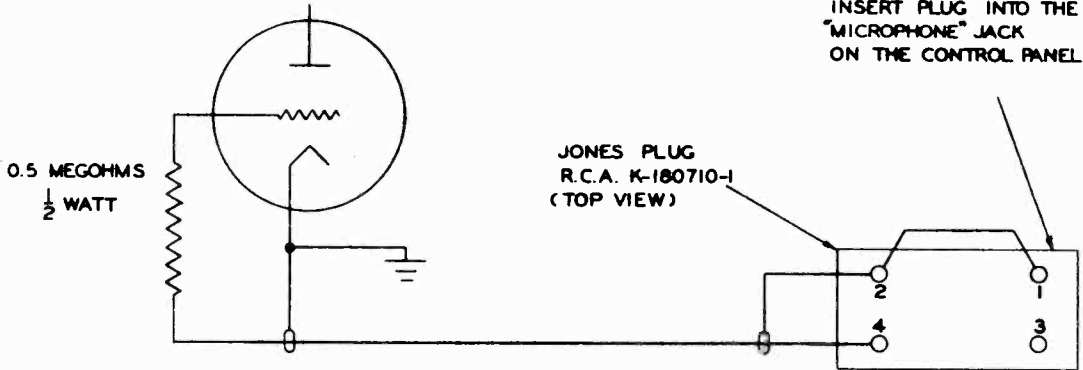
MODELS MI-4822-B,
MI-4822-C

RCA MFG. CO., INC.

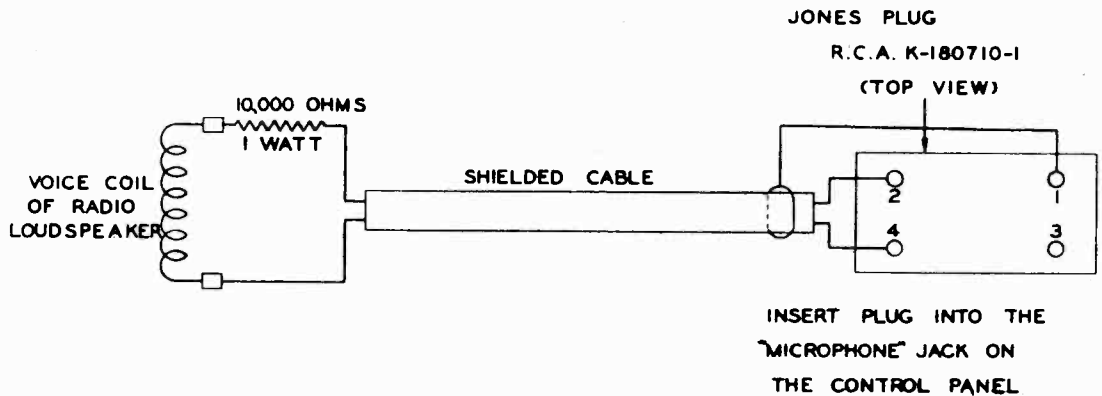
MODELS MI-4824-B,
MI-4824-C



ADAPTER FOR RADIO RECORDING



SCHEMATIC DIAGRAM OF ABOVE ADAPTER



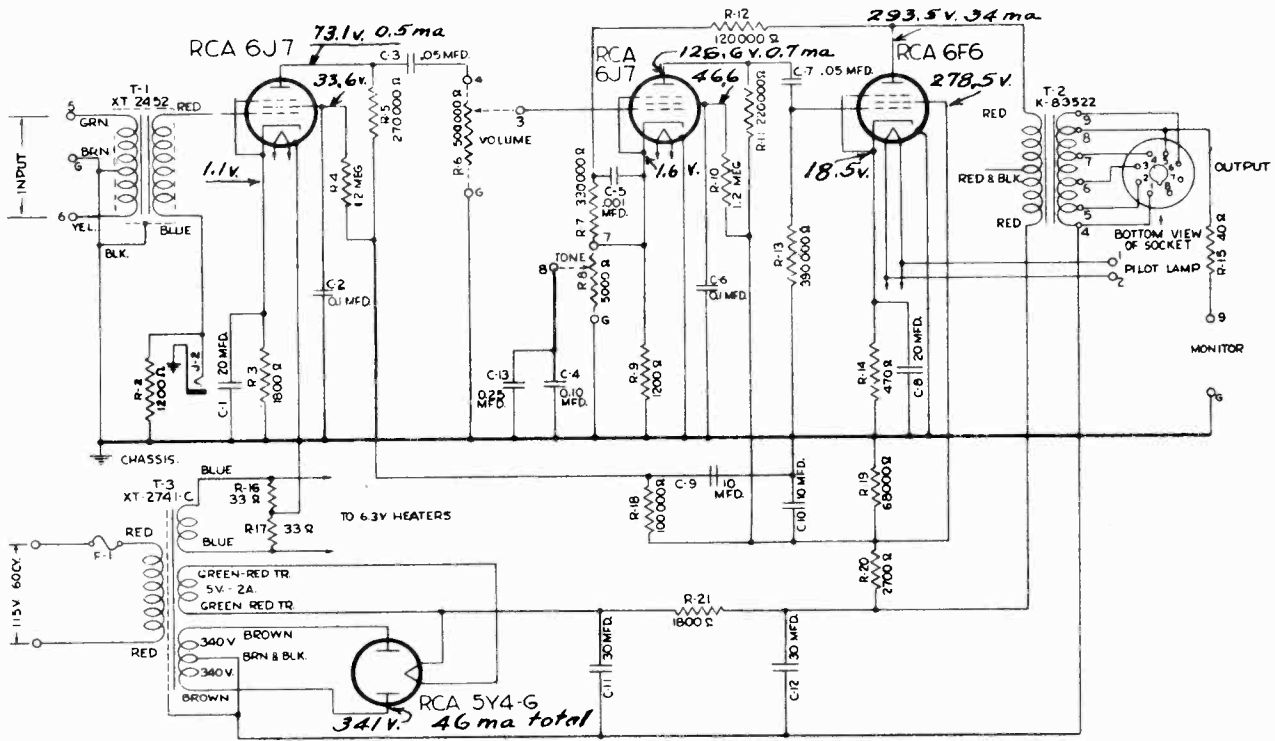
OPTIONAL METHOD OF RECORDING FROM A RADIO
WHEN NOT CONVENIENT TO USE ADAPTER
DESCRIBED ABOVE.

FIGURE 4 - RECORDING FROM RADIOS.

P-170369-1

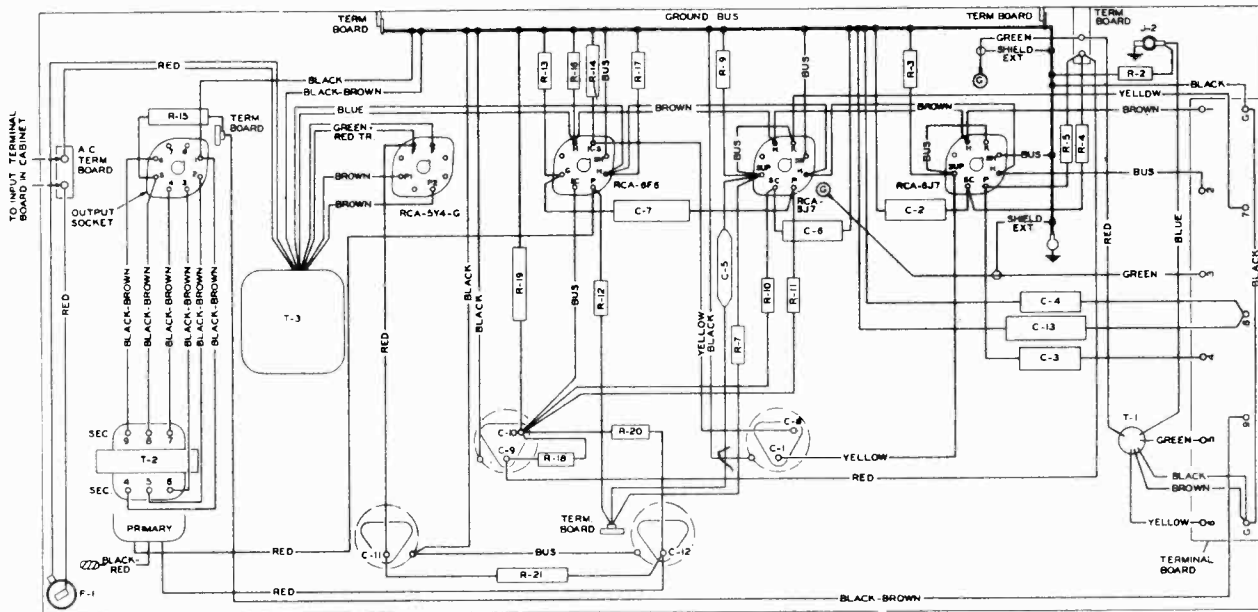
RCA MFG. CO., INC.

MODELS MI-12700,
MI-12700-A



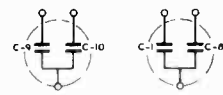
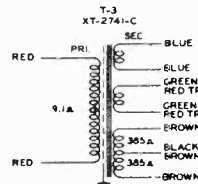
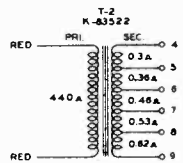
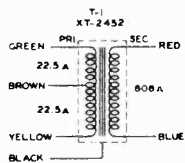
AMPLIFIER FOR MI-12700 P-170221-4

Figure 6



INTERNAL CONNECTIONS

BOTTOM VIEW



MI-12700

T-613035-0

Figure 7

MODELS MI-12700,
MI-12700-A

RCA MFG. CO., INC.

Voltage 105 to 125 volts
Frequency 60 cycles

POWER CONSUMPTION

Amplifier 57 watts
Motor 70 watts

INPUT IMPEDANCE

Microphone receptacle 250 ohms
Radio input jack 1,200 ohms
Load Impedances 0.53, 2.6, 7.1, 15, 27 ohms
Power Output (with less than 5% distortion) 3 watts
Voltage required for cutter head approx. 3.5 volts

MAXIMUM INPUT LEVELS

Microphone receptacle -28 db*
Radio input jack -13 db*
Average Over-all Amplifier Gain 100 db
Over-all Frequency Response 60-6,500 cycles per second

RCA RADIOTRON COMPLEMENT

(1) RCA-6J7 Voltage Amplifier (3) RCA-6F6 Power Output
(2) RCA-6J7 Driver (4) RCA-5Y4-G Rectifier

SPEAKER

Type 12-inch Permanent Magnet
Voice Coil Impedance 2.2 ohms at 400 cycles
* 0.006 W=zero level.

Mechanical Specifications

Height 35 1/4 inches
Width 27 inches

Depth 22 inches
Weight—with cutter, less microphone 136 pounds



Figure 1

Lubrication

Approximately once every three months or oftener if the instrument is subjected to constant use, remove the turntable and metal cover plate over the drive mechanism. Place a few drops of S.A.E. No. 50 oil in the oil wick at top of motor housing. At the same time place a drop of oil on the idler pulley bearing and also in the turntable bearing. Great care should be taken to keep the rubber tire on the idler pulley free from oil and grease at all times. At the same time the worm gear and worm wheel of the recording mechanism should be lubricated with a small amount of clean, high-grade, light-body grease, such as vaseline. The feed screw, upper, and lower support rods should never be lubricated. If they become dusty or dirty they should be wiped off with a clean, dry rag free from lint.

General Description

The MI-12700 and MI-12700-A Disc Recording Equipments consist of a microphone, amplifier, edge-driven 16-inch turntable, recording cutter head with feed mechanism, play-back pickup, speaker and V.I. meter, together with all necessary switches and controls, all mounted in a cabinet fitted with casters.

The only difference in these instruments is that the MI-12700 cutter head feeds from outside in while the MI-12700-A cutter head feeds from inside out.

This instrument will record and instantly play back records of the lacquer coated aluminum disc type. Either a steel or sapphire cutting tool may be used. The steel cutter is satisfactory for approximately 15 minutes of recording, after which it must be discarded, while the sapphire can be used for approximately three hours of recording and at this time can be returned to the factory for re-sharpening. The sapphire cutter makes records having less surface noise than the steel cutting tool makes; however, the surface noise is very low on records made with the steel cutter.

This instrument can also be used to play any other laterally cut records up to 16 inches in diameter. Records can be recorded and played at either 78 or 33 1/3 r.p.m.

The cutting head is equipped with a "float stabilizer" which is mounted to the side of the cutting head by means of viscoloid damping blocks.

Turntable Drive Adjustment

The turntable drive motor is suspended on rubber mountings to prevent vibrations from being transmitted to the rest of the equipment. It is extremely important that these rubber mountings be in their proper positions at all times and that the motor should not come in direct contact with any of the adjacent parts except the idler pulley. Improper turntable drive may result if the rubber tire on the idler pulley becomes dried out, has flat spots worn on it, or collects oil, grease, or dirt. Likewise, improper driving action will result if the spring which pulls this idler pulley against the motor pulley and the turntable has insufficient tension.

The idler pulley bearing may occasionally bind due to an accumulation of thread cut from records wrapping up under it. This will not be visible from the top, hence, at occasional intervals the pulley should be removed, thoroughly cleaned, oiled and replaced.

RCA MFG. CO., INC.

MODELS MI-12701,
MI-12702

When the instrument is received from the factory the cutter head and its driving mechanism, completely assembled, are packed separately. Remove the flat metal plate on the back of the motor board. Place the mechanism in position over the turntable, as shown in Figure 1, with its swivel in the clearance hole through the motor board. Rotate the driving flange of the cutter mechanism until its three pins engage the three holes in the turntable and be sure that driving flange center is accurately fitted over top of the turntable spindle. Using the bolts which originally held the flat metal plate to the motor board, fasten the swivel to the motor board, being extremely careful not to let the mechanism slip out of position while tightening these bolts.

Plug the cutting head leads into the two pin jacks provided on top of the motor board.

FOR FURTHER DATA ON CUTTER HEAD
SEE MODEL MI-12701

Adjustments to Cutter Head Drive Mechanism

The cutting head drive screw should rotate freely and be free from end play. If end play is present loosen the jamb screw which locks the cone point bearing located at end away from driving gear and adjust this bearing until end play is eliminated (being careful not to cause binding), then tighten jamb screw.

Two cone pointed set screws support the cutter head and its mounting bracket. These should be adjusted to prevent end play but to permit free movement of the cutter head up and down.

The depth of the groove should be maintained with fairly close precision. In order to maintain constant depth of groove, the leveling set screw located on swivel base can be adjusted so that the recording mechanism is raised slightly more at the inner diameter of the record than at the outer diameter (approximately 1/64 inch). This is to offset the tendency to cut deeper at the inner diameter of the record where the surface speed is less. Compare the grooves and walls at the inner diameter of the record by means of a microscope or magnifying glass, with the grooves and walls at the outer diameter of the record. They should be the same.

A good method of checking the depth of cut (controlled by adjusting tension of cutter head supporting spring) is to observe the width of the cut groove in comparison to the width of the remaining wall by means of a microscope. The standard feed screw cuts 112 grooves per inch, and the proper width of groove is equal to, but never more than, the width of the remaining wall. The widths of groove and wall will then be about 0.0045 inch each, and the depth of the groove will be about 0.0025 inch. These measurements are all made with blank grooves (no input sound).

Groove depth may vary somewhat, depending on the softness or freshness of the record, and it is desirable to recheck frequently the groove dimensions as explained above.

The cutting head is adjusted on its mounting bracket at the factory so that the angle formed by the front of the cutting tool and the record is approximately 88½ degrees. This may sometimes have to be changed in order to prevent sing or chatter and to cut a clean polished groove when using re-ground cutting points or different records. Loosen the two screws which fasten the cutter head to its mounting bracket and with respect to this bracket raise the head to decrease the angle or lower the head to increase the angle. Then tighten the screws securely.

Check cutter head drive spring to be sure it is not bent and that it engages drive screw properly.

Practical Operating Hints

Practical experience with these instruments in the field indicates that the following points should be carefully observed in order to secure the best possible recording:

- 1—Be sure the instrument is level at all times.
- 2—Be sure the cutter supporting carriage is parallel to the turntable or approximately 1/64 inch closer at the outer edge of the record than at the inside. This adjustment should be made by means of the leveling set screw located in the main swivel.

3—Depth of cut is very important. It is controlled by increasing or decreasing the tension on the spring which supports the cutter head. The depth should be adjusted so that the width of each groove is approximately equal to the space between the grooves. This can be readily observed by looking at a test cut through a small magnifying glass.

4—Since sapphire cutting tools are rather expensive, they should be used with care. If the groove depth is too great, it is very easy to chip the sapphire cutting tool if it cuts all the way through the lacquer coating and touches the aluminum disc.

5—When recording an orchestra there is very likely to be considerable vibration transmitted to the instrument through the floor. If such is the case it is advisable to place the instrument on soft, felt pads to prevent this vibration from being transmitted directly to the instrument from the floor.

6—Correct grouping of recording artists and correct microphone placement are of extreme importance in order to get the best possible results. This grouping and placing will be facilitated by listening in a pair of RCA High Fidelity Headphones such as MI-3453-B plugged into the monitoring jack on the top motor board, prior to making a recording.

7—No artist, speaker, or singer should ever get closer than approximately one foot to the microphone. Best results are usually obtained when they never approach the microphone closer than approximately three feet. When a person does come too close to the microphone his voice usually becomes very boomy and unnaturally deep-throated.

8—On the back of the amplifier is located a jack into which radio output may be plugged in order to make recordings of an incoming radio program.

If desired, a more simplified method of connection can be used by removing the first audio tube from the radio set and connecting its grid contact through a 1-megohm resistor to the tip of a telephone plug inserted in this jack and connecting the sleeve of this plug to the ground of the radio chassis.

9—Regardless of what method of connection is used for making radio recordings, it is important to keep the radio volume control turned down low enough so that the first tube in the recording amplifier unit is not overloaded. The surest way to get this correct adjustment is to set the main volume control on the recorder at approximately No. 5 position and then adjust the radio volume control so that the average peaks of the incoming signal show an indication of zero level on the recording level meter and the occasional very loud peaks show a level of approximately plus 3 on this meter.

10—When cutting a record it is advisable to lower the cutter head and let it cut two or three blank grooves before starting the modulation. At the end of the recording when the modulation has stopped, the cutter head should remain on the record to cut two or three blank grooves before it is raised.

11—When recordings of speech only (not music) are being made, superior results will usually be obtained if the RCA MI-6226 aerodynamic microphone is used. However, music recordings should be made with the velocity microphone supplied with the equipment.

12—The recording level is extremely important and is controlled by the volume control located on the motor board. The signal actually being fed to the cutter head is measured by the V. I. (volume indicator) meter also mounted on the motor board. During all recordings the volume control should be adjusted so that the average peaks show an indication of zero level on the V. I. meter and the occasional very loud peaks show a level of approximately plus 3. Experience is very valuable in adjusting the level for various types of recordings. In general the level should be as high as possible (in order to override surface noise) and still avoid distortion or "cross talk" from adjacent grooves in the record.

Centering Loudspeaker Cone

To center the loudspeaker cone, first remove the front dust cover, then loosen the spider screws and insert three narrow feelers at equal distances in the gap. Tighten spider screws, remove the feelers and fasten a new dust cover in place with loudspeaker cement.

MODELS MI-12700,
MI-12700-A

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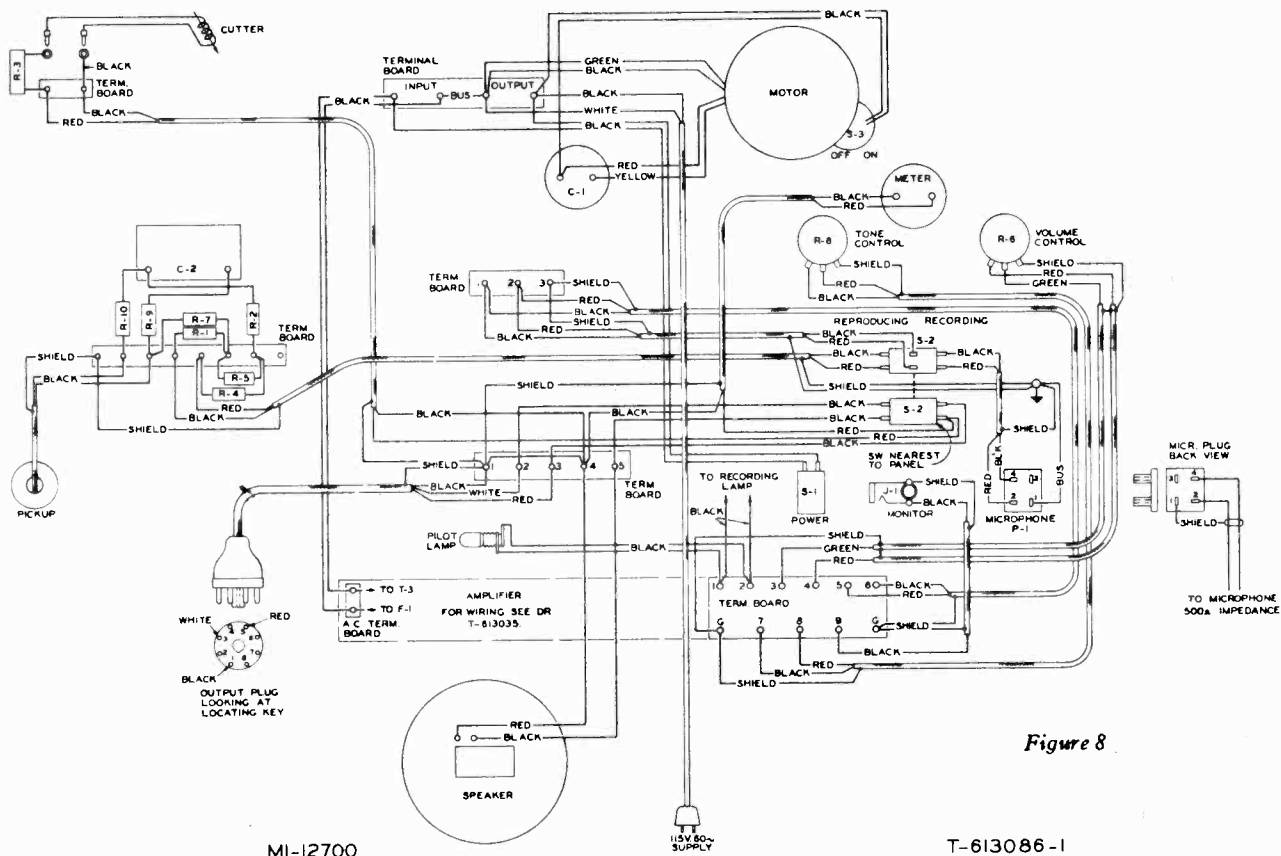


Figure 8

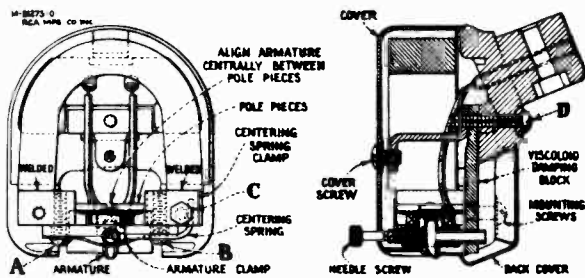
Record Thread

It is important to keep all record thread which accumulates from cutting cleaned out of all bearings at all times. Failure to do this will cause sticking and binding.

Magnetic Pickup and Tone Arm

A flat bronze spring for adjusting needle pressure on the record is located between the tone arm and its horizontal supporting arm. This spring should be bent upward or downward as necessary so that the needle pressure on the record will be approximately three ounces.

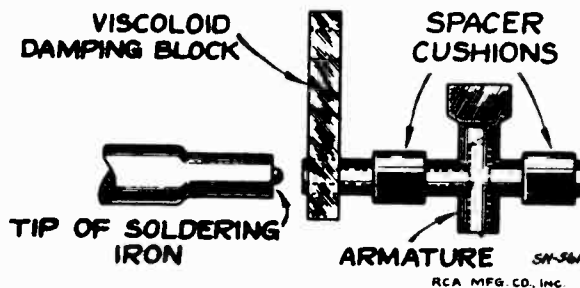
Refer to Figure 4 showing the pickup inner structure. The armature is shown in its proper relation to the magnet pole pieces, i.e., exactly centered. Whenever this centering adjustment has been disturbed, the screws A, B, and C should be loosened and the armature clamp adjusted to the point where the vertical axis of the armature is at right angles to the horizontal axis of the pole pieces, and centered between them.



Details of Pickup

Figure 4

This centering operation may be facilitated by inserting a small rod or nail into the armature needle hole, using it as a lever to test the angular movement of the armature. The limitations of the movement in each direction will be caused by the armature striking the pole pieces. The proper adjustment is obtained when there is equal angular displacement of the armature and adjustment rod or nail to each side of the vertical axis of the magnet and coil assembly. The screws A and B should then be secured, observing care not to disturb the adjustment of the armature clamp. Then place the pickup in a vise and secure the centering spring-clamp by means of the screw C, allowing the centering spring to remain in the position at which the armature is exactly centered between the pole pieces. With a little practice, the correct adjustment of the armature may be readily obtained. The air gap between the pole pieces and the armature should be kept free from dust, filings, and other such foreign materials which would obstruct the movement of the pickup armature.



Special Soldering Iron Tip

Figure 5

MI-12700-A

RCA MFG. CO., INC.

MODELS MI-12700,

The viscoloid block which is attached to the back end of the armature shank serves as a mechanical filter to eliminate undesirable resonances and to cause the frequency response to be uniform. Should it be necessary to replace this damping block, it may be done by removing screw D and the cover support bracket from the mechanism and taking off the old viscoloid block. The surface of the armature which is in contact with the viscoloid should be thoroughly cleaned with fine emery cloth. Then insert the new block so that it occupies the same position as it did originally. Make certain that the block is in correct vertical alignment with the armature. The hole in the new viscoloid block is somewhat smaller than the diameter of the armature in order to permit a snug fit. When the viscoloid is aligned on the armature, screw D and the cover support bracket should be replaced. Heat should be applied in the armature (viscoloid side) so that the viscoloid block will fuse at the point of contact and become rigidly attached to the armature. A special-tip soldering iron constructed as shown in Figure 5 will be found very useful in performing this operation. The iron should be applied only long enough to slightly melt the block and cause a small bulge on both sides.

Whenever there is defective operation due to an open or shorted pickup coil, this coil should be replaced. The method

of replacement will be obvious upon inspection of the pickup assembly and by study of the cut-away illustrations. Make sure that the new coil is properly centered with the hole in its support strip and glued securely in that position. It is important to readjust the armature as previously explained after re-assembly of the mechanism. Only rosin core solder should be used for soldering the coil leads in the pickup. This same type of solder should be used when necessary for soldering the centering spring to the armature.

Loss of magnetization will not usually occur when the pickup has received normal care because the magnet and pole pieces are one unit and the magnetic circuit remains practically closed at all times. When the pickup has been mishandled, subjected to a strong a-c field, jolted, or dropped, there may be an appreciable loss of magnetic strength, in which case it will be necessary to re-magnetize the entire structure. To do this, it will be necessary to first remove the pickup mechanism from the tone arm, and then remove the magnet assembly. Place the magnet assembly on the poles of a standard pickup magnetizer such as the RCA Stock No. 9549 Pickup Magnetizer and charge the magnet in accordance with the instructions accompanying the magnetizer. It is preferable to check the polarity of the pickup magnet and to re-magnetize it so that the same polarity is maintained.

REPLACEMENT PARTS

Insist on genuine factory-tested parts, which are readily identified and may be purchased from authorized dealers.

STOCK No.	DESCRIPTION	Unit List Price	STOCK No.	DESCRIPTION	Unit List Price
AMPLIFIER ASSEMBLIES			TURNTABLE DRIVE ASSEMBLIES		
30314	Cap—Grid cap	.03	32941	Capacitor—2.5 mfd. motor capacitor (C1)	3.70
12635	Capacitor—1,000 mmfd. (C5)	.50	32246	Motor—110 volts, 60 cycle turntable motor	X
4886	Capacitor—.05 mfd. (C3, C7)	.20	32512	Pulley—Idler pulley, tire, and bushing	7.75
4839	Capacitor—.1 mfd. (C2, C4, C6)	.30	32513	Pulley—Motor pulley assembly	3.40
12484	Capacitor—.25 mfd. (C13)	.30	32511	Spring—Eccentric "U" spring	.15
32332	Capacitor—10-10 mfd. (C9-C10)	2.05	32862	Spring—Roller tension spring	.25
32331	Capacitor—20-20 mfd. (C1, C8)	2.80	32514	Spring—Speed-shift coil spring	.25
32020	Capacitor—30 mfd. (C11, C12)	4.25	14804	Switch—Turntable motor switch (S3)	.60
14133	Fuse—1 ampere (F1)	.18	PICKUP AND ARM ASSEMBLIES		
30187	Jack—Radio jack (J2)	.75	32358	Arm—Arm less pickup unit	12.80
32059	Post—Fuse post	1.00	12540	Armature and spring assembly	2.20
30789	Resistor—33 ohms, $\frac{1}{2}$ watt (R16, R17)	.20	32364	Cable—Pickup cable	.70
32330	Resistor—40 ohms, 2 watts (R15)	1.30	12541	Coil	1.05
30681	Resistor—470 ohms, 1 watt (R14)	.22	32360	Cover—Front cover for pickup	1.15
30731	Resistor—1,200 ohms, $\frac{1}{2}$ watt (R2, R9)	.20	32361	Cover—Back cover for pickup	.25
30930	Resistor—1,800 ohms, $\frac{1}{2}$ watt (R3)	.20	14115	Mechanism—Comprising armature, spring, clamp and damper	2.30
32329	Resistor—1,800 ohms, 5 watts (R21)	1.60	12539	Needle screw	.15
30730	Resistor—2,700 ohms, $\frac{1}{2}$ watt (R20)	.20	32357	Pickup unit complete	9.65
30225	Resistor—68,000 ohms, 2 watts (R19)	.25	32359	Spring—Phosphor bronze spring	.25
3252	Resistor—100,000 ohms, $\frac{1}{2}$ watt (R18)	.20	MISCELLANEOUS ASSEMBLIES		
30180	Resistor—120,000 ohms, $\frac{1}{2}$ watt (R12)	.20	27833	Bracket—Pilot lamp bracket	X
14583	Resistor—220,000 ohms, $\frac{1}{2}$ watt (R11)	.20	16823	Cord—Power cord	X
30651	Resistor—270,000 ohms, $\frac{1}{2}$ watt (R5)	.20	32805	Jewel—Pilot lamp red jewel and nut	X
30784	Resistor—330,000 ohms, $\frac{1}{2}$ watt (R7)	.20	4340	Lamp—Pilot lamp 6.3 volts	.17
11988	Resistor—390,000 ohms, $\frac{1}{2}$ watt (R13)	.20	32054	Plug—4-contact microphone plug	1.00
30162	Resistor—1.2 meg., $\frac{1}{2}$ watt (R4, R10)	.20	26573	Plug—8-contact amplifier output plug	.60
33084	Socket—Octal tube and output socket	.25	25941	Plug—For power cord	.60
30251	Transformer—Input transformer XT-2452 (T1)	8.20	32333	Resistor—5 ohms, 10 watts (R3)	1.95
7852	Transformer—Output transformer (T2)	2.00	30732	Resistor—47 ohms, $\frac{1}{2}$ watt (R5)	.20
31380	Transformer—Power transformer XT-2741-C (T3)	6.35	13961	Resistor—82 ohms, $\frac{1}{2}$ watt (R9)	.20
SPEAKER ASSEMBLIES (MI-6247)			30540	Resistor—100 ohms, $\frac{1}{2}$ watt (R1, R2, R4, R7)	.20
31275	Cone	1.75	5164	Resistor—560 ohms, $\frac{1}{2}$ watt (R10)	.20
31825	Dust Cap	.05	INSTANTANEOUS RECORDING DEVICES		
9713	Speaker	20.00	(MI-4815 Outside-in) (MI-4820 Inside-out)		
CONTROL PANEL ASSEMBLIES			32475	Armature and spring assembly complete	4.10
26714	Bracket—for recording-reproducing switch (S2)	1.25	32479	Cable—Lead wire for recorder head	.95
23421	Jack—Monitor Jack (J1)	.55	32476	Coil	.75
30075	Knob—Volume, tone or (S2) control knob	.50	32457	Cover—Front cover for recorder head	2.40
32334	Meter—Decibel meter	X	32477	Damper Assembly	.35
32055	Socket—4-contact microphone socket (P1)	.70	32460	Feed plate and spring assembly (MI-4815 only)	4.89
17507	Switch—D.P.D.T. switch part of (S2)	1.60	32461	Feed plate and spring assembly (MI-4820 only)	4.89
30163	Switch—D.P.S.T. switch part of (S2)	.75	MI-4821	Feed screw and gear assembly (MI-4815 only)	X
13462	Switch—Power switch (S1)	.85	MI-4819	Feed screw and gear assembly (MI-4820 only)	X
32607	Tone Control—5,000 ohms (R8)	1.00	32482	Screw—No. 6-32 slotted for recorder head bracket	.30
32608	Volume Control—500,000 ohms (R6)	1.00	12539	Screw—Needle holding screw	.15
MOTORBOARD ASSEMBLIES			32465	Screw—tension adjustment screw and nut	X
32654	Ball—Turntable shaft ball-bearing	.08	32456	Recorder—Recorder head complete	18.00
32608	Capacitor—2 mfd., 300 volts (C2)	2.00	32463	Spring—Recorder head tension spring	.25
11881	Lamp Base Assembly	.90	MI-4036-G		
11711	Lampshade	.65	VELOCITY MICROPHONE		
4340	Lamp—6.3 volts	.17	32585	Cable—30 ft. microphone cable with strain relief	4.20
32590	Jack—Hex tip jack	.10	20911	Ribbon	.75
11762	Needle box and lid	.50	14140	Screen	8.50
32515	Turntable—Turntable disc	16.80	14141	Transformer	6.25

X—Price upon application to local RCA Distributor.

ALL PRICES ARE SUBJECT TO CHANGE OR WITHDRAWAL WITHOUT NOTICE.

MODELS MI-12700,
MI-12700-A

RCA MFG. CO., INC.

POWER SUPPLY

MI-12701..... 105-125 volts, 60 cycles
MI-12702..... 210-250 volts/105-125 volts, 50, 60 cycles

POWER CONSUMPTION

Amplifier..... 60 watts
Motor..... 70 watts

Input Impedance (Microphone receptacle)..... 100,000 ohms
Load Impedance (At amplifier output socket)..... 0.53; 2.6; 7.1; 15; 27 ohms
Power Output (5% distortion)..... 3 watts
Power Level (.006 watt Reference Level)..... 27 db
Voltage Required for Cutter Head..... 3.5 volts
Maximum Input Level..... -28 db
Average Over-all Gain..... 100 db
Frequency Response..... 60 to 6,500 cycles
Record Lines Cut..... 112 Lines per inch

RCA RADIOTRON COMPLEMENT

(1) RCA-6J7..... Voltage Amplifier (3) RCA-6F6..... Power Output
(2) RCA-6J7..... Driver (4) RCA-5Y4-G..... Rectifier

SPEAKER

Type..... 6-inch Permanent Magnet
Voice Coil Impedance..... 6 ohms at 400 cycles

Mechanical Specifications

Height..... 12½ inches Depth..... 17½ inches
Width..... 15½ inches Weight..... 37½ pounds

General Description

The MI-12701-12702 are portable type instantaneous disc recorders consisting of a turntable, cutter head, pickup head, 3 watt amplifier, dynamic speaker and MI-6228 type microphone. The turntable speed is 78 r.p.m. and the turntable will accommodate discs of any diameter from six to twelve inches. The MI-12701 Recorder is for use on 105-125 volts a.c., 60 cycles only. The MI-12702 Recorder is normally shipped connected for 220 volt 50 cycle operation. If it is desired to operate this unit on 110 volts, the power transformer connection may be changed to the 110 volt tap. If it is desired to operate this unit on a 60 cycle supply line, a 60 cycle drive pulley may be substituted for the 50 cycle pulley on the motor drive shaft. When the pulleys are changed, it may be necessary to adjust the position of the motor for proper turntable drive. See "Adjustments." It is recommended that RCA instantaneous Recording discs be used for recording with this equipment.

The equipment may also be used for playing standard 78 r.p.m. records. RCA Victor Green Shank Chromium Needles are recommended for this use.

This instrument will record and instantly play back records of the lacquer coated aluminum disc type. Either a steel or sapphire cutting tool may be used. The steel cutter is satisfactory for approximately 15 minutes of actual recording after which it must be discarded, while the sapphire can be used for approximately 12 hours of recording and then may be returned to the factory for re-sharpening. Records made with a sapphire cutter tend to have less surface noise than records made with a steel cutting tool, however, the surface noise is very low on records made with either type of cutter.



Figure 1.—MI-12701 Portable Recorder

Adjustments

Drive Mechanism.—The feed screw should be adjusted so that it has a minimum amount of end play yet rotates freely. Loosen the two set screws before attempting to adjust the cone pointed end play screws. The feed plate should be adjusted so that there is no back lash and no play between the feed plate and the feed screw.

The motor should be adjusted so that when the motor switch is in the "off" position, the motor pulley does not touch the edge of the turntable. When the motor switch is in the "on" position, the motor pulley should engage the turntable securely. This adjustment may be made by loosening the right-hand motor mounting screw and moving it in its slot in the desired direction.

Pickup Arm.—A flat bronze spring for adjusting pickup needle pressure on the record is located between the tone arm and its horizontal supporting arm. This spring should be bent upward or downward as necessary so that the pickup needle pressure on the record will be approximately three ounces.

Lubrication.—The feed screw and feed plate should be lubricated every two or three months with a small amount of clean high-grade light body grease, such as vaseline.

The motor should be lubricated about every 500 operating hours with a few drops of S.A.E. No. 50 oil placed in the two red oil holes one at each end of the motor. Access to the motor is gained by removing the motorboard.

RCA MFG. CO., INC.

MODELS MI-12701,
MI-12702

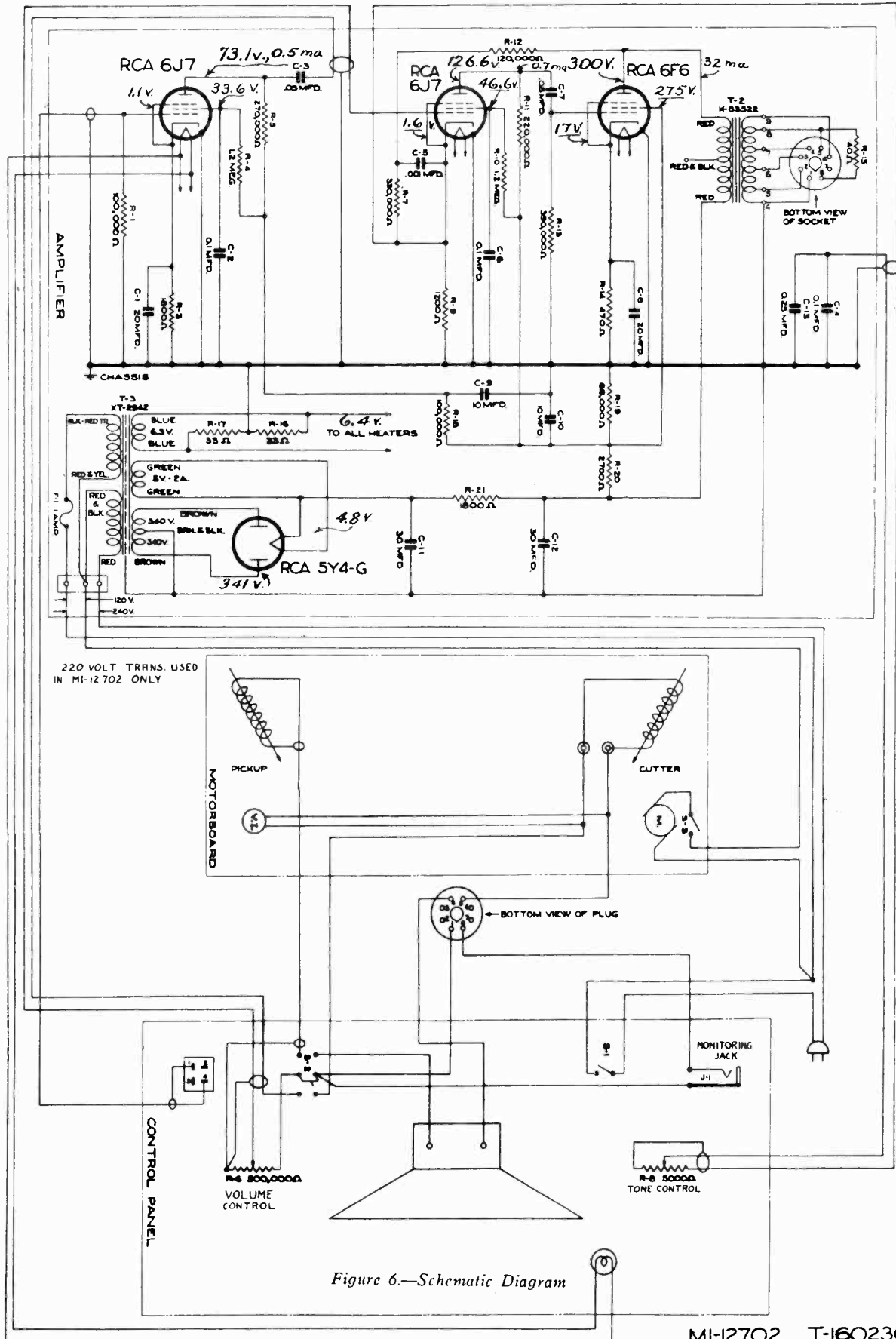


Figure 6.—Schematic Diagram

MI-12702 T-160230-O

MODEL MI-12701,
MI-12702

RCA MFG. CO., INC.

Recording Cutter Head

Figure 4 shows the cutter head inner structure. It should be noted that the armature is shown in its proper position, correctly centered between the magnet pole pieces. Whenever this centering adjustment has been disturbed, the screws "A," "B," and "C" should be loosened and the armature adjusted to a point where its vertical axis is at right angles to the horizontal axis of the pole pieces, and exactly centered between them.

This centering operation may be facilitated by inserting a small nail or rod into the armature needle hole and using it as a lever to test the angular movement of the armature. The proper adjustment is obtained when there is equal angular displacement of the armature and adjustment nail or rod on each side of the vertical axis of the magnet and coil assembly. When this adjustment has been obtained screws "A" and "B" should be tightened. Then place the cutter head in a vise and secure the centering spring by means of screw "C" allowing the centering spring to remain in the position at which the armature is exactly centered between the pole pieces. The air gap between the pole pieces and the armature should be kept free from dust, filings, or any other foreign material.

Figure 5 shows a rear view of the cutter head with the back cover plate removed. This view shows the viscoloid damping block fastened at the top under screw "A" and at the bottom fastened to the armature by means of nut and washer "C." If the armature requires much readjustment as described above, the nut "C" should be loosened thereby allowing the viscoloid block to find its own correct position on the armature after which nut "C" should be securely tightened.

Loss of magnetization will not usually occur unless the cutter head has been mishandled, subjected to a strong a-c field, jolted, or dropped. However, if remagnetizing is necessary, the cutter head should be removed from its bracket and the magnet assembly removed from the cutter head. Place the magnet assembly on the poles of a standard pickup magnetizer such as RCA Stock No. 9549 and charge the magnet in accordance with the instructions accompanying this magnetizer. It is preferable to check the polarity of the magnet and to remagnetize it so that the same polarity is maintained

Magnetic Pickup

The pickup used is of an improved design. The horseshoe magnet is rigidly welded to the pole pieces and is irremovable. There is a centering spring attached to the armature to maintain proper adjustment and to provide a limiting effect on the movement of the armature. The frequency response is substantially uniform over a wide range. Service operations which may be necessary on the pickup are as follows:

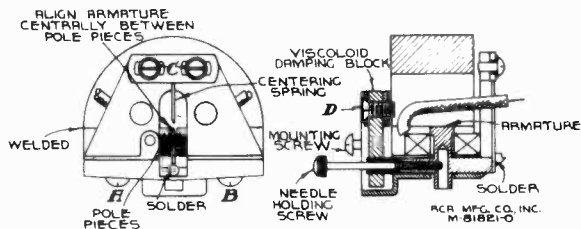


Figure 2.—Details of Pickup

Centering Armature.—Refer to the figure showing the pickup inner structure. The armature is shown in its proper relation to the magnet pole pieces, i. e., exactly centered. Whenever this centering adjustment has been disturbed it will be necessary to remove the pickup mechanism from the tone arm by removing the needle holding screw and the two mounting screws from the front of the tone arm, holding the pickup assembly to keep it from dropping. Unsolder the two leads from the lugs on the terminal board at the rear of the pickup. Insert a small rod or nail into the needle hole and replace the needle holding screw, tightening it to hold the rod securely. If the armature clamping screws A and B have

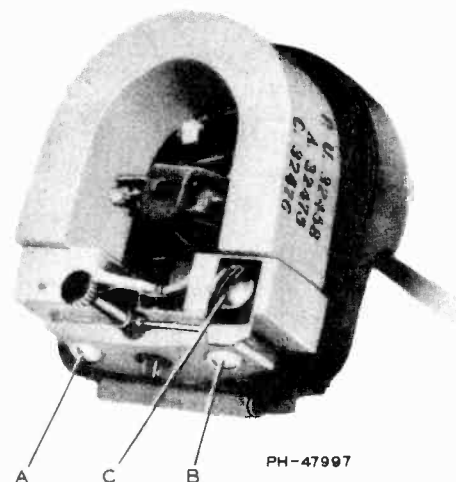


Figure 4.—Front View Cutter Head

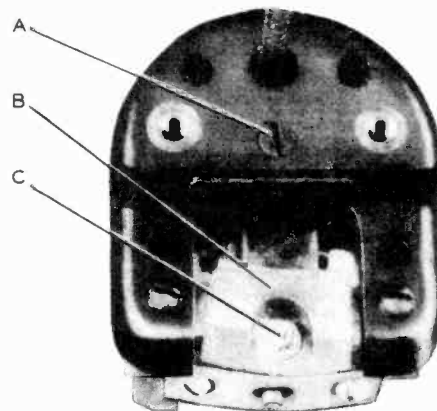


Figure 5.—Rear View Cutter Head PH-47906

not been disturbed, screws C should be loosened which will permit the armature to be moved from side to side, the rod acting as a lever to perform this operation. The proper adjustment is obtained when the armature is moved to the extreme position on each side (the movement being limited by the armature striking the pole pieces) and then brought to the mid position between these two extremes. Screws C should then be tightened. The armature position should then be central between the pole pieces and at right angles to them. With a little practice, the correct adjustment of the armature will be obtained. The air gap between the pole pieces and the armature should be kept free from dust, filings, and other foreign material which would obstruct the movement of the pickup armature.

Damping Block.—The viscoloid damping block which is attached to the front end of the armature shank serves as a mechanical filter to eliminate undesirable resonances and to cause the frequency response to be uniform. Should it be necessary to replace this damping block, the pickup mechanism should be removed from the tone arm as explained above. Remove screw D and the damping block from the pickup assembly. Make sure that the shaft of the armature which contacts the viscoloid is clean. Then insert the new damping block so that it occupies the same position as that of the original block, and is in correct vertical alignment with the armature. The hole in the block is somewhat smaller than the diameter of the armature in order to permit a snug fit. With the damping block properly aligned on the armature, screw D with its washer should then be replaced. Heat should be applied to the armature (viscoloid side) so that the damping block will fuse at the point of contact and become rigidly attached to the armature. A special-tip soldering iron, constructed as shown, will be found very useful in perform-

RCA MFG. CO., INC.

MODELS MI-12701,
MI-12702

ing this operation. The iron should be applied only long enough to slightly melt the block, causing a small bulge on both sides.

Replacing Coil.—Remove the pickup mechanism and terminal board as described above. Remove screws A and B and the magnet assembly. Remove the bakelite coil support (with coil attached) and insert the new coil support assembly in its place, after which replace the magnet assembly and center the armature as described above, then re-assemble the remainder of the unit. Only rosin core solder should be used for soldering the coil leads and pickup leads to the pickup terminal board. This same type of solder should be used when necessary for soldering the centering spring to the armature.

Magnetizing.—Loss of magnetization will not usually occur when the pickup has received normal care. When the pickup has been mishandled, subjected to a strong a-c field, jolted, or dropped, there may be an appreciable loss of magnetic strength, in which case it will be necessary to remagnetize the entire structure. To do this, it will be necessary to first

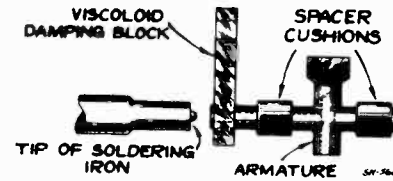
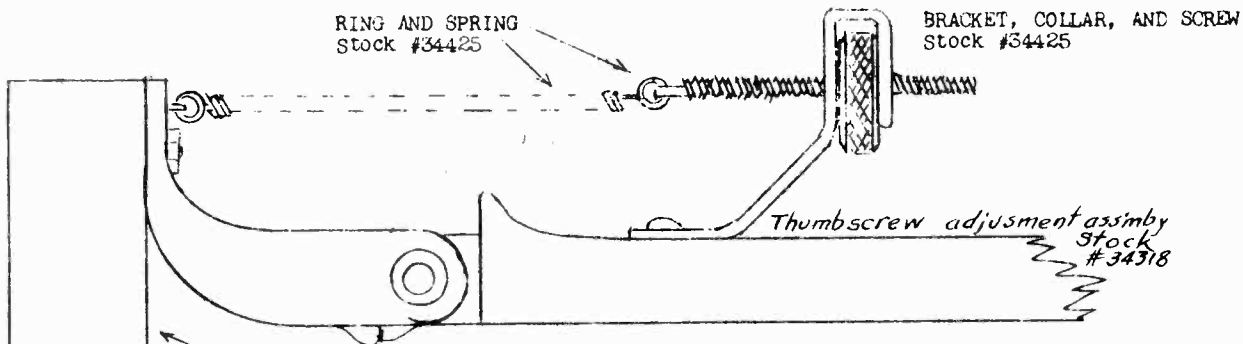


Figure 3.—Special Soldering Iron Tip

remove the pickup mechanism from the tone arm, and then remove the magnet assembly. Place the magnet assembly on the poles of a standard pickup magnetizer such as the RCA Stock No. 9549 Pickup Magnetizer and charge the magnet in accordance with the instructions accompanying the magnetizer. It is preferable to check the polarity of the pickup magnet and to remagnetize it so that the same polarity is maintained.

Operating Hints

- 1—Be sure the instrument is level at all times.
- 2—It is advisable to test for depth of cut of the cutter after the cutter has been changed. The proper depth of cut may be determined by looking at a test cut through a magnifying glass. As the width of the cut depends on the depth, because of the shape of the cutter head, the depth of each groove is properly adjusted when the width of each groove is approximately equal to the space between the grooves. It may be advisable to have an extra blank record to test for depth of cuts before each recording. *See note below*
To adjust for depth of cut, proceed as follows:
To cut a shallower groove loosen the machine screw that holds the clip in place on the recorder arm, slide the clip toward the base of the recorder arm a very small amount and tighten the machine screw. Cut a new groove and test for depth and width. If the groove is still not shallow enough, proceed as above until the desired depth is obtained.
To cut a deeper groove proceed as above except move the clip toward the recorder head thus removing some of the tension from the weight adjusting spring.
- 3—To remove any "flutter" or needle "chatter," it is necessary to change the angle of the cutter, this may be accomplished as follows:
Loosen the two screws which hold the recorder head to the casting, slide the recorder head upwards slightly and tighten the two screws. This adjustment will cause the stylus to cut more perpendicularly to the record and may remove the "flutter." If raising the recorder head does not eliminate the "flutter," then the reverse should be done, that is, lower the recorder head nearer to the record.
- 4—Before recording, the volume of voice or music or whatever it is desired to record should be tested at the actual volume to be used while recording, and the volume control set so that the meter indicates in the green area of the meter dial during average recording passages.
- 5—Do not shut "off" the motor switch before lifting the recorder head off the record.
- 6—The cuttings should be removed from the recording by moving the fingers or a small fine brush in a gentle circular motion over the record. Do not scrub.
- 7—When a new cutter is used, loosen the machine screw which holds the spring adjusting clip in place on the recorder arm, slide the clip toward the base of the recorder arm and tighten the machine screw. This is to make sure that the groove depth for the new cutter is not too deep. If the groove is too deep the cutting tool may be easily chipped, if it cuts through the lacquer coating and touches the aluminum disc.
- 8—Correct grouping of recording artists and microphone placement are of extreme importance in order to get the best possible results. This grouping and placing will be facilitated by listening in on a pair of RCA High Fidelity headphones, such as MI-3453-B, plugged into the monitoring jack on the front panel, prior to making a recording.
- 9—When cutting a record it is advisable to lower the cutting head and let it cut two or three blank grooves before starting the modulation. At the end of the recording, when the modulation is stopped, the cutter head should remain on the record to cut two or three blank grooves before it is raised.



CUTTER HEAD In order to facilitate adjustment of cutter head for depth of cut, the thumbscrew adjustment shown above is now used. To cut a shallower groove increase the tension on the weight adjusting spring by means of the knurled nut. Cut a new groove and test for depth and width. To cut a deeper groove decrease the tension on the spring, thus allowing a greater portion of the weight of the cutter head on the record. See Hint 2 above.

MODELS MI-12700,
MI-12700-A

RCA MFG. CO., INC.

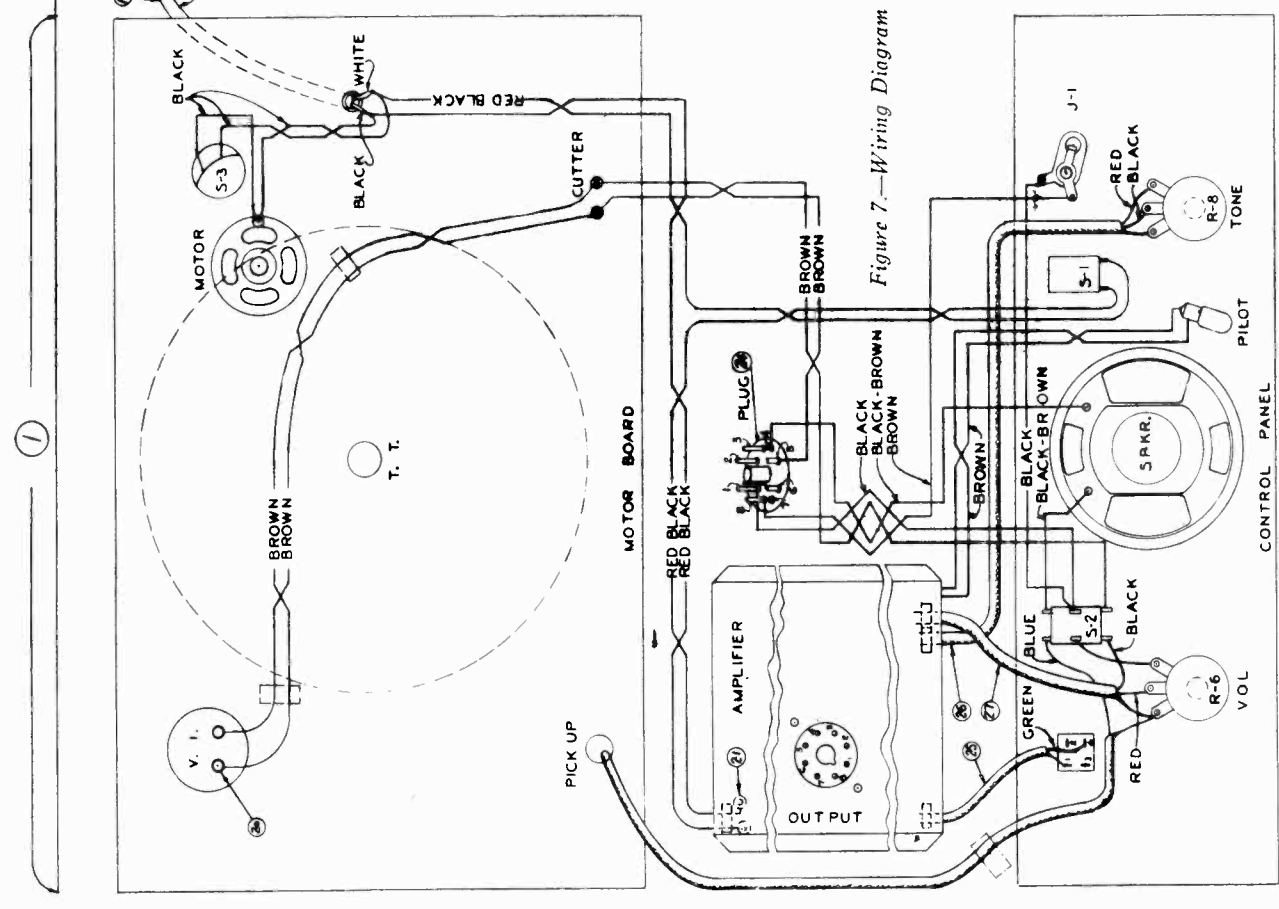
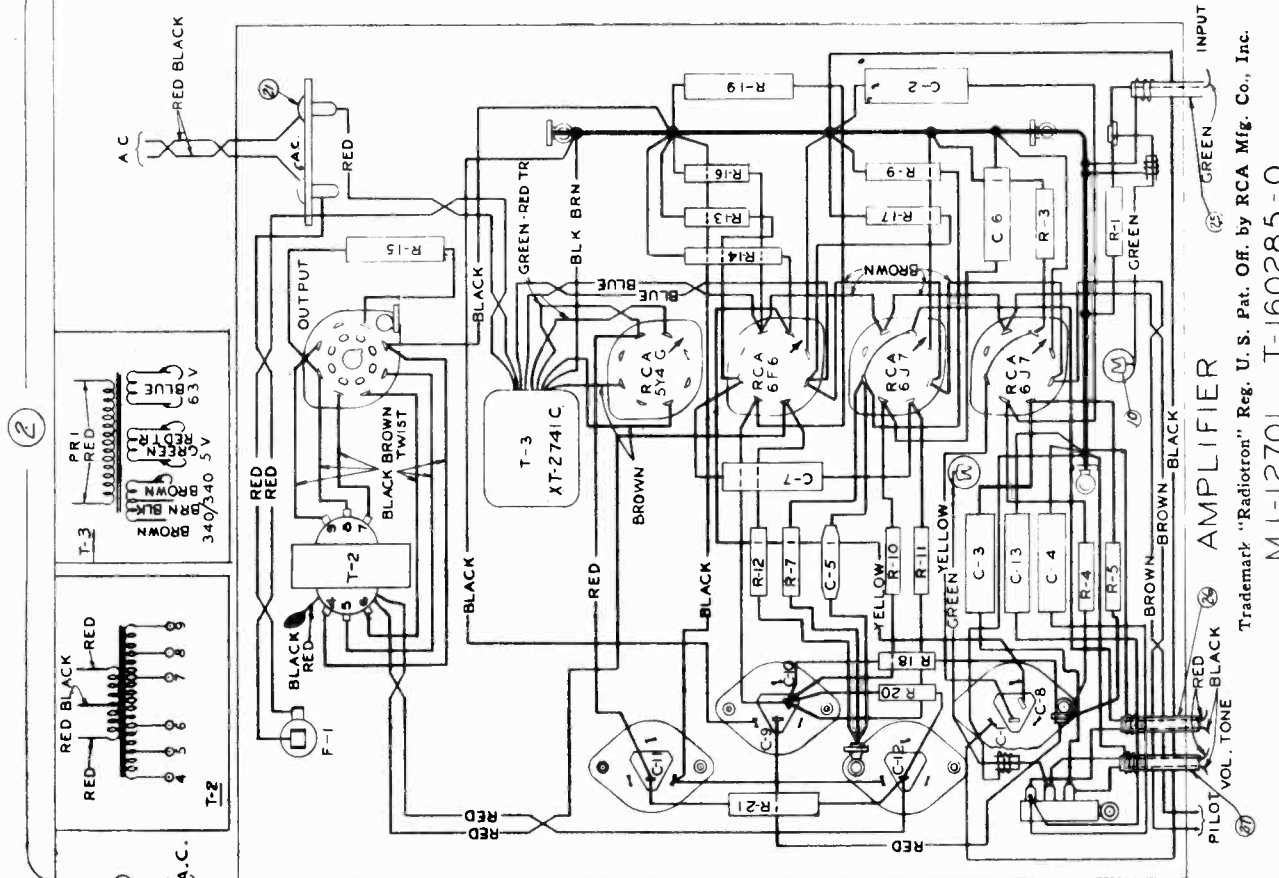


Figure 7. - Wiring Diagram

INPUT GREEN (25)
 AMPLIFIER
 PILOT VOL. TONE RED BLACK (26)
 T-160285-0

Trademark "Radiotron" Reg. U. S. Pat. Off. by RCA Mfg. Co., Inc.

RADIO PRODUCTS CORP.

MODELS RC50, RC51,
RC52, RC53ISSUE A 1941
SERVICE MANUALRECORD
CHANGER
RC50
RC51
RC52
RC53

OPERATING INSTRUCTIONS

SETTING

Briefly, the Operating Instruction Manual as supplied to the customer contains the following:

MOUNTING

The changer is held solid by three channel shaped nuts under the changer. Loosen, three complete turns only, but do not remove. Tighten again for reshipping.

CAUTIONS

Either twelve 10" or ten 12" records, not intermixed, may be played. A starting groove or eccentric inside groove are not needed for automatic operation.

Do not use force to start or stop changer mechanism.

Do not leave records on supports when changer is not being used as they will warp and cause trouble in changing. Keep all records in albums.

The last record in the stack will keep repeating until the changer is stopped.

The needle should never require replacing with normal use—Never drop the needle—Never remove and then replace the same needle.

The top of the record holder post may be turned to either the 10" or 12" position. When the record holder clip is snapped toward the center, the changer is set to play the size record indicated on the clip.

LOADING

The records are placed over the center post, resting on the offset of the post, in the center, and the record post on the outside edge. Snap the clip down on top of the stack of records.

STARTING

Turn knob to ON position, after changer has attained speed turn the knob to REJECT position and release, the entire stack of records will then play through.

REJECTING

Turn knob to REJECT and release. This may be done any time a record is playing.

UNLOADING

Turn knob to OFF, remove center post by pulling up, remove records, reinsert center post, turning until it drops into place.

THE CHANGE CYCLE

When the pickup (9) comes to the end of the record, screw (55) on the pickup mover arm (54) pushes against the trigger bracket (35F) at point (X) starting the change cycle. This could also be done by turning knob (12) which causes lever (52) to push bracket (35F) at point (X).

This releases starting bracket (30) at point (Y) and allows (30) to protrude at point (Z), thereby becoming, in effect, one of the missing teeth in the large gear (35). The motor is constantly revolving the turntable, pinion shaft (21), and pinion gear (21B) at the toothless part of (35). When bracket (30) is released it engages a stud at the bottom of pinion gear (21B), starting the large gear (35).

As the large gear (35) begins its one revolution for a complete cycle, the raising pin (60) is pushed up by the outside ridge of gear (35) to remain there keeping the pickup above the record surface, until the cycle is finishing when the pin (60) is allowed to come down.

As soon as the pickup is above the surface of the record, the roller of mover arm (54) is pushed by the cam on (35), to move the pickup out beyond the edge of the record.

At $\frac{1}{3}$ rotation of gear (35) the end of mover arm (54) enters the outside groove of the cam on (35) and also the end of the "Z" lever (63) is beginning to be pushed by pulley (35C). This "Z" lever (63), from $\frac{1}{3}$ to $\frac{3}{4}$ rotation of (35) is in the process of turning 135° and then back, shaft (4E) in the record holder post (4). As (4E) turns, its cam top pushes the record remover (4F) toward the spindle and thereby pushes

one record off the edge of (4B) and allows the record to fall on the turntable.

The $\frac{1}{4}$ remaining distance that the large gear travels is used to bring the pickup (9) back to the edge of the record and set it down at the correct place for either a 10 or 12 inch record.

This is preset by turning the post (4) which rotates size cam (40) to either the 10 or 12 inch position, locked in place by the pressure of the detent spring (44). As this cam is rotated, it pushes the size lever (73) to either of two positions, and by means of its funnel shaped bracket at the end, guides the size switch (33) on the revolving gear (35) to the proper position opening either the 10 or 12 inch track and, therefore, directs the roller on the mover arm (54) to travel the correct track on the gear cam (35) setting the pickup over the proper place on the record, 10 or 12 inch.

Also, in this final $\frac{1}{4}$ revolution the starting bracket (30) is being moved back to its starting position by hitting the reset piece on the separating plate (36). When (30) is moved back, it is again caught at (X) by trigger bracket (35F) ready to be released to start a future cycle.

As the larger gear (35) is approaching the completion of its one revolution, the pickup lift pin (60) is riding down the cam track and allowing pickup (9) to set down on the record.

Just as the gap on the large gear (35) meets the pinion gear (21B), and (35) stops, the detent spring (75) snaps against roller (35C) and holds gear (35) in this position completing the change cycle.

MODELS RC50, RC51,
RC52, RC53

RADIO PRODUCTS CORP.

SERVICE ADJUSTMENTS

IF CHANGING CYCLE FAILS TO STOP

With the center post (3) out remove the large nut (2) in the center of the turntable (1) and lift off the turntable. Loosen the two screws (23) this will free the large cast gear (35). Push these screws to the point where the small gear (21B) is free in the blank part of the teeth in the large gear (35), but as far as possible from the starting teeth of the large gear when it is in the locked or stopped position. Tighten the screws (23) in the slots firmly and re-assemble the turntable and nut. Check and see if the starting lever (30) on the underside of the large gear (35) is cocked by trigger bracket (35F) when the large gear makes a complete revolution. If not, check springs (35A) and (35B). Spring (35A) pushes lever (30) to the engaging position when released by trigger bracket (35F) held against lever (30) by spring (35B).

PICKUP ARM ADJUSTMENTS

VERTICAL MOVEMENT

To adjust the height of the pickup arm (9) turn the knurled screw (9I) on the underside of the pickup arm (9) directly above the pickup arm lift shaft (60). Turn the screw (9I) counter-clockwise to raise the pickup arm, and clockwise to lower the pickup arm.

HORIZONTAL MOVEMENT

If the pickup arm (9) does not come down on the record so the needle first touches the record about $\frac{1}{8}$ inch from the edge, an adjustment is required. The inside part of the large gear (35) has two tracks, the inner one for ten inch records and the outer one for twelve inch records. It is only necessary to set the pickup (9) for one size, either the ten, or twelve inch. Turn the large gear (35) around until the roller pin in the mover arm (54) is just about to leave one of the tracks. If the pin of the mover arm (54) is in the inside track a ten inch record must be on the turntable and if in the outside track a twelve inch record is required. Now loosen the two screws (57 and 59) that secure the pickup arm shaft (9D) to the mover arm (54) and turn pickup arm (9) to correct point. Tighten screw through the slot first (59) and then the set screw (57).

The pickup arm shaft (9D) has a small spring (58) fastened to it underneath the changer to push the needle over into the first groove on records without a starting groove. The force the spring (58) exerts is adjusted by moving the hook in the end of the spring (58) to another hole in the hook plate (62). Facing the underside of the changer with the plate (62) in the upper left hand corner, moving the hook in the spring (58) to a hole to the left will increase the tension, to the right will decrease the tension. If the needle jumps several grooves when pushed over the spring tension is too light, while if the arm does not move all the way over to the first groove more spring tension is required.

TRIP ADJUSTMENTS

The position trip adjustment is a screw (55) located near the end of the mover arm (54) underneath the changer. To trip earlier turn the screw (55) clockwise, to trip later turn the screw counter-clockwise. Lock adjustment with nut (56).

RECORD HOLDER POST ADJUSTMENTS

With the changer properly loaded the bottom record on the stack should rest for about $\frac{1}{8}$ to $\frac{3}{8}$ of an inch on each side of the top (4B) of the record holder post (4), if not adjust as follows: With the center post (3) out remove the large nut (2) in the center of the turntable (1) and lift off the turntable. Loosen the two screws (18) in the slots in line with the record holder post and the center. Push the screw heads (18) the required amount toward, or away from the record holder post (4) and tighten the two screws (18).

The top of the record holder post (4) is fastened by the shaft on (4A) inside the post to the size cam (4D) underneath, which has two rectangular holes into which snaps a spring arm (44). The pressure this arm

(44) exerts on the above size cam (40) may be adjusted by the screw (45) which presses against the arm (44). The arm (44) should press firmly against the size cam (40) so it will snap tightly into either of the two holes. When the spring arm (44) is in the rectangular hole farthest from the outside of the size cam (40) the top of the record holder post (4) should be in the ten inch position. If the screw (45) is too tight it will be hard to turn the top of the record holder post (4). The size cam (40) is fastened to the shaft of (4A) inside the record holder post (4) by two hex head set screws (41).

If both sides of the record pusher (4F) on the top of the record holder post (4) do not push against the lower record at the same time, loosen the two hex head screws (41) and turn the top of the record holder post (4) slightly to the proper position. Tighten the screws (41).

SETTING FOR 10 OR 12 INCH RECORDS

The edge of the size cam (40) pushes against a knurled screw (71) on size change lever (73). This sets a switch (33) on the cam part of main gear (35), for the pickup (9) to drop for either a ten inch or twelve inch record by causing pin in the arm fastened to the mover arm (54) to travel through one of two tracks in the inside of the large cast gear (35). After adjustment is made tighten the lock nut (72) on the knurled screw (71).

RECORDS FAIL TO DROP

If a record fails to drop during a changing cycle, but the record pusher (4F) on top of the record holder post (4) is operating and the adjustments under "Record Holder Post" are correct, proceed as follows: Set the large gear (35) in the locked position and the top of the record holder post (4) in either the ten inch or twelve inch position. Loosen the single hex head screw (70) which secures a "U" bracket (69) to the inside shaft (4E) of the record holder post (4) underneath the changer. Turn the shaft (4E) slightly until the sides of the record pusher (4F) are about $\frac{1}{8}$ of an inch back of the edge from where the records drop. The hex head screw (70) should now be firmly tightened.

While the large gear (35) makes one complete revolution, during a changing cycle, the pusher arm (4F) should extend past the edge from where the records drop, and return.

NOTE I

50 CYCLE OPERATION

If operation is desired on 50 cycle current, a small spring (15), see parts list, must be added to the motor shaft in the following manner:

With the center post (3) out, remove the large nut (2) in the center of the turntable (1) and lift off the hand. Hold conversion spring (15) in the right hand turntable. Hold motor rotor with fingers of the left with the extension upwards. Hook lower end of spring (15) over edge of rotor shaft drive pulley and with a downward twisting effort in a direction to unwind or enlarge the inside diameter of the conversion spring (15) force down over entire pulley length. The extension which is provided for ease of assembly only, should then be sprung away from the pulley sufficiently to allow it to be snapped off with a pair of diagonals, at the spring surface so no protrusion will remain to impair operation of the drive pulley. The motor shaft pulley thus enlarged will provide proper turntable speed with the motor operating on 50 cycle current.

NOTE II

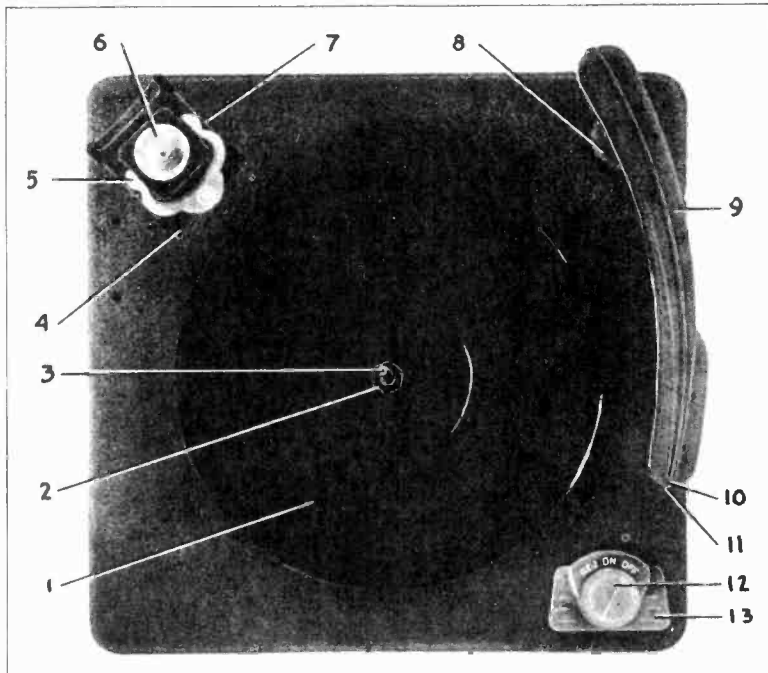
RC-50 is standard 60 cycle record changer with Alden type socket for A.C. connection.

RC-51 is standard 60 cycle record changer except spring bushing has been added to motor shaft to increase size and provide correct speed on 50 cycle. Same A.C. connection as RC-50.

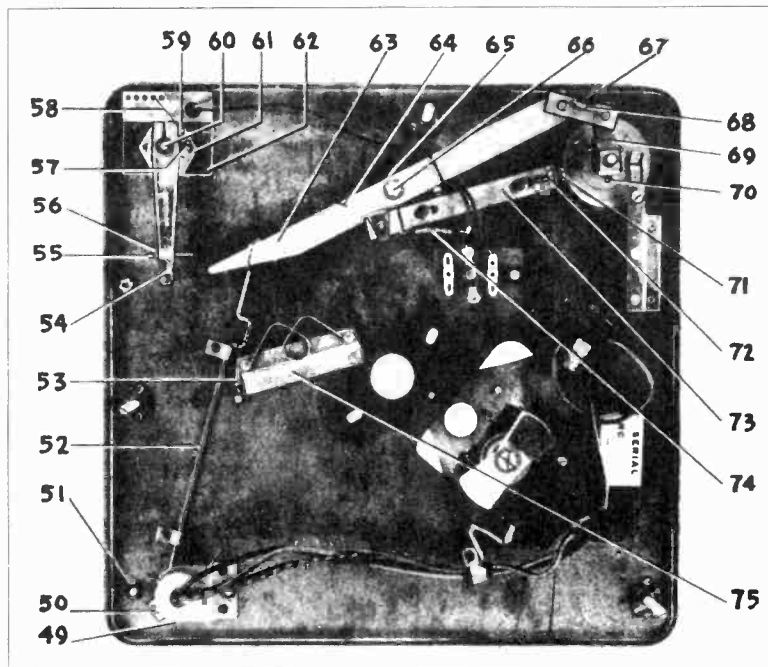
RC-52 is standard 60 cycle record changer with standard A.C. cord and plug.

RC-53 same as RC-52 except with 50 cycle bushing added as on RC-51.

RADIO PRODUCTS CORP.

MODELS RC50, RC51,
RC52, RC53

TOP VIEW - COMPLETE

BOTTOM VIEW
GEAR AND BEARING ASSEMBLY REMOVED

MOUNTING HARDWARE

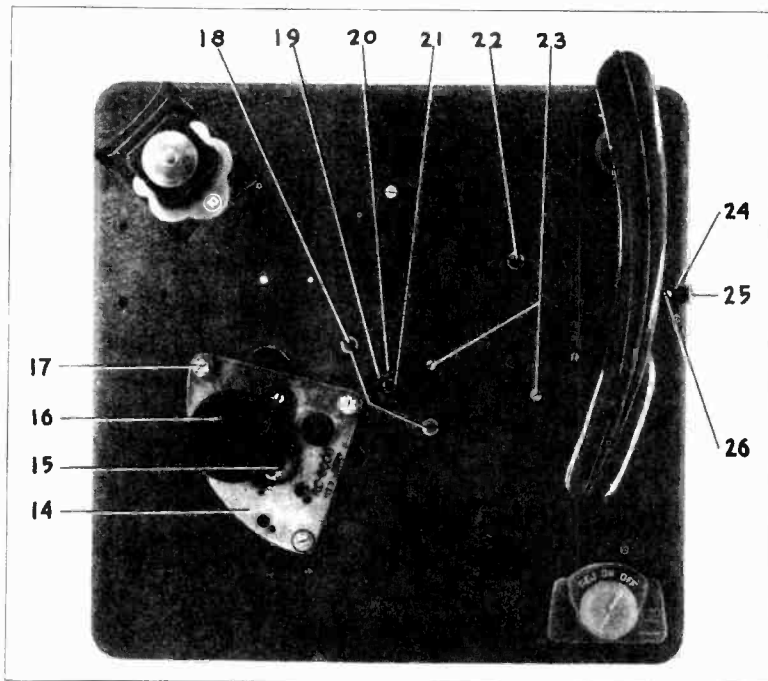
RC4010	Record changer mounting spring, 1/2 doz.	\$.10
RC7017	Record changer mounting screw	.05
P4781	Record changer mounting bracket	.10
P4694	Record changer mounting bracket (Slide-A-Way only)	.10

1	RC-6000T	Turntable only	\$1.70
2	RC-3025	Turntable nut	.15
3	GA-35	Offset center post	1.35
4	GA-31	Complete record changer post	3.00
5	RC-5003	Record clamp (Plastic)	.20
6	RC-5002	Record changer shelf cap (Plastic)	.15
7	RC-2003	Record shelf support post	.65
8	RC-2005	Pickup arm support post	.65
9	GA-32	Complete pickup arm assembly	7.75
10		Needle screw (Phillips type head)	.15
11	RC-6008	Lifetime needle	1.50
12	RC-5001	Knob (Plastic)	.10
13	RC-5000	Escutcheon (Plastic)	.20

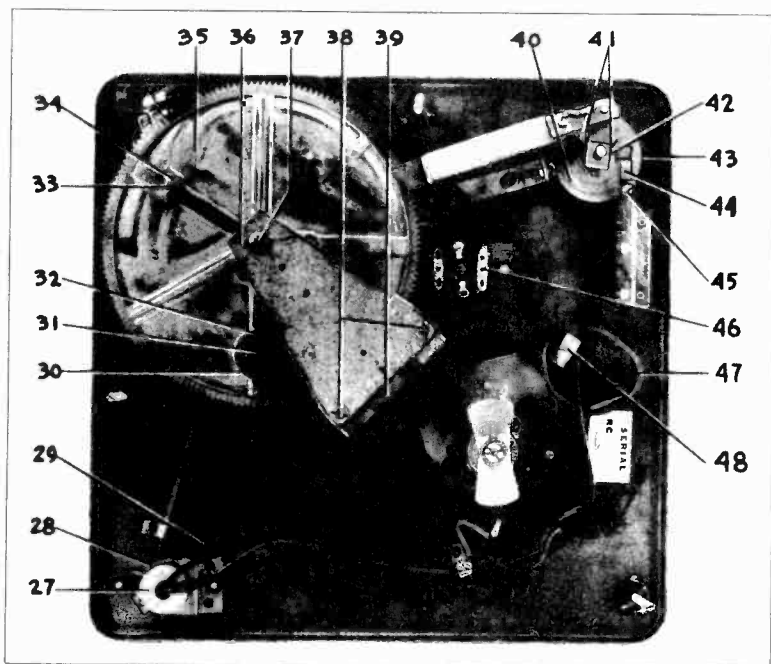
49	P-2328	Spring washer	\$.05
50	GA-15	AC switch lever and stud assembly	.25
51	P-4626	Tinnerman clamps for mounting escutcheon (13) (1/2 doz.)	.05
52	RC-4012	Reject lever	.10
53	RC-4003	Reject lever spring	.05
54	GA-27	Pickup arm mover assembly (with parts below to 59, inclusive)	1.50
55	RC-7002	8-32x1" slotted screw, headless	.05
56	RC-7024	Hex. nut (1/2 doz.)	.05
57	P-2729	Set screw (1/2 doz.)	.05
58	RC-4018	Lead in spring	.05
59	RC-7016	8-32x5/8" Fil. head screw (1/2 doz.)	.05
60	RC-3034 P-1399	Raising pin Horseshoe washer	.10
61	RC-7029	Pickup arm support post mounting nut	.05
62	RC-1030	Lead in spring, hook-plate	.05
63	G-29	"Z" Bracket assembly	.30
64	RC-4013	"Z" Bracket spring	.05
65	RC-3027	"Z" Bracket mounting stud	.10
	P-206	8-32x3/4" Round head screw	} (Set) .05
66	P-993	Hex. nut	
	P-214	Lockwasher	
	P-269 A	Washer	
67	RC-1006	Lever link	.05
68	RC-4001	Lever link spring	.05
69	G-28	"U" Bracket assembly (complete with set screw)	.25
70	P-2692	"U" Bracket set screw, only (1/2 doz.)	.05
71	RC-7000	Size change adj. screw	} \$.05
72	P-993	Size change adjusting lock nut	
73	GA-12	Size change lever assembly (complete with screw & lock nut)	.25
74	RC-4002	Size change lever spring	.05
75	GA-34	Wire detent spring and bracket	.25

MODELS RC50, RC51,
RC52, RC53

RADIO PRODUCTS CORP.



TOP VIEW - 1, 2, 3, REMOVED

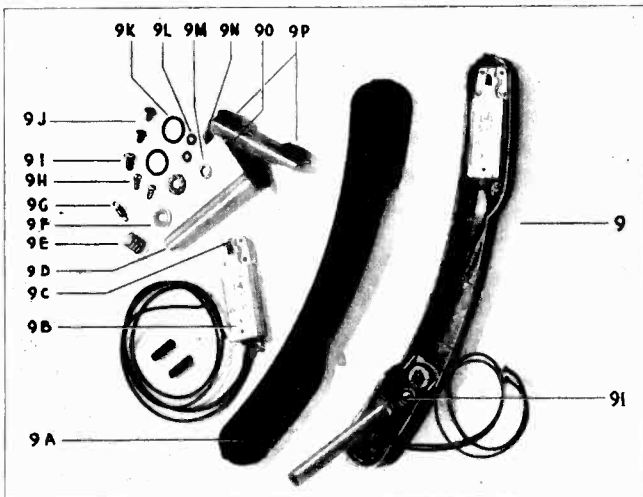


BOTTOM VIEW - COMPLETE

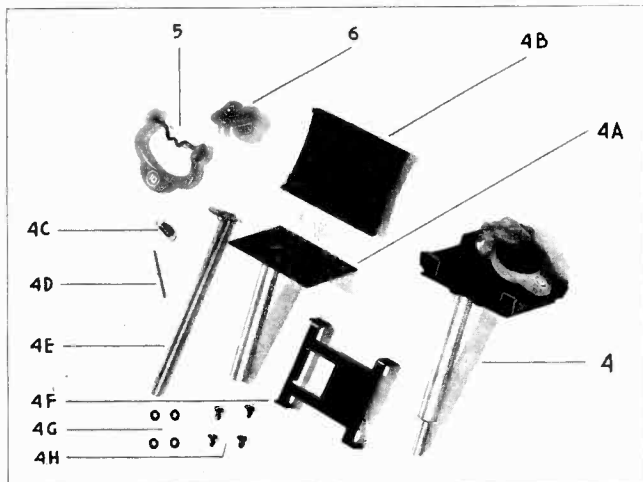
- 14 RC-6000 M Motor only, 60 cycle (Type I or II) Type I shown\$5.75
- 15 50 cycle bushing (Fits over motor shaft, see note I)15
- 16 Idler wheel 1.00
- P-1518 6/32x5/8" mounting screws (3 each).10
 - P-1466 Lockwashers (3 each).10
 - 17 P-269 Washers (3 each).10
 - Sleeves05
 - Rubber grommets05
- 18 RC-7006 10-24 x 3/8" mounting screws and lockwashers05
- 19 RC-7010 Cork washer05
- 20 RC-6003 Thrust bearing75
- 21 RC-3021 Pinion shaft45
- 22 RC-7027 10-32 - 3/8" mounting screw and lockwasher05
- 23 P-4080 6-32 x 1/4" Sems type mounting screws (Pr.)05
- 24 RC-1029 Arm rest10
- 25 RC-5004 Arm rest cap (Plastic).. .10
- P-2437 6-32 x 3/8" round head screw
 - 26 P-1466 Lockwasher (Set)05
 - P-825 Hex. nut
- 27 RC-6002 AC switch and cover....\$.45
- 28 RC-1011 AC switch mounting bracket05
- 29 RC-4015 AC switch lever wire spring05
- 30 GA-24 Starting bracket assembly25
- 31 RC-3015 Starting bracket mounting stud10
- 32 RC-1025 Starting bracket mounting washer05
- 33 RC-2007 Size switch10
- 34 RC-4007 Size Switch Mtg. Spring05
- 35 RC-2000 Large gear and cam (Springs [35A] and [35B] attached) 2.00
- 36 GA-25 Separating plate and reset bracket35
- 37 RC-7027 10-32 x 3/8" mounting screws and lockwashers (Pair)05
- 38 RC-7006 10-24 x 3/8" mounting screws and lockwashers (Pair)05
- 39 GA-33 Bearing assembly75
- 40 G-30 Size cam assembly (Complete with set screws)35
- 41 RC-7021 Hex head set screws (only) (1/2 doz.) .05
- 42 RC-3032 Spacer05
- 43 RC-7029 Mounting nut05
- 44 GA-13 Detent cam spring and bracket assembly (complete with screw & lock nut)30
- P-1098 Adjusting screw 6-32x3/8"05
 - P-825 Adjusting lock nut05
 - 46 RC-6006 Soldering panel05
 - RC-6009 AC cable and Alden plug for RC50 and 51 (as shown), see Note II... .35
 - 47 RC-4894 AC line cord and plug for RC52 and 53..... .55
 - 48 P-1692 AC cable clamp05

RADIO PRODUCTS CORP.

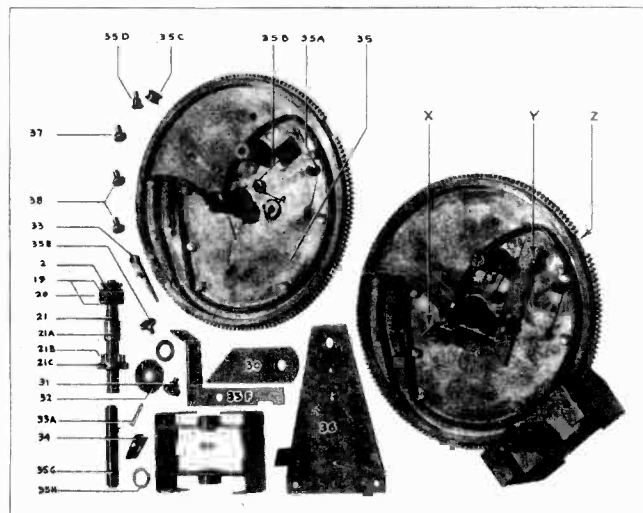
MODELS RC50, RC51,
RC52, RC53



- 9 GA-32 Complete pickup arm assembly\$7.75
- 9A RC-2004 Pickup arm casting..... .85
- 9B RC-6001 Pickup crystal cartridge 4.50
- 9C Needle screw only (Phillip's type head)..... .15
- 9D GA-21 Pickup lower mounting bracket and sleeve50
- 9E RC-4004 Pickup arm adjusting spring05
- 9F P-3423 Washer (½ doz.) .05
- 9G RC-4005 Pickup arm tension spring05
- 9H RC-7026 Mounting screw (Pick-up crystal cartridge) (Pair)05
- 9I RO-7001 Pickup arm adjusting screw05
- 9J P-270 A 4-36x¼" Screw (½ doz.) .05
- 9K RC-1023 Bakelite washer (½ dz.) .05
- 9L RC-7013 Lockwasher (½ doz.) .05
- 9M RC-7018 Pickup arm adjusting washer (½ doz.) .05
- 9N RC-1013 Pick arm upper mounting bracket10
- 9O RC-3008 Pickup arm pivot pin05
- 9P RC-7008 Rubber grommet. (Pair) .05



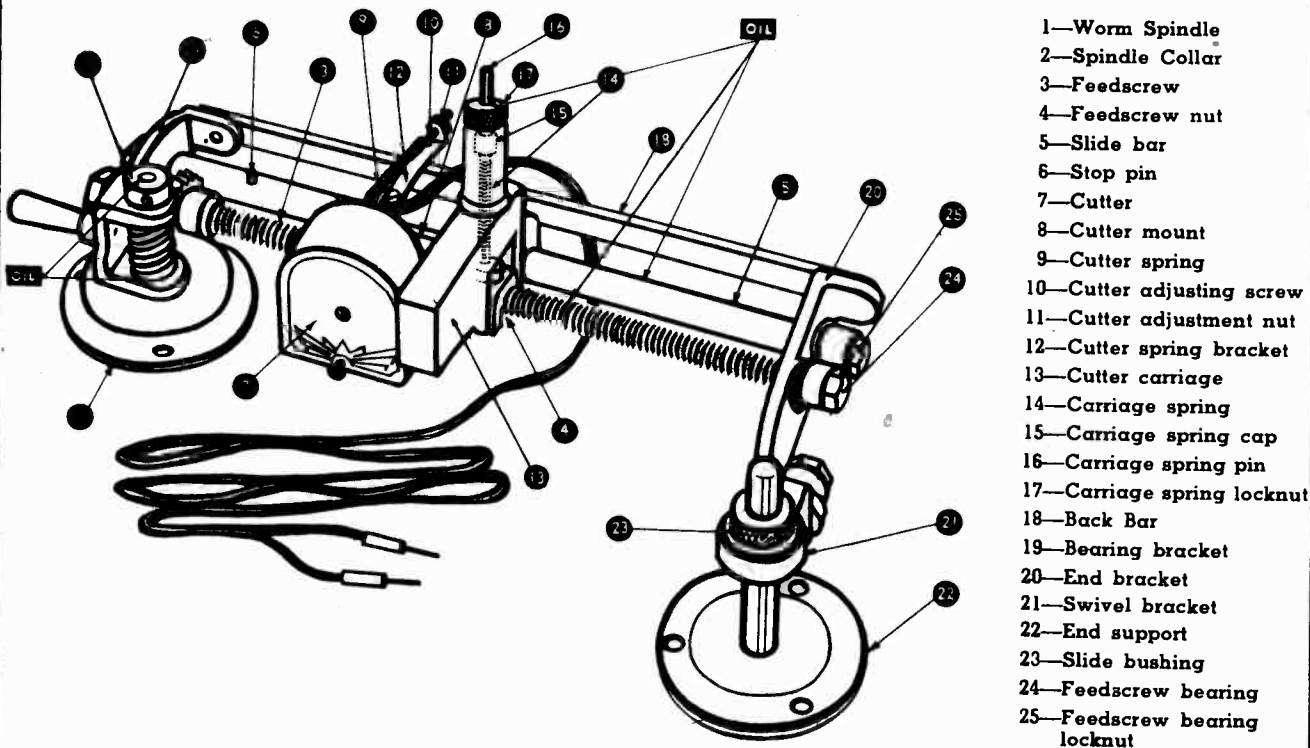
- 4 GA-31 Complete record changer post..... 3.00
- 4A GA-17 Mounting shelf plate and sleeve..... .60
- 4B RC-2002 Record changer shelf..... .50
- 4C RC-4000 Record clamp spring..... .05
- 4D RC-3002 Record clamp spring pin..... .05
- 4E GA-18 Small cam and shaft..... .25
- 4F RC-1001 Record remover..... .25
- 4G P-7013 Lockwasher (½ doz.) .05
- 4H P-270-A 4-36x¼" screw (½ dz.) .05
- 5 RC-5003 Record clamp..... .20
- 6 RC-5002 Record changer shelf cap (Plastic)..... .15



- 2 RC-3025 Turntable nut.....\$ 15
- 19 RC-7010 Cork washer (Pair) .05
- 20 RC-6003 Thrust bearing..... .75
- 21 RC-3021 Pinion shaft..... .45
- 21A RC-3024 Pinion gear ferrule..... .10
- 21B RC-2001 Pinion gear..... .20
- 21C RC-7007 Allen head set screw..... .10
- GA-22 Large gear assembly (with parts below to 35F, inclusive)..... 3.75
- 30 GA-24 Starting bracket assembly..... .25
- 31 RC-3015 Starting bracket mounting stud..... .10
- 32 RC-1025 Starting bracket mounting washer..... .05
- 33 RC-2007 Size switch..... .10
- 33A RC-3013 Size switch stud..... .05
- 34 RC-4007 Size switch mounting spring..... .05
- 35 RC-2000 Large gear and cam (Springs 35A and 35B attached)..... 2.00
- 35A RC-4008A Starting bracket spring..... .05
- 35B RC-4009 Trigger bracket spring..... .05
- 35C RC-3018 Ejector roller..... .10
- 35D RC-3019 Ejector roller stud..... .05
- 35E RC-3016 Trigger bracket stud..... .05
- 35F RC-1016 Trigger bracket..... .15
- 35G RC-3017 Large gear mounting post..... .20
- 35H RC-1023 Bakelite washer. (Pair) .05
- 36 GA-25 Separating plate and reset bracket..... .35
- 37 RC-7027 10-32 x ¾" mounting screws and lockwashers (Pair)..... .05
- 38 RC-7006 10-24 x ¾" mounting screws and lockwashers (Pair)..... .05
- 39 GA-33 Bearing assembly..... .75

MODELS R12, R16

REK-O-KUT CORP.



- 1—Worm Spindle
- 2—Spindle Collar
- 3—Feedscrew
- 4—Feedscrew nut
- 5—Slide bar
- 6—Stop pin
- 7—Cutter
- 8—Cutter mount
- 9—Cutter spring
- 10—Cutter adjusting screw
- 11—Cutter adjustment nut
- 12—Cutter spring bracket
- 13—Cutter carriage
- 14—Carriage spring
- 15—Carriage spring cap
- 16—Carriage spring pin
- 17—Carriage spring locknut
- 18—Back Bar
- 19—Bearing bracket
- 20—End bracket
- 21—Swivel bracket
- 22—End support
- 23—Slide bushing
- 24—Feedscrew bearing
- 25—Feedscrew bearing locknut

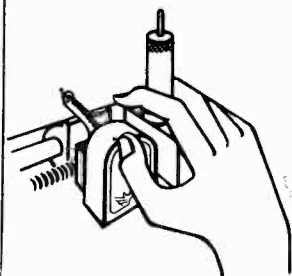
MOUNTING DIRECTIONS

1. Insert brass drive pin in turntable as per instructions on stroboscope template
2. Place record on turntable.
3. Place REK-O-KUT on record so that spindle (1) fits over turntable shaft and drive pin. **HOLD SPINDLE FLUSH TO RECORD.**
4. Place cork spacer on record near outer edge under slide bar (5).
5. Place end support (22) on motor board. Loosen set screw in slide bushing (23); lift REK-O-KUT to permit slide bar (5) to rest on cork. Hold spindle flat while tightening set screw on slide bushing.
6. Fasten end support to motor board with three screws (use No. 10 wood or machine screws as needed).
7. Before final tightening of screws on motor board, lift spindle from record and replace. Spindle should drop over turntable shaft and drive pin freely. Fasten end support screws tightly. REK-O-KUT should now be resting flush on record and should be parallel to turntable.

LUBRICATION

Keep REK-O-KUT lubricated with light machine oil or light vaseline as indicated.

OPERATION



The REK-O-KUT records inside out on acetate only. Place thumb of right hand on cutter and grip carriage with index and third fingers, as illustrated, so that cutter carriage shaft comes between the index and third fingers. Move carriage to pin stop on slide bar. Start turntable, lower carriage on feedscrew and then lower the head gently on the record. The REK-O-KUT is now operating. Upon completion of the recording, lift carriage as far back as it will go. This will permit spring lock to catch and hold carriage firmly in place.

Your REK-O-KUT and cutter have been carefully set and adjusted at the factory for proper recording. However, for varying conditions and thicknesses of records, the pressure on the cutting stylus will have to be varied. This is done by loosening cutter adjustment nut (11) for deeper cuts and tightening for lighter cuts as required. The depth of your cut should be equal to about the thickness of a hair, which is approximately .0025".

Should threads from the record catch in the working part of worm spindle, remove spindle by removing spindle collar (2) and turning spindle counterclockwise and pulling gently. Clean out all threads and replace spindle and spindle collar. Make sure the spindle spins freely.

MODELS 101.208,
101.210

SEARS ROEBUCK CO.

MODELS 101.205,
101.206,
101.207

Alphabetically arranged index letters are used in the illustrations and in the description to facilitate locating of parts in the illustrations. Parts with the prefix letter "A" will be found in the illustration of the top of the record changer. Parts with the prefix letter "B" and "C" will be found in the illustration of the bottom of the changer. Parts with the prefix letter "D" will be found in the illustration of the pickup arm control mechanism.

DESCRIPTION OF OPERATION:

To load the instrument with records, turn the changer blades AJ to the position as shown in the top view (counter-clockwise) and place a stack of ten 12" or twelve 10" records on the center spindle, allowing them to rest upon the lower changer blades.

The operation of the changer mechanism is controlled by means of the single button AG on the base plate AK. Turn the button to point to Automatic. Then press down to start cycle. The changer will then automatically play all records in the order stacked.

To remove records, after all have been played and the turntable switched off, lift each set of changer blades AJ slightly and turn them clockwise approximately one half a turn. Records can then be removed.

To change records any time when the needle is on the record, merely press the control button down momentarily.

To play records singly, turn changer blades AJ away from center of table, and turn the control button to Manual.

There are three conditions which cause the mechanism of the instrument to trip and proceed through the change cycle. (i.e., automatically to remove the pickup arm from last played record, release the next record, and replace the pickup arm in its playing position.

1. Pressing down control button AG rotates the reject rod BD. The bent end of BD (which is same as DC) strikes the ratchet casting DF, which is fastened to trip rod DE (BE in bottom view), rotating rod BE. This pivots the bent end of BE away from the end of follower CL, allowing the heavy end of follower CL to drop, pivoting about its axis (which extends through follower arm BJ and drive arm CJ) and engaging it in the worm CN. The worm CN has a left and right thread which carries the follower CL to the opposite end of CN and returns it. This action through the axis pin of follower CL causes the pivoting of drive arm CJ and clutch arm CK about their common axis.

The construction of drive arm CJ and clutch arm CK together with the clutch spring CG, provides protection against breakage of the instrument or records in case of jamming.

The clutch arm CK thrusts the drive link BL, actuating the blade bell crank BM, and in turn the blade crank CE through tie bar CF which is riveted to the blade bell crank BM. This action operates the changer blades AJ.

2. When a record has been played and the pickup arm has reached a definite distance from the center spindle following the spiral groove towards the center of the record, the stop adjusting screw DV in the pickup crank strikes the ratchet casting DF, which in turn rotates the trip rod DE, causing the engagement of the follower CL, etc.

3. Records that have an eccentric groove inside of the playing or modulated grooves will give the pickup arm AC an oscillatory movement. This oscillation is transmitted to the pickup crank DT, which, when in the playing position, drags the pawl DU across the ratchet DF, with the pawl spring DS tending to hold the pawl DU straight out, and any back movement of the arm DA and crank DT causes the pawl DU to catch on the ratchet DF, pushing it away against the tension of ratchet spring DG and rotating trip rod DE. DE in turn releases follower CL, engaging it in worm CN, etc.

The operation of the pickup arm DA (AC in top view) is controlled by the cam DW which is synchronized with the changer blades AJ. The rack link BH transmits action from the blade bell crank BM, through the rack DD, (BC in bottom view) to cam pinion DH.

The determination of the set down position of the pickup arm AC originates at the selector AA. As the changer blades AJ pivot in operation, the selector AA is intercepted by the edge of a record. This stops the rotation of the selector crank CC fastened to the selector, (CD in bottom view) and in turn the axial movement of selector rod CB (same as DP), said axial movement being caused by selector spring DM.

The rod CB interferes with the arcial movement of the pickup crank DT, in accordance with the size of the record passing through the blades AJ, causing the cam follower DR to follow the outer groove or to be allowed to ride into the inner groove in the face of cam DW. The outer groove controls the setdown position for 12" records, and the inner controls the 10" records.

ADJUSTMENTS:

Should the changer blades AJ be forceably turned out of proper adjustment, loosen the clamping screws in the blade crank CE and/or the blade bell crank BM, and with the machine in neutral at the end of a cycle or in the playing position, turn the blades so that the upper blades are equi-distant and within 1/8" of the edge of a 12" record. Then clamp screws securely.

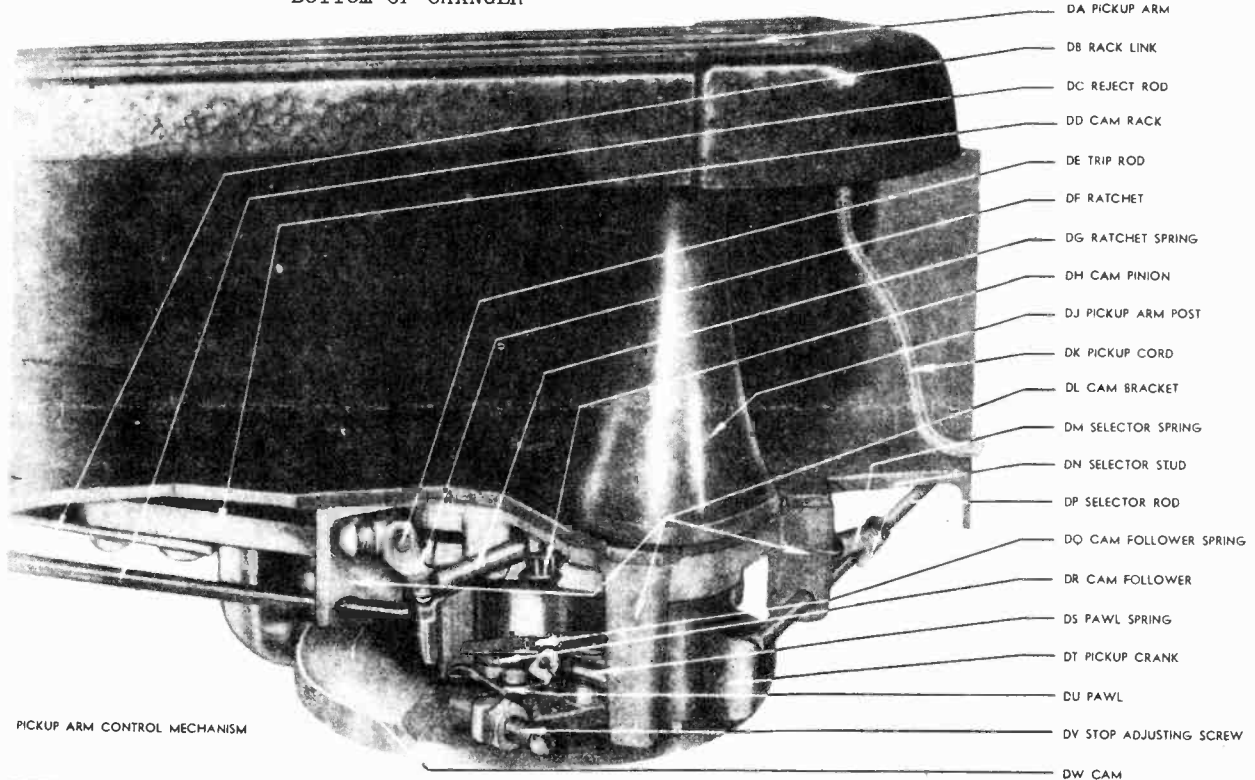
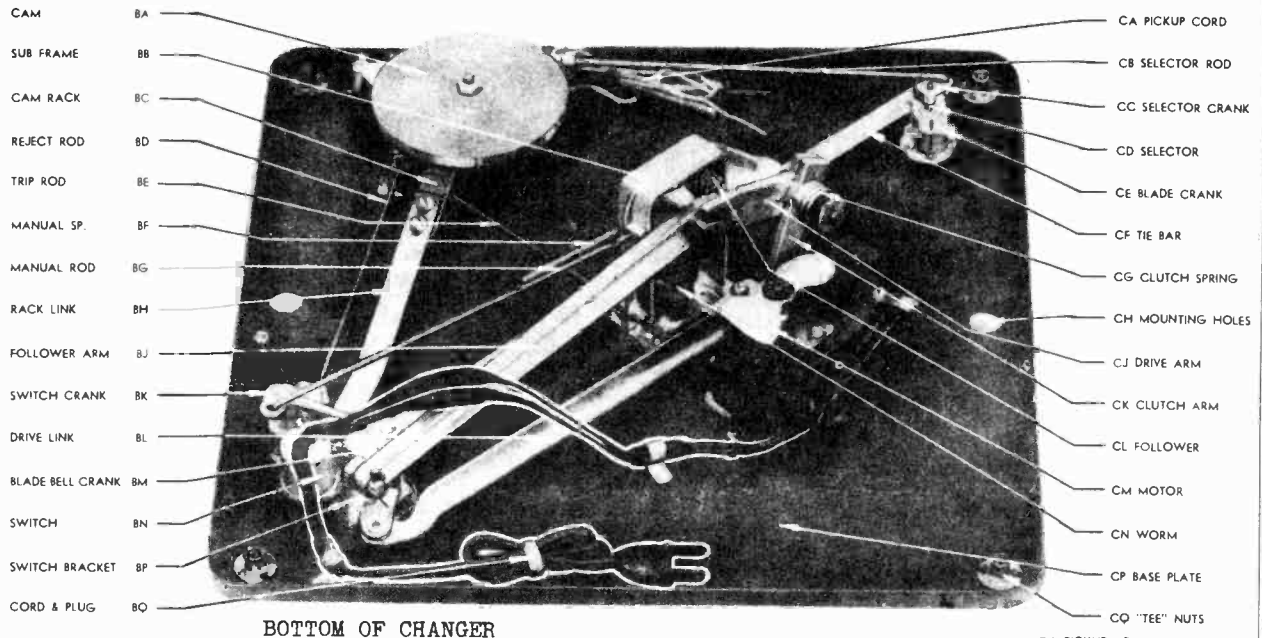
MODELS 101.205,
101.206,
101.207

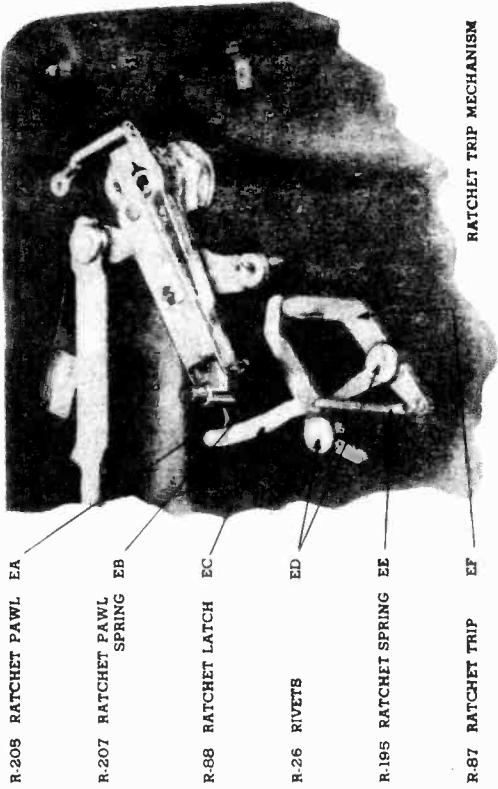
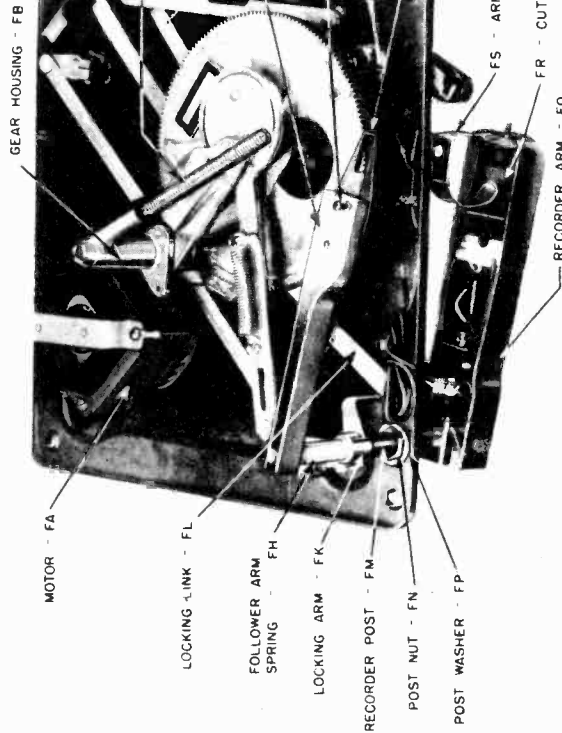
SEARS ROEBUCK CO.

MODELS 101.208,
101.210

To adjust the setdown position of tone arm, turn off the machine during cycle just before the pickup arm descends to a record, loosen the set screw in crank DT, and while holding the crank DT in place, turn the pickup arm AC until it is straight above the outside groove of the record. Then re-tighten the set screw.

The adjustment of the ratchet DF on rod DE (BE in bottom view); the selector crank CC on the switch button shaft; the small casting on the straight end of DC (BD in bottom view); and the selector crank CC on the selector CD are limited and are obvious from the description of the cycle.





RATCHET TRIP MECHANISM

PART NUMBER	DESCRIPTION	SELLING PRICE EACH
10164241	Pawl Locking Arm.	.79
10164247	Lead Thrust Screw	.33
10164248	Lead Thrust Nut	.33
10164252	60 Cy. 110 v. Recorder Motor	17.82
10164256	Gear Box Assembly	6.27
10164259	Cutter Arm, wrinkle finish, less cutter	7.70
10164260	Post Nut	.09
10164261	Post	1.01
10164262	Straddle Plate	.26
10164263	Cutter Arm Rest	.35
10164264	Idler Wheel	1.98
10164265	Idler Mounting Bracket	.16
10164266	Turntable 10", rim not chrome	4.62
10164267	Turntable Shaft	2.64
10164268	Gear Housing	2.31
10164269	Lead Screw	2.86
10164271	Follower Spring	.11
10164272	Pawl Locking Link	.53
10164274	Needle Chuck Screw, Webster	.26
10164279	Webster R-85 Cutter with 36" lead, 8 ohm	10.78
10164285	Tension Spring	.20
10164287	Cutter head rest screw	.01
10164293	Cutter Head Rest Nut	.02
10164310	Pivot Post Washer	.01
10164312	Cutter Arm Assembly, wrinkle finish, Webster	19.25
10164313	Follower Assembly	19.25
10164316	Idle Pivot Screw	2.42
10164363	Idle Assembly Washer	.05
10164366	Motor Pulley 60 cycle	.09
10164369	Motor 110 v. 50 cycle	.49
10164391	Lockwasher	19.14
10164508	Lockwasher	.02

PART NUMBER	DESCRIPTION	SELLING PRICE EACH
GC	10164535 Turntable, chrome rim	8.80
	10164547 Counter-balanced Tone Arm Assembly (Webster cartridge or equivalent)	13.86
FQ	10164553 Shure Cutter with 36" lead, 4.2 ohm	10.78
	10164556 Cutter Arm, less cutter, smooth finish	7.70
	10164557 Pulley Support Ring	.02
	10164567 Cutter Arm Assembly, Shure Cutter	19.25
	10164568 Needle Chuck Screw, Shure	.26

OPERATION OF MECHANISM:

The lead screw, FC, is driven through a worm on the turntable spindle in housing FB. When the follower, FD, engages in the screw, FC, the arm is made to travel uniformly across the recording disc. The tension in the follower FD, the adjustment for which is described in the next paragraph, keeps it firmly in the lead screw thread, assuring uniform movement of the cutting head.

ADJUSTMENT:

Adjusting screw FJ should be turned sufficiently so that the follower FD will apply sufficient pressure on the lead screw FC when the arm is in the recording position so that it is necessary to lift the arm GA approximately 2" before the follower FD clears the lead screw FC.

DESIGNATION IN PHOTOGRAPHS	PART NUMBER	DESCRIPTION	SELLING PRICE EACH
EA	10164205	Ratchet pawl	.05
EB	10164207	Ratchet pawl spring	.04
EC	1016488	Ratchet Latch	.44
ED	1016426	Rivets	.03
EE	10164195	Ratchet spring	.04
EF	1016487	Ratchet trip	.44

FOR OTHER DATA SEE
NEW PRODUCTS 220
AND 320 SERIES

MARCH 5, 1941

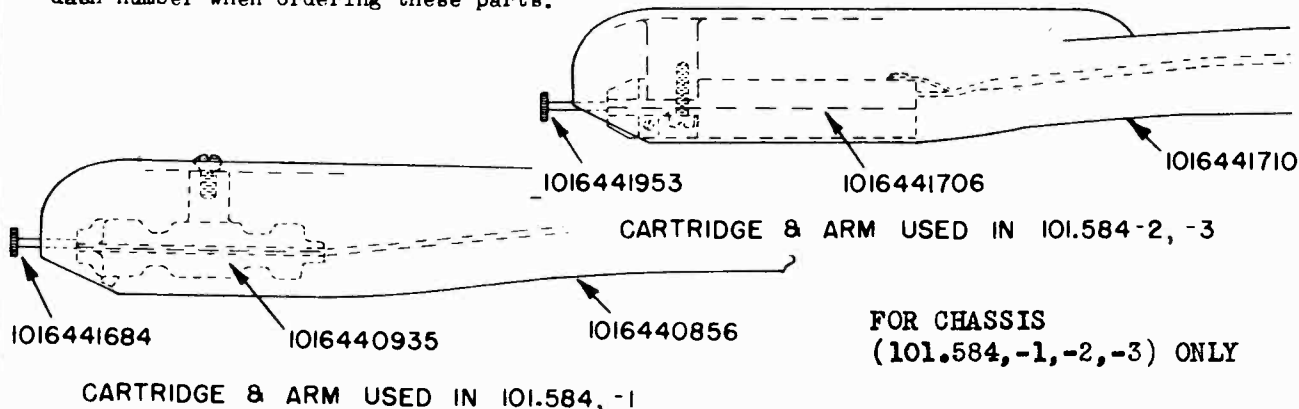
(Chassis 101.584,-1,-2,-3) SEARS ROEBUCK CO.

MODELS 6346, 6346A,
6446, 6446A

SUBJECT: ADDITION OF SUFFIX NUMBER -3 TO 101.584 CHASSIS:

(Chassis 101.584-4,-5)

Assemblies identified as 101.584-3 are the same as 101.584 except that they use a different tone arm and pickup cartridge, not interchangeable with the ones used in 101.584. The drawings below illustrate the tone arms and cartridges used in 101.584,-1,-2,-3. Be sure to give the proper part number and also mention the complete identification number including the dash number when ordering these parts.



SUBJECT: ADDITION OF SUFFIX NUMBERS -4 AND -5 TO CHASSIS IDENTIFICATION NUMBER 101.584:

Chassis identified by the suffix number -4 are the same as those identified by the suffix number -1 except that the record changer unit has certain changes incorporated, as explained below.

Chassis identified by the suffix number -5 are the same as those identified by -3 except that the record changer unit has certain changes incorporated, as explained in the following paragraphs.

The record changer design has been changed so that the adjustment, controlling the distance from the record pin at which the trigger will trip and the change cycle will begin, can be made through a hole in the top plate, marked "AR" in the photograph. Turn the screw head clockwise for earlier tripping; counter-clockwise for later tripping. (The effect is to alter the position of the Cam CJ which strikes the Trigger CP. It may be found that the cam has been revolved through a half turn; in this case, the above directions would apply only after the cam has been returned to the correct position by revolving the screw head half a turn.)

In the original RL, under "ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES", instructions were given that the arm should be adjusted to clear the stack of records by only 1/8". This dimension may be made 1/4". If the pickup is made to rise too close to the bottom record, the stud may never clear the groove in the cam gear and the arm will keep moving back and forth continuously.

With the revised design, the following parts, contained in the Parts List of the original RL, are omitted.

LOCATION FOR OTHER INFORMATION
(See Photographs) SEE WEBSTER MODEL 210

of Original RL)	PART NUMBER	DESCRIPTION	SELLING PRICE EACH
11	10164408051	Cam gear assembly	1.87
13	10164408362	Guide arm assembly	2.74
15	1016420874	Trigger spring	.05
16	1016440811	Trigger	.13
19	1016440873	Lock spring	.02
39	1016440806	Cam lever	.36
78	1016440870	Reject rod	.10
93	10164408151	Lever hub assembly	.38

FOR CHASSIS
(101.584-4,-5)
ONLY

Required additions to the Parts List, shown in the following photographs, are:

LOCATION CODE	PART NUMBER	DESCRIPTION	SELLING PRICE EACH
AI	10164409313	Pickup Support Bracket Assembly	.17
BK-BL	10164408011	Shelf Plate, Selector Plate	1.90
CA	1016442413	Swivel Shaft and Head Assembly	.57
CH	10164408363	Swivel Tube and Trunnion Assembly	1.36
CL	10164423443	Stop Lever and Trigger Adj. Assembly	1.61
DF	10164408052	Cam Gear	1.87
DI	10164423393	Sub-Plate and Gear Assembly (EJ)	6.33
ED	10164409071	Changer Shaft Collar	.46
EJ	10164423393	Sub-Plate and Gear Assembly (DI)	6.33
EP	1016443334	Rejection Rod Support	.04
FB	1016442414	Male Plug with #7002 Shell	.08
FE	1016442415	Shim - (Assortment)	.01
FI	1016442347	Rejection Rod	.11
FT	1016443417	Tone Arm Lift Plate	.16
FU	1016442418	Hinge Pin Spring	.04
FV	1016442351	Tone Arm Hinge Pin	.04

PRICES SUBJECT
TO CHANGE WITH-
OUT NOTICE.

J. P. SEEBURG CORP.

Automatic Record Changer Operating Instructions

POWER SUPPLY FOR RECORD CHANGER

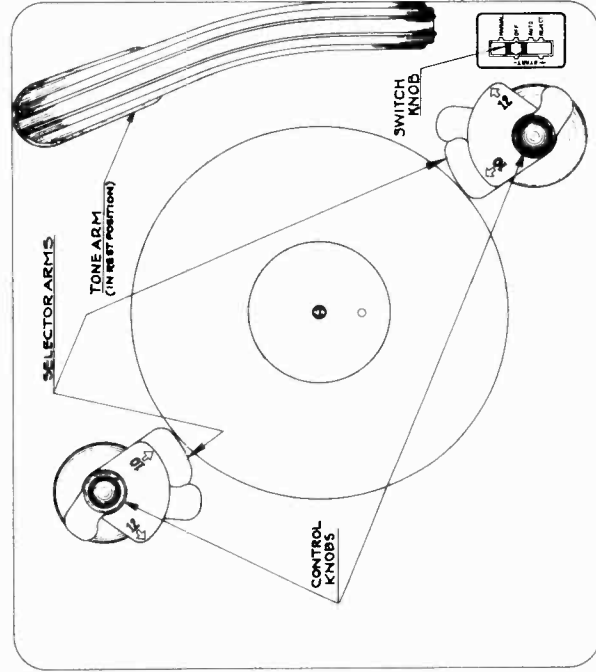
The Changer is equipped with a constant-speed self-starting motor. Under all normal conditions it starts automatically and runs at correct speed.

Each Changer is designed to operate on a certain voltage and frequency (cycles) only. Be sure to look at your radio nameplate and see that the instrument you have conforms to your power supply before plugging in cord. The rating of your power supply can be determined by calling the local electric company.

SETTING FOR SIZE OF RECORD

The Changer plays up to fourteen 10" or ten 12" records at one loading. All records must be the same size for each loading.

FIGURE (1)



PHONOGRAPH NEEDLES

Various types and kinds of needles are available for use in phonograph tone arms. All have their virtues, as well as their faults, for use in ordinary phonographs, where needles can be changed after each record. For playing ten or more records at one set-up, as with this Changer, no attempt should be made to use ordinary steel or fibre points, since continued use of worn points will be likely to ruin both quality of reproduction and the records as well. Any kind of needle can be used which has a point durable enough to play ten records or more without damaging them.

In general there are two types of needles which can be satisfactorily used on an Automatic Record Changer: those which require changing after approximately 12 records, and the so-called permanent type needles which are rated in terms of "hours of service". In no case should the manufacturers' claims for these needles be exceeded, since in all probability the needles are rated in terms of their maximum life. If at any time short of the rated life, particularly in the case of the semi-permanent type needles, there is any reason to suspect that the needle has become unduly worn, it would probably be advisable to replace it with a new one. For your convenience suitable provision has been made for playing "home" or "instantaneous" recordings by means of a retractable drive pin in the turntable (see Turntable Drive Pin). Special needles are recommended for use with home recordings in order to prolong their life and obtain the maximum tone quality. Needle manufacturers designate this particular type of needle as "Shadographed", "Red Shank", "Transcription", and other similar names all of which are intended to indicate that the needle has a perfectly rounded point which will not damage the most fragile records. In general this type of needle is not suitable for commercial records. Any steel needle which has been used on a commercial record should never be used to play back a home recording.

For convenience, the tone arm on your changer may be raised to a nearly vertical position, so that the needle may be easily inserted; the needle screw should be tightened firmly.

MODEL B

J. P. SEEBURG CORP.

On each post you will see selecting arms. The position of these arms determines the setting for different size records. To set for 10 or 12 inch records, it is merely necessary to grasp the posts by the knobs at the top, lift, and turn until the 10" or 12" arrows are pointing toward the center of the turntable. When in either the 10" or 12" position, the posts will snap into place except when they are held up by hand. Be sure to set both posts for the same size record.

Figure (1) shows the Changer with the selecting arms set for 10" records and ready to be loaded; the tone arm is in the rest position and the switch is in the "OFF" position.

FIGURE (2)

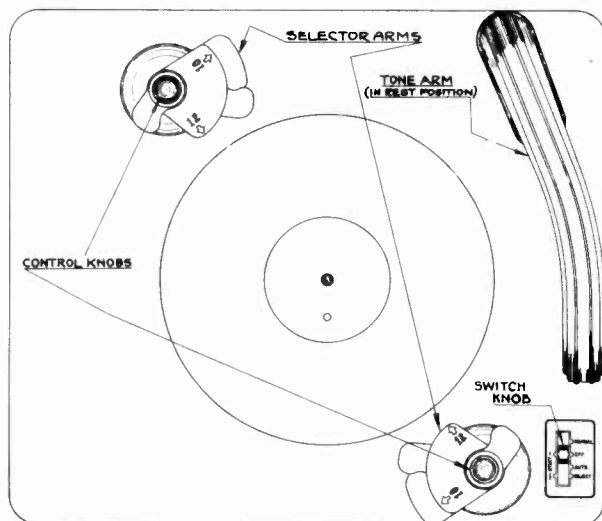


Figure (2) shows the Changer set for 12" records and ready to be loaded; the tone arm is in the rest position and the switch knob is in the "OFF" position.

LOADING

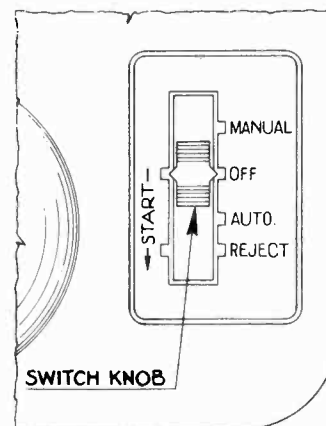
See that the selecting arms of both posts are turned toward the center of the turntable as indicated by the engraved arrows, and that both sets of arms are set for the same size (10" or 12") records as described in the preceding paragraph.

Place the stack of records (up to fourteen 10" or ten 12") over the center pin so that they will rest on the selecting arms.

STARTING THE CHANGER

1. Turn on the radio (allowing approximately 30 seconds for the tubes to warm up) and throw the phonograph-radio knob, or control to the phonograph position.
2. Move the switch knob on the record changer panel, (see Figure 3) to the "reject" position. The motor will start, the record changer will go into automatic operation, and, at the same time, the switch knob will, of its own accord, move to the "automatic" position.

FIGURE (3)



HOW TO REJECT A RECORD

Move the switch knob on the changer panel (see Figure 3) to the "reject" position. You can do it at any time after the needle has come into contact with that record.

PLAYING INDIVIDUAL COMMERCIAL RECORDS

Should it be desired to play an individual record merely set up the machine as described above for the proper size (10" or 12" as indicated on the selecting arms), place the record on top of the arms as described under "Loading", and set the machine in operation by means of the switch knob described under "Starting the Changer". In other words, play an individual record in the same manner as you would play a stack of that size.

MANUAL OPERATION

This changer can be operated manually (that is, as though the machine were an individual record player without any automatic features) by merely moving the switch knob to the "manual" position (see Figure 3). With the switch knob in this position the tone arm is perfectly free to move back and forth as the operator desires. Home recordings are best played in the manual position as well as old or odd sized records not intended for automatic usage. The change from "manual" operation to automatic operation is controlled solely by the switch knob shown in Figure 3 and the change can be made at any time. Should the change from "automatic" to "manual" be made while the mechanism is in the midst of a changing cycle, the machine will complete the cycle after which the tone arm will be free and in the manual operating condition.

TURNTABLE DRIVE PIN

For convenience in playing "home" or "instantaneous" recordings, the turntable on your machine has been provided with retractable drive pin. This pin will project through a hole in one of the above type records to prevent slippage while that record is being played. The weight of a commercial record will depress the pin until it is flush with the turntable surface so that it has no effect.

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UNLOADING

First switch off the motor by moving the switch knob to the "OFF" position (see Figure 3). Move the tone arm to the rest position by raising it just enough so that the needle clears the record and move it to the extreme outside. A click will be heard and the tone arm will then remain in the rest position until the changer is again ready to be operated. (If the tone arm is in the midst of a change cycle, time should be allowed for the machine to complete this cycle and the needle to come to rest on the record before the control knob is thrown to the "OFF" position.) Grasp each post by the control knobs at the top and turn them out of the way.

FIGURE (4)

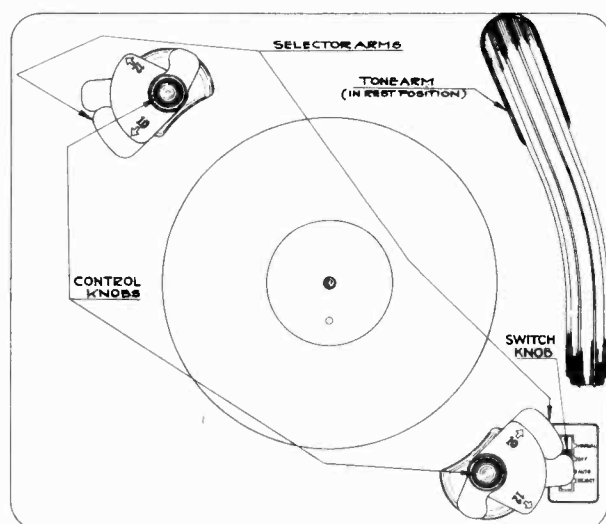


Figure 4 shows the selector arms turned for unloading, the tone arm in the rest position, and the control switch in the "OFF" position.

Lift the played records from the turntable, then return the posts to the proper playing position on the selecting arms (see Figures 1 and 2.) The Changer may then be loaded with a new stack of records according to the size shown on the selecting arms.

USE OF TONE CONTROL

If the radio through which this Changer is being played has a tone control switch, do not forget to adjust it, as well as the volume control, to the position which best brings out the tonal qualities of the kind of records being played.

TURNING OFF CHANGER

1. Move the switch knob to the "off" position. (See Figure 3.)

CAUTION: The lead wire which emerges from the rear of the tone arm and goes down thru the metal base plate is so placed and arranged that it will not restrict the free movement of the tone arm across the record. It is important that this wire be free and loose at all times. Do not attempt to push the excess wire thru the panel.

2. Lift the tone arm and move it to the rest position at the extreme outside of the changer panel. If the changer is going through a "change cycle" allow the tone arm to come to the playing position before attempting to place the tone arm in the rest position. If you prefer to turn off your Changer by the use of any other switch than the one on the Changer itself, be sure to turn it off while needle is resting upon a record; otherwise, the selecting arms cannot be correctly reset.

3. To avoid warping of records, never leave records resting on the selector arms.

IF CHANGER IS LEFT RUNNING

No damage will be done if you forget to turn off Changer after it has played its entire load of records. It will simply repeat the last record until stopped or reloaded.

FAILURE TO PLAY THE NEXT RECORD

An old record may occasionally be found (made before the introduction of automatic changers) which does not carry the needle close enough to center-pin of turntable to set the changer mechanism in operation. Should one of these old records be found in the stack, merely moving the switch knob to the "reject" position will instantly set the Changer mechanism in action again. Any need for doing this can be avoided by placing the old record at top of stack to be played, so that it will come into position last.

CAUSE OF NOISY RECORDS

A background of noise and scratching indicates worn records. Poor tone may be evidence of a worn needle. Some records will wear longer than others, even if kept equally clean. This is due not only to quality of manufacture, and care given the records, but also to the kind of music recorded.

CARE OF RECORDS

To insure long life for your requires only slight effort. Do not expose them to heat from the sun, nor to heat from nearby stoves or radiators. Store them preferably in albums, but in any case keep them always in a cool, dry place, resting vertically or horizontally. Remove dust and dirt, using soft cloth and light circular motion. If fluids are used for lubricating record surfaces, keep in mind that these often tend to attract dust, and extra effort is necessary to clean it off. Even a fine film of dust very often contains abrasive particles which, when ground against the record surface by the steel needle, can cause very rapid wear of the recorded music.

THE AUTOMATIC RECORD CHANGER UNIT IS CONSTRUCTED of a minimum number of working parts, and in operation is simple and reliable. As with all mechanical articles, minor adjustments may be necessary at time by your authorized service man.

MODEL B

J. P. SEEBURG CORP.

I. SETTING UP RECORD CHANGER MECHANISM

Two screws are used to hold the record changer mechanism during shipping; these two screws (a, a, Fig. IV) MUST be removed so that the changer floats freely on its mounting springs. The two holes in the metal sub-panel can be covered by means of the two small matching plug buttons accompanying the machine. If the turntable has been packed separately, it will be necessary to place it over the center spindle and gently press it down, taking care that the motor idler wheel (Fig. IV, Item 66) is not damaged and being sure

that the turntable properly engages the drive pin (Fig. IV, point b).

The mounting parts, supplied with the standard Model "B" changer, are shown in their proper positions in Fig. VII. (NOTE: Some models use only the upper mounting springs and special studs.)

The changer panel assembly must float freely on the mounting springs at all times during normal playing operation.

II. GENERAL FUNCTION OF THE RECORD CHANGER

A. MANUAL PLAYBACK

With the switch knob (see Fig. IV, Item 67) in the "Manual" position, this changer is designed to operate as a single record-player and as such can be used to play individual records of any diameter up to and including 12". The turntable is equipped with a retractable pin (Fig. III, Item 60) so that it is possible to play home recordings as well. Moving the switch knob to the "Manual" position starts the turntable and locks out all of the automatic features of the record changer. The tone arm must be lifted by hand and placed on the record; after the record is played it is necessary to remove the tone arm by hand. During any of the time that the record is being played, it is possible to move the tone arm in or out on the record at will; it is also possible to play either "inside out" or "outside in" recordings.

tion; merely move it to that position momentarily after which the knob will return to the "Automatic" position of its own accord.

A "Rest" position of the tone arm has been provided in order to facilitate unloading the changer (see separate operating instruction sheet). This position of the tone arm is obtained by lifting it from the record being played and moving it to the extreme outside position. The tone arm will latch into place along the outside edge of the changer sub-panel and remain there even though the switch knob is in the "Automatic" posi-

tion and the turntable still running. (NOTE: If the tone arm has played the record far enough, lifting the tone arm or moving it out will trip the automatic mechanism. Allow the mechanism to go through its change cycle and the needle to come down on the next record without hindrance after which the tone arm may be moved to the "Rest" position). If the tone arm is in the "Rest" position and the switch knob in the "Automatic" position, it is merely necessary to momentarily move the switch knob to the "Reject" position and release it in order to again set the changer into automatic operation.

III. METHOD OF OPERATION

The record changer belongs to the general classification of the mutilated gear type. This means that during the time that a record is being played the large die cast gear (see Fig. I, Item 1) and all associated mechanism is at rest.

Under the condition of manual operation, the automatic operation of the mechanism is locked out so that the trip mechanism

is inoperative and so that the tone arm is free.

Under automatic conditions, the tone arm is controlled during the change cycle by means of the various cams, acting through levers, on the large drive gear (see Fig. I, Item 1) which also synchronizes, through the drive link, the movement of the selector arms.

IV. LUBRICATION

A. MOTOR

The motor is equipped with oilless bearing and requires no lubrication.

B. TURNTABLE SPINDLE BEARINGS

Turntable spindle bearings are lubricated at the factory and do not require any lubrication for one year. After one year they should be oiled with

one or two drops of a light grade oil. Do not over-oil!

The top bearing can be oiled by lifting off the turntable. Make sure, when replacing the turntable, that the pin in the turntable spindle slips into the slot on the bottom surface of the turntable hub. Also, care should be taken not to damage the Motor Idler Pulley.

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Never under any circumstance allow oil to come in contact with Motor Idler Pulley.

C. SQUEAK DUE TO RECORDS RUBBING ON TURNTABLE SPINDLE

This can be eliminated by gently lining up the stack of records.

V. TONE ARM INDEXING ON 10" AND 12" RECORDS

In general the pickup indexing is accomplished by the tone arm locator lever (Fig. II, Item 31) engaging the 12" reset lever (Fig. II, Item 37). Setting the selector arms for 10" or 12" records moves the 12" reset lever so that it serves as a stop for the tone arm locator lever at either point "c" (Fig. II) for 12" records or point "d" (Fig. II) for 10" records. Since the tone arm locator lever is a single piece of metal, the distance between the 10" setting at "d" and the 12" setting at "c" is fixed; it is only necessary to properly adjust the tone arm indexing for one size record. The steps in making this adjustment are as follows:

1. With the switch knob in the "off" position, move the tone arm to the "rest" position so that its outer edge is approximately lined up with the extreme outside edge of the record changer panel.
2. Loosen the hex-head cap screw on the under side of the record changer panel (see Fig. II, Item 28) slightly.
3. Line up the outer edge of the tone arm with the outer edge of the record changer panel by eye. This is a preliminary ad-

loosened at the hex-head cap screw (see Fig. II, Item 28).

6. After obtaining a correct indexing of the tone arm on the 12" diameter records, check the indexing on a 10" diameter record

and tighten the hex-head cap screw firmly.

NOTE: Incorrect action of the booster spring or Tone Arm Retard Lever may produce the effect of improper tone arm indexing. (See Section VIII-B).

VI. TONE ARM ADJUSTMENTS (OTHER THAN INDEXING)

A. NEEDLE PRESSURE

The needle pressure is controlled by means of the counter-balance spring (see Fig. VI) at the rear of the arm. The spring tension has been set to provide the needle pressure necessary for correct operation of the pickup. Should it be necessary to make adjustment of this counter balance spring, it is generally advisable to contact your factory service department for the correct needle pressure; be sure to include the part number stamped on the under side of the crystal cartridge and the model number of the set. Care should be taken that the counter-balance spring does not rub against the inside of the tone arm skirt or any associated parts in such a way that it impedes or binds the free vertical movement of the tone arm. (CAUTION: It is a popular fallacy that it is possible to prolong needle and record life by reducing the needle pressure on a given pickup below those pressures recommended by the manufacturer. Any such attempt will probably increase record and needle wear as well as seriously impair the tone quality of the instrument. The correct needle pressure is a function of

the crystal and tone arm design and cannot be satisfactorily changed for a given set of component parts.)

B. TONE ARM HEIGHT ADJUSTMENTS

The Tone Arm Height Adjustment Screw (Fig. VI) controls only the height of the tone arm when it is in the playing position with no record on the turntable. The correct setting of this adjustment screw is that which, under the above condition, allows the tone arm to descend until the needle point is very slightly below the level of the turntable surface.

The Tone Arm Adjustment Screw should not be used to adjust the height to which the tone arm rises during a change cycle; this height is controlled solely by the length of the Tone Arm Lift Pin (Fig. VI).

C. TONE ARM HINGE ADJUSTMENTS

Should the tone arm hinge show evidence of binding or impeding the free vertical movement of the tone arm, it may be necessary to replace this part (Fig. III, Item 58) (as pointed out above, binding may also be due to rubbing of the counter-balance spring).

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VII. "AUTOMATIC" TRIP ADJUSTMENTS

This changer incorporates a dual trip to insure positive cutoff on various types of records.

A. MINIMUM CIRCLE DIAMETER TRIP

After the tone arm has played in far enough so that the distance of the needle from the center spindle is approximately 1-7/8", the record changer will trip regardless of whether or not there is a cutoff or eccentric groove on the record. This type of trip is known as "a minimum diameter circle trip." The diameter of this minimum circle is set at the factory to be approximately 3-3/4". Variations in adjustment or readjustment of this operation can be obtained by moving the position of the trip shoe (see Fig. II, Item 29) slightly. The trip shoe is

VIII. "BOOSTER" SPRING ADJUSTMENTS

A. BOOSTER SPRING SETTING

The function of the booster spring (Fig. II, Item 30) is to move the needle from the margin groove automatically. Most present day records have what is known as a "lead-in groove" which automatically carries the needle from the margin of the record into the record grooves. In the case of the older type records, and particularly those of the mechanically recorded type which have no lead-in grooves, the booster spring supplies just enough pressure to move the needle across the margin to the record grooves. This booster spring is built into the tone arm locator lever (see Fig. II, Item 31) and consists of a single piece of light spring

should be made with a pair of light pliers or with the fingers. The tension, measured at the point of contact between the booster spring (Fig. II, Item 30) and the tone arm lever (Fig. II, Item 25) is set at the factory to values between seven and fifteen grams depending upon the type of needle and cartridge used (cartridges requiring extremely light needle pressure also require a light booster spring tension.) CAUTION: The Shielded Pickup Lead Wire (Fig. II, Item 22) must have sufficient slack between the tone arm and the point where the tone arm lead enters the sub-panel to permit free sidewise movement of the tone arm; otherwise the action of the booster spring may be over-come or overemphasized. This lead must be checked before attempting any booster spring adjustments.

B. ECCENTRIC GROOVE TRIP

In order to make the trip action of the changer mechanism operate under various conditions, a second tripping device has been included which operates due to any outward movement of the tone arm after it has played to within approximately 2-1/2" of the center spindle. This trip is actuated by a small dog and ratchet combination (see Fig. II, Item 44) and is adjusted at the factory.

wire (see Fig. II, Item 30). The side pressure exerted by this spring should be just sufficient so that the needle will move across the margin of a record which contains no lead-in groove. After any adjustment of this booster spring, check its operation on both 10" and 12" records to make sure that it functions properly. Do not increase the operating pressure of the booster spring to such a point that it tends to make the needle slide across the first few record grooves. Access to the booster spring can be obtained when the tone arm is in the "Rest" position, with the switch knob turned off, by moving the tone arm locator lever assembly out toward the edge of the changer sub-panel with the finger. Adjustment of the spring tension

B. TONE ARM RETARD LEVER ADJUSTMENTS

The function of the Tone Arm Retard Lever (Fig. II, Item 49) is to provide a smooth motion of the tone arm as it moves from the outer edge of the panel in towards the edge of the record to be played, during an automatic change cycle.

An additional function of the tone arm retard lever is to prevent action of the booster spring (Fig. II, Item 30) until the needle has lowered onto the outer edge of the record to be played. Insufficient tension of the Tone Arm Retard Lever Spring (Fig. II, Item 47) will permit action of the booster spring before the needle comes to rest on the record, giving the effect of incorrect tone arm indexing. Excessive pressure of the tone arm retard lever spring will cause rough, jerky action of the tone arm as it moves from the outer edge of the changer panel.

IX. ACTION OF THE SWITCH KNOB

In general, the switch knob controls both the tone arm action and the electrical "On-Off" switch. In all positions of the switch knob, excepting the "Off" position, the electrical circuit through the switch is closed.

A. "OFF" POSITION

With the switch knob in the "Off" position, the tone arm will lock at the extreme outside edge of the changer panel. This position of the tone arm logically accompanies the "Off" position of the electrical switch in order to facilitate the loading or unloading of records either for auto-

B. "MANUAL" POSITION

When the switch knob is thrown to the "Manual" position, the electrical switch circuit is closed and the tone arm is freed from its locked position due to the action of the projection on the Manual and Reject lever (Fig. II, Item 20) which partially dis-

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playing on the outside of a 12" record. (See Section X also).

D. "REJECT" POSITION

When the switch knob is thrown to the "Reject" position, it acts through levers (Fig. II, Item 36, Item 20) and the trip lever (Fig. II, Item 44) clearing the clutch engagement lever (Fig. II, Item 41) so that it will drop down and engage one of the lower projections of the pinion gear and thus set into operation the automatic change mechanism. In the "Reject" position of the switch knob, the roller lever and roller assembly (Fig. I, Item 6) together with its spring (Fig. I, Item 9) is intended to exert a continuous pressure on the main control slide (Fig. II, Item 36) so that as soon as the switch knob is released, the latter will be returned to the "Automatic" position. Failure of the switch knob to return to the "Automatic" position when released can result from improper action at this point, as well as binding of the main control slide at various bearing surfaces.

Under B, the tone arm locator (Fig. II, Item 31) and the upper slide (Fig. II, Item 36) hook together at point "g" during manual operation. When the switch knob is then thrown into "Automatic" or "Reject" position, these two parts completely disengage during the next change cycle due to the cam action of the main drive gear which forces the tone arm lever to the outer edge of the sub-panel and allows the upper slide (Fig. II, Item 36) to clear the tone arm locator lever at point "g". See also Fig. VIII.

The tone arm locator lever provides the 10" or 12" indexing for the tone arm during automatic operation by its engagement with the 12" reset lever (Fig. II, Item 37). The two levers must hook securely behind the projecting tip on the tone arm locator lever (as shown at point "c" on Fig. II) when the 12" record is being played. This is to prevent the tone arm locator lever and also the tone arm from sweeping toward the center should the 12" setting of the selector arm blade be changed to 10" while the tone arm is

X. "SELECTOR ARM" ADJUSTMENTS

Under all ordinary conditions it should not be necessary to make any adjustment of the selector blades themselves. Should such an adjustment become necessary it can best be accomplished by using a standard make of record of the proper diameter and of average thickness for gauging the selector blades (Fig. III, Items 54 and 55). The setting of these blades can be accomplished by means of a pair of long nosed pliers and is

correct when the blades lift slightly upon engaging a record of average thickness.

The position of the selector arm (Fig. III, Item 54) controls the tone arm indexing for 10" or 12" records through its engagement with the 12" set rod at point "k" (Fig. III). Motion of the 12" set rod is transmitted through the changer base panel to the 12" reset lever (Fig. II, Item 37). Sufficient tension is

arm lever (Fig. II, Item 25); otherwise the tone arm will be scraped across the turntable. Also, it is essential that the engagement at "g" be such that there is a hooking action (see Fig. VIII) at this point in order to prevent the tone arm locator (Fig. II, Item 31) and tone arm from sweeping toward the center when the switch is moved out of the manual position.

In addition to the action of the switch knob on both the tone arm latch at point "f" and tone arm locator locking at point "g" when the switch knob is moved to the "Manual" position, there is an additional action of the control lever (Fig. II, Item 36) through the Manual and Reject Lever (Fig. II, Item 20) which restrains the trip dog from acting. This latter operation results in the tone arm being freed from the automatic tripping action which occurs in all positions of the switch knob other than the "Manual" position. It is only necessary that the Manual and Reject Lever so engage the clutch engagement lever (Fig. II, Item 41) that the latter cannot drop sufficiently far to engage any of the lower projections of the pinion gear.

C. "AUTOMATIC" POSITION

With the switch knob in the "Automatic" position, the tone arm latch lever (Fig. II, Item 24) will lock the arm at point "f" (Fig. II) at any time when the tone arm is moved to the outside position. This tone arm latch is released during a change cycle through its engagement at point "h" (Fig. II) with the drive gear. As noted above

point "f" (see Fig. II). At the same time the tone arm locator lever (Fig. II, Item 31) is held at point "g" (Fig. II) by the upper slide (for enlarged view see Fig. VIII). In this position, it is essential that the engagement between the upper slide and tone arm locator lever be positive as shown in sketch (Fig. VIII). In all other positions of the switch knob, the upper slide is held by the main control slide (Fig. II, Item 36) so that it cannot engage the tone arm locator lever at point "g". The purpose of the spring (Fig. II, Item 32, also see Fig. VIII) attached to the upper slide is to provide a means whereby the engagement at point "g" may be made should the switch knob be moved to the "Manual" position when the tone arm lever (Fig. II, Item 25) is not in the outward position. (Such an action would occur when the switch knob is moved from the "Automatic" position to the "Manual" position while a record is being played). The tone arm locator lever (Fig. II, Item 31) would then be against either the 10" or 12" indexing stop, and as the tone arm is swung into the outside rest position, the tone arm locator (Fig. II, Item 31) must be able to catch at point "g" (see Fig. VIII).

When the tone arm is in the "Rest" position and the switch knob is thrown to "Manual", it is essential that the sequence be carefully observed between the action of the latch lever (Fig. II, Item 24) and the upper slide (Fig. II, Item 31). The latter should be in a position to provide a positive stop for the tone arm locator lever BEFORE the latch lever releases the tone

provided through the spring (Fig. II, Item 38) to maintain a hooking action between two levers (Fig. II, Item 31 and 37) at point "p". This is to prevent the tone arm locator lever and

also the tone arm from sweeping toward the center should the 12" setting of the selector arm be changed while the tone arm is playing on the outside of a 12" record.

XI. MISCELLANEOUS MECHANICAL NOTES

A. "FEEDBACK" OR "HOWL" OR "MICROPHONISM"

1. Inspect the under side of the panel to make sure that the changer does not come into contact with any part of the cabinet at any point other than at the four corners where it rests on the mounting springs. Also check to be sure that the studs (Fig. I, Item 14) do not rub against the side of the holes of the cabinet panel.

2. A tendency toward microphonism may be due to any one or all of the four mounting springs being drawn down too tightly; loosening these mounting springs will reduce any tendency toward feedback.

It should be remembered that there is no disadvantage in any phonograph equipment which tends to become microphonic at volume control settings above those in the usable range. That is, if the set does not feed-back up to the volume control settings at which distortion appears when playing an average record, it will operate satisfactorily.

B. "RUMBLE"

1. Remove the turntable and inspect the rubber rimmed

motor idler pulley (Fig. IV, Item 66) for flat or worn spots which would tend to jar the turntable.

2. With the turntable removed, rotate the turntable spindle to be sure that it turns smoothly.

C. "WOW" OR "SPEED VARIATION"

1. Remove the turntable and rotate the turntable spindle (Fig. II, Item 40) with the fingers to determine whether it tends to bind. High friction at this point may be sufficient to cause the motor to slow down instantaneously. Apply ONLY a drop or two of light oil to the two spindle bearings. If the turntable shaft is bent to such an extent that replacement is necessary, it is recommended that the entire Spindle and Pinion Gear Assembly (Fig. II, Item 39, Also Fig. V) be replaced instead of replacing only the spindle assembly. This Spindle and Pinion Gear Assembly (see Fig. V) is fitted with precision machines at the factory, thus insuring proper clearances and smooth operation.

D. REPEATED TRIPPING

1. Turn off the changer during a change cycle so that the clutch engagement lever (Fig. II, Item 41) may be moved up and down with the finger. This clutch engagement lever should lock into the up position due to its engagement with the trip lever (Fig. II, Item 44) at the point "m". If this engagement is not positive, inspect the bearing point of the trip lever (Fig. II, Item 44) for evidences of dirt or binding. A more positive engagement may be obtained by strengthening the spring (Fig. II, Item 50). CAUTION: This spring tension must be JUST SUFFICIENT to lock the clutch engagement lever in the up position. Excessive tension of the spring will result in failure to trip.

2. Repeated tripping may also be due to the fact that the switch knob does not return to the "Automatic" position when released. This condition can result from binding of the roller lever (Fig. I, Item 6) on its bearing, insufficient tension in spring (Fig. I, Item 9), or excessive friction or binding in the motion of the control lever (Fig. II, Item 36).

E. FAILURE TO TRIP

1. Turn off the changer during a change cycle so

that the clutch engagement lever (Fig. II, Item 41) may be actuated with the finger while the trip lever is being held away, so that the engagement lever does not lock in the "up" position. The clutch engagement lever must not stick in the up position due to binding at any point. CAUTION: It is not advisable to use any lubricant at the bearing point of the clutch engagement lever (Fig. II, Item 51); this bearing is intended to be a loose fit, run dry, and operate due to gravity.

2. Excessive pressure on spring (Fig. II, Item 50) would tend to make the needle jump out of the cut-off groove of the record (see paragraph D-1 above) and prevent tripping.

3. The Shielded Pickup Lead Wire (Fig. II, Item 22) must have sufficient slack between the tone arm and the point where the tone arm lead enters the sub-panel to permit free sidewise movement of the tone arm. The Shielded Lead should be so positioned that it loosely rests near the tone arm post immediately below the point at which it leaves the tone arm bracket. Under no circumstances should the Shielded wire be fastened in place, pulled taut, or restrict free tone arm movement. This is particularly important in

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machines which use extremely light pressure pickup cartridges.

F. INSUFFICIENT POWER TO COMPLETE A CHANGE CYCLE

1. Inspect the bearing of the main drive gear (Fig. I, Item 1) for excessive friction or binding.
2. Inspect the selector arm bearings for excessive friction or binding.

G. JAMMING OF THE MECHANISM

1. Should the changer jam at any time during a change cycle for some reason other than jamming of the selector arms with the records being changed, remove the records and attempt to free the machine by rotating the turntable in a reverse direction through a quarter turn. If the jam is apparently cleared by such action, the machine should be checked by operating it automatically several times, but with no records.
2. If the jam does not clear by rotating the turntable in a reverse direction, inspect the underside of the changer panel for damaged or missing parts.
3. Inspect the meshing of the drive gear (Fig. I,

Item 1) with the pinion gear (Fig. I, Item 11). If the two gears do not mesh (that is, if they are not so timed as to fit together properly) it is probably due to the fact that the clutch engagement lever (Fig. II, Item 41) has been damaged or bent. This clutch engagement lever is intended to so contact one of the lower projections on the pinion gear (Fig. I, Item 11) that the teeth of this pinion gear (Fig. I, Item 11) and the teeth of the main drive gear (Fig. I, Item 1) be timed to fit together properly whenever the mechanism starts a change cycle. If the clutch engagement lever (Fig. II, Item 41) is bent, it may be straightened until, by trial, the two gears mesh properly when the changer is tripped. It is advisable that the changer mechanism be operated by hand so that this timing or meshing between the two gears can be more closely observed during any adjustments or inspections.

H. TONE ARM DOES NOT INDEX CORRECTLY

Refer to Sections V and VIII, for complete information on setting of tone arm.

XII. STANDARD MODEL "B" RECORD CHANGER PARTS LIST

Particular models vary slightly from the standard model. It is suggested that

your factory service department be consulted for special parts not shown in this listing.

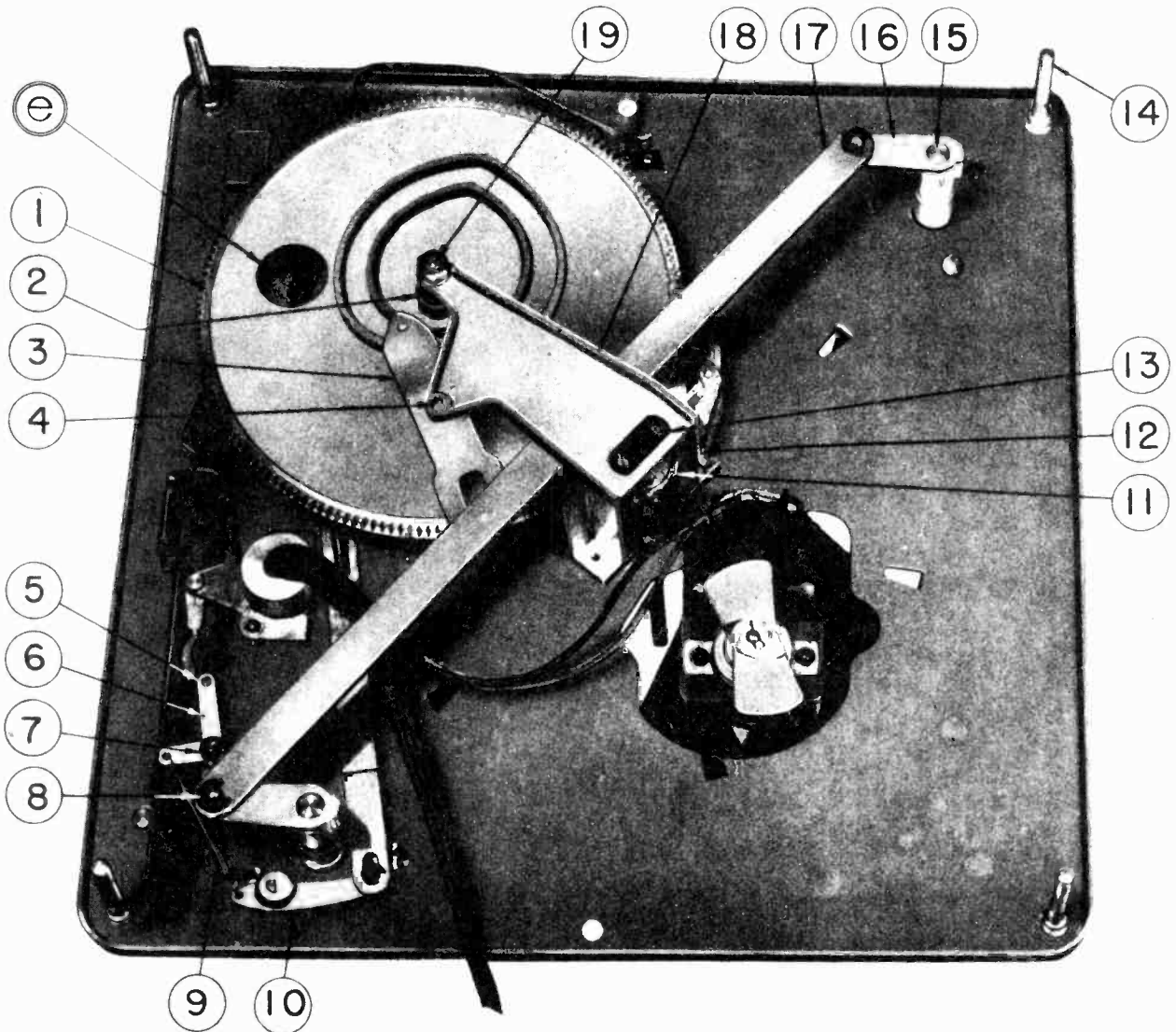
NOTE: Several assemblies listed in this manual should be bought only as assemblies, since these require special tools and precision adjustment which the factory is equipped to provide, thus insuring satisfactory operation of the changer mechanism. These assemblies are as follows:

Drive Gear Assembly (Fig. I, Item 1)
 Roller Lever Assembly (Fig. I, Item 6)
 12" Reset Arm Assembly (Fig. I, Item 10)
 Selector Shaft Assembly (Fig. I, Item 15)
 Drive Crank Assembly (Fig. I, Item 16)
 Tone Arm Lever Assembly (Fig. II, Item 25)
 Tone Arm Locator Assembly (Fig. II, Item 31)
 Switch Plate Assembly (Fig. II, Item 35)
 Control Lever Assembly (Fig. II, Item 36)
 Spindle and Pinion Gear Assembly (Fig. II, Item 39 and Fig. V)
 Trip Lever Assembly (Fig. II, Item 44)
 Selector Arm and Blade Assembly No. 1 (Fig. III, Item 54)
 Selector Arm and Blade Assembly No. 2 (Fig. III, Item 55)
 Tone Arm Mounting Assembly (Fig. III, Item 58 and Fig. VI)
 Motor Assembly (Fig. IV, Item 63)

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FIGURE 1 - UNDERSIDE VIEW OF CHANGER MECHANISM

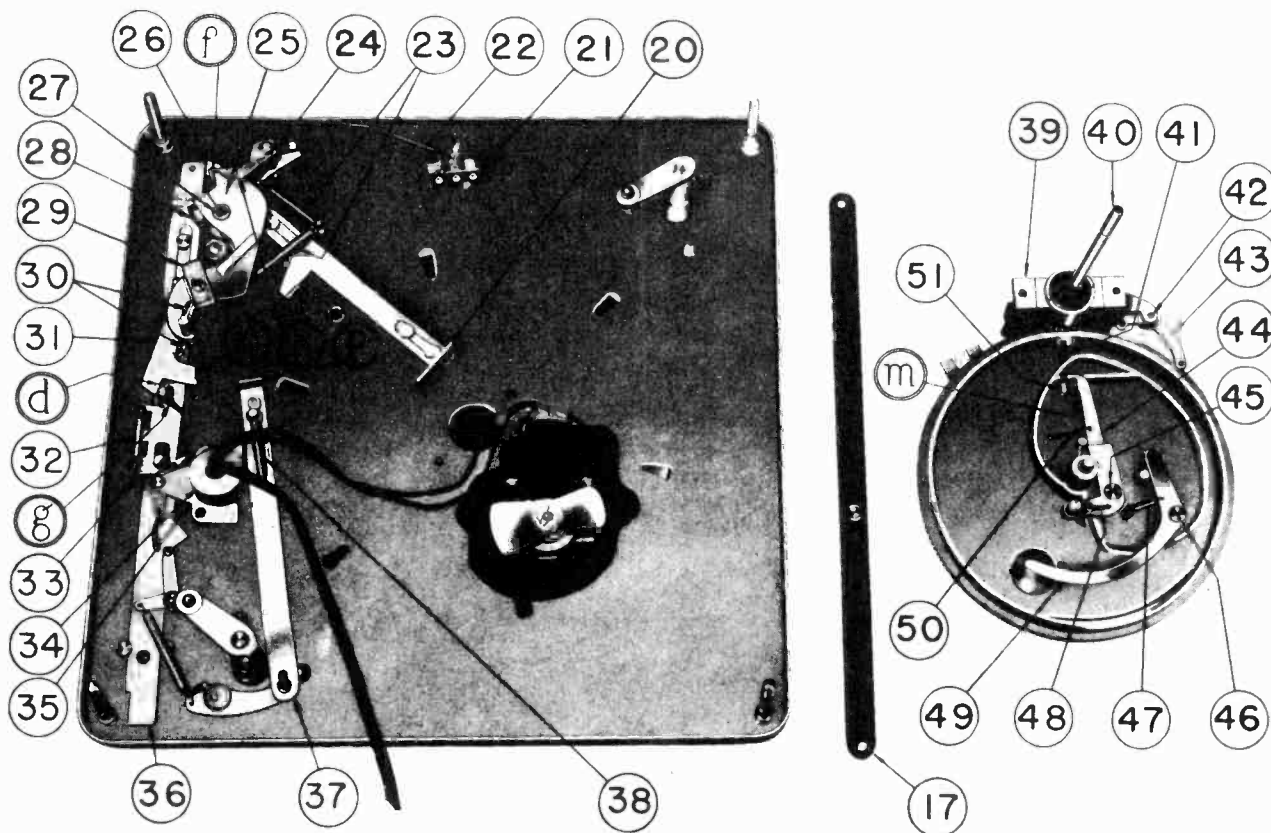


ITEM NO.	PART NO.	DESCRIPTION	NO. USED
1	B-27356-A	- Drive Gear Assembly.	1
2	B-27050	- Fiber Thrust Washer.	1
3	B-27098(*)	- Cam Drive Link Assembly.	1
4	B-27053(*)	- Cam Drive Link Stud.	1
5	B-27094	- Roller	1
6	B-27349-A	- Roller Lever Assembly.	1
7	J-22021	- 1/8" Snap Washer	3
8	H-20065	- 3/16" Snap Washer.	3
9	B-27093	- Roller Lever and 12" Set Arm Spring.	1
10	B-27129-A	- 12" Reset Arm Assembly	1
11	B-27043(*)	- Pinion Gear.	1
12	B-27048(*)	- Stop Lever Spring.	1
13	J-22096(*)	- Thrust Plate	1
14	B-27085	- Panel Mounting Stud.	4
15	B-27346-A	- Selector Shaft Assembly.	2
16	B-27345-A	- Drive Crank Assembly	2
17	B-27347-A(*)	- Drive Link Assembly.	1
18	B-27131-A(*)	- Spindle Housing and Bushing Assembly	1
19	B-27049	- Drive Gear Shaft	1

(*) See Fig. V for Detail Assembly

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FIGURE 11 - UNDERSIDE VIEW OF CHANGER MECHANISM, DISASSEMBLED



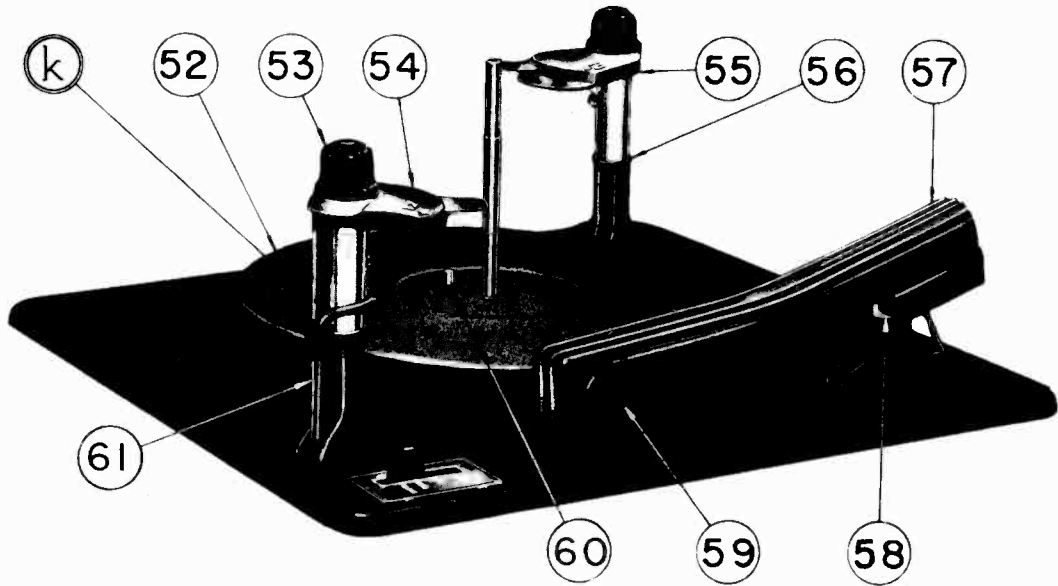
ITEM NO.	PART NO.	DESCRIPTION	NO. USED	ITEM NO.	PART NO.	DESCRIPTION	NO. USED
20	B-27029	- Manual and Reject Lever. . .	1	37	B-27075	- 12" Reset Lever.	1
21	10069	- Terminal Strip	1	38	J-22121	- 12" Reset Lever Spring . . .	1
22	J-22136	- Shielded Wire.	1	39	B-27130A(*)	- Spindle and Pinion Gear Assembly	1
23	J-22094	- Tone Arm Locator (and Latch) Spring	2	40	J-22406(*)	- Turntable Spindle Assembly .	1
24	B-27030	- Tone Arm Latch Lever	1	41	B-27057	- Clutch Engagement Lever. . .	1
25	B-27352-A	- Tone Arm Lever Assembly. . .	1	42	B-27047(*)	- Stop Lever Pivot Pin	1
26	B-27028	- Connecting Link.	1	43	B-27097(*)	- Drive Gear Stop Lever Assembly.	1
27	B-27003	- Tone Arm Lift Pin.	1	44	B-27351-A	- Trip Lever Assembly.	1
28	71177	- Cap Screw 1/4"-20.	1	45	B-27060	- Trip Lever Shoulder Screw. .	1
29	B-27036	- Trip Shoe.	1	46	B-27088	- Retard Lever Shoulder Screw.	1
30	H-20129	- Booster Spring	1	47	B-27067	- Retard Lever Spring.	1
31	B-27353-A	- Tone Arm Locator Assembly. .	1	48	B-27063	- Trip Dog Spring.	1
32	B-27083	- Upper Slide Spring	1	49	B-27065	- Tone Arm Retard Lever. . . .	1
33	J-22365	- Lower Slide Spring	1	50	B-27092	- Trip Lever Spring.	1
34	B-27026	- A.C. Switch.	1	51	B-27058	- Clutch Engagement Lever Pin.	1
35	B-27354-A	- Switch Plate Assembly. . . .	1				
36	B-27355-A	- Control Lever Assembly . . .	1				

(*) See Fig. V for Detail Assembly View

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FIGURE III - TOP VIEW OF RECORD CHANGER



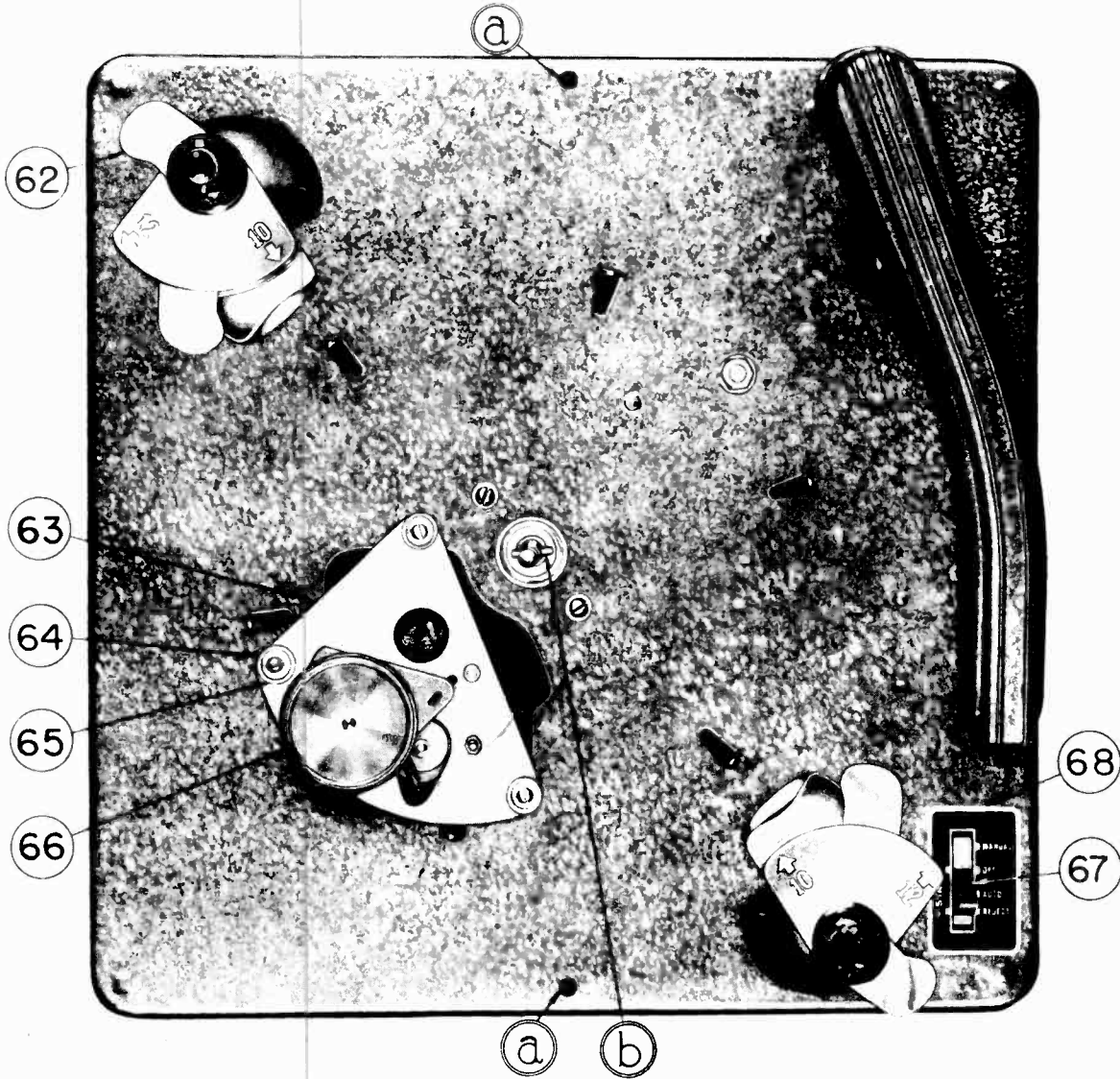
ITEM NO.	PART NO.	DESCRIPTION	NO. USED
52	J-22278	- Turntable.	1
53	B-27079	- Control Knob	2
54	B-27132-A	- Selector Arm and Blade Assembly No. 1.	1
55	B-27133-A	- Selector Arm and Blade Assembly No. 2.	1
56	H-20014	- Thrust Washer.	4
57	B-27507	- Tone Arm	1
58	B-27137-A(*)	- Tone Arm Mounting Assembly . . .	1
59	B-27090	- Tone Arm Cartridge	1
60		- Retractable Pin.	1
61	J-22063	- 12" Set Rod.	1

(*) See Detailed Assembly View Fig. VI

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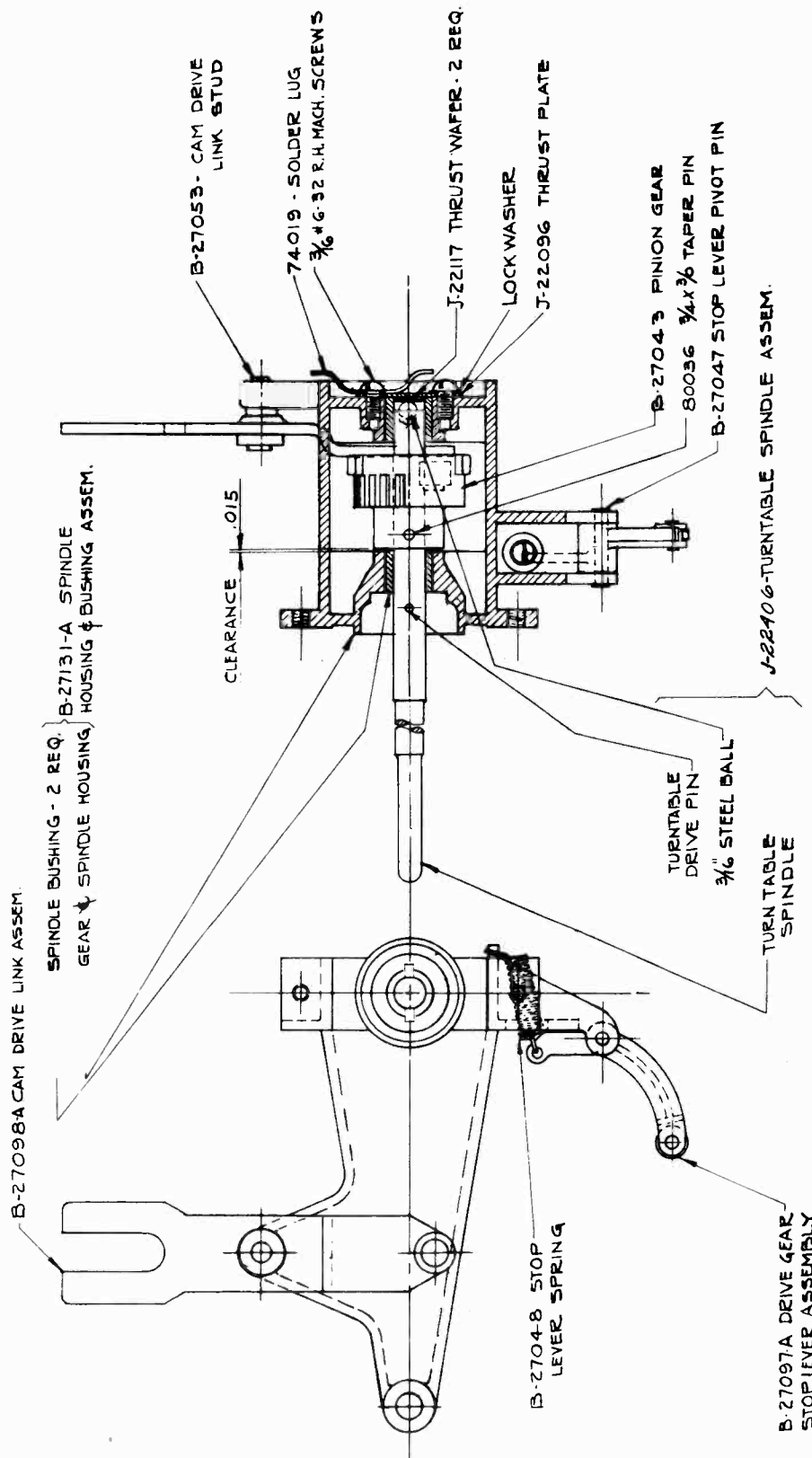
FIGURE IV - TOP VIEW OF RECORD CHANGER, DISASSEMBLED



ITEM NO.	PART NO.	DESCRIPTION	NO. USED
62	J-22099	- 12" Selector Blade.	2
63	B-27110	- Motor Assembly.	1
64	J-22266	- Motor Mounting Bushings	3
65	J-22144	- Motor Grommet	3
66	J-22143	- Motor Idler Pulley.	1
67	B-27018	- Switch Control Knob	1
68	B-27074	- Control Escutcheon.	1

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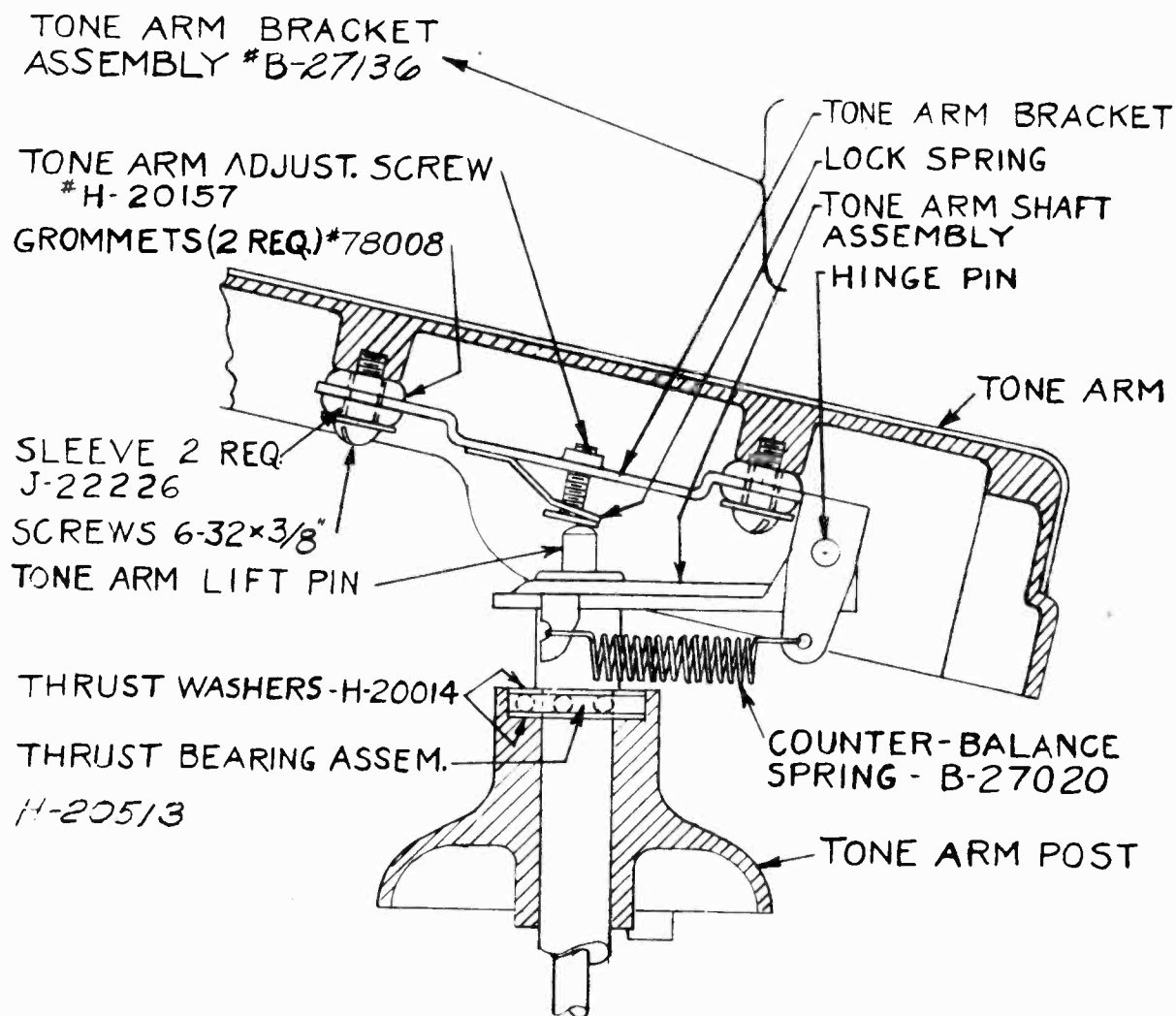


ITEM NO.	PART NO.	DESCRIPTION	NO. USED	ITEM NO.	PART NO.	DESCRIPTION	NO. USED
1	11266	- Steel Ball	1	10	B-27048	- Spring	1
2	74019	- Solder Lug	1	11	B-27053	- Cam Drive Link Stud	1
3	80036	- Taper Pin	1	12	B-27097	- Drive Gear Stop Lever Assembly	1
4	J-22087	- Turntable Drive Pin	1	13	B-27098	- Cam Drive Link Assembly	1
5	J-22096	- Thrust Plate	1	14	B-27131	- Spindle Housing and Bushing Assembly	1
6	J-22117	- Thrust Wafer	2				
7	J-22148	- Turntable Spindle	1				
8	B-27043	- Pinion Gear	1				
9	B-27047	- Stop Lever Pivot Pin	1				

FIGURE V - SPINDLE AND HOUSING ASSEMBLY

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FIGURE VI - TONE ARM MOUNTING ASSEMBLY

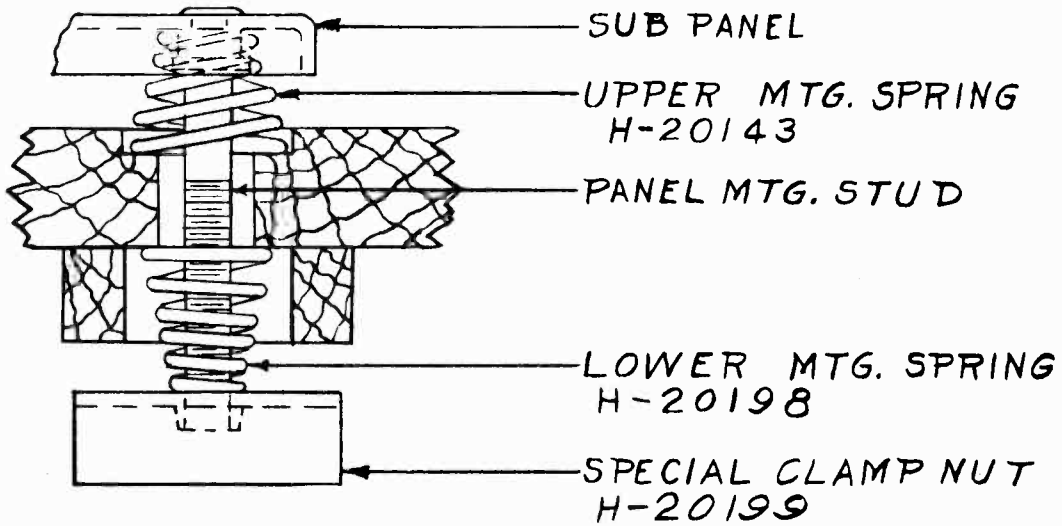


ITEM NO.	PART NO.	DESCRIPTION	NO. USED
1	78008	- Grommet.	2
2	H-20014	- Thrust Washer.	2
3	H-20157	- Tone Arm Adjusting Screw	1
4	H-20513	- Thrust Bearing Assembly.	1
5	J-22226	- Sleeve	2
6	B-27020	- Counter Balance Spring	1
7	B-27136	- Tone Arm Bracket Assembly.	1

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FIGURE VII - MOUNTING PARTS

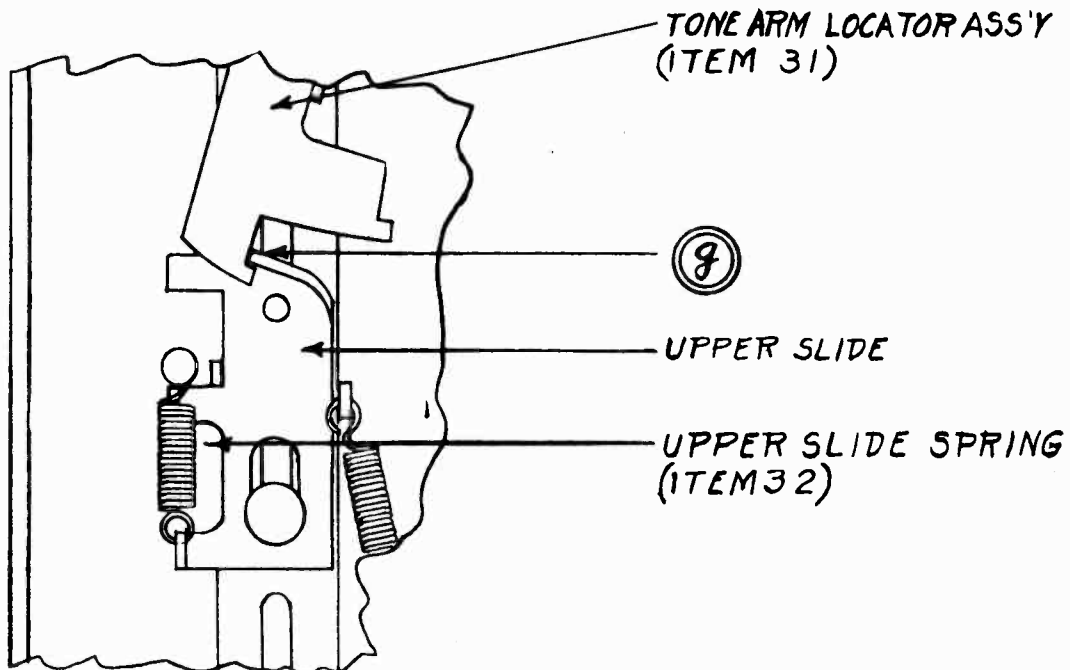


PART NO.	DESCRIPTION	NO. USED
H-20143	- Upper Mounting Spring	4
H-20198	- Lower Mounting Spring	4
H-20199	- Special Clamp Nut	4

(Panel Mounting Stud shown on Fig. I, Item 14)

(NOTE: Some models use only the Upper Mounting Spring)

FIGURE VIII - SKETCH SHOWING LOCKING OF LOCATOR LEVER IN MANUAL POSITION



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The lead wire which emerges from the rear of the tone arm and goes down through the metal panel is so placed that it will not restrict the free movement of the tone arm across the record. It is important that this wire be free and loose at all times. DO NOT ATTEMPT TO PUSH THE EXCESS WIRE THROUGH THE PANEL.

Holding the turntable while the motor is running will damage the mechanism — throw the switch knob to the "OFF" position before slowing down or stopping the turntable.

II. MANUAL OPERATION

This changer can be operated manually (that is, as though the machine were an individual record player without any automatic features) by moving the control knob to the "MANUAL" position (See Figure 4). With the control knob in this position the tone arm is free of all automatic mechanism. The Selector Arms may be turned out of the way as shown in Figure 5, and discussed under "UNLOADING". Home recordings and old or odd sized records not intended for automatic usage should be played with the Control Knob in the "MANUAL" position. Should the change from "AUTOMATIC" to "MANUAL" be made while the mechanism is in the midst of a changing cycle, the machine will complete the cycle after which the tone arm will be free and in the manual operating condition.

Should it be desired to play an individual commercial record, set the Selector Arms as described above for the proper size (10-inch or 12-inch). Place the record on top of the arms as described under "LOADING" and start the changer as described under "STARTING THE CHANGER". In other words, play an individual commercial record in the same manner as you would play a stack of that diameter.

III. NOTES ON OPERATION OF THE RECORD CHANGER

A. HOW TO REJECT A RECORD

In the event that you do not care to listen to a particular record which is being played automatically, you may reject it at any time after the needle has come to rest on that record by pushing the Control Knob into the "REJECT" position and then releasing.

B. USE OF RETRACTABLE PIN

For making or playing "home" recordings, the turntable on your machine has been provided with a retractable pin. This pin will project through a hole in the home recording blank to prevent slippage while that record is being played or made. The weight of a commercial record will depress the pin until it is flush with the turntable surface so that it has no effect.

C. USE OF TONE CONTROL

If the radio through which this Changer is being played has a tone control, do not forget to adjust it, as well as the volume control, to the position which best brings out the tonal qualities of the kind of records being played.

D. IF CHANGER IS LEFT RUNNING

No damage will be done if you forget to turn off changer after it has played its entire load of records. It will simply repeat the last record until stopped or reloaded.

E. FAILURE TO PLAY THE NEXT RECORD

An old record may occasionally be found (made before the introduction of automatic changers) which does not carry the needle close enough to center of turntable to set the changer mechanism in operation. Should one of these old records be found in the stack, moving the Control Knob to the "REJECT" position will instantly set the changer mechanism in action again. Any need for doing this can be avoided by placing the old record at top of stack to be played, so that it will come into position last.

VII. OPERATION OF THE RECORDER MECHANISM

A. INSERTION OF CUTTING NEEDLE

The recorder arm, shown on a preceding page in Figure 12 may be raised to a nearly vertical position for easy insertion of the "cutting" or "recording" needle. Additional information on recording needles will be given in another section.

- a. Insert the needle as far as possible into the cutter head.
- b. Be sure that the needle is so positioned that the needle screw tightens against the flat on the needle shank (See Figure 22).
- c. See that the needle screw is firmly tightened.

G. ENDING THE CUT

At the conclusion of the recording, the Recorder Arm Control Lever should be raised up and thrown back to the disengaged position and the entire recording arm swung out until it lies along the outer edge of the panel. The Recorder Arm Control lever can then be lowered to the horizontal position in order to lock the recording arm in its rest position (see Figure 12).

D. ADJUSTING VOLUME CONTROL

After first allowing the needle to cut two or three quiet grooves, turn up the volume control, slowly, until the desired volume level has been obtained; the correct level to be used while recording is discussed in detail under the title "Recording Level".

Insofar as possible this volume control setting should be determined to some extent before actually starting the recording. At the end of the record slowly turn down the volume control and allow the needle to run a few quiet grooves before lifting it from the blank. Fading in and fading out the program by means of the volume control together with the quiet grooves at the start and finish of the record will result in a much more pleasing overall effect upon playback, particularly when recording from the radio since it is often necessary to start and stop during a program.

VIII. ADJUSTMENTS

Two adjustments are provided: recorder arm height adjustment and depth of cut adjustment. The recorder arm height adjusting screw and the depth of cut adjustment knob are both shown on Figure 15.

The recorder arm height adjusting screw controls both the recorder arm height and the cutting needle angle. The depth of cut adjustment controls the depth of cut by varying the needle pressure. The method and purpose of these adjustments are explained in the sections immediately following.

IX. ADJUSTING RECORDER ARM HEIGHT

The height of the recorder arm can be varied by means of the slotted screw head which is on the top of the recorder arm and toward the back, approximately flush with the surface (See Figure 16). In order to make this adjustment, it is necessary to insert a cutting needle, and with the switch knob turned "OFF" and a record blank on the turntable, place the recorder arm in the cutting position. Now, raise or lower the recorder arm by means of the above mentioned adjustment screw until the needle screw is slightly below center in the slot at the front end of the recorder arm. Figure 16 shows this needle screw in the normal, correct position.

The purpose of this adjustment is to allow sufficient up and down movement of the cutter head so that it can follow minor variations in the record surface during cutting. The movement of the needle screw in the slot while recording is a good indication of the flatness of the recording blank being cut. Warped or uneven recording blanks will cause excessive up and down movements of the cutter head, as indicated by the needle screw; be sure that this needle screw does not touch at the top or bottom of the slot while recording.

The same adjusting screw which controls the recorder arm height can also be used to change the angle of the cutting needle. This adjustment is described in a following section.

NEEDLE PRESSURE

The pressure on the cutting needle can be varied by means of the chrome-plated knob on top of the Recorder Arm (See Figure 15) and it controls the depth of cut. This knob has engraved upon it the letters "L", "M" and "H", indicating light, medium and heavy pressures and provides an easy means of compensating for different types of needles and blanks.

MODEL BR (MODIFIED)

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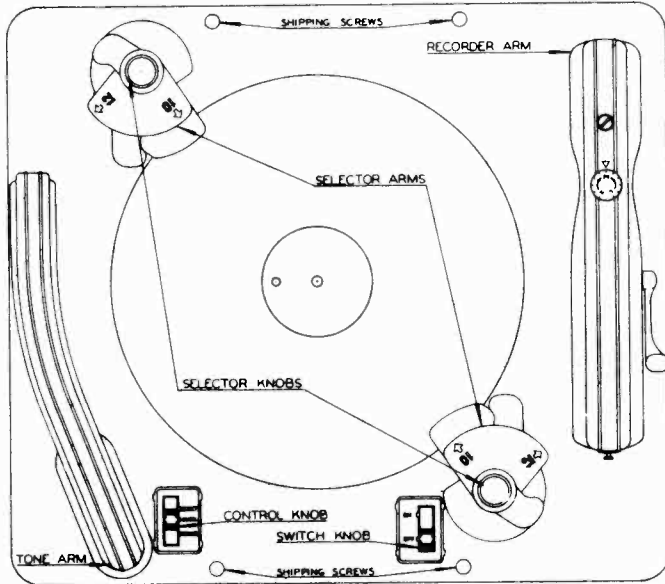


Figure 1
 Fig. (1) shows the Changer with the selector arms set for 10 inch records and ready to be loaded. The tone arm is in the rest position and the switch knob is in the "OFF" position.

Fig. (2) shows the Changer set for 12 inch records and ready to be loaded. The tone arm is in the rest position and the switch knob is in the "OFF" position.

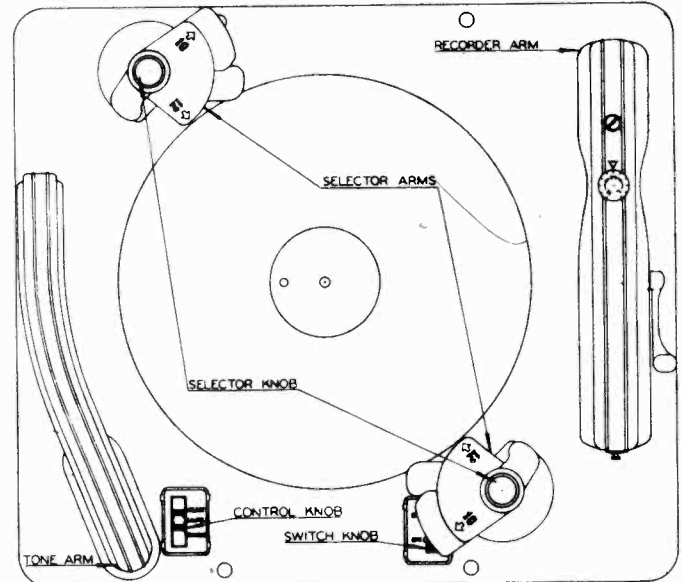


Figure 2

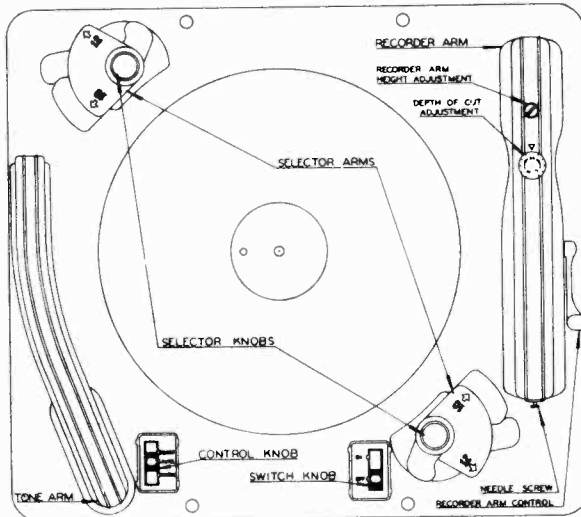
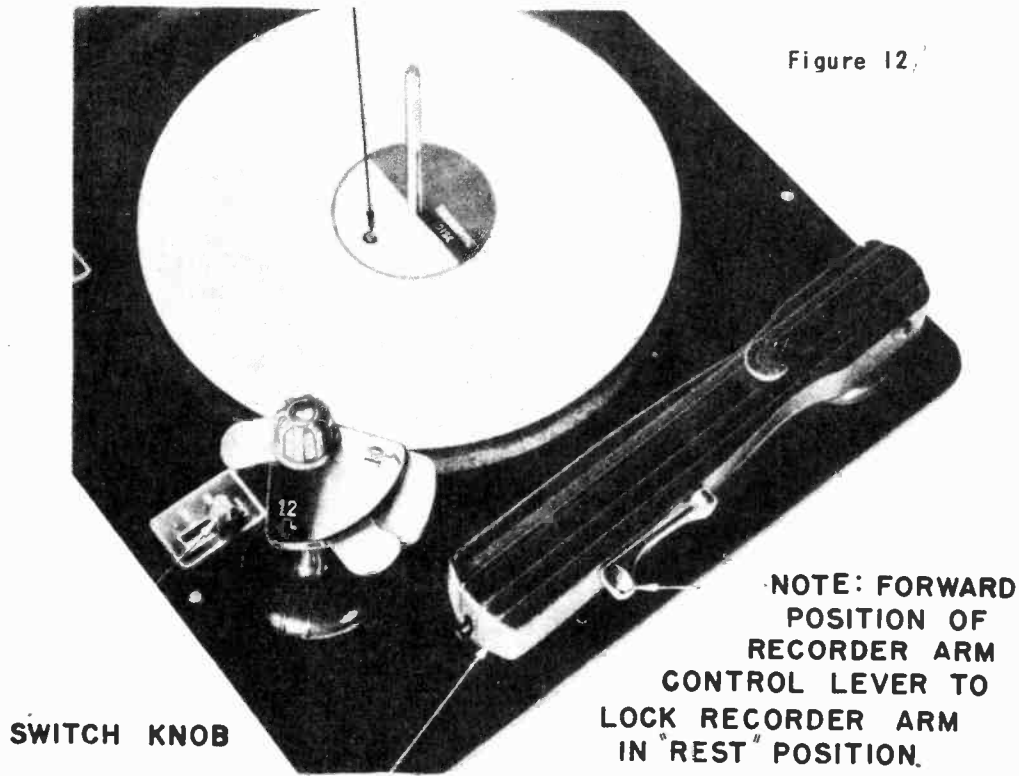


Figure 5
 Fig. (5) shows the Selector Arms turned for unloading, the tone arm in the rest position, and the switch knob in the "OFF" position.

RETRACTABLE PIN

Figure 12.



-RECORDER ARM IN "REST" POSITION

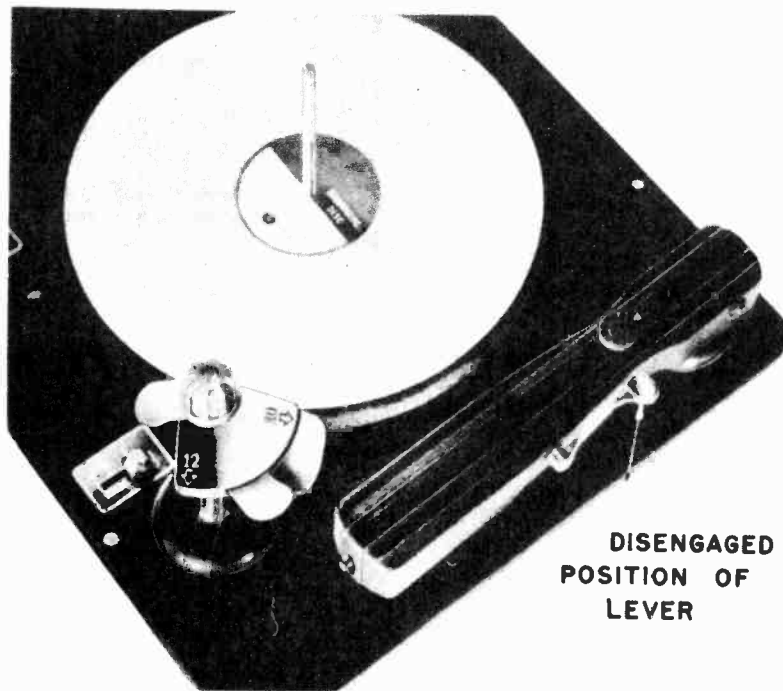
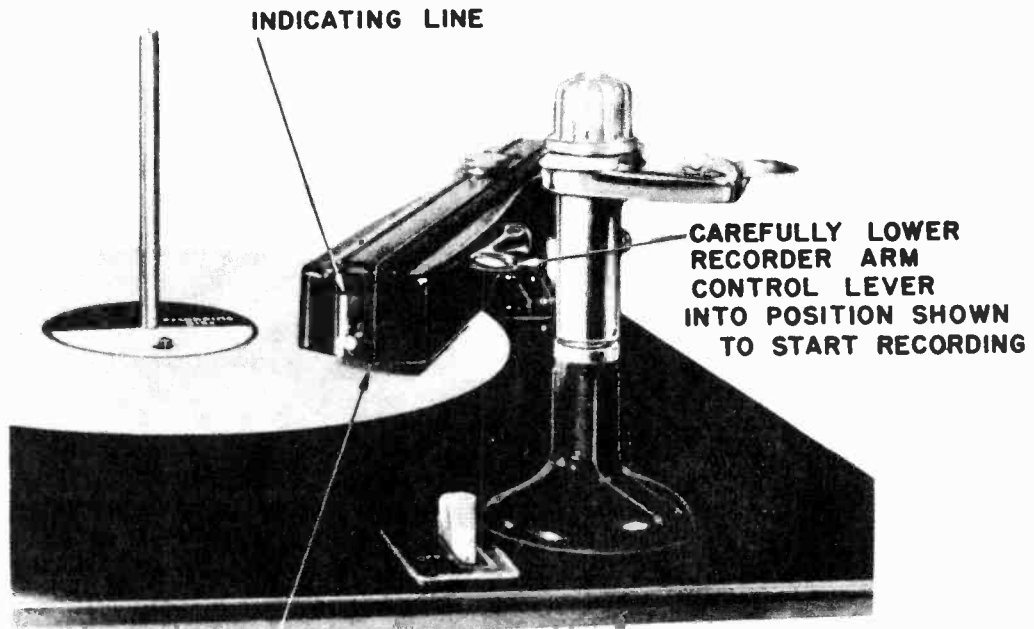


Figure 13

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CUTTING NEEDLE

Figure 14

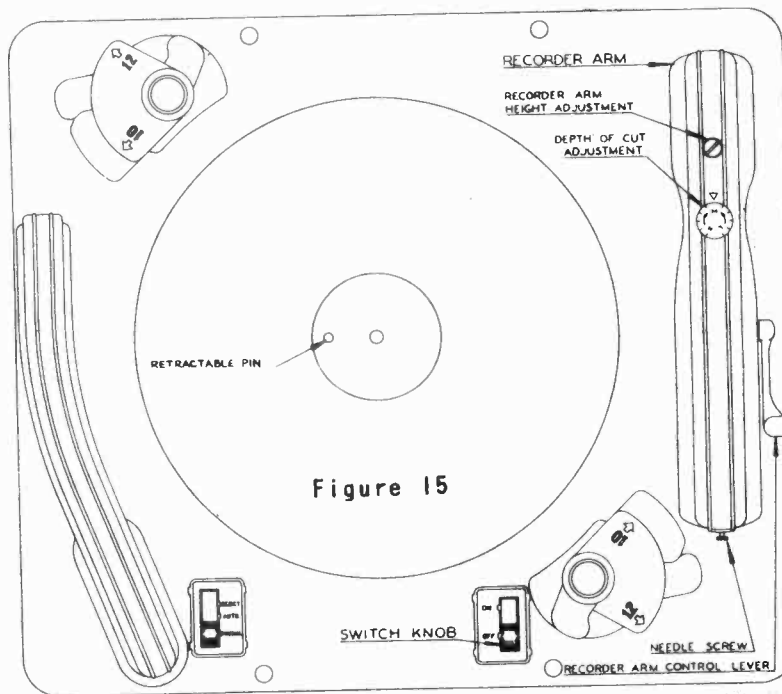
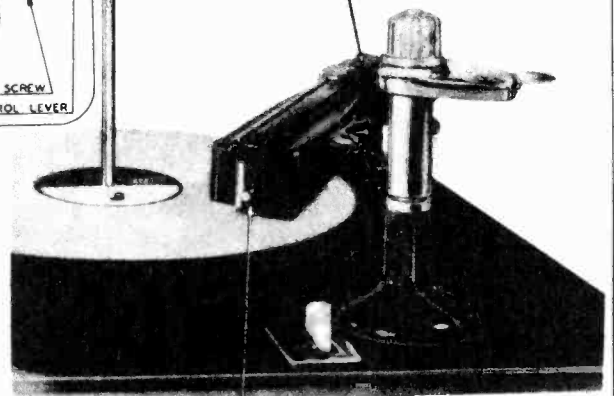


Figure 15

FIGURE 15 TOP VIEW OF RECORD CHANGER SHOWING DETAILS OF RECORDING MECHANISM.



RECORDER ARM HEIGHT ADJUSTMENT SCREW



NOTE POSITION OF NEEDLE SCREW IN SLOT

FIGURE 16- THIS ILLUSTRATION SHOWS POSITION OF RECORDER ARM HEIGHT ADJUSTMENT SCREW.



Figure 16

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I. SETTING UP RECORD CHANGER MECHANISM

Two screws are used to hold the record changer mechanism during shipping; these two screws (Fig. 1, Item 5) MUST be removed so that the changer floats freely on its mounting springs. The two holes in the metal sub-panel can be covered by means of the two small matching plug buttons accompanying the machine. If the turntable has been packed separately, it will be necessary to place it

tion of the tone arm is obtained by lifting it from the record being played and moving it to the extreme outside position. The tone arm will latch into place along the outside edge of the changer sub-panel and remain there even though the switch knob is in the "Automatic" position and the turntable still running. (NOTE: If the tone arm has played the record far enough, lifting the tone arm or moving it out will trip the automatic

mechanism. Allow the mechanism to go through its change cycle and the needle to come down on the next record without hindrance after which the tone arm may be moved to the "Rest" position). If the tone arm is in the "Rest" position and the switch knob in the "Automatic" position, it is merely necessary to momentarily move the switch knob to the "Reject" position and release it in order to again set the changer into automatic operation.

The changer panel assembly must float freely on the mounting springs at all times during normal playing operation.

II. GENERAL FUNCTION OF THE RECORD CHANGER

III. METHOD OF OPERATION

A. MANUAL PLAYBACK

With the switch knob (see Fig. 1, Item 7) in the "Manual" position, this changer is designed to operate as a single record-player and as such can be used to play individual records of any diameter up to and including 12 inches. Moving the switch knob to the "Manual" position starts the turntable and locks out all of the automatic features of the record changer. The tone arm must be lifted by hand and placed on the record; after the record is played it is necessary to remove the tone arm by hand. During any of the time that the record is being played, it is possible to move the tone arm in or out on the record at will; it is also possible to play either "inside out" or "outside in" recordings.

B. AUTOMATIC OPERATION

The Changer is designed to change automatically, EITHER fourteen 10 inch records or ten 12 inch records at one loading. After the changer has been properly loaded (see separate operating instruction sheet),

The record changer belongs to the general classification of the mutilated gear type. This means that during the time that a record is being played the large gear (see Fig. V, Item 2) and all associated mechanism is at rest.

Under the condition of manual operation, the automatic operation of the mechanism is locked out so that the trip mechanism

is inoperative and so that the tone arm is free.

Under automatic conditions, the tone arm is controlled during the change cycle by means of the various cams, acting through levers, on the large drive gear (see Fig. V, Item 2) which also synchronizes, through the drive link, the movement of the selector arms.

IV. LUBRICATION

A. MOTOR

The motor is equipped with oilless bearing and requires no lubrication.

B. TURNABLE SPINDLE BEARINGS

Turntable spindle bearings are lubricated at the factory and do not require any lubrication for one year. After one year they should be oiled with one or two drops of a light grade oil. Do not over-oil.

The top bearing can be oiled by lifting off the turntable. Make sure, when replacing the

turntable, that the pin in the Turntable Spindle slips into the slot on the bottom surface of the turntable hub. Also, care should be taken not to damage the Motor Idler Pulley.

Never under any circumstance allow oil to come in contact with Motor Idler Pulley.

C. SQUEAK DUE TO RECORDS RUBBING ON TURNABLE SPINDLE

This can be eliminated by gently lining up the stack of records.

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V. TONE ARM INDEXING ON 10" AND 12" RECORDS

In general the tone arm indexing is accomplished by the tone arm locator lever (Fig. IV, Item 25) engaging the 12 inch reset lever (Fig. IV, Item 18). Setting the selector arms for 10 inch or 12 inch records moves the 12 inch reset lever so that it serves as a stop for the tone arm locator lever at either point "w" (Fig. IV) for 12 inch records or point "r" (Fig. IV) for 10 inch records. Since the tone arm locator lever is a single piece of metal, the distance between the 10 inch setting at "r" and the 12 inch setting at "w" is fixed; it is only necessary to properly adjust the tone arm indexing for one size of record. The steps in making this adjustment are as follows:

1. With the switch knob in the "off" position, move the tone arm to the "rest" position so that its outer edge is approximately lined up with the extreme outside edge of the record changer panel.
2. Loosen the two set screws on the under side of the record changer panel (see Fig. V, point t) slightly.
3. Line up the outer edge of the tone arm with the outer edge of the record changer panel by eye. This is a preliminary adjustment to obtain approximately correct indexing.
4. Place a 12 inch record on the turntable, put the machine into automatic operation by pulling the switch knob to the "Re-

ject" position and releasing it. Note the point at which the needle FIRST strikes the margin of the 12 inch record. (The word "first" is used to indicate the fact that after the needle has touched the record, the booster spring will attempt to move the needle in toward the center. Proper setting of the tone arm indexing position is concerned only with the point at which the needle first makes contact with the record; for this reason, it may be advisable to slow down the movement of the tone arm by partially holding the turntable so that the action may be more readily observed during adjustment.)

5. If the needle did not strike the record approximately an eighth of an inch in from the outside edge, move the tone arm in the desired direction a slight amount by slipping the tone arm lever (see Fig. IV, Item 24) which has been previously loosened at the two set screws (see Fig. V, point t).
6. After obtaining a correct indexing of the tone arm on the 12 inch diameter records, check the indexing on a 10 inch diameter record and tighten the two set screws firmly.

NOTE: Incorrect action of the booster spring or Tone

Arm Retard Lever may produce the effect of improper

VI. TONE ARM ADJUSTMENTS (OTHER THAN INDEXING)

A. NEEDLE PRESSURE

The needle pressure is controlled by means of the counterbalance spring (see Fig. II, Item 10) at the rear of the arm. The spring tension has been set to provide the needle pressure necessary for correct operation of the pickup. Should it be necessary to make adjustment of this counterbalance spring, it is generally advisable to contact your factory service department for the correct needle pressure; be sure to include the part number stamped on the under side of the crystal cartridge and the model number of the set. (CAUTION: It is a popular fallacy that it is possible to prolong needle and record life by reducing the needle pressure on a given pickup below those pressures recommended by the manufacturer. Any such attempt will probably increase record and needle wear as well as seriously impair the tone quality of the instrument. The correct needle pressure is a function of the crystal and tone arm design and cannot be satisfactorily changed for a given set of component parts.)

VII. "AUTOMATIC" TRIP ADJUSTMENTS

This changer incorporates a dual trip to insure positive cutoff on various types of records.

A. MINIMUM CIRCLE DIAMETER TRIP

After the tone arm has played in far enough so that the distance of the needle from the center spindle is approximately

tone arm indexing. (See Section VIII).

B. TONE ARM HEIGHT ADJUSTMENTS

The Tone Arm Height Adjustment Screw (Fig. II, Item 8) controls only the height of the tone arm when it is in the playing position with no record on the turntable. The correct setting of this adjustment screw is that which, under the above condition, allows the tone arm to descend until the needle point is very slightly below the level of the turntable surface.

The Tone Arm Height Adjustment Screw should not be used to adjust the height to which the tone arm rises during a change cycle; this height is controlled solely by the length of the Tone Arm Lift Pin (Fig. II, Item 9).

C. TONE ARM HINGE ADJUSTMENTS

Should the tone arm hinge show evidence of binding or impeding the free vertical movement of the tone arm, it may be necessary to replace this part (Fig. II, Item 3).

1-7/8 inches, the record changer will trip regardless of whether or not there is a cutoff or eccentric groove on the record. This type of trip is known as "a minimum circle diameter trip."

The diameter of this minimum circle is set at the factory to be approximately 3-3/4 inches.

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Variations in adjustment or readjustment of this operation can be obtained by moving the trip shoe (see Fig. IV, Item 23) slightly. The trip shoe is locked in position by means of a screw when the adjustment has been satisfactorily completed. This screw must be adjusted thru a hole cut in the main drive gear, when the machine is not in a change cycle.

B. ECCENTRIC GROOVE TRIP

In order to make the trip action of the changer mechanism operate under various conditions, a second tripping device has been included which operates due to any outward movement of the tone arm after it has played to within approximately 2-1/2 inches of the center spindle. This trip is actuated by a small dog, (Fig. IV, point k) engaging the fine toothed ratchet, and is adjusted at the factory.

VIII. "BOOSTER" SPRING ADJUSTMENTS

A. BOOSTER SPRING SETTING

The function of the booster spring (Fig. V, Item 11) is to move the needle from the margin of the record into the first groove automatically. Most present day records have what is known as a "lead-in groove" which automatically carries the needle from the margin of the record into the record grooves. In the case of the older type records, and particularly those of the mechanically recorded type which have no lead-in grooves, the booster spring supplies just enough pressure to move the needle across the margin to the record grooves. This booster spring is built into the tone arm locator lever (see Fig. IV, Item 25) and consists of a single piece of light spring wire (see Fig. V, Item 11). The side pressure exerted by this spring should be just sufficient so that the needle will move across the margin of a record which contains no lead-in groove. After any adjustment of this booster spring, check its operation on both 10 inch and 12 inch records to make sure that it functions properly.

booster spring may be overcome or overemphasized. This lead must be checked before attempting any booster spring adjustments.

B. TONE ARM RETARD LEVER ADJUSTMENTS

The function of the Tone Arm Retard Lever (Fig. V, Item 4) is to provide a smooth motion of the tone arm as it moves from the outer edge of the panel in towards the edge of the record to be played, during an automatic change cycle.

An additional function of the tone arm retard lever is to pre-

IX. ACTION OF THE SWITCH KNOB

In general, the switch knob controls both the tone arm action and the electrical "On-Off" switch. In all positions of the switch knob, excepting the "Off" position, the electrical circuit through the switch is closed.

A. "OFF" POSITION

With the switch knob in the "Off" position, the tone arm will lock at the extreme outside edge of the changer panel. This position of the tone arm logically accompanies the "Off" position of the electrical switch in order to facilitate the loading or unloading of records either for automatic or manual operation. This locked position of the tone arm results from the engagement of the Tone Arm Latch Lever (Fig. IV, Item 1) with the projection on the Tone Arm Lever (Fig. IV, Item 24, point d).

vent action of the Booster Spring (Fig. V, Item 11) until the needle has lowered onto the outer edge of the record to be played. Insufficient tension of the Tone Arm Retard Lever Spring (Fig. V, Item 3) will permit action of the booster spring before the needle comes to rest on the record, giving the effect of incorrect tone arm indexing. Excessive pressure of the tone arm retard lever spring will cause rough, jerky action of the tone arm as it moves from the outer edge of the changer panel.

B. "MANUAL" POSITION

When the switch knob is thrown to the "Manual" position, the electrical switch circuit is closed and the tone arm is freed from its locked position due to the action of the projection on the Main Control Slide (Fig. IV, Item 21) which partially disengages the Tone Arm Latch Lever by striking it on its projection at point "e" (Fig. V). At the same time the tone arm locator lever (Fig. IV, Item 25) is held at point "r" (Fig. V) by the upper slide. In this position, it is essential that the engagement between the upper slide and tone arm locator lever be positive as shown in Fig. V. The purpose of the spring (Fig. V, left, Item 9) attached to the upper slide is to provide a means whereby the engagement at point "r" (Fig. V) may be made should the switch knob be moved to the "Manual" position when the tone arm lever (Fig. IV, Item 24) is

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not in the outward position. (Such an action would occur when the switch knob is moved from the "Automatic" position to the "Manual" position while a record is being played). The tone arm locator lever (Fig. IV, Item 25) would then be against either the 10 inch or 12 inch indexing stop, and as the tone arm is swung into the outside rest position, the tone arm locator lever (Fig. IV, Item 25) must be able to catch at point "r" (Fig. V).

When the tone arm is in the "Rest" position and the switch knob is thrown to "Manual", it is essential that the sequence be carefully observed between the action of the latch lever (Fig. IV, Item 1) and the upper slide (Fig. V, point "r"). The upper slide should be in a position to provide a positive stop for the tone arm locator lever (Fig. IV, Item 25) BEFORE the latch lever (Fig. IV, Item 1) releases the tone arm lever (Fig. IV, Item 24); otherwise the tone arm will be scraped across the turntable. Also, it is essential that the engagement at "r" be such that there is a hooking action at this point in order to prevent the tone arm locator lever (Fig. IV, Item 25) and the tone arm from sweeping toward the center when the switch is moved out of the "Manual" position.

The switch knob performs the additional function of preventing the trip mechanism from operating when the switch knob is in the "Manual" position. The motion of the Main Control Slide (Fig. IV, Item 21) is transmitted through the Connecting Link (Fig. V, Item 12) to the Manual and Reject Lever (Fig. IV, Item 17). The

projection on this lever at point "w" (Fig. V) engages the upper end of the Clutch Engagement Lever (Fig. III, Item 6) at point "h" (Fig. IV) and so prevents the Clutch Engagement Lever from engaging the lower projections of the continuously rotating pinion gear thus preventing the start of a change cycle.

C. "AUTOMATIC" POSITION

With the switch knob in the "Automatic" position, the tone arm latch lever (Fig. IV, Item 1) will lock the tone arm lever at point "d" (Fig. IV) at any time when the tone arm is moved to the outside position. This tone arm latch is released during a change cycle through its engagement at point "s" (Fig. V) with the main drive gear. As noted above under Section B, the tone arm locator (Fig. IV, Item 25) and the upper slide (Fig. IV, point "r") hook together at point "r" (Fig. V) during "Manual" operation. When the switch knob is thrown into "Automatic" or "Reject" position, these two parts completely disengage during the next change cycle due to the cam action of the main drive gear which forces the tone arm lever to the outer edge of the sub-panel and allows the upper slide (Fig. IV, point "p") to clear the tone arm locator lever at point "r".

The tone arm locator lever provides the 10 inch and 12 inch indexing for the tone arm during automatic operation by its engagement with the 12 inch reset lever (Fig. IV, point "g", Item 18). The 12 inch reset lever must hook securely behind the projecting tip on the tone arm locator lever (as shown at point "r" on Fig. IV) when the 12 inch

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record is being played. This is to prevent the tone arm locator lever and the tone arm from sweeping toward the center should the 12 inch setting of the selector arms be changed to 10 inch while the tone arm is playing a 12 inch record. (See Section X also).

D. "REJECT" POSITION

When the switch knob is pushed into the "Reject" position, the motion of the switch knob is transmitted to the Manual and Reject Lever (Fig. IV, Item 17) (as described under Section B). The projection at "u" (Fig. V) engages the projecting stud on the trip lever near point "k" (Fig. IV). The Trip Lever releases the Clutch Engagement Lever (Fig. III, Item 6) at point "h" (Fig. IV). The switch knob should not remain in the "Reject" position. The switch knob is returned to the "Automatic" position due to the tension in the Switch Spring (Fig. V, Item 10) acting on the Switch Lever (Fig. V, Item n).

E. "A.C." SWITCH OPERATION

In Figure IV the switch knob is in the "off" position. The electrical motor switch is open. If the switch knob and the Main Control Slide (Fig. IV, Item 21) are moved downwards, referring to Fig. IV, into the "Automatic" position, the right end of the

Switch Lever (Fig. IV, Item n) will rest against the panel stud located just to the lower right of the A.C. Switch (Fig. IV, Item 22). The Switch Lever (Fig. IV, Item n) will then move the A.C. Switch to the "on" position.

Through its engagement with the projection on the Main Control Slide (Fig. IV, Item 21), the Detent Lever (Fig. IV, Item m) prevents the Switch Spring (Fig. V, Item 10) tension from pulling the Main Control Slide into the "off" position.

Further movement of the Main Control Slide, into the "Reject" position, results in increased Switch Spring (Fig. V, Item 10) tension which will return the slide to the "Automatic" position after the finger is removed from the switch knob.

The Switch Knob is in the "Manual" position, with the A.C. Switch "on", in Figure V. The Switch Lever (Fig. V, Item n) is against the panel stud to the left of the A.C. Switch, near the edge of the panel. This position of the switch lever corresponds to the "on" position of the Switch Lever when in "Automatic" operation except the force is applied on the opposite side of the Switch Lever, bearing in the opposite direction.

X. "SELECTOR ARM" ADJUSTMENTS

A. SELECTOR BLADES

Under all ordinary conditions it should not be necessary to make any adjustment of the selector blades themselves. Should such an adjustment become

necessary it can best be accomplished by using a standard make and of average thickness for gauging the setting of the selector blades (Fig. VII). The setting of these blades can be

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accomplished by means of a pair of long nosed pliers and is correct when the blades lift slightly upon engaging a record of average thickness.

The 12 inch selector blade (see Fig. VII) is held in the level position, when not selecting records, by the 12 inch blade spring. This blade must be free to move upwards during record selection but must return to the level position, after selection, under the influence of the 12 inch blade spring. (Fig. VII shows a cross section of these parts).

B. SELECTOR KNOBS

The plastic knobs (Fig. I, Item 3) on top of each selector arm (Fig. I, Item 4) cannot be used to set the selector arms (see separate operating instruction sheet).

The plastic knobs rotate on the Selector Knob Support Screw (see Fig. VII) and can be removed by prying them upwards. Repeated removal of the knobs will necessitate their replacement.

C. SETTING OF SELECTOR ARMS

The position of the selector arms (Fig. I, Item 4) determines the tone arm indexing for ten inch or twelve inch records, through the position of the 12 inch Set Cam (Fig. IV, Item 20). The position of this cam determines the position of the 12 inch Set Lever (Fig. IV, Item 19) which communicates the motion of the Set Cam to the 12 inch Set Slide (Fig. IV, Item 18). The 12 inch Set Slide (Fig. IV, Item 18)

serves as a stop for the Tone Arm Locator (Fig. IV, Item 25) at point "v" for 12 inch records, or point "r" for 10 inch records.

The 12 inch Reset Lever Spring (Fig. V, Item 9) is stronger than the 12 inch Reset Slide Spring (Fig. V, Item 9). Point "v" on the Tone Arm Locator Lever should then hook securely with point "g" on the 12 inch Reset Slide if the setting of the selector arms is changed to the ten inch setting while the changer is playing a twelve inch record automatically.

D. ACTION OF SELECTOR ARMS DURING AUTOMATIC OPERATION

The Selector Arms (Fig. I, Item 4) are rotated by the Drive Link (Fig. IV, Item 4). The Drive Link is moved by the circular cam (Fig. V, Item X) on the main Drive Gear Assembly (Fig. V, Item 2). The motion of the Drive Link (Fig. IV, Item 4) is communicated to the selector shaft through the Drive Cranks (Fig. IV, Item 6) and the Drive Crank Pawl-Ratchet Washer combination (Fig. IV, Item 9, 10). Failure of the Drive Crank Pawl (Fig. IV, Item 9) to engage the Ratchet Washer (Fig. IV, Item 10) will prevent the Selector Arms from synchronizing correctly and result. This condition may also be due to improper setting of the Selector Arms during loading, (see separate operating instructions). A damaged or broken Drive Pawl Spring (Fig. IV, Item 7) or a bind in the Drive Crank Pawl (Fig. IV, Item 9) will result in improper record selection.

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XI. MISCELLANEOUS MECHANICAL NOTES

A. "FEEDBACK" OR "HOWL" OR "MICROPHONISM"

1. Inspect the under side of the panel to make sure that the changer does not come into contact with any part of the cabinet at any point other than at the four corners where it rests on the mounting springs.

It should be remembered that there is no disadvantage in any phonograph equipment which tends to become microphonic at volume control settings above those in the usable range. That is, if the set does not feed-back up to the volume control settings at which distortion appears when playing an average record, it will operate satisfactorily.

B. "RUMBLE"

1. Remove the turntable and inspect the rubber rimmed motor idler pulley (Fig. II, Item 14) for flat or worn spots which would tend to jar the turntable.

2. With the turntable removed, rotate the turntable spindle to be sure that it turns smoothly.

C. "WOW" OR SPEED VARIATION

1. Remove the turntable and rotate the turntable spindle (Fig. II, Item 1) with the fingers to determine whether it tends to bind. High friction at this point may be sufficient to cause the motor to slow down instantaneously. Apply ONLY a drop

of two of light oil to the two spindle bearings. If the turntable shaft is bent to such an extent that replacement is necessary, it is recommended that the entire Spindle and Pinion Gear Assembly (Fig. IV, Item 13, also Fig. VI) be replaced instead of replacing only the spindle assembly. This Spindle and Pinion Gear Assembly (see Fig. VI) is fitted with precision machines at the factory, thus insuring proper clearances and smooth operation.

D. REPEATED TRIPPING

1. Turn off the changer during a change cycle so that the Clutch Engagement Lever (Fig. III, Item 6) may be observed. This Clutch Engagement Lever should lock into the up position due to its engagement with the Trip Lever (Fig. IV, Item 14) at the point "h" (Fig. V). If this engagement is not positive, inspect the bearing point of the trip lever (Fig. IV, Item 15) for evidences of dirt or binding. A more positive engagement may be obtained by strengthening the spring (Fig. IV, Item 11). CAUTION: This spring tension must be JUST SUFFICIENT to lock the clutch engagement lever in the up position. Excessive tension of the spring will result in failure to trip.

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2. Repeated tripping may also be due to the fact that the switch knob does not return to the "Automatic" position when released. This condition can result from insufficient tension in spring (Fig. V, Item 10), or excessive friction or binding in the motion of the Main Control Slide (Fig. IV, Item 21).

E. FAILURE TO TRIP

1. Turn off the changer during a change cycle so that the Clutch Engagement Lever (Fig. III, Item 6) may be actuated with the finger while the trip lever is being held away, so that the Clutch Engagement Lever does not lock in the "up" position. The Clutch Engagement Lever must fall by gravity.
- CAUTION: It is not advisable to use any lubricant at the bearing point of the clutch engagement lever (Fig. III, points c); this bearing is intended to be a loose fit, and must be checked for binds.

2. Excessive pressure on spring (Fig. IV, Item 11) would tend to make the needle jump out of the cut-off groove of the record (see paragraph D-1 above) and prevent tripping.
3. The Shielded Pickup Lead Wire (Fig. II, Item 2) must have sufficient slack between the tone arm and the point where the tone arm lead enters the sub-panel to permit free side-wise movement of the tone

arm. The Shielded Lead should be so positioned that it loosely rests near the tone arm post immediately below the point at which it leaves the tone arm bracket. Under no circumstances should the Shielded wire be fastened in place, pulled taut, or restrict free tone arm movement. This is particularly important in machines which use extremely light pressure pickup cartridges.

F. INSUFFICIENT POWER TO COMPLETE A CHANGE CYCLE

1. Inspect the bearing of the main drive gear (Fig. V, Item 2) for excessive friction or binding.

G. JAMMING OF THE MECHANISM

1. Should the changer jam at any time during a change cycle for some reason other than jamming of the selector arms with the records being changed, remove the records and attempt to free the machine by rotating the turntable in a reverse direction through a quarter turn. If the jam is apparently cleared by such action, the machine should be checked by operating it automatically several times, but with no records.

2. If the jam does not clear by rotating the turntable in a reverse direction, inspect the underside of

the changer panel for damaged or missing parts.

3. Inspect the meshing of the drive gear (Fig. V, Item 2) with the pinion gear (Fig. VI, Item 6). If the two gears do not mesh (that is, if they are not so timed as to fit together properly) it is probably due to the fact that the Clutch Engagement Lever (Fig. III, Item 6) has been damaged or bent. This Clutch Engagement Lever is intended to so contact one of the lower projections on the pinion gear (Fig. VI, Item 6) that the teeth of this pinion gear and the teeth of the main drive gear (Fig. V, Item 2) will be timed to fit together

properly whenever the mechanism starts a change cycle. If the Clutch Engagement Lever (Fig. III, Item 6) is bent, it may be straightened until, by trial, the two gears mesh properly when the changer is tripped. It is advisable that the changer mechanism be operated by hand so that this timing or meshing between the two gears can be more closely observed during any adjustments or inspection.

H. TONE ARM DOES NOT INDEX CORRECTLY

Refer to Sections V and VIII, for complete information on setting of tone arm.

XII. STANDARD RECORD CHANGER SERVICE PARTS LIST

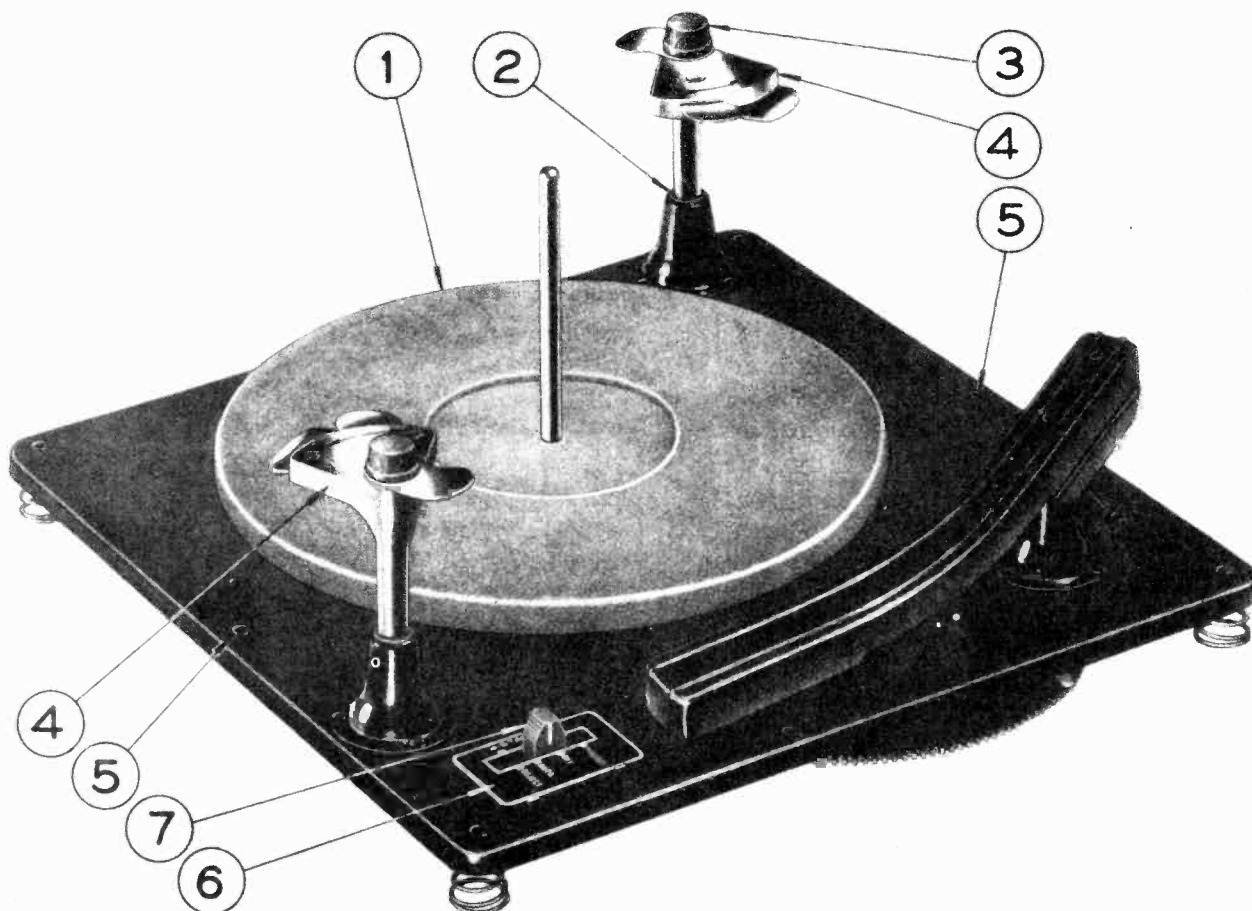
Particular models vary slightly from the standard model. It is suggested that your factory service department be consulted for special parts not shown in this listing.

Wherever possible only complete assemblies should be purchased inasmuch as the factory is equipped to provide precision fitting of these assemblies.

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MODEL C

FIGURE I - TOP VIEW OF RECORD CHANGER

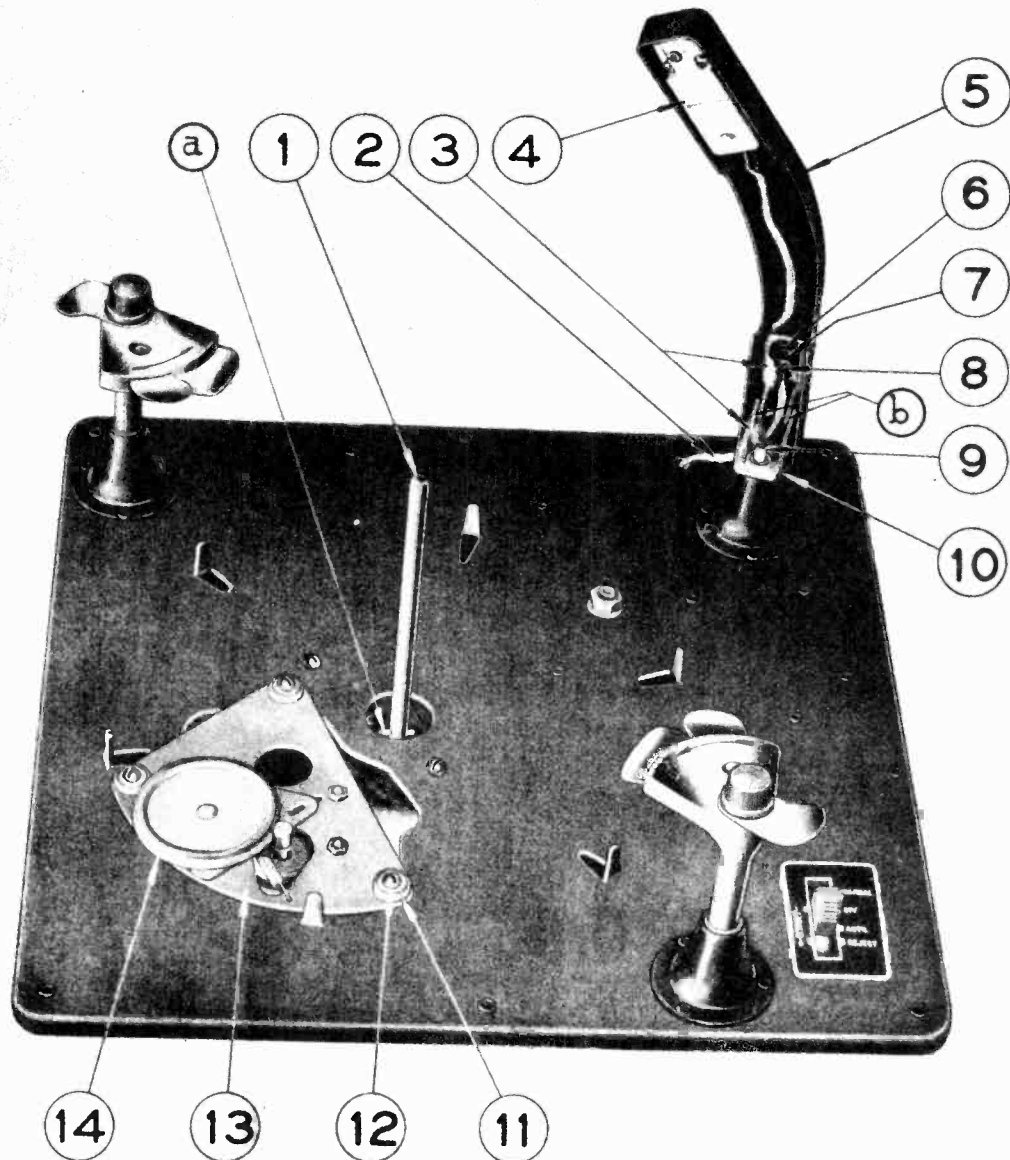


ITEM	PART NO.	DESCRIPTION	NO. REQ.
1	C-29048	- Turntable	1
2	72025	- Thrust Washer	2
3	C-29135	- Selector Knob	2
4	C-29156-A	- Record Support Arm, Blade and Shaft Assembly (See Fig. VII for Details)	2
5	B-27091	- Plug Button	2
6	B-27074	- Control Escutcheon.	1
7	C-29136	- Switch Control Knob	1

MODEL C

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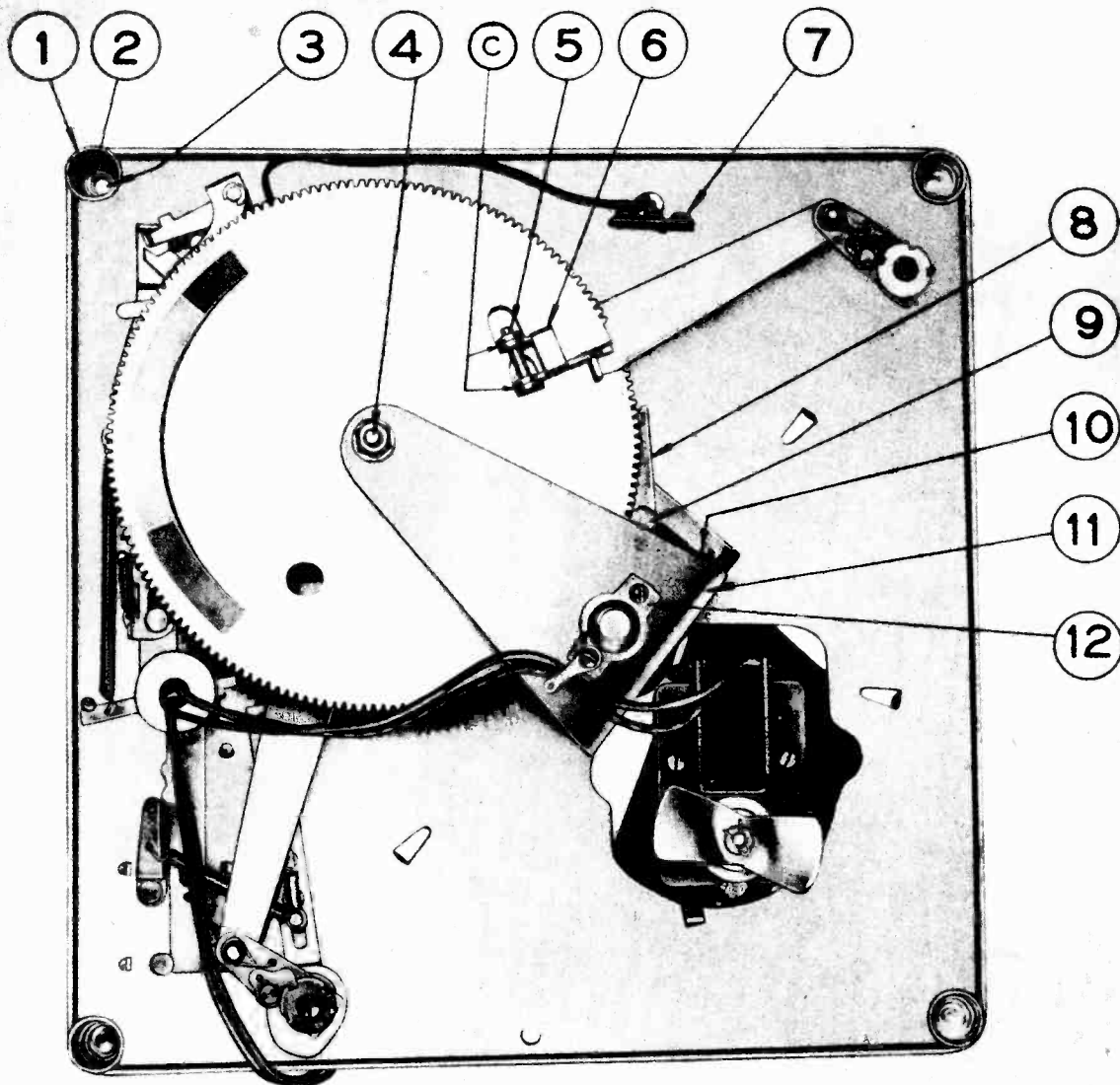
FIGURE 11 - TOP VIEW OF RECORD CHANGER, DISASSEMBLED



ITEM	PART NO.	DESCRIPTION	NO. REQ.
1	C-29161-A	- Spindle, Pin and Ball Assembly.	1
2	C-29027	- Tone Arm Pickup Wire.	1
3	C-29150-A	- Tone Arm Shaft and Bracket Assembly	1
4	B-27090	- Tone Arm Cartridge.	1
5	C-29153-A	- Tone Arm.	1
6	78008	- Grommet	2
7	C-29128	- Tone Arm Adjusting Lock Spring.	1
8	71051	- Tone Arm Height Adjusting Screw	1
9	C-29016	- Tone Arm Lift Pin	1
10	C-29127	- Tone Arm Counter Balance Spring	1
11	J-22144	- Motor Mounting Grommet.	3
12	J-22266	- Motor Mounting Bushing.	3
13	C-29028	- Motor Assembly.	1
14	J-22143	- Motor Pulley.	1

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FIGURE III - BOTTOM VIEW OF RECORD CHANGER

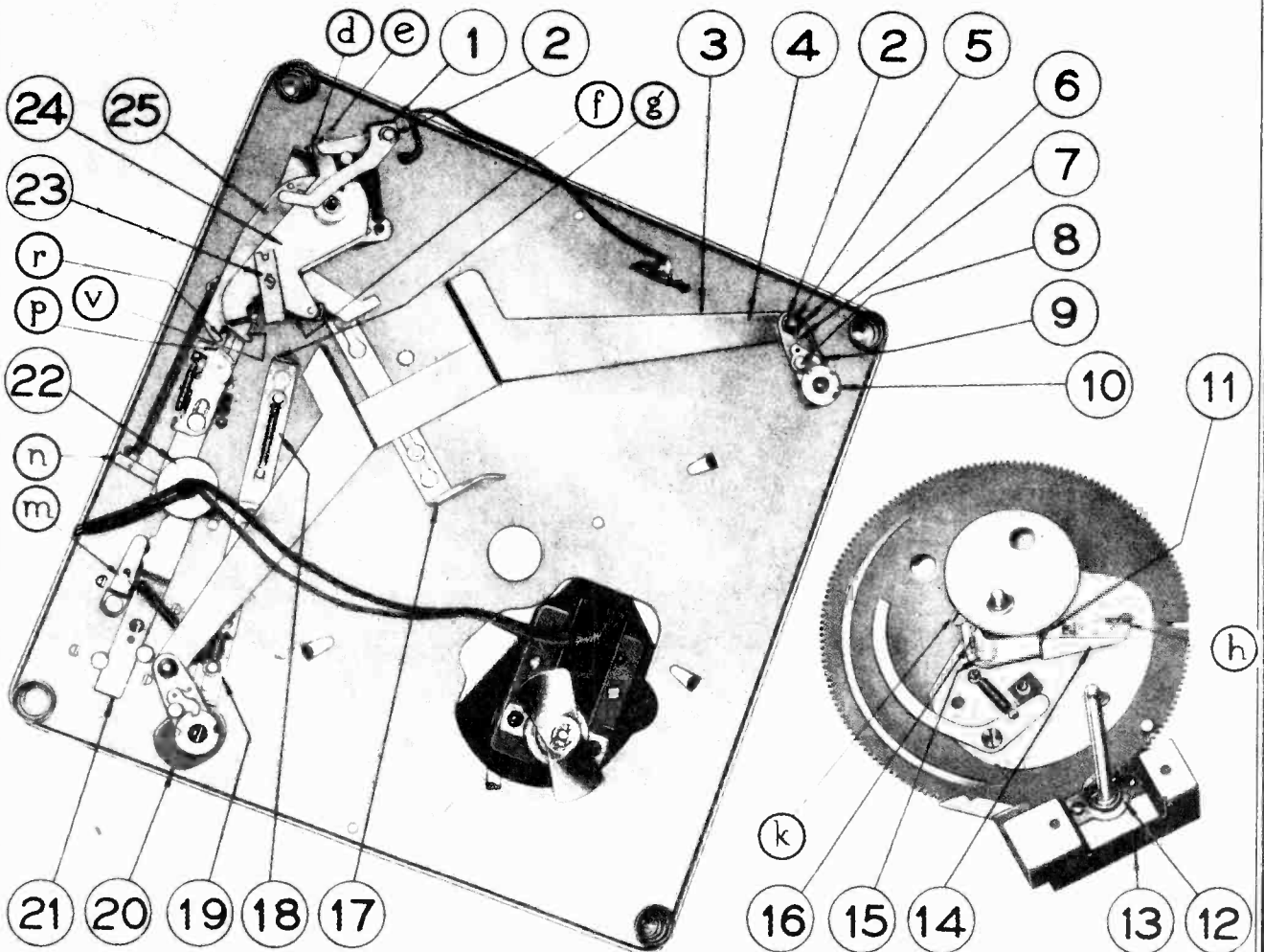


ITEM	PART NO.	DESCRIPTION	NO. REQ.
1	H-20198	- Panel Mounting Spring	4
2	C-29114	- Spring Retainer Cup	4
3	79024	- Rivet	4
4	C-29074	- Drive Gear Shaft.	1
5	C-29088	- Clutch Engagement Lever Pin	1
6	C-29087	- Clutch Engagement Lever	1
7	10069	- Terminal Strip.	1
8	C-29077	- *Drive Gear Stop Lever.	1
9	C-29067	- *Stop Lever Shoulder Rivet.	1
10	C-29086	- *Stop Lever Spring.	1
11	C-29125-A	- *Spindle Housing and Stop Lever Assy.	1
12	C-29090	- *Thrust End Spindle Bearing Retainer.	1

NOTE: *See Fig. VI for Detailed Assembly View.

MODEL C

J. P. SEEBURG CORP.

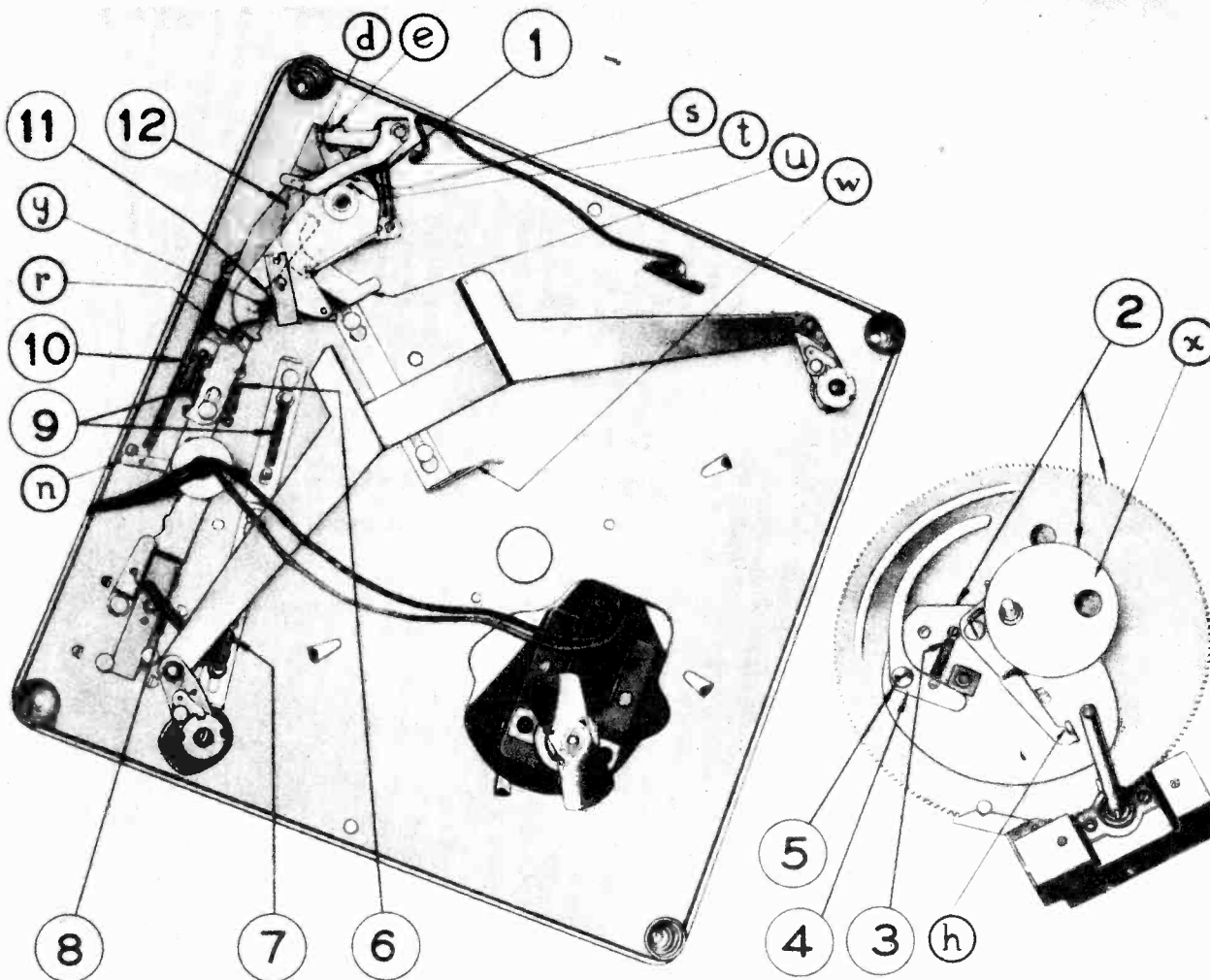
FIGURE IV - BOTTOM VIEW OF RECORD CHANGER,
DISASSEMBLED, SWITCH "OFF"

ITEM	PART NO.	DESCRIPTION	NO. REQ.	ITEM	PART NO.	DESCRIPTION	NO. REQ.
1	C-29018	- Tone Arm Latch Lever . . .	1	14	C-29162-A	- Trip Lever Assembly. . .	1
2	J-22021	- "C" Washer	3	15	C-29100	- Trip Lever Shoulder Screw.	1
3	C-29155	- Drive Link and Crank Assembly	1	16	B-27063	- Trip Dog Spring.	1
4	C-29079	- Drive Link	1	17	C-29063	- Manual and Reject Lever. . .	1
5	C-29083	- Drive Crank Shoulder Rivet.	2	18	C-29059	- 12" Set Slide.	1
6	C-29105	- Drive Crank.	2	19	C-29060	- 12" Set Lever.	1
7	C-29129	- Drive Pawl Spring.	2	20	C-29113	- 12" Set Cam.	1
8	C-29118	- Drive Pawl Shoulder Rivet.	2	21	C-29160-A	- Main Control Slide As- sembly	1
9	C-29112	- Drive Crank Pawl	2	22	B-27026	- Switch	1
10	C-29036	- Ratchet washer	2	23	C-29011	- Trip Shoe.	1
11	B-27092	- Trip Lever Spring.	1	24	C-29151-A	- Tone Arm Lever Assembly. . .	1
12	C-29089	- *Spindle Bearing Re- tainer	3	25	C-29019	- Tone Arm Locator	1
13	C-29158-A	- *Spindle and Gear Bracket Assembly (Complete)	1		C-29117	- 12" Set Cam Pin (Not shown - used with Item 20)	1

*See Fig. VI for detailed assembly view.

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FIGURE V - BOTTOM VIEW OF RECORD CHANGER, DISASSEMBLED, SWITCH "ON"; "MANUAL" POSITION

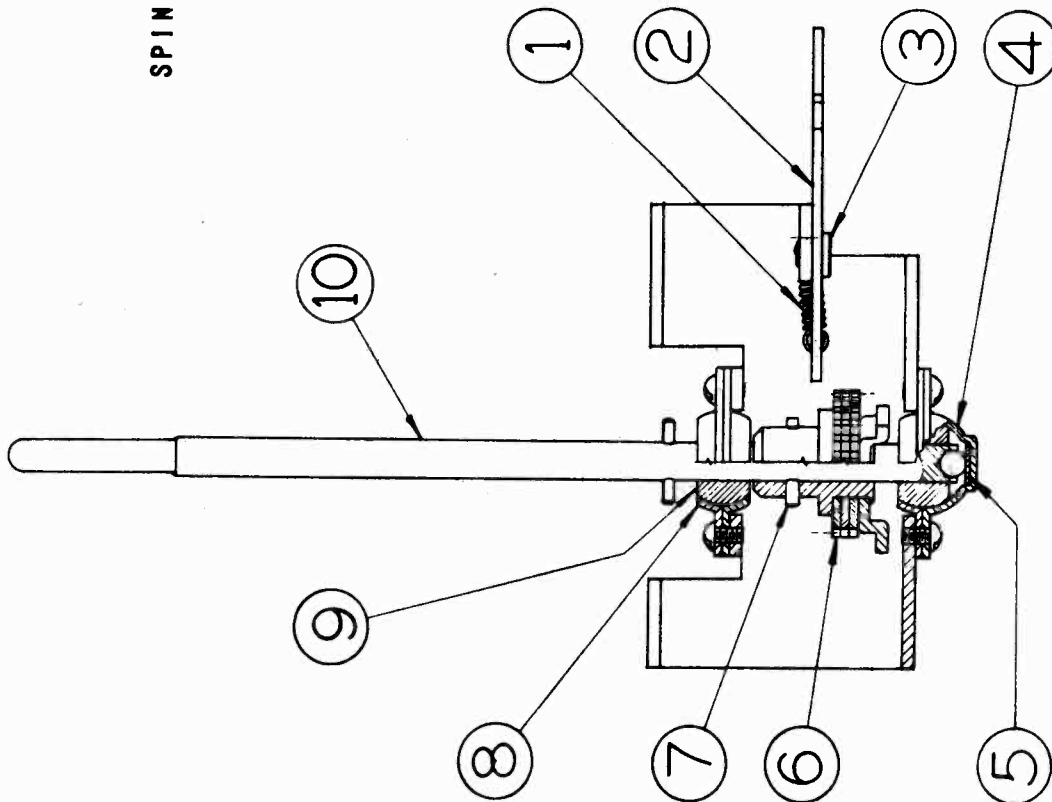


ITEM	PART NO.	DESCRIPTION	NO. REQ.
1	C-29130	- Tone Arm Locator and Latch Spring . . .	1
2	C-29122-A	- Drive Gear and Cam Assembly	1
3	B-27067	- Retard Lever Spring	1
4	B-27065	- Tone Arm Retard Lever	1
5	B-27088	- Retard Lever Shoulder Screw	1
6	C-29133	- Lower Slide Spring.	1
7	C-29061	- 12" Reset Lever Spring.	1
8	J-22094	- Detent Arm Spring	1
9	J-22058	- Upper Slide and Reset Slide Spring. .	2
10	C-29131	- Switch Spring	1
11	H-20129	- Booster Spring.	1
12	B-27028	- Connecting Link	1

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FIGURE VI -

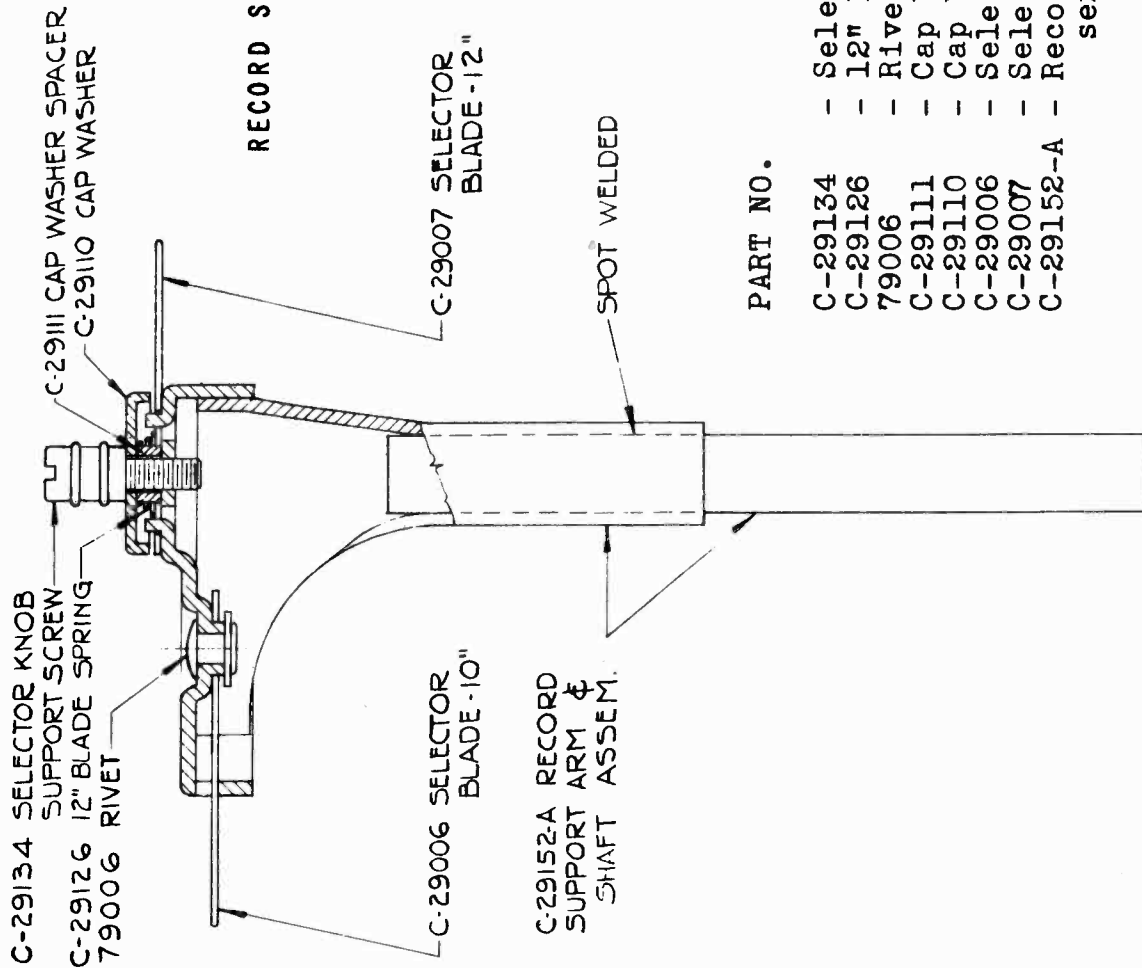
SPINDLE AND GEAR BRACKET ASSEMBLY



ITEM	PART NO.	DESCRIPTION	NO. REQ.
1	C-29086 C-29125-A	- Stop Lever Spring - Spindle Housing and Stop Lever Assembly Consists of the follow- ing parts:	1
2	C-29077	- Stop Lever.	1
3	C-29067	- Stop Lever Shoulder Rivet - Drive Gear and Spindle Housing	1
	C-29158-A	- Spindle Bearing Assembly (Complete) Consists of the follow- ing parts:	1
4	C-29090	- Thrust End Spindle Bear- ing Retainer.	1
5	J-22117	- Thrust Wafer.	1
6	C-29124-A	- Pinion and Hub Assembly	1
7	80061	- #3/0 x 1/2" Taper Pin	1
8	C-29089	- Spindle Bearing Retainer.	3
9	C-29058	- Spindle Bearing	2
10	C-29161-A	- Turntable Spindle, Pin and Ball Assembly Included in this Assembly are:	1
	C-29052	- Drive Pin	1
	11266	- Steel Ball.	1

FIGURE VII -

RECORD SUPPORT ARM, BLADE AND SHAFT ASSEMBLY



PART NO.	DESCRIPTION	NO. REQ.
C-29134	- Selector Knob Support Screw.	1
C-29126	- 12" Blade Spring	1
79006	- Rivet.	1
C-29111	- Cap Washer Spacer.	1
C-29110	- Cap Washer	1
C-29006	- Selector Blade - 10"	1
C-29007	- Selector Blade - 12"	1
C-29152-A	- Record Support Arm and Shaft Assembly	1

MODEL J Series
(Early)

J. P. SEEBURG CORP.

GENERAL INSTRUCTIONS

1. FUNCTION OF RECORD CHANGER WHEN IT IS GOING THRU A CHANGE CYCLE --

The Model "J" Record Changer plays and automatically changes 14 or less ten-inch records or 10 or less 12-inch records.

The Record Changer is started by turning the switch control knob, (Item 65, Fig. 4) to "ON" this starts the motor and moves trip rod (Item 32, Fig. 1), which rotates trip lever assembly (Item 20, Fig. 1), causing it to disengage from Engagement Clutch Cam, (Item 79, Fig. 2). The Engagement Clutch Cam will then rotate due to tension from spring, (Item 27, Fig. 1). This causes it to contact the pin on the top side of Drive Gear Assembly, (Item 4, Fig. 1), as it rotates, and in turn, moves the Drive Link Assembly, (Item 31, Fig. 1), and the Selector Shaft Crank Assembly #1 and #2 to the position shown in Fig. 2. Also the tone arm reset link (Item 80, Fig. 2), has moved to where it has released the latch, (Item 18, Fig. 1), and carried the tone arm to its extreme outward position. The Tone Arm lifter link (Item 81, Fig. 2), has raised the tone arm to its extreme height, by means of the Lifter Plate Assembly, (Item 21, Fig. 1). The tone arm is kept from "floating" free by the friction of the Tone Arm Brake Spring which also compresses the tone arm booster spring, (Item 13, Fig. 1) due to its very light tension.

The Drive Gear Assembly (Item 4, Fig. 1), continues to rotate which causes the top pin to disengage from the Automatic Engagement Clutch Cam which is moved back to latch with the tone arm trip lever, and the lower pin to engage the drive link assembly, moving it back to its initial position. This swings in the tone arm to either the 10-inch or 12-inch record playing position and lowers it to the record. At the same time it releases the Tone Arm Brake Spring allowing the Tone Arm Booster Spring to act.

2. PHONOGRAPH NEEDLES --

Various types and kinds of needles are available for use in phonograph tone arms.

For playing ten or more records at one setup with this Record Changer, no attempt should be made to use ordinary needles with steel or fiber points since continued use of worn needle points will damage the records being played.

Any needle can be used that is designed to play 15 or more records.

It is well to keep in mind that even if the amplifying system, speaker and tone arm are of the best quality, a poor needle will result in poor reproduction of music.

There are a number of good semi-permanent types of needles on the market which are rated in number of plays. It is usually more economical to use one of these needles which is rated at 1000 plays or more.

It is very important to remember not to remove and then replace any needle that has been used.

3. CHASSIS MOUNTING

On the bottom surface of the panel are four mounting studs, each threaded to take a 1/4-20" machine screw. The mounting panel rests on four tapered coil springs, the small end of each spring is pressed over a mounting stud and the large end of each spring fits into a socket in the top surface of the mounting shelf in cabinet.

Four spacing blocks 1/2" thick and with a 5/8" hole are fastened to the lower side of the mounting shelf. The 5/8" hole in each is centered with the center of the 7/16" screw clearance hole. These are to be provided and located on the lower side of the mounting shelf into which each of the lower mounting springs are to fit.

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(Early)

The 1/4"-20 machine screws are turned through the four wing nuts until the head of each screw is against the bottom side of each wing nut.

The four lower springs which are of smaller diameter than the upper springs are slipped over the ends of each of the 1/4"-20 machine screws with the tapered end toward the head and resting on the wing nuts.

OPERATING INSTRUCTIONS

1. TO PREPARE CHANGER FOR OPERATION --

(A) Setting Record Changer to Play Ten Inch Records:

Turn both knobs until the arrows are pointing toward the center of the turntable. When in this position any number up to and including fourteen 10-inch records can be played.

(B) Setting Record Changer to Play Twelve Inch Records:

Turn both knobs until the arrows marked "12" are pointing toward the center of the turntable. When in this position any number up to and including ten 12-inch records can be played.

2. LOADING --

(A) If 10-inch records are to be played, set knobs as described in (A) above and place any number up to and including 14 records (ten inch only) over center pin so that they will rest on the selecting arms.

(B) If 12-inch records are to be played, set knobs as described in (B) above and place any number up to and including 10 records (twelve inch only) over center pin so that they will rest on the arms.

3. STARTING THE RECORD CHANGER --

1. Turn on the radio (allowing approximately 30 seconds for the tubes to warm up) and throw the phonograph-radio knob or control to the phonograph position.

2. Turn the switch knob on the Record Changer panel to "ON". The motor will then start and the record changer will go into automatic operation of its own accord.

4. PLAYING AN INDIVIDUAL RECORD --

An individual record can be played in the same manner as a stack of records would be played, i.e., if it is a 10-inch record, follow the instructions pertaining to 10-inch records. If it is a 12-inch record, follow the instructions pertaining to 12-inch records.

A 10-inch record may be played manually by turning the selecting arm knobs to the unloading position and leaving them in this position--records may then be put on or taken off the turntable by merely moving the tone arm outward until it catches, and placing the 10-inch records over the spindle and down onto the turntable. The "ON" and "OFF" switch knob is then pushed down and the 10-inch record will be played and repeated if left on the turntable. To remove the record it is only necessary to move the tone arm outward until it catches, and lift the record off of the turntable.

5. TURNING OFF RECORD CHANGER --

Turn switch knob to "OFF" position while the tone arm is still on the record. If the switch knob should be turned off while Record Changer is going through a change cycle, it will be difficult to adjust the selector arms correctly for the automatic playing of 10-inch or 12-inch records.

6. UNLOADING RECORDS --

1. Turn switch knob to "Off" position.
2. Remove any records remaining on the selector arms.
3. Move tone arm outward until it catches in outward position.
4. Turn selector arms so that records will clear them.
5. Remove records from turntable.

7. LUBRICATION --

(A) Motor: The motor is equipped with oilless bearing and requires no lubrication.

(B) Turntable Spindle Bearings: Are lubricated at the factory and do not require any lubrication for one year. After one year they should be oiled with 1 or 2 drops of a light grade oil.

The top bearing can be oiled by lifting off turntable. Make sure when replacing turntable to see that pin in Turntable Spindle slips into slot on bottom surface of Turntable hub and also care should be taken not to injure Rubber Idler Drive Wheel.

Never under any circumstance allow oil to come in contact with Rubber Idler Drive Wheel.

(C) Squeak Due To Records Rubbing On Turntable Spindle: This can be eliminated by gently lining up the stack of records.

SERVICE NOTES

1. PICKUP DOES NOT INDEX PROPERLY ON TEN INCH OR TWELVE INCH RECORDS --

(A) Adjustment for correct indexing of 10-inch records:

1. Swing tone arm outward until tone arm lever assembly, (Item 19, Fig. 1) latches with tone arm latch lever, (Item 18, Fig. 1) which is held to tone arm shaft, (Item 77, Fig. 1) by two setscrews.
2. Make sure these setscrews are tight and that there is a slight play between the tone arm lever assembly and the panel, (Item 5, Fig. 1). This will give proper clearance at ball race assembly, (Item 74, Fig. 3).

The tone arm lever assembly, (Item 19, Fig. 1) is held against tone arm latch lever, (Item 18, Fig. 1) by the tension of tone arm locator lever spring, (Item 16, Fig. 1).

3. Next loosen the clamping screw in the Swivel Bracket Assembly (Item 46, Fig. 3.)

4. Now move tone arm, (Item 60, Fig. 4) until its outside edge is 1/8" from the outside edge of the panel (Item 5, Fig. 1) and retighten screw securely.

2. RECORD CHANGER DOES NOT GO INTO ITS CHANGING CYCLE AT END OF RECORD --

(A) Worn or Damaged Stop Groove: If the stop groove in the record is worn out or damaged, discard such a record.

(B) Cut-off Adjustment May Be Incorrect: The Record Changer should go into its changing cycle when the needle enters the stop groove and has traveled to within a distance of 1-7/8" from the center of the turntable shaft.

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6. TONE ARM ADJUSTMENTS FOR 12" RECORDS --

1. Turn both Control Knobs until the arrows marked "12" are pointing toward the center of the turntable.

TONE ARM ADJUSTMENTS FOR 10" RECORDS --

1. Turn both knobs until the arrows marked "10" are pointing toward the center of the turntable.
2. Place a 10" record on the turntable and start Record Changer.

3. Note where needle contacts record. Correct contacting is about 1/8" from the outside edge of record. If contacting of needle is not correct as mentioned, loosen the screw which holds Tone Arm Locator Shoe 10" (Item 15, Fig. 1) and slide shoe in or out as required, then tighten screw.

7. 2. Place a twelve inch record on the turntable.

3. Start Record Changer and note where needle contacts record. Correct contacting is about 1/8" from the outside edge of record.
4. Set Rod (Item 56, Fig. 3) is operated by Selector Arm (Item 61, Fig. 4). The 12" Set Link (Item 10, Fig. 1) operates as a stop when Record Changer is set for 12" records. When Tone Arm Locator Assembly (Item 12, Fig. 1) contacts 12" Set Link the Tone Arm should be in the correct position to play a 12" record.

If at this point, the position of Tone Arm is incorrect, loosen the screw which holds the Tone Arm Locator Shoe 12" Item 14, Fig. 1) and move in either direction as required and tighten screw.

8. TONE ARM HEIGHT ADJUSTMENTS --

Set the Record Changer for ten-inch records, turn Switch to "ON" and allow Record Changer to go thru a changing cycle with no record on the Turntable. The clearance between Turntable and the bottom surface of the Tone Arm should be approximately 1/8". Usually this clearance can be obtained by adjusting the Tone Arm Adjustment Screw (Item 70, Fig. 5). It is well to check the following points before making any adjustment.

Check clearance between Roller (Item 51, Fig. 3) and Selector Crank Shaft Assembly (Item 7, Fig. 1). There should be approximately 1/32" clearance at this point. If the clearance is greater, it would be due to the pressure on the Spring Washer (Item 50, Fig. 3) being too great. This will prevent the Tone Arm Lifter Reset Spring (Item 82, Fig. 5) from returning the Tone Arm Lifter Link Assembly (Item 81, Fig. 2) sufficiently. To relieve the pressure on the Spring Washer, lower the Selector Shaft Collar (Item 6, Fig. 1) slightly.

9. TONE ARM LOWERS ON RECORD TOO SUDDENLY --

If the Tone Arm lowers too suddenly, the Spring Washer (Item 50, Fig. 3) which is located between the Tone Arm Lifter Link Assembly (Item 81, Fig. 2) and Selector Shaft Crank Assembly Post (Item 7, Fig. 1) is not under sufficient pressure. The setscrews in the Selector Shaft Collar (Item 6, Fig. 1) should be loosened and the Selector Shaft Collar pressed upward slightly and set screws tightened.

If the Record Changer does not go into its changing cycle when the needle has reached the above mentioned distance, the Tone Arm Trip Lever Shoe, (Item 23, Fig. 1), should be moved toward the outside edge of the panel. To do this, it is necessary to loosen the thumb nut, (Item 22, Fig. 1), and then retighten after adjustment has been made.

If the Record Changer goes into its changing cycle before the needle has reached a distance of 1-7/8" from the center of the turntable, the Tone Arm Trip Lever Shoe should be moved inward toward the center of the Record Changer.

3. RECORD CHANGER DOES NOT GO INTO ITS CHANGING CYCLE WHEN SWITCH KNOB IS TURNED ON --

when the switch is turned to "ON" the Record Changer should start its changing cycle. If it does not, the following points should be checked.

1. Make sure motor is running.
2. Check Trip Rod, (Item 32, Fig. 1), to make sure it releases Trip Lever Assembly, (Item 20, Fig. 1), from Engagement Clutch Cam Assembly, (Item 79, Fig. 2), when Switch Knob is being turned on. If Trip Lever Assembly is not released, Trip rod should be shortened by bending until Trip Lever clears Engagement Clutch Cam Assembly, when Switch Knob is turned.
3. Make sure that Clutch Reset Pawl, (Item 40, Fig. 2,) clears Drive Link Assembly, Item 31, Fig. 1.

4. RECORD CHANGER CONTINUES TO REPEAT ITS CHANGING CYCLE WITHOUT PLAYING RECORDS --

(A) Trip Lever Assembly, (Item 20, Fig. 1) does not latch in Engagement Clutch Cam Assembly (Item 79, Fig. 2), which may be due to causes listed below:

1. Trip Rod (Item 32, Fig. 1), may be bent so that it is too short, holding Trip Lever Assembly from contacting Engagement Clutch Cam Assembly.
2. Springs (Item 24 or 35, Fig. 1) may be disconnected.

5. NO SOUND WHEN NEEDLE IS ON MOVING RECORD --

1. Muting switch (Item 26, Fig. 1), may be out of adjustment. The contacts of this switch should be open whenever its long blade is not resting on the shoe of the Engagement Clutch Cam Assembly (Item 79, Fig. 2). If the contacts remain closed after the long blade has left the shoe, they should be adjusted by bending until there is a separation of approximately 1/32".

Switch should be checked to make sure contacts are closed when long blade is resting on the shoe of the Engagement Clutch Cam Assembly.

2. The lugs on the Muting switch may have been bent together.
3. Pickup cartridge in Tone Arm may have been damaged or may be defective.

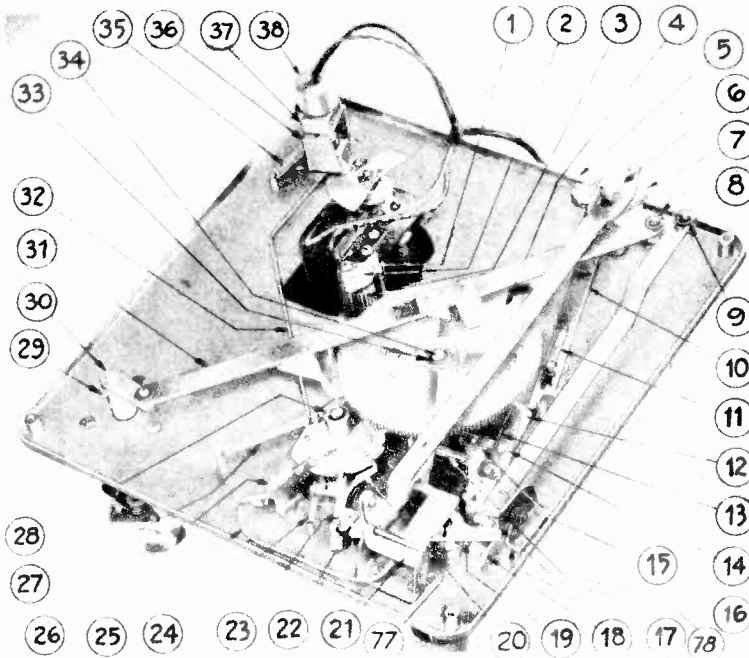
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MODEL J Series
(Early)

Figure 1

MODEL "J" RECORD CHANGER

Fig. 1



ITEM NO.	PART No.	DESCRIPTION	NO. USED
1	J-22096	Spindle Thrust Plate	1
2	J-22808	Spindle Bearing Housing Assy.	1
3	J-22010	Drive Pinion	1
4	J-22810	Drive Gear Assy.	1
5	J-22149	Panel, Post & Stud Assy.	1
6	F-1063	Selector Shaft Collar	1
7	J-22803	Selector Shaft Crank Assy. Post #1	1
8	72021	Flat Washer	3
9	H-20065	"C" Washer	3
10	J-22041	12" Set Link	1
11	J-22121	12" Reset Link Spring	1
12	J-22147	Tone Arm Locator & Bushing Assy.	1
13	H-20129	Tone Arm Booster Spring	1
14	J-22036	Tone Arm Locator Shoe 12"	1
15	J-22037	Tone Arm Locator Shoe 10"	1
16	J-22094	Tone Arm Locator Spring	1
17	J-22038	Tone Arm Latch & Guide Bracket	1
18	J22101	Tone Arm Latch Lever	1
19	J-22807	Tone Arm Lever Assy.	1
20	J-22812	Trip Lever Assy.	1
21	J-22813	Tone Arm Lift Plate Assy.	1
22	10380	Thumb Nut	1
23	10355	Tone Arm Trip Shoe	1
24	J-22058	Trip Lever Spring	1
25	J-22136	Pickup Shielded Wire	1
26	J-22116	Muting Switch	1
27	J-22090	Clutch Spring	1
28	72024	Flat washer	1
29	80035	Taper Pin	3
30	J-22805	Selector Shaft Drive Crank Assy. Post #2	1
31	J-22816	Drive Link Assy.	1
32	J-22055	Trip Rod	1
33	72024	Flat Washer	1
34	J-22002	Drive Gear Stud	1
35	J-22121	Switch Spring	1
36	J-22102	Switch Mounting Bracket	1
37	J-22103	Switch Retainer Bracket	1
38	J-22118	Switch	1
77	J-22067	Tone Arm Shaft	1
78	J-22134	Reset Arm Stop Washer	1

Figure 2

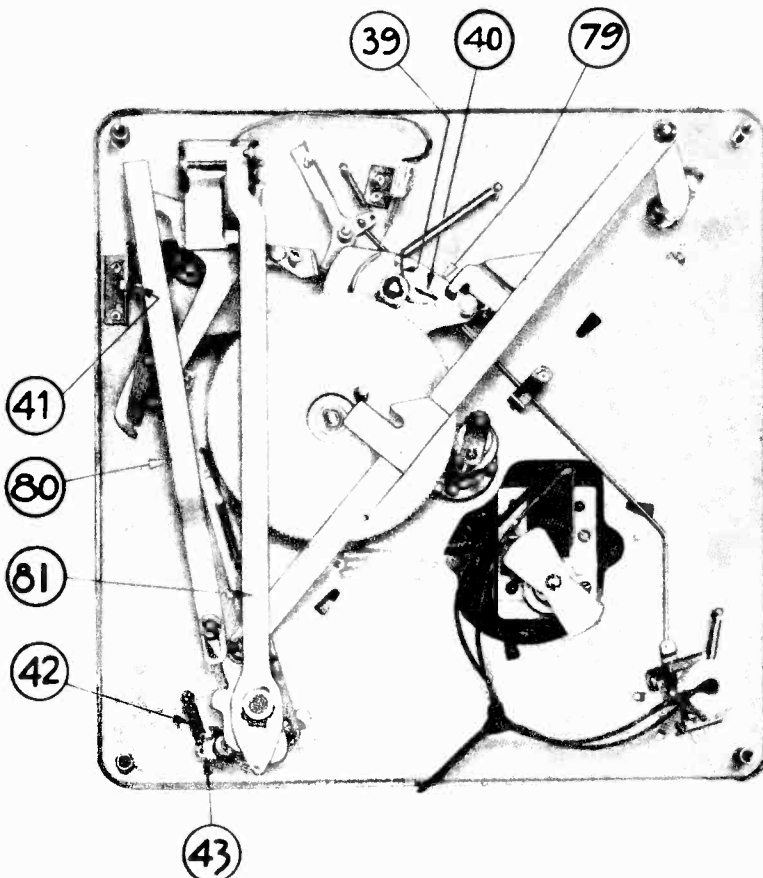


Fig. 2

39	J-22017	Clutch Reset Pawl Spring	1
40	J-22016	Clutch Reset Pawl	1
41	J-22123	Latch Lever Shoulder Screw	1
43	J-22811	12" Set Arm Assy.	1
79	J-22802	Engagement Clutch Cam Assy.	1
80	J-22804	Tone Arm Reset Link	1
81	J-22806	Tone Arm Lifter Link Assy.	1

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Figure 3

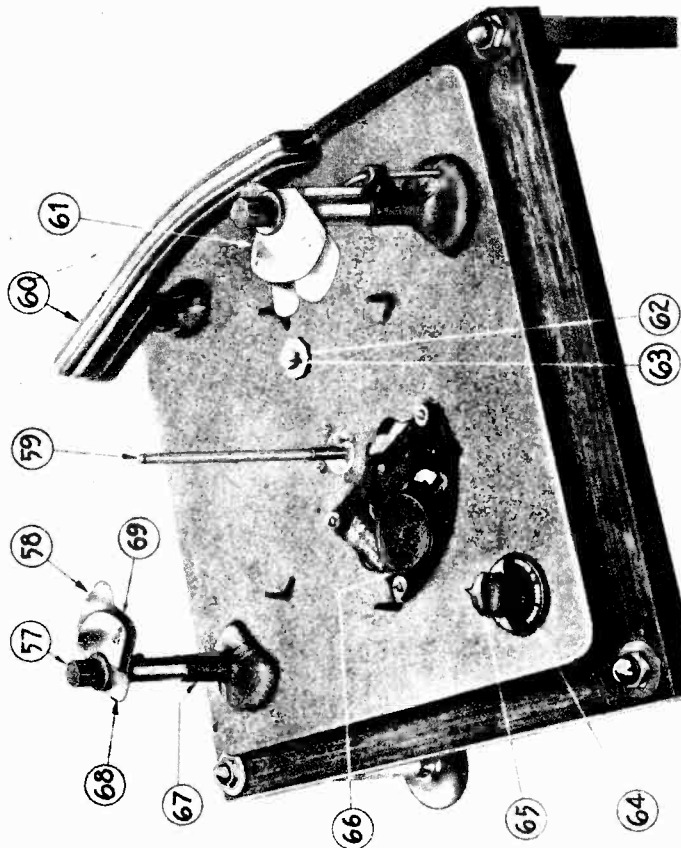
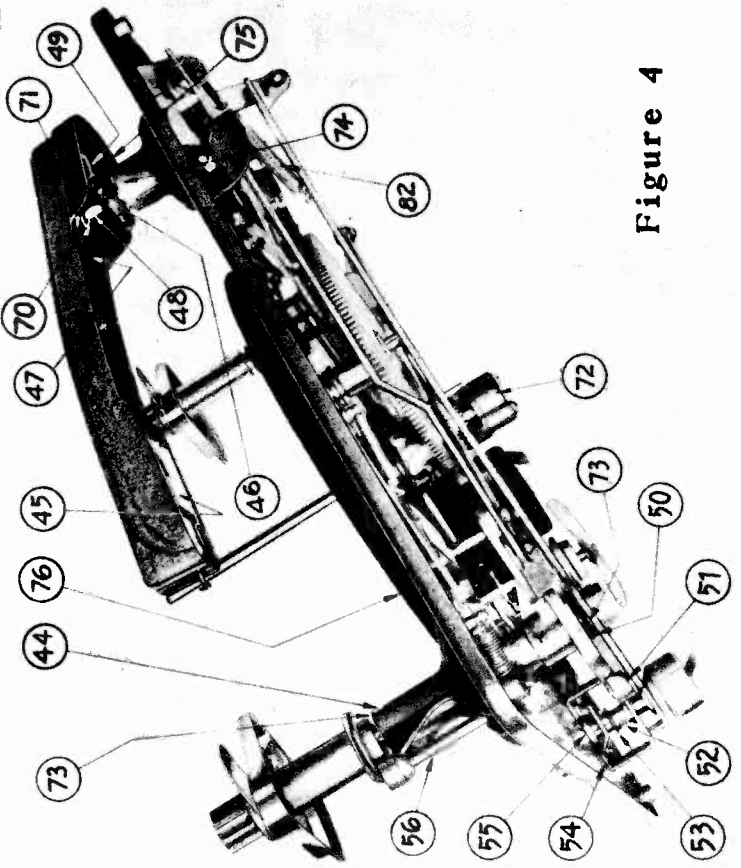


Figure 4



MODEL "J" RECORD CHANGER

Fig. 3

ITEM NO.	PART NO.	DESCRIPTION	NO. USED
44	J-22061	Record Support Post #1	1
45	J-22125	Tone Arm Cartridge	1
46	J-22080	Tone Arm Swivel Bracket	1
47	J-22081	Tone Arm Mounting Bracket	1
48	J-22068	Tone Arm Lift Pin	1
49	J-22133	Counter Balance Spring	1
50	J-22129	Spring Washer	1
51	J-22014	Roller	2
52	J-22131	Switch Return Spring	1
53	72050	Flat Washer	2
54	J-22104	Switch Reject Slide	1
55	J-22809	Switch Collar & Reject Pin Assy.	1
56	J-22063	12" Set Rod	1
70	H-20157	Tone Arm Adjusting Screw	1
71	H-22039	Adjusting Screw Lock Spring	1
72	J-22117	Thrust Wafer	1
73	H-20014	Thrust Washer	5
74	H-20513	Ball Race Assy.	1
75	H-20101	Rubber Bumper	1
76	J-22078	Turntable	1
82	J-22025	Tone Arm Lifter Reset Spring	1
57	J-22077	Control Knob	2
58	J-22098	Selector Blade 10"	2
59	J-22148	Turntable Spindle	1
60	J-22079	Tone Arm	1
61	J-22071	Selector Arm #1	1
62	J-22152	Special Washer	1
63	J-22150	Drive Gear Stud Locknut	1
64	J-22106	Switch Escutcheon	1
65	J-22105	Switch Control Knob	1
66	J-22009	Motor	1
67	J-22062	Record Support Post #2	1
68	J-22099	Selector Blade 12"	2
69	J-22072	Selector Arm #2	1

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SERVICE NOTES

1. PICKUP DOES NOT INDEX PROPERLY ON TEN INCH OR TWELVE INCH RECORDS —

(A) Adjustment for correct indexing of 10-inch records:

1. Swing tone arm outward until tone arm lever assembly, (Item 19, Fig. 1) latches with tone arm latch lever, (Item 18, Fig. 1) which is held to tone arm shaft, (Item 77, Fig. 1) by two setscrews.
2. Make sure these setscrews are tight and that there is a slight play between the tone arm lever assembly and the panel, (Item 5, Fig. 1). This will give proper clearance at ball race assembly, (Item 74, Fig. 3).

The tone arm lever assembly, (Item 19, Fig. 1) is held against tone arm latch lever, (Item 18, Fig. 1) by the tension of tone arm locator lever spring, (Item 16, Fig. 1).

3. Next loosen the clamping screw in the Swivel Bracket Assembly (Item 46, Fig. 3).
4. Now move tone arm, (Item 60, Fig. 4) until its outside edge is 1/8" from the outside edge of the panel (Item 5, Fig. 1) and retighten screw securely.

2. RECORD CHANGER DOES NOT GO INTO ITS CHANGING CYCLE AT END OF RECORD —

- (A) Worn or Damaged Stop Groove: If the stop groove in the record is worn out or damaged, discard such a record.
- (B) Cut-off Adjustment May Be Incorrect: The Record Changer should go into its changing cycle when the needle enters the stop groove and has traveled to within a distance of 1-7/8" from the center of the turntable shaft.

If the Record Changer does not go into its changing cycle when the needle has reached the above mentioned distance, the Tone Arm Trip Lever Shoe, (Item 23, Fig. 1), should be moved toward the outside edge of the panel. To do this, it is necessary to loosen the thumb nut, (Item 22, Fig. 1), and then retighten after adjustment has been made.

If the Record Changer goes into its changing cycle before the needle has reached a distance of 1-7/8" from the center of the turntable, the Tone Arm Trip Lever Shoe should be moved inward toward the center of the Record Changer.

3. RECORD CHANGER DOES NOT GO INTO ITS CHANGING CYCLE WHEN SWITCH KNOB IS TURNED ON —

When the switch is turned to "ON" the Record Changer should start its changing cycle. If it does not, the following points should be checked.

1. Make sure motor is running.
2. Check Trip Rod, (Item 32, Fig. 1), to make sure it releases Trip Lever Assembly, (Item 20, Fig. 1), from Engagement Clutch Cam Assembly, (Item 79, Fig. 2), when Switch Knob is being turned on. If Trip Lever Assembly is not released, Trip rod should be shortened by bending until Trip Lever clears Engagement Clutch Cam Assembly, when Switch Knob is turned.

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3. Make sure that Clutch Reset Pawl, (Item 40, Fig. 2), clears Drive Link Assembly, Item 31, Fig. 1.

4. RECORD CHANGER CONTINUES TO REPEAT ITS CHANGING CYCLE WITHOUT PLAYING RECORDS --

- (A) Trip Lever Assembly (Item 20, Fig. 1) does not latch in Engagement Clutch Cam Assembly (Item 79, Fig. 2), which may be due to causes listed below:

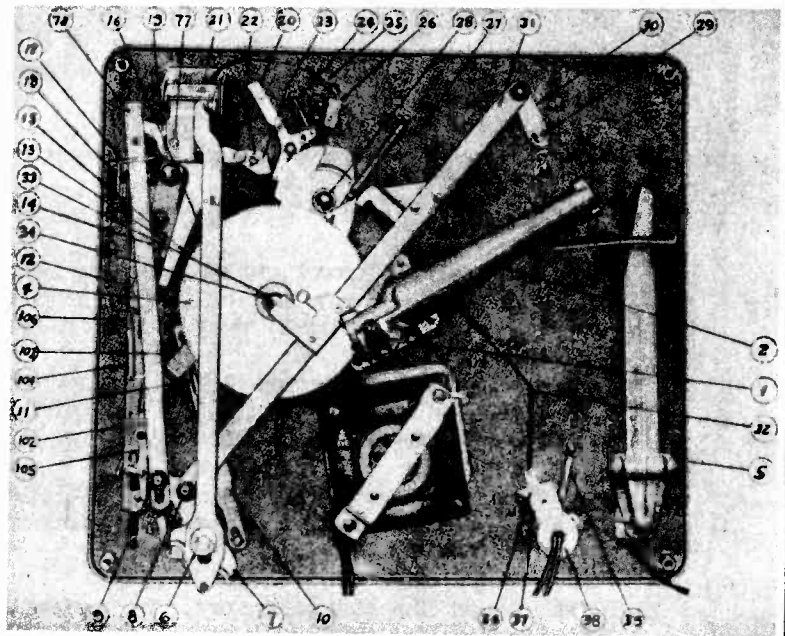


Fig. 1

1. Trip Rod (Item 32, Fig. 1), may be bent so that it is too short, holding Trip Lever Assembly from contacting Engagement Clutch Cam Assembly.
2. Springs (Items 24 or 35, Fig. 1) may be disconnected.

5. NO SOUND WHEN NEEDLE IS ON MOVING RECORD --

1. Muting switch (Item 26, Fig. 1), may be out of adjustment. The contacts of this switch should be open whenever its long blade is not resting on the shoe of the Engagement Clutch Cam Assembly (Item 79, Fig. 2). If the contacts remain closed after the long blade has left the shoe, they should be adjusted by bending until there is a separation of approximately $1/32$ ".

Switch should be checked to make sure contacts are closed when long blade is resting on the shoe of the Engagement Clutch Cam Assembly.

2. The lugs on the Muting switch may have been bent together.
3. Pickup cartridge in Tone Arm may have been damaged or may be defective.

6. TONE ARM ADJUSTMENTS FOR 12" RECORDS --

1. Turn both Control Knobs until the arrows marked "12" are pointing toward the center of the turntable.
2. Place a twelve inch record on the turntable.
3. Start Record Changer and note where needle contacts record. Correct contacting is about $1/8$ " from the outside edge of record.

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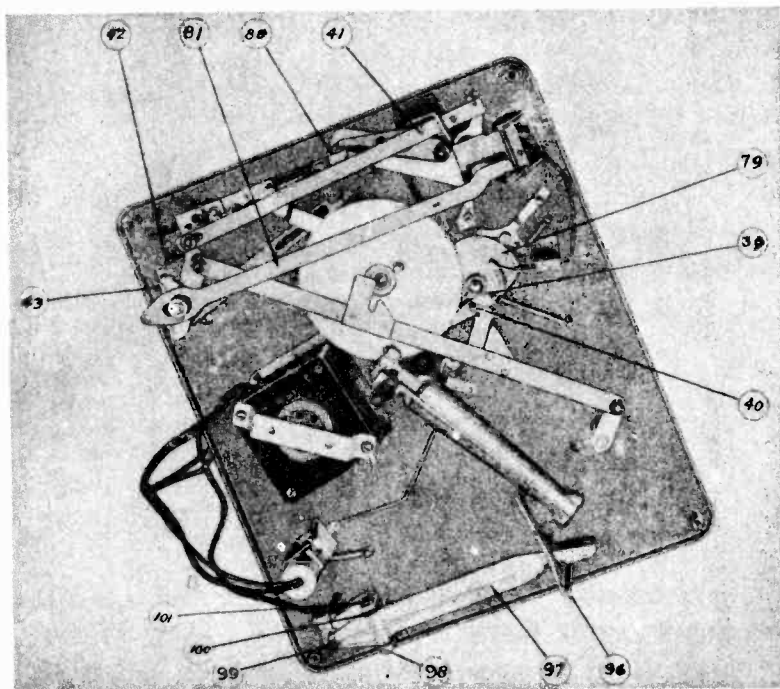
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(Early)

Fig. 2

4. Set Rod (Item 56, Fig. 3) is operated by Selector Arm (Item 61, Fig. 4). The 12" Set Link (Item 10, Fig. 1) operates as a stop when Record Changer is set for 12" records. When Tone Arm Locator Assembly (Item 12, Fig. 1) contacts 12" Set Link the Tone Arm should be in the correct position to play a 12" record.

If at this point, the position of Tone Arm is incorrect, loosen the screw which holds the Tone Arm Locator Shoe 12" (Item 14, Fig. 1) and move in either direction as required and tighten screw.

7. TONE ARM ADJUSTMENTS FOR 10" RECORDS --

1. Turn both knobs until the arrows marked "10" are pointing toward the center of the turntable.
2. Place a 10" record on the turntable and start Record Changer.
3. Note where needle contacts record. Correct contacting is about 1/8" from the outside edge of record. If contacting of needle is not correct as mentioned, loosen the screw which holds Tone Arm Locator Shoe 10" (Item 15, Fig. 1) and slide shoe in or out as required, then tighten screw.

8. TONE ARM HEIGHT ADJUSTMENTS --

Set the Record Changer for ten-inch records, turn Switch to "ON" and allow Record Changer to go thru a changing cycle with no record on the Turntable. The clearance between Turntable and the bottom surface of the Tone Arm should be approximately 1/8". Usually this clearance can be obtained by adjusting the Tone Arm Adjustment Screw (Item 70, Fig. 3). It is well to check the following points before making any adjustment.

Check clearance between Roller (Item 51, Fig. 3) and Selector Crank Shaft Assembly (Item 7, Fig. 1). There should be approximately 1/32" clearance at this point. If the clearance is greater, it would be due to the pressure on the Spring Washer (Item 50, Fig. 3) being too great. This will prevent the Tone Arm Lifter Reset Spring (Item 82, Fig. 3) from returning the Tone Arm Lifter Link Assembly (Item 81, Fig. 2) sufficiently. To relieve the pressure on the Spring Washer, lower the Selector Shaft Collar (Item 6, Fig. 1) slightly.

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9. TONE ARM LOWERS ON RECORD TOO SUDDENLY --

If the Tone Arm lowers too suddenly, the Spring Washer (Item 50, Fig. 3) which is located between the Tone Arm Lifter Link Assembly (Item 81, Fig. 2) and Selector Shaft Crank Assembly Post (Item 7, Fig. 1) is not under sufficient pressure. The setscrews in the Selector Shaft Collar (Item 6, Fig. 1) should be loosened and the Selector Shaft Collar pressed upward slightly and set screws tightened.

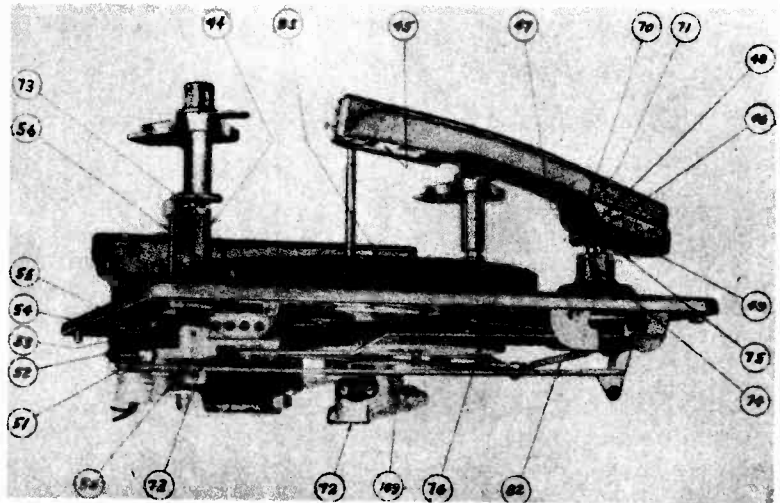


Fig. 3

SERVICE NOTES
(RECORDER)

1. FUNCTION OF MANUAL CONTROL BUTTON AND RELATIVE PARTS

When Manual Control Button (Item 84, Fig. 4) is moved to the Manual Play-Back recording position, it moves the Manual Control Slide (Item 102, Fig. 1) which in turn moves Clutch Lock Slide (Item 103, Fig. 1) into a position which prevents Engagement Clutch Cam Assembly (Item 79, Fig. 2) from rotating. When Engagement Clutch Cam Assembly is in the above mentioned position and is not free to rotate, the Changer will not go into its changing cycle.

Also when the Manual Control Button is in the above mentioned position, the Manual Control Slide has moved the Locator Lock Slide (Item 106, Fig. 1) into a position where it engages the Tone Arm Locator & Bushing Assembly (Item 12, Fig. 1) and prevents same from bearing against Tone Arm Lever Assembly (Item 19, Fig. 1) allowing the Tone Arm to swing freely without hindrance and without setting Changer into its changing cycle. When the Manual Control button is in the automatic position the Changer will function normally as an automatic record changer.

2. POSSIBLE MECHANICAL CAUSES OF POOR RECORDINGS

- (A) Threads from record cuttings getting down onto Rubber Idler drive wheel (Item 83, Fig. 4) and between drive wheel and motor pulley. This will cause very bad speed variation of the turntable and, of course, will result in very inferior recording. Cuttings may also wrap around motor shaft and cause motor to slow down or stop.

To remove the record cuttings, the turntable should be lifted by applying an even lifting force at opposite edges of the turntable while the turntable spindle is gently tapped downward on its top end, and the record cuttings then removed. The Rubber Idler Drive Wheel should be taken off - this can be accomplished by un-snapping the small snap cotter ring and slipping Rubber Idler Drive Wheel off its shaft, after which all record cuttings can be removed.

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Note: It is very important that no grease or oil be gotten on the surface of the Rubber Idler Drive Wheel.

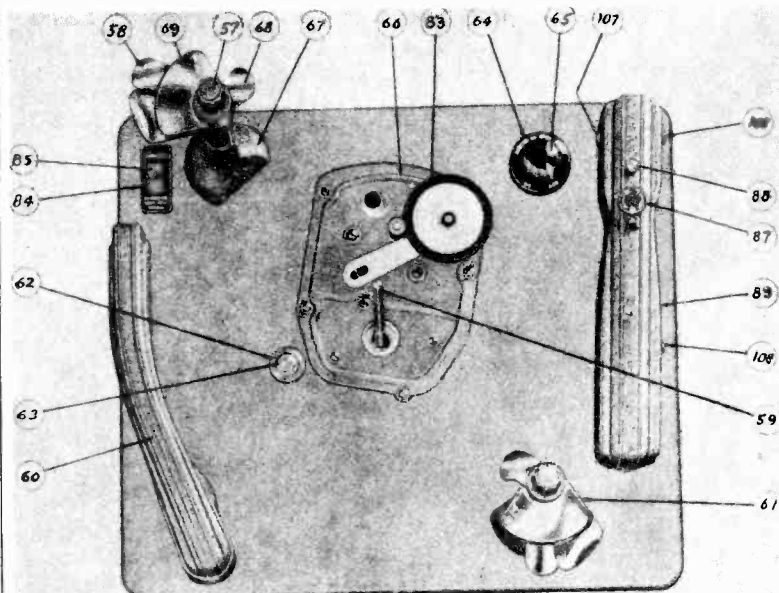


Fig. 4

slight up and down variation of the record or turntable. A record cut in this manner will, when played back, have a high scratch level, rough cutting and a tendency for the needle to jump from one groove to another.

(C) Damaged Rubber Idler Drive Wheel (Item 83, Fig. 4)

Rubber Idler Drive Wheel may have become damaged by:

1. Allowing oil or grease to come in contact with same.
2. By allowing turntable to drop and cut into the outside surface of the Rubber Idler Drive Wheel.
3. Stopping the turntable by hand while the motor is running will cause a flat spot on the surface of the Rubber Idler Drive Wheel.

Note: If the Rubber Idler Drive Wheel has been damaged in any of the above mentioned ways, it should be replaced with a new one.

(D) Vibration Reaching the Recorder While A Blank is Being Recorded: It is very important the floor or the surface upon which the Recorder rests remain quiet as any vibration such as people walking across the floor or shaking of the instrument in which the Recorder is mounted will seriously effect the quality of the finished recording.

(E) Recorder Not Level: It is very important that the Recorder is standing level. This can be checked by placing a small level on the turntable and checking same in two positions at right angles to each other and then leveling instrument in which Recorder is mounted.

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(F)

Bent or Damaged Turntable Spindle: If the Turntable Spindle (Item 59, Fig. 4) has been bent in shipment, or by someone exerting a heavy pressure on one side, it should be replaced with a new one. A bent Turntable Spindle will cause the surface of the Turntable to move up and down while it is turning and, of course, will seriously effect the quality of both recording and play-back.

Note: When removing the Turntable an even upward lifting force should be applied at opposite edges of the Turntable while Turntable Spindle is gently tapped downward on its top end.

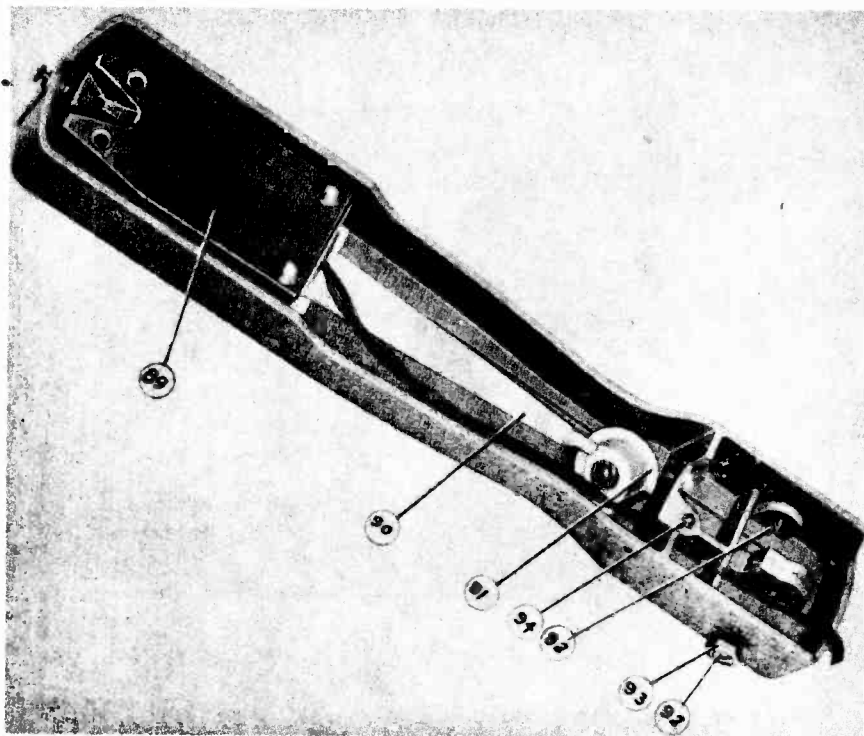


Fig. 5

- (G) **Record Cuttings Causing A Bind Between Turntable Spindle (Item 59, Fig. 4) and Its Bearing:**

It is very important that all record cuttings are removed from Turntable Spindle and its bearing.

- (H) **Tension On Rubber Idler Drive Wheel (Item 83, Fig. 4) Too Great:** If the tension on the Rubber Idler Drive Wheel is too great, this will result in a "wow" or a rumble in the recording. To decrease the tension on Rubber Idler Drive Wheel, loosen the screw holding the lug which is located beneath the Rubber Idler Drive Wheel and turn it slightly in a clockwise direction. This will reduce the spring tension on the Rubber Idler Drive Wheel. When the spring tension is correct, the spring will be approximately at right angles to the lug.
- (I) **Tension On Rubber Idler Drive Wheel (Item 83, Fig. 4) Too Weak:** This will cause very bad speed variation. Turntable will slow down and then speed up as audio current of varying intensity reaches the cutter cartridge.

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MODEL J Series
(Late)GENERAL INSTRUCTIONS

1. FUNCTION OF RECORD CHANGER WHEN IT IS GOING THRU A CHANGE CYCLE --

The Model "J" Record Changer plays and automatically changes 14 or less ten-inch records or 10 or less 12-inch records.

The Record Changer is started by turning the switch control knob, (Item 10, Fig. 1) to "ON" this starts the motor and moves trip rod (Item 35, Fig. 2), which rotates trip lever assembly (Item 21, Fig. 2), causing it to disengage from Engagement Clutch Cam, (Item 25, Fig. 2). The Engagement Clutch Cam will then rotate due to tension from spring, (Item 29, Fig. 2). This causes it to contact the pin on the top side of Drive Gear Assembly, (Item 4, Fig. 2), as it rotates, and in turn, moves the Drive Link Assembly, (Item 34, Fig. 2), and the Selector Shaft Crank Assembly #7 and #33 to a new position. Also the tone arm reset link (Item 12, Fig. 2), has moved to where it has released the latch, (Item 19, Fig. 2), and carried the tone arm to its extreme outward position. The Tone Arm lifter link (Item 23A, Fig. 2), has raised the tone arm to its extreme height, by means of the Lifter Plate Assembly, (Item 23, Fig. 2). The tone arm is kept from "Floating" free by the friction of the Tone Arm Brake Spring which also compresses the tone arm booster spring, (Item 13, Fig. 2) due to its very light tension.

The Drive Gear Assembly (Item 4, Fig. 2), continues to rotate which causes the top pin to disengage from the Automatic Engagement Clutch Cam which is moved back to latch with the tone arm trip lever, and the lower pin to engage the drive link assembly, moving it back to its initial position. This swings in the tone arm to either the 10-inch or 12-inch record playing position and lowers it to the record. At the same time it releases the Tone Arm Brake Spring allowing the Tone Arm Booster Spring to act.

2. PHONOGRAPH NEEDLES --

Various types and kinds of needles are available for use in phonograph tone arms.

For playing ten or more records at one setup with this Record Changer, no attempt should be made to use ordinary needles with steel or fiber points since continued use of worn needle points will damage the records being played.

Any needle can be used that is designed to play 15 or more records.

It is well to keep in mind that even if the amplifying system, speaker and tone arm are of the best quality, a poor needle will result in poor reproduction of music.

There are a number of good semi-permanent types of needles on the market which are rated in number of plays. It is usually more economical to use one of these needles which is rated at 1000 plays or more.

It is very important to remember not to remove and then replace any needle that has been used.

3. CHASSIS MOUNTING --

On the bottom surface of the panel are four mounting studs, each threaded to take a 1/4-20" machine screw. The mounting panel rests on four tapered coil springs, the small end of each spring is pressed over a mounting stud and the large end of each spring fits into a socket in the top surface of the mounting shelf in cabinet.

Four spacing blocks 1/2" thick and with a 5/8" hole are fastened to the lower side of the mounting shelf. The 5/8" hole in each is centered with the center of the 7/16" screw clearance hole. These are to be provided and located on the lower side of the mounting shelf into which each of the lower mounting springs are to fit.

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The 1/4"-20 machine screws are turned through the four wing nuts until the head of each screw is against the bottom side of each wing nut.

The four lower springs which are of smaller diameter than the upper springs are slipped over the ends of each of the 1/4"-20 machine screws with the tapered end toward the head and resting on the wing nuts.

OPERATING INSTRUCTIONS

1. TO PREPARE CHANGER FOR OPERATION --

(A) Setting Record Changer to Play Ten Inch Records:

Turn both knobs until the arrows are pointing toward the center of the turntable. When in this position any number up to and including fourteen 10-inch records can be played.

(B) Setting Record Changer to Play Twelve Inch Records:

Turn both knobs until the arrows marked "12" are pointing toward the center of the turntable. When in this position any number up to and including ten 12-inch records can be played.

2. LOADING --

(A) If 10-inch records are to be played, set knobs as described in (A) above and place any number up to and including 14 records (ten inch only) over center pin so that they will rest on the selecting arms.

(B) If 12-inch records are to be played, set knobs as described in (B) above and place any number up to and including 10 records (twelve inch only) over center pin so that they will rest on the arms.

3. STARTING THE RECORD CHANGER --

1. Turn on the radio (allowing approximately 30 seconds for the tubes to warm up) and throw the phonograph-radio knob or control to the phonograph position.

2. Turn the switch knob on the Record Changer panel to "ON". The motor will then start and the record changer will go into automatic operation of its own accord.

4. PLAYING AN INDIVIDUAL RECORD --

An individual record can be played in the same manner as a stack of records would be played, i.e., if it is a 10-inch record, follow the instructions pertaining to 10-inch records. If it is a 12-inch record, follow the instructions pertaining to 12-inch records.

A 10-inch record may be played manually by turning the selecting arm knobs to the unloading position and leaving them in this position--records may then be put on or taken off the turntable by merely moving the tone arm outward until it catches, and placing the 10-inch records over the spindle and down onto the turntable. The "ON" and "OFF" switch knob is then pushed down and the 10-inch record will be played and repeated if left on the turntable. To remove the record it is only necessary to move the tone arm outward until it catches, and lift the record off of the turntable.

5. TURNING OFF RECORD CHANGER --

Turn switch knob to "OFF" position while the tone arm is still on the record. If the switch knob should be turned off while Record Changer is going through a change cycle, it will be difficult to adjust the selector arms correctly for the Automatic playing of 10-inch or 12-inch records.

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6. UNLOADING RECORDS --

1. Turn switch knob to "Off" position.
2. Remove any records remaining on the selector arms.
3. Move tone arm outward until it catches in outward position.
4. Turn selector arms so that records will clear them.
5. Remove records from turntable.

7. LUBRICATION --

- (A) Motor: The motor is equipped with oilless bearing and requires no lubrication.
- (B) Turntable Spindle Bearings: Are lubricated at the factory and do not require any lubrication for one year. After one year they should be oiled with 1 or 2 drops of a light grade oil.

The top bearing can be oiled by lifting off turntable. Make sure when replacing turntable to see that pin in Turntable Spindle slips into slot on bottom surface of Turntable hub and also care should be taken not to injure Rubber Idler Drive Wheel.

Never under any circumstances allow oil to come in contact with Rubber Idler Drive Wheel.

- (C) Squeak Due to Records Rubbing On Turntable Spindle: This can be eliminated by gently lining up the stack of records.

SERVICE NOTES

1. PICKUP DOES NOT INDEX PROPERLY ON TEN INCH OR TWELVE INCH RECORDS --

(A) Adjustment for correct indexing of 10-inch records:

1. Swing tone arm outward until tone arm lever assembly, (Item 20 Fig. 2) latches with tone arm latch lever, (Item 19, Fig. 2) which is held to tone arm shaft, (Item 22, Fig. 2) by two setscrews.
2. Make sure these setscrews are tight and that there is a slight play between the tone arm lever assembly and the panel, (Item 5A, Fig. 2). This will give proper clearance at ball race assembly, (Item 10, Fig. 3).

The tone arm lever assembly, (Item 20, Fig. 2,) is held against tone arm latch lever, (Item 19, Fig. 2) by the tension of tone arm locator lever spring, (Item 16, Fig. 2).

3. Next loosen the clamping screw in the Swivel Bracket Assembly (Item 4, Fig. 3.)
4. Now move tone arm, (Item 5, Fig. 1) until its outside edge is 1/8" from the outside edge of the panel (Item 5A, Fig. 2) and retighten screw securely.

2. RECORD CHANGER DOES NOT GO INTO ITS CHANGING CYCLE AT END OF RECORD --

- (A) Worn or Damaged Stop Groove: If the stop groove in the record is worn out or damaged, discard such a record.
- (B) Cut-off Adjustment May Be Incorrect: The Record Changer should go into its changing cycle when the needle enters the stop groove and has traveled to within a distance of 1-7/8" from the center of the turntable shaft.

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If the Record Changer does not go into its changing cycle when the needle has reached the above mentioned distance, the Tone Arm Trip Lever Shoe, (Item 24A, Fig. 2), should be moved toward the outside edge of the panel. To do this, it is necessary to loosen the thumb nut, (Item 24, Fig. 2), and then retighten after adjustment has been made.

If the Record Changer goes into its changing cycle before the needle has reached a distance of 1-7/8" from the center of the turntable, the Tone Arm Trip Lever Shoe should be moved inward toward the center of the Record Changer.

3. RECORD CHANGER DOES NOT GO INTO ITS CHANGING CYCLE WHEN SWITCH KNOB IS TURNED ON --

When the switch is turned to "ON" the Record Changer should start its changing cycle. If it does not, the following points should be checked.

1. Make sure motor is running.
2. Check Trip Rod, (Item 35, Fig. 2), to make sure it releases Trip Lever Assembly, (Item 21, Fig. 2), from Engagement Clutch Cam Assembly, (Item 25, Fig. 2), when Switch Knob is being turned on. If Trip Lever Assembly is not released, Trip rod should be shortened by bending until Trip Lever clears Engagement Clutch Cam Assembly, when Switch Knob is turned.
3. Make sure that Clutch Reset Pawl, (Item 33A, Fig. 8) clears Drive Link Assembly, Item 34, Fig. 2).

4. RECORD CHANGER CONTINUES TO REPEAT ITS CHANGING CYCLE WITHOUT PLAYING RECORDS --

(A) Trip Lever Assembly, (Item 21, Fig. 2) does not latch in Engagement Clutch Cam Assembly (Item 25, Fig. 2), which may be due to causes listed below:

1. Trip Rod (Item 35, Fig. 2), may be bent so that it is too short, holding Trip Lever Assembly from contacting Engagement Clutch Cam Assembly.
2. Springs (Item 26 or 11, Fig. 2) may be disconnected.

5. NO SOUND WHEN NEEDLE IS ON MOVING RECORD --

1. Muting switch (Item 28, Fig. 2), may be out of adjustment. The contacts of this switch should be open whenever its long blade is not resting on the shoe of the Engagement Clutch Cam Assembly (Item 25, Fig. 2). If the contacts remain closed after the long blade has left the shoe, they should be adjusted by bending until there is a separation of approximately 1/32".

Switch should be checked to make sure contacts are closed when long blade is resting on the shoe of the Engagement Clutch Cam Assembly.

2. The lugs on the Muting switch may have been bent together.
3. Pickup cartridge in Tone Arm May have been damaged or may be defective.

6. TONE ARM ADJUSTMENTS FOR 12" RECORDS --

1. Turn both Control Knobs until the arrows marked "12" are pointing toward the center of the turntable.

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(Late)

2. Place a twelve inch record on the turntable.
3. Start Record Changer and note where needle contacts record. Correct contacting is about $1/8$ " from the outside edge of record.
4. Set Rod (Item 19, Fig. 3) is operated by Selector Arm (Item 6, Fig. 1). The 12" Set Link (Item 10, Fig. 2) operates as a stop when Record Changer is set for 12" records. When Tone Arm Locator Assembly (Item 12, Fig. 2) contacts 12" Set Link the Tone Arm should be in the correct position to play a 12" record..

If at this point, the position of Tone Arm is incorrect, loosen the screw which holds the Tone Arm Locator Shoe 12" (Item 14, Fig. 2) and move in either direction as required and tighten screw.

7. TONE ARM ADJUSTMENTS FOR 10" RECORDS --

1. Turn both knobs until the arrows marked "10" are pointing toward the center of the turntable.
2. Place a 10" record on the turntable and start Record Changer.
3. Note where needle contacts record. Correct contacting is about $1/8$ " from the outside edge of record. If contacting of needle is not correct as mentioned, loosen the screw which holds Tone Arm Locator Shoe 10" (Item 15, Fig. 2) and slide shoe in or out as required, then tighten screw.

8. TONE ARM HEIGHT ADJUSTMENTS --

Set the Record Changer for ten-inch records, turn Switch to "ON" and allow Record changer to go thru a changing cycle with no record on the Turntable. The clearance between Turntable and the bottom surface of the Tone Arm should be approximately $1/8$ ". Usually this clearance can be obtained by adjusting the Tone Arm Adjustment Screw (Item 5, Fig. 3). It is well to check the following points before making any adjustment.

Check clearance between Roller (Item 51, Fig. 3) and Selector Crank Shaft Assembly (Item 7, Fig. 2). There should be approximately $1/32$ " clearance at this point. If the clearance is greater, it would be due to the pressure on the Spring Washer (Item 14, Fig. 3) being too great. This will prevent the Tone Arm Lifter Reset Spring (Item 11, Fig. 3) from returning the Tone Arm Lifter Link Assembly (Item 23A, Fig. 2) Sufficiently. To relieve the pressure on the Spring Washer, lower the Selector Shaft Collar (Item 6, Fig. 2) slightly.

9. TONE ARM LOWERS ON RECORD TOO SUDDENLY --

If the Tone Arm lowers too suddenly, the Spring Washer (Item 14, Fig. 3) which is located between the Tone Arm Lifter Link Assembly (Item 23A, Fig. 2) and Selector Shaft Crank Assembly Post (Item 7, Fig. 2) is not under sufficient pressure. The setscrews in the Selector Shaft Collar (Item 6, Fig. 2) should be loosened and the Selector Shaft Collar pressed upward slightly and set screws tightened.

MODEL J "Std."
(Late)

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SECTION I
MODEL "J"
Standard Record Changer
FIG. I

ITEM NO.	PART NO.	DESCRIPTION	NO. USED
1	J-22099	- Selector Blade 12"	2
2	J-22077	- Control knob	2
3	J-22139-A	- Selector Arm & Blade Assembly #2	1
4	J-22137	- Turntable Spindle Assembly	1
5	J-22079	- Tone Arm	1
6	J-22138-A	- Selector Arm & Blade Assembly #1	1
7	J-22152	- Special Washer	1
8	J-22150	- Drive Gear Stud Lock-Nut	1
9	J-22106	- Switch Escutcheon	1
10	J-22217	- Switch Control Knob	1
11	J-22009	- Motor Assembly	1

FIG. II

1	J-22096	- Spindle Thrust Plate	1
2	J-22808-A	- Spindle Bearing Housing Assembly	1
3	J-22010	- Drive Pinion	1
4	J-22810	- Drive Gear Assembly	1
5	J-22815-A	- Selector Shaft Assembly #1	1
6	F-1063	- Selector Shaft Collar	1
7	J-22803-A	- Selector Shaft Drive Crank Assy.	1
8	72040	- Spring Washer	2
9	H-20065	"C" Washer 3/16"	6
10	J-22041	- 12" Set Link	1
11	J-22121	- Switch & 12" Reset Link Spring	1
12	J-22804	- Tone Arm Reset Link Assembly	2
13	H-20129	- Tone Arm Booster Spring	1
14	J-22280-A	- Tone Arm Locator Assembly	1
15	J-22037	- Tone Arm Locator Shoe	1
16	J-22094	- Tone Arm Locator Spring	1
17	J-22134	- Reset Arm Stop Washer	1
18	J-22038	- Tone Arm Latch & Guide Bracket	1
19	J-22101	- Tone Arm Latch Lever	1
20	J-22807-A	- Tone Arm Lever Assembly	1
21	J-22812-A	- Trip Lever Assembly	1
22	J-22067	- Tone Arm Shaft	1
23	J-22813-A	- Tone Arm Lift Plate Assembly	1
24	10380	- Thumb Nut	1
25	J-22802-A	- Engagement Clutch Cam Assembly	1
26	J-22058	- Trip Lever Spring	1
27	J-22136	- Pickup Shielded Wire	1
28	J-22116	- Muting Switch	1
29	J-22090	- Clutch Spring	1
30	72024	- Flat Washer	2
31	J-22814-A	- Selector Shaft Assembly #2	1
32	80036	- 3/4" x #3/0 Taper Pin	2
33	J-22805-A	- Selector Shaft Crank Assembly	1

Model "J" Standard Record Changer

ITEM NO.	PART NO.	DESCRIPTION	NO. USED
34	J-22816	- Drive Link Assembly	1
35	J-22055	- Trip Rod	1
36	J-22002	- Drive Gear Mounting Stud	1
37	J-22102	- Switch Mounting Bracket	1
38	J-22103	- Switch Retainer Bracket	1
39	J-22218	- A.C. Motor Switch	1
5a		- Panel	1
23a	J-22806	- Tone Arm Lifter Link Assembly	1
24a	10355	- Tone Arm Trip Shoe	1

FIG. III - Continued

1	H-20014	- Thrust Washer	5
2	J-22078	- Turntable	1
3	J-22125	- Tone Arm Cartridge	1
4	J-22284-A	- Tone Arm Swivel Assembly	1
5	H-20157	- Tone Arm Adjusting Screw	1
6	J-22068	- Tone Arm Lift Pin	1
7	J-22133	- Counter Balance Spring	1
8	H-20101	- Rubber Bumper	1
9	J-22123	- Shoulder Screw	1
10	H-20513	- Ball Race Assembly	1
11	J-22025	- Tone Arm Lifter Reset Spring	1
12	J-22117	- Thrust wafer	1
13	H-20014	- Thrust Washer (See Item 1)	5
14	J-22129	- Spring Washer	1
15	J-22131	- Switch Return Spring	1
16	72030	- Flat Washer 1/4"	2
17	J-22104	- Switch Reject Slide	1
18	J-22809	- Switch Collar & Reject Pin Assy.	1
19	J-22063	- 12" Set Rod	1
51	J-22014	- Roller	1

FIG. IV

1	J-22022	- Tone Arm Lifting Bracket	1
2	J-22038	- Tone Arm Latch & Guide Bracket	1
3	J-22806-A	- Tone Arm Lifter Link Assembly	1
4	J-22041	- 12" Set Link	1
5	J-22816-A	- Drive Link Assembly	1
6	J-22804-A	- Tone Arm Reset Link Assembly	1
7	J-22810-A	- Drive Gear Assembly	1
8	J-22078	- Turntable	1
9	J-22283-A	- Switch & Mtg. Bracket Assembly (Comp.)	1
10	J-22809	- Switch Collar & Reject Pin Assy.	1
11	J-22102	- Switch Mounting Bracket	1
12	J-22131	- Switch Return Spring	1
13	J-22103	- Switch Retainer Bracket	1

J. P. SEEBURG CORP.

MODEL J "Std." (Late)

Model "J" Standard Record Changer

ITEM NO.	PART NO.	DESCRIPTION	NO. USED	ITEM NO.	PART NO.	DESCRIPTION	NO. USED
14	J-22218-A	A.C. Motor Switch.	1	27	J-22017	Clutch Reset Pawl Spring	1
15	J-22009	Motor Assembly	1	28	10379	Spring	1
16	J-22143	Motor Idler Pulley	1	29	J-22907-A	Tone Arm Lever Assembly	1
17	J-22266	Motor Mounting Bushing	3	30	10377	Shoulder Screw	1
18	J-22144	Motor Grommet	3	31	10380	Thumb Nut	1
19	J-22099	Selector Arm Blade 12"	2	32	10356	Tone Arm Trip Dog	1
20	J-22077	Control Knob	2	33	J-22812-A	Trip Lever Assembly	1
21	J-22138-A	Selector Arm & Blade Assembly #1	1	34	H-20129	Tone Arm Booster Spring	1
22	J-22139-A	Selector Arm & Blade Assembly #2	1	35	J-22037	Tone Arm Locator Shoe	1
23	J-22096	Spindle Thrust Plate	1	36	J-22280-A	Tone Arm Locator Assembly	1
24	J-22117	Thrust Wafer	1	37	J-22104	Switch Reject Slide	1
25	J-22808-A	Spindle Bearing Housing Assembly	1	38	J-22026	Lifting Bracket Hinge Pin	1
26	J-22281-A	Spindle Bearing Assembly (Comp.)	1	39	J-22068	Tone Arm Lift Pin	1
27	J-22137	Turntable Spindle Assembly	1	40	J-22067	Tone Arm Shaft	1
28	J-22010	Drive Pinion	1	41	J-22025	Tone Arm Lifter Reset Spring	1
29	J-22106	Switch Escutcheon	1	42	J-22044	12" Set Link Spring	1
30	80035	Taper Pin	1	43	J-22121	Switch & 12" Reset Link Spring	2
				44	J-22090	Clutch Spring	1
				45	J-22058	Trip Lever Spring	1
				46	J-22094	Tone Arm Locator Spring	1
				47	J-22063	12" Set Rod	1
				48	J-22814-A	Selector Shaft Assembly #2	1
				49	J-22815-A	Selector Shaft Assembly #1	1
				50	F-1063	Selector Shaft Collar	1
				51	J-22055	Trip Rod	1
				52	J-22116	Muting Switch	1
				53	J-22805	Selector Drive Crank Assembly	1
				54	B-27129-A	12" Set Arm Assembly	1
				55	J-22803-A	Selector Shaft Drive Crank Assy.	1

FIG. V - Continued

Model "J" Standard Record Changer

ITEM NO.	PART NO.	DESCRIPTION	NO. USED
14	J-22218-A	A.C. Motor Switch.	1
15	J-22009	Motor Assembly	1
16	J-22143	Motor Idler Pulley	1
17	J-22266	Motor Mounting Bushing	3
18	J-22144	Motor Grommet	3
19	J-22099	Selector Arm Blade 12"	2
20	J-22077	Control Knob	2
21	J-22138-A	Selector Arm & Blade Assembly #1	1
22	J-22139-A	Selector Arm & Blade Assembly #2	1
23	J-22096	Spindle Thrust Plate	1
24	J-22117	Thrust Wafer	1
25	J-22808-A	Spindle Bearing Housing Assembly	1
26	J-22281-A	Spindle Bearing Assembly (Comp.)	1
27	J-22137	Turntable Spindle Assembly	1
28	J-22010	Drive Pinion	1
29	J-22106	Switch Escutcheon	1
30	80035	Taper Pin	1

FIG. IV - Continued

FIG. V

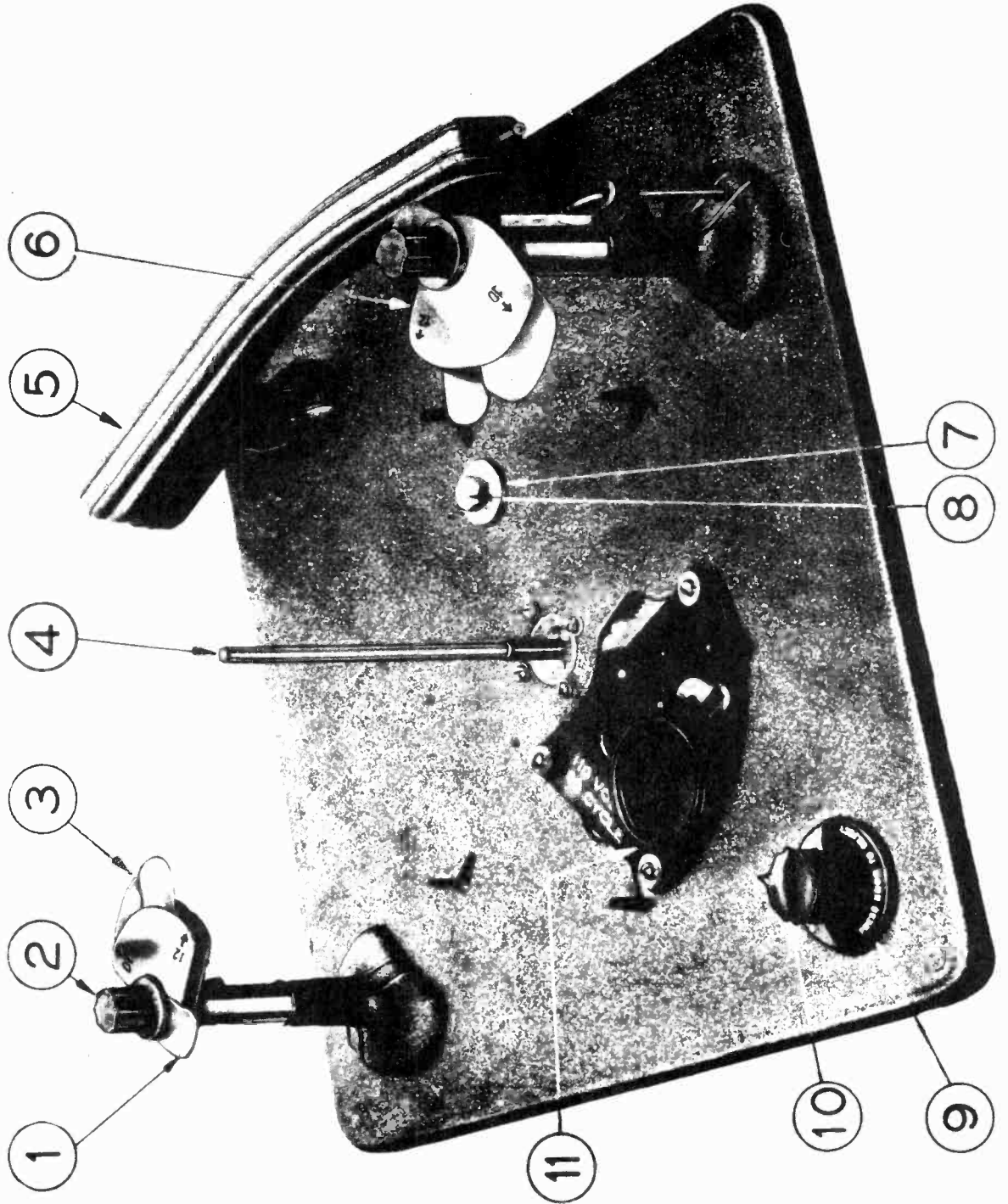
1	H-20199	Clamp Nut	4
2	H-20198	Mounting Spring (Lower)	4
3	H-20143	Mounting Spring (Upper)	4
4	78001	Grommet	2
5	J-22284-A	Tone Arm Swivel Assembly	1
6	H-20101	Rubber Bumper	1
7	J-22133	Tone Arm Counter Balance Spring	1
8	J-22226	Sleeve	2
9	H-20513	Ball Race Assembly	1
10	H-20014	Thrust Washer	5
11	J-22136	Pickup Shielded Wire	1
12	J-22125	Tone Arm Cartridge	1
13	J-22079	Tone Arm	1
14	J-22101	Tone Arm Latch Lever	1
15	72024	Flat Washer (.625 O.D.)	2
16	72021	Flat Washer (.500 O.D.)	2
17	72039	Flat Washer (.575 O.D.)	3
18	J-22129	Spring Washer (3/4")	2
19	72040	Spring Washer (7/16")	1
20	H-20065	3/16" "C" Washer	2
21	J-22021	1/8" "C" Washer	6
22	J-22152	Special Washer	3
23	J-22123	Latch Lever Shoulder Screw	1
24	80036	Taper Pin 3/4" x #3/0	2
25	J-22813-A	Tone Arm Lift Plate Assembly	1
26	J-22802-A	Engagement Clutch Cam Assembly	1

J. P. SEEBURG			
PANEL SIZE	YOUR PART NO.	MODEL	VOLTAGE FREQUENCY
14 x 14	130303	J-1A 126	115 60 CY.
14 x 14	130979	J-1A 150	115 25 CY.
14 x 14	130869	J-1A 260	115 50 CY.
14 x 14	130867	J-22867	220 60 CY.
14 x 16	B130563	JR-1B 150	115 60 CY.
14 x 16	130885	JR-1B 260	115 50 CY.
14 x 16	130884	JR-1B	220 60 CY.
14 x 16	130796	J-1C 125	115 60 CY.
14 x 16	130978	J-1C 150	115 25 CY.
14 x 16	130874	J-1C	115 50 CY.
	131535	J-1D	115 60 CY.
	CR25	J-1E	115 60 CY.
	(CR25- 14 x 16)	J-1F	117 60 CY.

MODEL J "Std."
(Late)

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FIGURE I - MODEL "J" STANDARD



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MODEL J "Std."
(Late)



FIGURE II - MODEL "J" STANDARD

MODEL J "Std."
(Late

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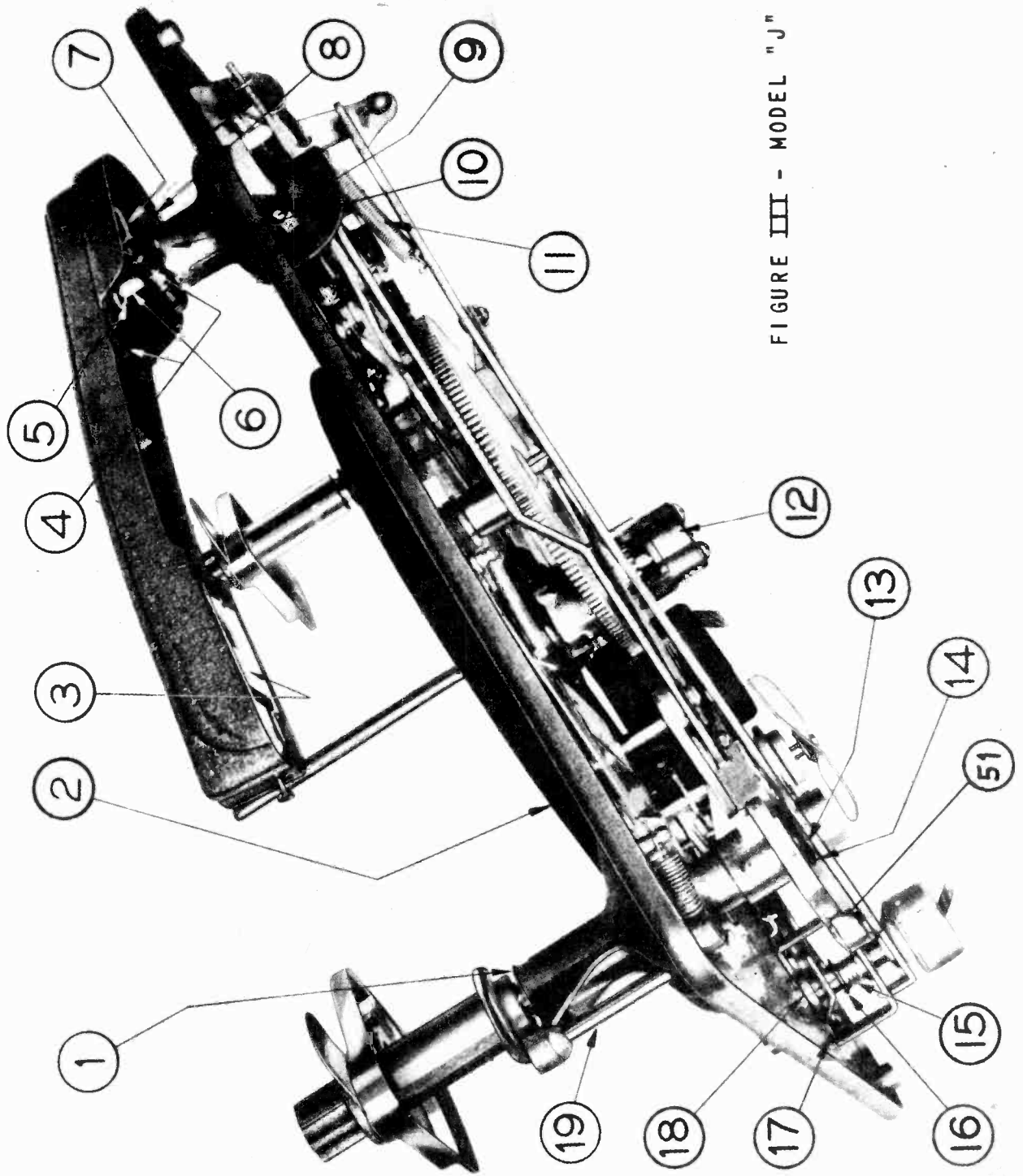


FIGURE III - MODEL "J" STANDARD

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MODEL J "Std."
(Late)

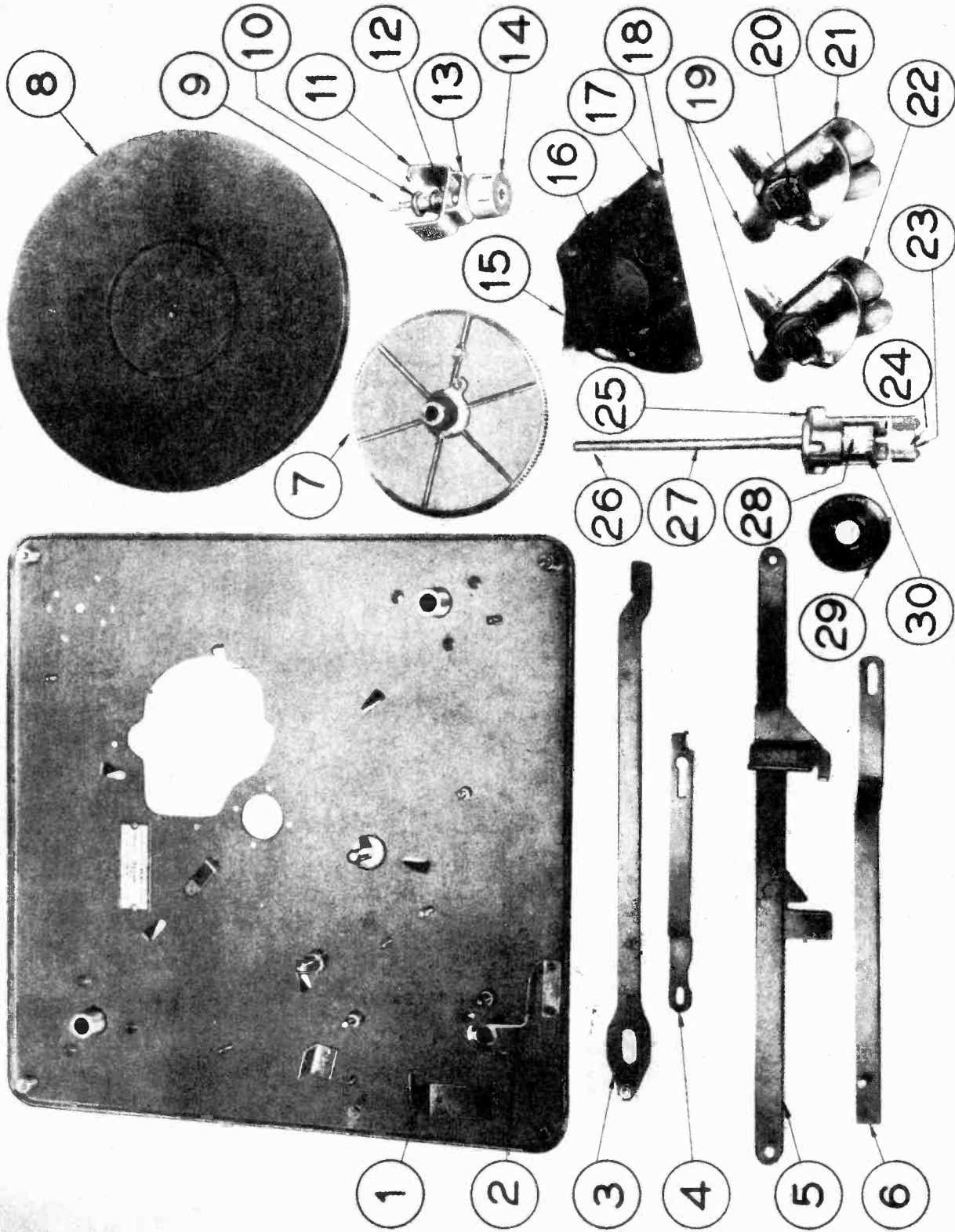


FIGURE IV - MODEL "J" STANDARD

MODEL J "Std."
(Late)

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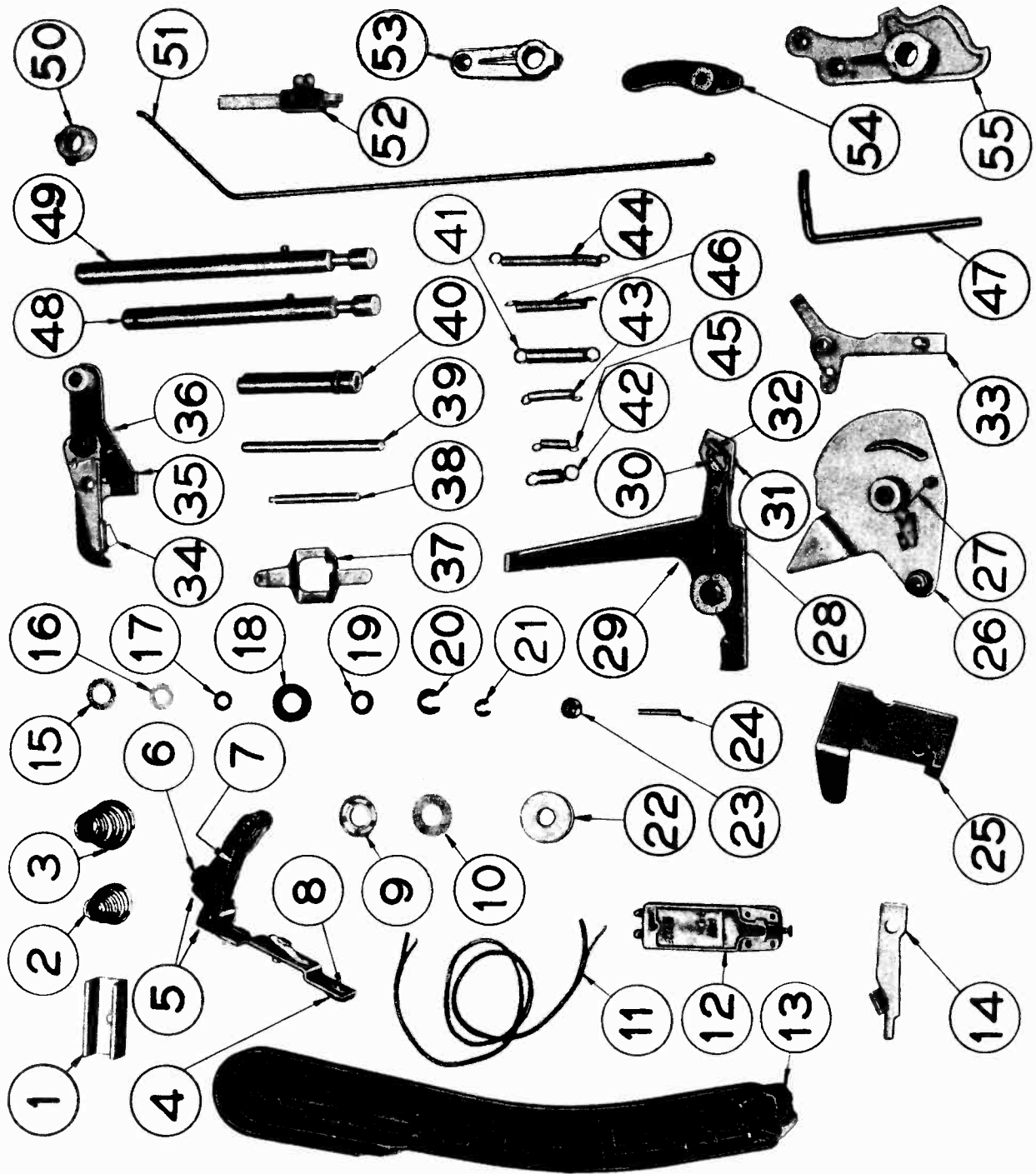


FIGURE V - MODEL "J" STANDARD

J. P. SEEBURG CORP.

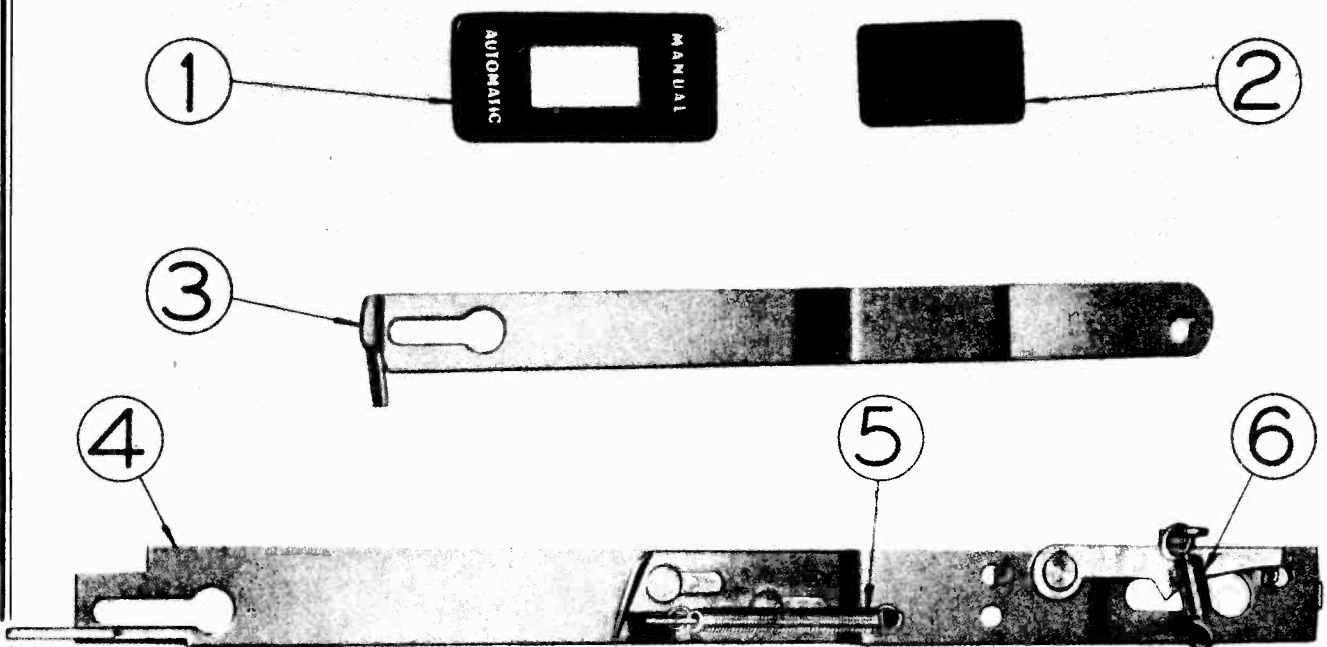
MODEL JM "Std."
(Late)SECTION II
Model "JM" StandardAdditional Service Parts for Standard Record Changer
with "Automatic-Manual" Feature.

FIG. VI

ITEM NO.	PART NO.	DESCRIPTION	NO. USED
1	J-22195	- Manual Control Escutcheon.	1
2	J-22360	- Manual Control Button.	1
* 3	J-22362	- Clutch Lock Slide.	1
4	J-22254-A	- Manual Control Slide Assembly.	1
5	J-22121	- 12" Reset Link Spring.	1
6	J-22365	- Slide Latch Spring	1
** Y	J-22387	- Manual Return Spring (Shown on FIG. VIII only).	1

Note- * Item 3 is #13 on Fig. VIII
 ** Item Y is #4 on Fig. VIII

FIGURE VI - MODEL "JM" STANDARD.



MODEL JR "Std."
(Late)

J. P. SEEBURG CORP.

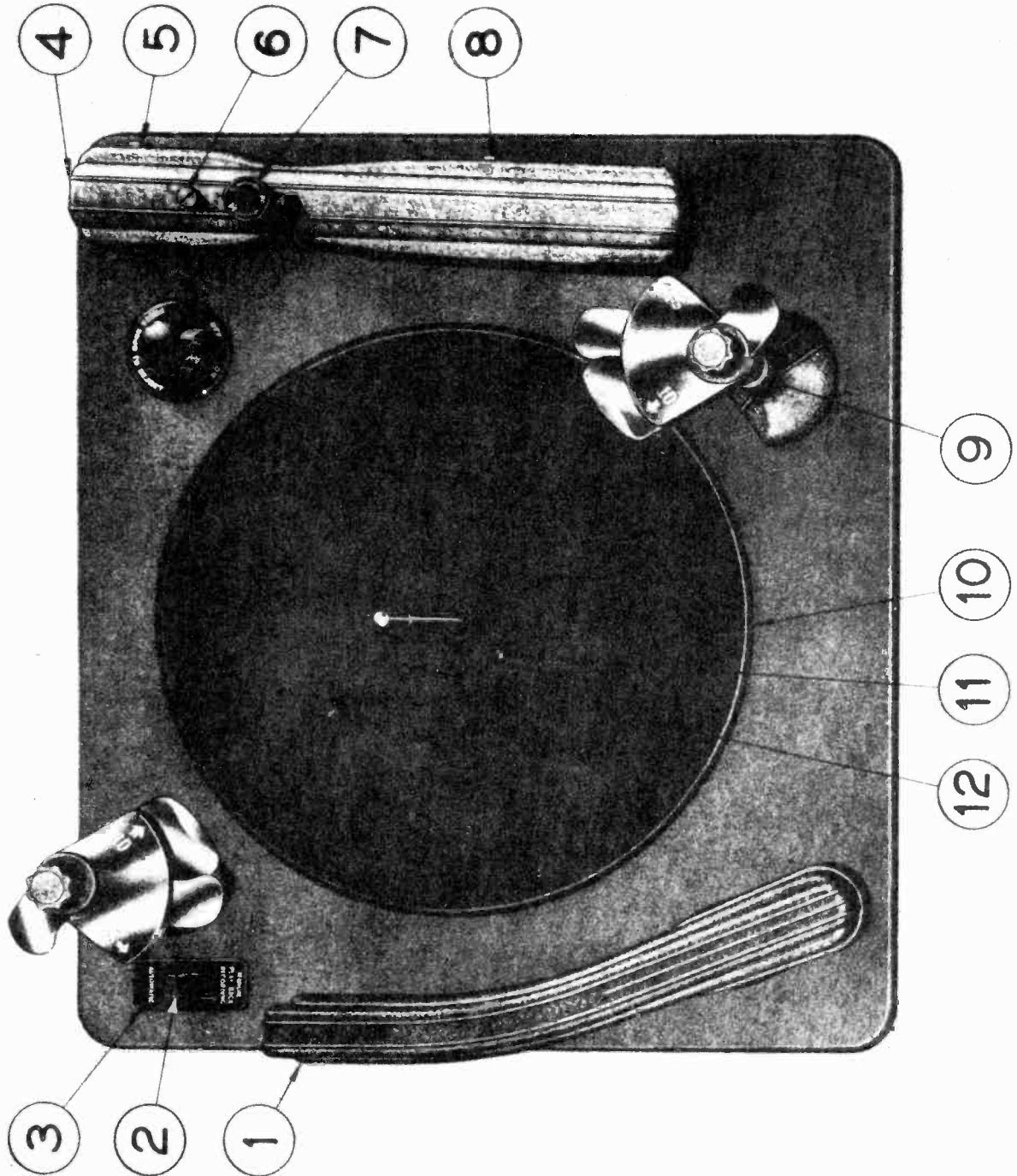
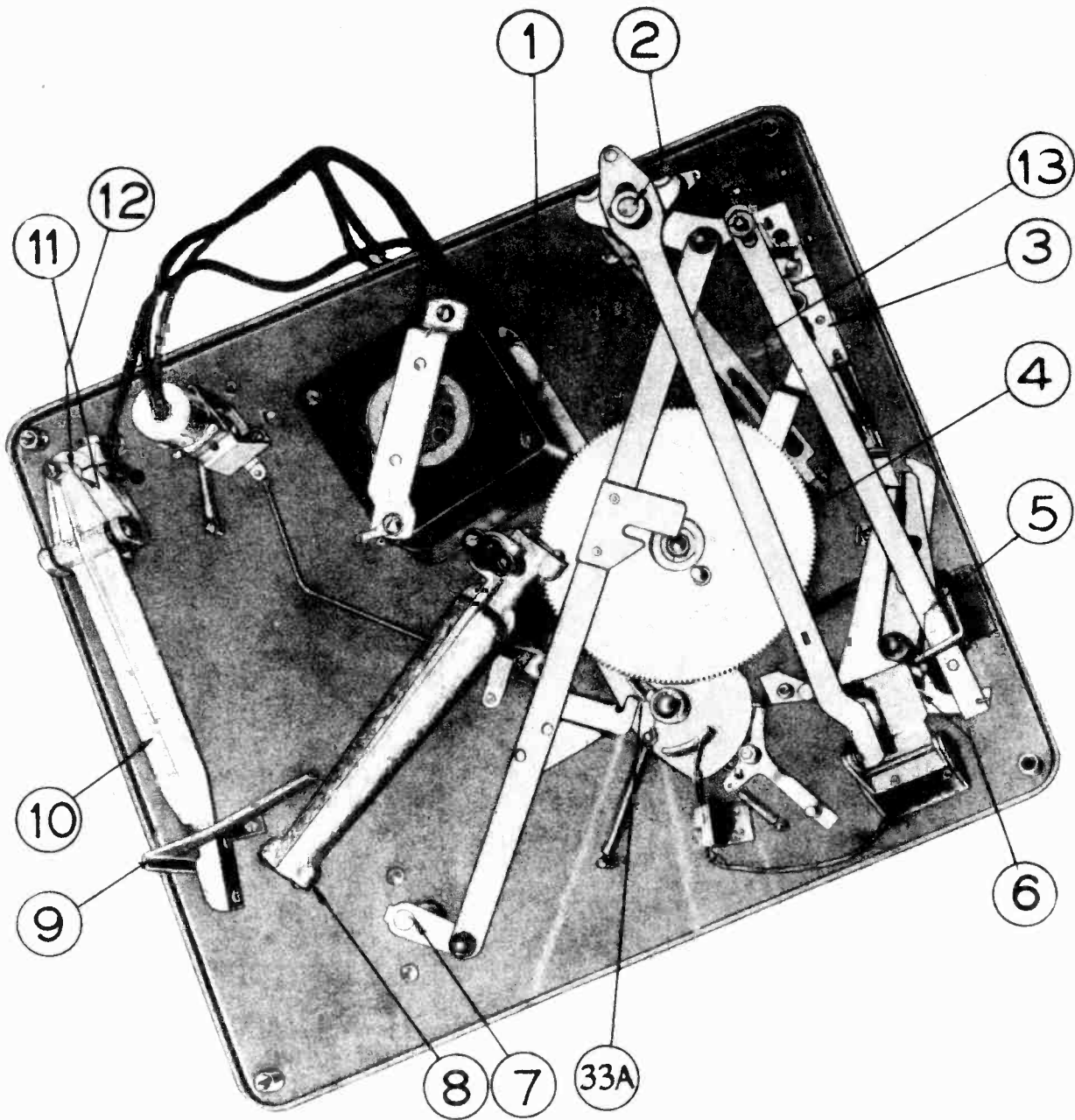


FIGURE VII - MODEL "JR" STANDARD

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MODEL JR "Std."
(Late)

FIGURE VIII - MODEL "JR" STANDARD



MODEL JR "Std."
(Late)

J. P. SEEBURG CORP.

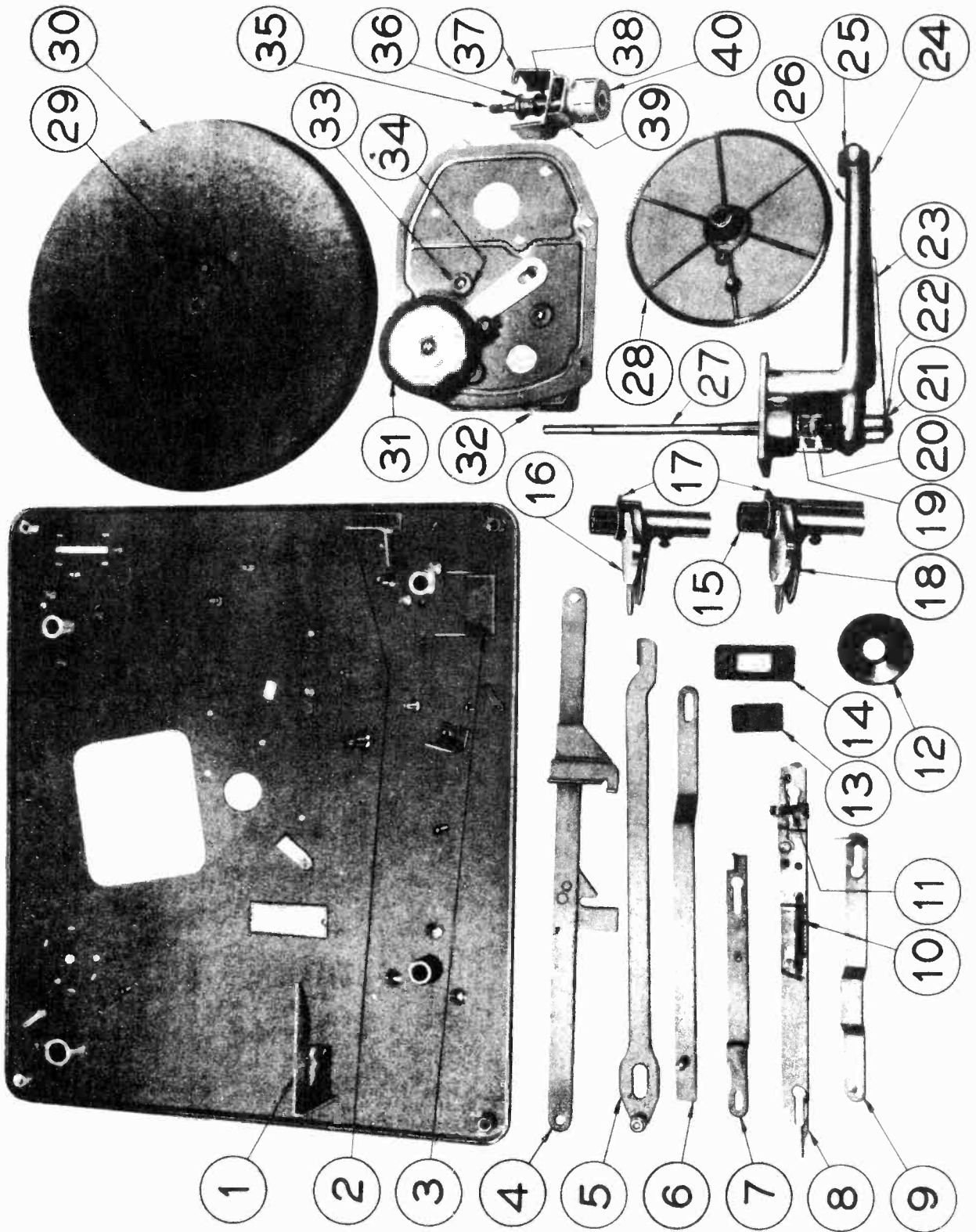


FIGURE IX - MODEL "JR" STANDARD

J. P. SEEBURG CORP.

MODEL JR "Std."
(Late)

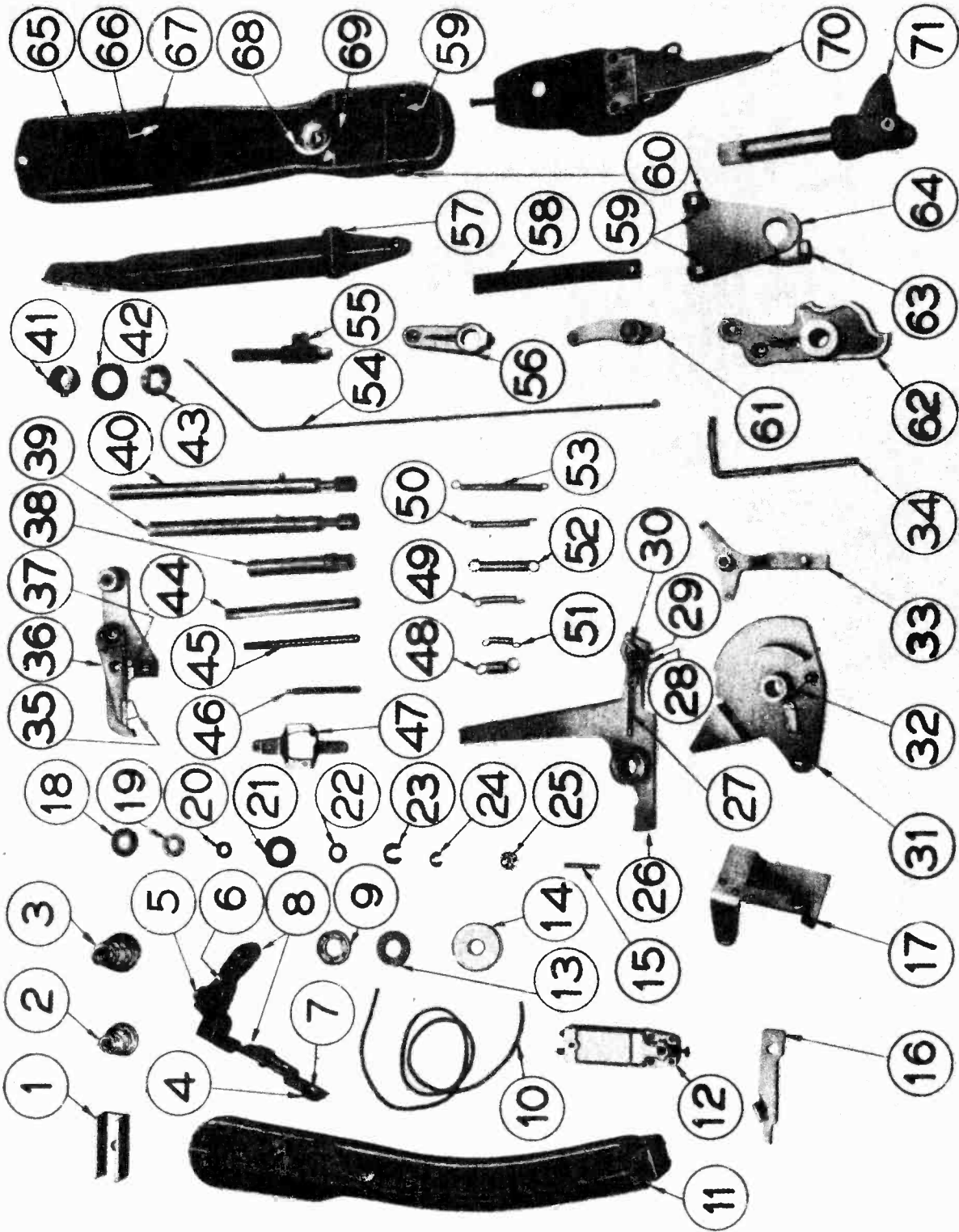


FIGURE X - MODEL "JR" STANDARD

MODEL JR "Std."
(Late)

J. P. SEEBURG CORP.

Model "JR" Standard Record Changer with Recorder Mechanism

SECTION III
MODEL "JR" STANDARD

Additional Service Parts for Standard Record Changer
with Recorder Mechanism ("Recordomatic").

FIG. VII

ITEM NO.	PART NO.	DESCRIPTION	NO. USED
1	J-22336	- Tone Arm	1
2	J-22360	- Manual Control Button	1
3	J-22361	- Manual Control Escutcheon	1
4	J-22140-A	- Recorder Arm & Pivot Assembly	1
5	J-22346	- Bearing Center Screw 1/4"-28	4
6	J-22314	- Recorder Arm Height Adjusting Screw	1
7	J-22317	- Pressure Control Knob	1
8	J-22324	- Cartridge Pivot Screw #10-48	1
9	J-22357	- Thrust Washer	2
10	J-22306	- Turntable	1
11		- Retractable Pin	1
12	J-22398-A	- Turntable Spindle Assembly	1

FIG. VIII

1	J-22303	- Motor (Complete)	1
2	J-22320	- Selector Shaft Assembly #1	1
3	J-22354-A	- Manual Control Slide Assembly	1
4	J-22387	- Spring	1
5	J-22356	- Tone Arm Shaft	1
6	J-22371	- Tone Arm Lift Pin	1
7	J-22321	- Selector Shaft Assembly #2	1
8	J-22354-A	- Spindle, Screw & Housing Assembly	1
9	J-22341	- Traverse Arm Support Bracket	1
10	J-22331-A	- Traverse Arm & Bracket Assembly	1
11	J-22350	- Recorder Arm Bracket & Sleeve Assy.	1
12	J-22326	- Traverse Lever Lifting Pin	1
13	J-22362	- Clutch Lock Slide	1
33A		- Clutch Reset Pawl	1

FIG. IX

1	J-22341	- Traverse Arm Support Bracket	1
2	J-22038	- Tone Arm Latch & Guide Bracket	1
3	J-22022	- Tone Arm Lifting Bracket	1
4	J-22316	- Drive Link Assembly	1
5	J-22306-A	- Tone Arm Lifter Link Assembly	1
6	J-22304	- Tone Arm Reset Link Assembly	1
7	J-22041	- 12" Set Link	1
8	J-22354-A	- Manual Control Slide Assembly	1
9	J-22362	- Clutch Lock Slide	1
10	J-22387	- Manual Return Spring	1
11	J-22365	- Slide Latch Spring	1
12	J-22106	- Switch Escutcheon	1
13	J-22360	- Manual Control Button	1

FIG. IX - Continued

14	J-22361	- Manual Control Escutcheon	1
15	J-22077	- Control Knob	2
16	J-22139-A	- Selector Arm & Blade Assembly #2	1
17	J-22099	- Selector Blade 12"	2
18	J-22138-A	- Selector Arm & Blade Assembly #1	1
19	J-22372	- Drive Pinion	1
20	80035	- Taper Pin	1
21	J-22340	- Thrust Plate Gasket	2
22	J-22117	- Thrust Wafer	1
23	J-22333-A	- Spindle Housing Assembly	1
24	J-22334-A	- Spindle, Screw and Housing Assy.	1
25	J-22335	- Thrust Plate	3
26	J-22332	- Feed Screw and Worm Gear Assembly	1
27	J-22298-A	- Turntable Spindle Assembly	1
28	J-22310	- Drive Gear Assembly	1
29		- Retractable Pin	1
30	J-22306	- Turntable	1
31	B-27319	- Motor Pulley	1
32	J-22303	- Motor (Complete)	1
33	J-22154	- Mounting Bushing	3
34		- Motor Grommet	3
35	J-22283-A	- Switch & Mtg. Bracket Assembly	1
36	J-22309	- Switch Collar & Reject Pin Assy.	1
37	J-22102	- Switch Mounting Bracket	1
38	J-22131	- Switch Return Spring	1
39	J-22103	- Switch Retainer Bracket	1
40	J-22218	- A.C. Motor Switch	1

FIG. X

1	H-20199	- Clamp Nut	4
2	H-20198	- Mounting Spring (Lower)	4
3	H-20143	- Mounting Spring (Upper)	4
4	78008	- Grommet	2
5	H-20101	- Rubber Bumper	1
6	J-22308	- Counter Balance Spring	1
7	J-22226	- Sleeve	2
8	J-22407	- Tone Arm Swivel Assembly	1
9	H-20513	- Ball Race Assembly	1
10	J-22136	- Pickup Shielded Wire	1
11	J-22336	- Tone Arm	1
12	J-22307	- Tone Arm Cartridge	1
13	H-20014	- Thrust Washer	3
14	J-22152	- Special Washer	1
15	80036	- Taper Pin 3/4" x #5/0	2
16	J-22101	- Tone Arm Latch Lever	1

J. P. SEEBURG CORP.

MODEL JR "Std."
(Late)

Model "JR" Standard Record Changer with Recorder Mechanism

Model "JR" Standard Record Changer with Recorder Mechanism

ITEM NO.	PART NO.	DESCRIPTION	NO. USED	ITEM NO.	PART NO.	DESCRIPTION	NO. USED
17	J-22813-A	- Tone Arm Lift Plate Assembly	1	64	J-22327	- Traverse Lever Bracket	1
18	72024	- Washer (.625 O.D.)	2	65	J-22140-A	- Recorder Arm & Pivot Assembly	1
19	72021	- Washer (.500 O.D.)	3	66	J-22324	- Cartridge Pivot Screw #10-48	1
20	72039	- Washer (.375 O.D.)	2	67	J-22349	- Lock Nut #10-48	1
21	J-22129	- Spring Washer (3/4")	1	68	J-22315	- Pressure Control Cam	1
22	72040	- Spring Washer (7/16")	2	69	J-22338	- Spring Washer	1
23	H-20065	- Snap Washer 3/16"	3	70	J-22822	- Cutter Cartridge Assembly	1
24	J-22021	- Snap Washer 1/8"	6	71	J-22830	- Recorder Arm Bracket & Sleeve Assy.	1
25	J-22123	- Latch Lever Shoulder Screw)	1				
26	J-22807-A	- Tone Arm Lever Assembly	1				
27	10379	- Trip Dog Spring	1				
28	10380	- Thumb Nut	1				
29	10377	- Shoulder Screw	1				
30	10356	- Tone Arm Trip Dog	1				
31	J-22802-A	- Engagement Clutch Cam Assembly	1				
32	J-22017	- Clutch Reset Pawl Spring	1				
33	J-22812-A	- Trip Lever Assembly	1				
34	J-22023	- 12" Set Rod	1				
35	H-20129	- Tone Arm Booster Spring	1				
36	J-22280-A	- Tone Arm Locator Assembly	1				
37	J-22037	- Tone Arm Locator Shoe	1				
38	J-22356	- Tone Arm Shaft	1				
39	J-22821	- Selector Shaft Assembly #2	1				
40	J-22820	- Selector Shaft Assembly #1	1				
41	F-1068	- Selector Shaft Collar	1				
42	J-22339	- Recorder Arm Bracket Thrust Washer	1				
43	J-22357	- Thrust Washer	2				
44	J-22326	- Traverse Lever Lifting Pin	1				
45	J-22371	- Tone Arm Lift Pin	1				
46	J-22026	- Lifting Bracket Hinge Pin	1				
47	J-22104	- Switch Reject Slide	1				
48	J-22044	- 12" Set Link Spring	1				
49	J-22121	- Switch & 12" Reset Spring	3				
50	J-22094	- Tone Arm Locator Spring	1				
51	J-22058	- Trip Lever Spring	1				
52	J-22025	- Tone Arm Lifter Reset Spring	1				
53	J-22090	- Clutch Spring	1				
54	J-22055	- Trip Rod	1				
55	J-22116	- Muting Switch	1				
56	J-22805-A	- Selector Drive Crank Assembly	1				
57	J-22832-A	- Traverse Bushing & Blade Assembly	1				
58	J-22337	- Tone Arm Pressure Blade	1				
59	J-22346	- Bearing Center Screw 1/4-28	4				
60	J-22325	- Lock Nut 1/4"-28	4				
61	B-27129-A	- 12" Set Arm Assembly	1				
62	J-22803-A	- Selector Shaft Drive Crank Assy.	1				
63	71177	- 1/4"-20 Cap Screw	1				

FIG. X - Continued

FIG. X - Continued

SECTION

- I Complete Service Parts List for Standard Model "JM" Changer.
- II Additional Service Parts List for Standard Model "JM" Record Changer.
- III Additional Service Parts List for Standard Model "JR" Record Changer Mechanism ("Record-O-Matic").
- IV Service Parts List for Non-standard Model "JM" Record Changers.
- V Service Parts List for Non-standard Model "JM" Record Changers.
- VI Service Parts List for Non-standard Model "JR" Record-O-Matics.

Particular attention is directed to Sections IV, V, VI which show the variations of non-standard Models "JM", "JM" and "JR" from the standard models (shown in Sections, I, II and III). Sections IV, V, and VI, must be referred to in order to determine the non-standard parts used in the particular model for which parts are to be ordered.

MODEL J Series (Late)
Non-Standard

J. P. SEEBURG CORP.

Model "J" Non-Standard Record Changer

SECTION IV

Model "J" Non-Standard

The following Parts Lists are variations from the Standard Model "J" Record Changer. Only special parts are listed. All Model numbers are in numerical order.

See Model "JM" for changers with manual control.
See Model "JR" for changers with recorder mechanism.

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
J-22189	- Plug Assembly	1	J-22272	- Lead & Plug Assembly	1
J-22294	- Pickup Extension	1	J-22273	- Switch (Radio-Phono)	1
			J-22274	- Shielded Lead Assembly	1
			J-22277-A	- Base Assembly	1
			10532	- Rubber Feet	4
			J-22292	- Strain Relief	1
			78002	- Rubber Grommet	1
			J-22383	- Switch Assembly	1
			82126	- 220,000 OHM 1/2 Watt 20% Resistor	1
			H-20143	- Panel Mtg. Spring (Upper) (omit from Standard List)	4
			H-20198	- Panel Mtg. Spring (Lower) (omit from Standard List)	4
			H-20199	- Special Clamp Nut (omit from Standard List)	4
				J-IE	
				Same as J-IE except:	
J-22167	- Motor Assembly (25 cycles)	1	J-22450	- Base Assembly	1
J-22190	- Turntable	1	10532	- Rubber Feet	4
			J-22142	- 2 Prong Plug (omit from Standard List)	1
				J-IF	
				Same as J-IF except:	
J-22160	- Motor Assembly (220 v. 60 cycles)	1	J-22421	- Base Assembly	1
			J-22433	- Radio Phono Escutcheon	1
			J-22278	- Turntable	1
				J-2A	
				Same as J-2A except:	
J-22189	- Plug Assembly	1	J-22382	- Tone Arm	1
J-22294	- Pickup Extension	1	J-22187	- Panel Mtg. Studs	4
			J-22186	- Panel Mtg. Spring	5
			J-22173	- Pickup Extension Lead	1
			J-22175	- Pickup Lead Plug	1
			J-22177	- Control Knob	2
			J-22231	- Motor Plug & Shield	1
J-22162	- Motor Assembly (115 v. 50 cycles)	1	H-20198	- Mtg. Spring (omit from Standard List)	1
				J-3A	
				Same as J-3A except:	

J. P. SEEBURG CORP.

MODEL J Series
(Late) Non-Standard

Model "J" Non-Standard Record Changer

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
	J-38			J-4A-150	
J-22179	- Shielded Lead	1	J-22183	- Motor Plug.	1
J-22175	- Pickup Lead Plug.	1	J-22162	- Motor Assembly (115 v. 50 cycles)	1
J-22382	- Tone Arm.	1			
J-22177	- Control Knob.	2			
J-22202	- Pickup Cartridge.	1			
J-22185	- Motor Plug.	1			
J-22186	- Mtg. Spring	5			
J-22187	- Chassis Mounting Stud	4			
H-20198	- Mtg. Spring (omit from Standard List)	1			
	J-38-150				
	Same as J-38 except:				
J-22162	- Motor Assembly (115 v. 50 cycles)	1	J-22167	- Motor Assembly (115 v. 25 cycles)	1
J-22163	- Motor Assembly (115 v. 25 cycles)	1	J-22158	- Turntable	1
J-22190	- Turntable	1			
	J-38-125				
	Same as J-38 except:				
J-22160	- Motor Assembly (220 v. 60 cycles)	1			
	J-38-260				
	Same as J-38 except:				
J-22175	- Motor Plug & Shield	1			
J-22177	- Control Knob.	2			
J-22382	- Tone Arm.	1			
J-22202	- Pickup Cartridge.	1			
J-22187	- Panel Mtg. Studs	4			
J-22186	- Panel Mtg. Spring	5			
J-22136	- Shielded Lead	1			
J-22175	- Plug.	1			
H-20198	- Mtg. Spring (omit from Standard List)	4			
	J-4A				
J-22183	- Motor Plug.	1			
J-22179	- Shielded Lead	1			
J-22175	- Pickup Lead Plug.	1			
J-22176	- Tone Arm.	1			
J-22177	- Control Knob.	1			
J-20099	- Tone Arm Cartridge.	2			
H-20100	- Cartridge Holder.	1			
J-22185	- Motor Plug.	1			

MODEL J Series
Non-Standard
(Late)

J. P. SEEBURG CORP.

Model "J" Non-Standard Record Changer		Model "J" Non-Standard Record Changer	
PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
	J-7A - Continued		J-7C - Continued
10062	- Terminal Strip	J-22348	- Switch Escutcheon
J-22186	- Chassis Spring	J-22185	- Motor Plug
80462	- 1.5 Megohm 1/4 Watt 10% Resistor	J-22186	- Panel Spring
J-22187	- Chassis Mtg. Stud	J-22187	- Mounting Studs
82939	- 500,000 OHM 1/4 Watt 10% Resistor	J-22202	- Pickup Cartridge
85002	- 50 MF Mica Condenser 20% (.00005 MFD)	H-20198	- Mtg. Springs (omit from Standard List)
H-20198	- Lower Mtg. Spring (omit from Standard List)		
	J-7A - I25		J-7C-125
	Same as J-7A except:		Same as J-7C except:
J-22167	- Motor Assembly (115 v. 25 cycles)	J-22163	- Motor Assembly (115 v. 25 cycles)
J-22158	- Turntable	J-22190	- Turntable
	J-7A-150		J-7C-150
	Same as J-7A except:		Same as J-7C except:
J-22162	- Motor Assembly (115 v. 50 cycles)	J-22162	- Motor Assembly (115 v. 50 cycles)
	J-7B		J-7C-260
	Same as J-7B except:		Same as J-7C except:
J-22230	- Pickup Lead	J-22160	- Motor Assembly (220 v. 60 cycles)
J-22175	- Pickup Lead Plug		
J-22231	- Motor Plug		J-88
	J-7B-125		J-22221
	Same as J-7B except:		- Pickup Cartridge
J-22163	- Motor Assembly (115 v. 25 cycles)	J-22255	- Motor Plug
J-22190	- Turntable	J-22256	- Pickup Extension Lead & Plug Assembly
	J-7B-150	H-20199	- Clamp Nuts (omit from Standard List)
	Same as J-7B except:		
J-22162	- Motor Assembly		J-118
	J-7C		J-22272
	Same as J-7C except:		- Lead & Plug Assembly
J-22175	- Pickup Lead Plug	J-22277-A	- Base Assembly
J-22382	- Tone Arm	J-22292	- Strain Relief
J-22179	- Pickup Lead	10532	- Rubber Feet
		78002	- Rubber Grommet

J. P. SEEBURG CORP.

MODEL J Series
Non-Standard
(Late)

Model "J" Non-Standard Record Changer

Model "J" Non-Standard Record Changer

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
J-118 - Continued					
H-20198	- Mtg. Spring (Lower) (omit from Standard (omit from Standard List)	4	J-22243	- Turntable.	1
H-20143	- Mtg. Spring (Upper) (omit from Standard List)	4	J-22235	- Pickup Cartridge	1
H-20199	- Special Nut (omit from Standard List)	4	J-22239	- Turntable Spindle.	1
J-22272	- Lead & Plug Assembly.	1	J-22240	- Friction Spring.	1
J-11C					
J-22272	- Lead & Plug Assembly.	1	J-22258	- Tone Arm	2
J-11D					
J-22177	- Control Knobs	2	J-22259	- Control Knob	2
J-22362	- Tone Arm.	1	J-22226	- Spacer (omit from Standard List)	2
J-22202	- Pickup Cartridge.	1	78001	- Grommet (omit from Standard List)	2
J-22187	- Panel Mtg. Studs.	4	J-12C		
J-22272	- Lead & Plug Assembly.	1	J-22269	- Motor Plug Assembly.	1
J-22425	- Base Assembly	1	J-22238	- Pickup Cartridge	1
10532	- Rubber Feet	4	J-22214	- Muting Switch.	1
J-22292	- Strain Relief	1	J-22205	- Shielded Lead.	1
78002	- Rubber Grommet	1	J-12D		
J-22422	- Mtg. Bushing (Special)	3	J-22269	- Motor Plug Assembly.	1
H-20105	- Spring Mtg. Studs (omit from Standard List)	3	J-22158	- Turntable.	1
J-22142	- Motor Plug (omit from Standard List)	1	J-22270	- Motor Assembly (115 v. 60 cycles)	1
H-20143	- Mtg. Spring (omit from Standard List)	4	J-22238	- Pickup Cartridge	1
H-20198	- Mtg. Spring (omit from Standard List)	4	J-22214	- Muting Switch.	1
H-20199	- Special Nut (omit from Standard List)	4	J-22205	- Shielded Lead.	1
J-12A					
J-22237	- Motor Plug Assembly.	1	J-22126	- Pickup Cartridge	1
J-22234	- Motor Assembly (115 v. 60 cycles)	1	J-22189	- Motor Plug	1
J-22243	- Turntable.	1	J-14A		
J-22235	- Pickup Cartridge	1	J-22126	- Pickup Cartridge	1
J-22258	- Tone Arm	1	J-22189	- Motor Plug	1
J-22259	- Control Knob	2	J-14B		
J-12B					
J-22237	- Motor Plug Assembly.	1	J-22189	- Motor Plug	1
J-22234	- Motor Assembly (115 v. 60 cycles)	1	J-15A		
J-22419	- Tone Arm Mtg. Bushing.	2	See Standard Model on preceding pages.		
J-16A					
J-22189	- Plug Assembly.	1			

MODEL J Series
Non-Standard
(Late)

J. P. SEEBURG CORP.

Model "J" Non-Standard Record Changer		Model "J" Non-Standard Record Changer	
PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
J-22189	- Plug Assembly.	J-22189	- Motor Plug
J-22162	- Motor Assembly (115 v. 50 cycles).		
	J-16A-150		J-23A
	J-17A		J-23B
J-22158	- Turntable.	J-22127	- Pickup Cartridge
J-22179	- Shielded Lead.	J-22427	- Motor Plug
	Special (115 v. 60 cycles) Motor	10083	- Terminal Strip
	J-17A-125	J-22428	- Pickup Extension Lead.
	Same as J-17A except:	J-22429	- Pickup Lead Plug
	Special (115 v. 25 cycles) Motor	J-22411	- Pickup Lead.
	J-19A		J-24A
J-22189	- Motor Plug	J-22158	- Turntable.
	J-19B	J-22414	- Motor Assembly
	J-22A	J-22413	- Line Cord & Plug Assembly.
	J-22A-125	J-22416	- Motor Switch Assembly.
	Same as J-22A except:		
J-22189	- Motor Plug	J-22417	- Motor Assembly (115 v. 25 cycles).
J-22396	- Tone Arm		J-25A
J-22400	- Light Trip Lever Assembly.		
J-22401	- Pickup Cartridge		
	J-22A		
J-22396	- Tone Arm	J-22432	- Pickup Cartridge
J-22400-A	- Light Weight Trip Assembly		
J-22401	- Pickup Cartridge		
J-22413	- Line Cord & Plug Assembly.		
J-22415	- Pickup Lead Assembly		
J-22416	- Switch Assembly.		
	J-22A-125		
	Same as J-22A except:		
J-22158	- Turntable.		
J-22417	- Motor Assembly (115 v. 25 cycles).		

J. P. SEEBURG CORP.

MODEL JM Series
Non-Standard
(Late)

SECTION V
Model "JM" Non-Standard
Model "JM" Record Changer with "Automatic-Manual" Control.
All Model numbers are in numerical order.

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
J-22278	- Turntable.	1	J-22162	- Motor Assembly (115 v. 50 cycles).	1
J-22179	- Shielded Lead.	1	J-22179	- Shielded Lead.	1
J-22187	- Chassis Mtg. Stud.	1	J-22175	- Pickup Lead Plug.	1
J-22175	- Pickup Lead Plug.	1	J-22396	- Tone Arm.	1
J-22382	- Control Knob.	2	J-22177	- Control Knob.	1
J-22177	- Control Knob.	1	J-22401	- Pickup Cartridge.	1
J-22202	- Tone Arm Cartridge.	2	J-22278	- Turntable.	1
J-22185	- Motor Plug.	1	J-22185	- Motor Plug.	1
J-22185	- Motor Plug.	1	J-22186	- Mtg. Spring.	5
J-22186	- Chassis Spring.	5	J-22187	- Chassis Mtg. Stud.	4
H-20198	- Mtg. Spring (omit from Standard List).	4	J-22400-A	- Trip Lever Assembly.	1
J-22186	- Panel Mtg. Spring.	5	H-20198	- Mtg. Spring (omit from Standard List).	4
J-22175	- Pickup Plug.	1	J-22189	- Motor Plug.	1
J-22177	- Control Knob.	2	J-22204	- Shielded Pickup Assembly.	1
J-22185	- Motor Plug.	1	H-20199	- Special Nut (omit from Standard List).	4
J-22187	- Panel Mtg. Stud.	4	J-22171	- Motor Assembly (Dual Voltage).	1
J-22202	- Tone Arm Cartridge.	1	J-22267	- Motor Plug.	1
J-22229	- Pickup Extension Lead.	1	J-22293	- Ground Wire & Pin Assembly.	1
J-22382	- Tone Arm.	1	J-22295	- Shielded Pickup Lead & Pin Assembly.	1
H-20198	- Lower Mtg. Spring (omit from Standard List).	4	J-22205	- Tone Arm Shielded Lead.	1
J-22179	- Shielded Lead.	1	J-22214	- Muting Switch.	1
J-22175	- Pickup Lead Plug.	1	H-20199	- Special Nut (omit from Standard List).	4
J-22382	- Tone Arm.	1	J-22299	- Manual Escutcheon.	1
J-22177	- Control Knob.	2	J-22175	- Pickup Lead Plug.	1
J-22202	- Pickup Cartridge.	1	J-22382	- Tone Arm.	1
J-22185	- Motor Plug.	1	J-22179	- Pickup Lead.	1
J-22186	- Mtg. Spring.	5	J-22348	- Switch Escutcheon.	1
J-22187	- Chassis Mtg. Stud.	4			
H-20198	- Chassis Mtg. Spring (omit from Standard List)	4			

MODEL JM Series
Non-Standard
(Late)

J. P. SEEBURG CORP.

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
Model "JM" Non-Standard Record Changer					
J-22185	Motor Plug	1	J-22167	Motor Assembly (115 v. 25 cycles)	1
J-22186	Panel Spring	5	J-22158	Turntable	1
J-22187	Mounting Studs	4	JM-9A See Standard Model		
J-22202	Pickup Cartridge	1	JM-9A-125 Same as JM-9A except:		
J-22278	Turntable	1	- Motor Assembly (115 v. 25 cycles)		
H-20198	Lower Mounting Spring (omit from Standard List)	4	- Turntable		
JM-7E - Continued					
JM-7E-125					
Same as JM-7E except:					
J-22163	Motor Assembly (115 v. 25 cycles)	1	JM-9B		
JM-7E-150					
Same as JM-7E except:					
J-22162	Motor Assembly (115 v. 50 cycles)	1	JM-13B		
JM-7E-260					
Same as JM-7E except:					
J-22160	Motor Assembly (220 v. 60 cycles)	1	- Tone Arm		
JM-7G					
J-22230	Pickup Lead	1	J-22246	Pickup Cartridge	1
J-22175	Pickup Lead Plug	1	J-22252	Turntable	1
J-22231	Motor Plug	1	J-22243	Turntable	1
J-22278	Turntable	1	J-22234	Motor Assembly	1
JM-7G-125					
Same as JM-7G except:					
J-22163	Motor Assembly (115 v. 25 cycles)	1	J-22283	Switch Assembly	1
JM-7G-150					
Same as JM-7G except:					
J-22162	Motor Assembly (115 v. 50 cycles)	1	J-22249	Drive Gear Assembly	1
JM-21A					
- Motor Plug					
- Panel Mtg. Studs (omit from Standard List)					
- Mtg. Spring (omit from Standard List)					
- Mtg. Spring (omit from Standard List)					
- Special Nut (omit from Standard List)					
JM-7G					
Same as JM-7G except:					
J-22162	Motor Assembly (115 v. 50 cycles)	1	J-22263	Drive Gear Mtg. Stud	1
JM-21A					
- Motor Plug					
- Panel Mtg. Studs (omit from Standard List)					
- Mtg. Spring (omit from Standard List)					
- Mtg. Spring (omit from Standard List)					
- Special Nut (omit from Standard List)					

J. P. SEEBURG CORP.

MODEL JR Series
Non-Standard
(Late)

SECTION VI

Model "JR" Non-Standard

The following Parts Lists are variations from the Standard Model "JR" Recordomatic Record Changer with Recorder Mechanism.

All Model numbers are in numerical order.

Model "JR" Non-Standard Record Changer with Recorder Mechanism

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
J-22189	- Motor Lead Plug.	1	J-22179	- Shielded Lead.	1
J-22224	- Cutter Cartridge	1	J-22175	- Pickup Lead Plug	1
J-22294	- Pickup Extension Lead.	1	J-22396	- Tone Arm	1
			J-22177	- Control Knob	2
			J-22401	- Tone Arm Cartridge	1
			J-22827	- Cutter Cartridge	1
			J-22203	- Cutter Cartridge Plug.	1
			J-22186	- Mtg. Spring.	5
			J-22187	- Chassis Mtg. Stud.	4
			J-22185	- Motor Plug	1
			J-22373	- Manual Control Escutcheon.	1
			J-22217	- Switch Knob.	1
			J-22348	- Switch Escutcheon.	1
			J-22379	- Guide Plate (Traverse Lever)	1
J-22352	- Motor Assembly (115 v. 50 cycles).	1	J-22400-A	- Trip Lever Assembly.	1
			H-20198	- Mtg. Spring (omit from Standard List)	4
J-22350	- Motor Assembly (220 v. 60 cycles).	1			
J-22226	- Cutter Cartridge	1	J-22183	- Motor Plug Assembly.	1
J-22193	- Cutter Lead Plug	1	J-22824	- Cutter Cartridge	1
			J-22352	- Motor Assembly (115 v. 50 cycles).	1
J-22179	- Shielded Pickup Lead	1			
J-22384	- Recorder Arm	1			
J-22175	- Pickup Lead Plug	1			
J-22382	- Tone Arm	1			
J-22177	- Control Knobs.	2			
J-22202	- Tone Arm Cartridge	1			
J-22827	- Cutter Cartridge	1			
J-22203	- Cutter Cartridge Plug.	1			
J-22186	- Chassis Spring.	5			
J-22187	- Chassis Mtg. Stud.	4			
J-22185	- Motor Plug	1			
J-22373	- Manual Control Escutcheon.	1			
J-22217	- Switch Knob.	1			
J-22348	- Switch Escutcheon.	1			
J-22218	- Switch Assembly.	1			
J-22379	- Guide Plate (Traverse Arm Rest).	1			
H-20198	- Mtg. Spring (Lower) (omit from Standard List)	4			

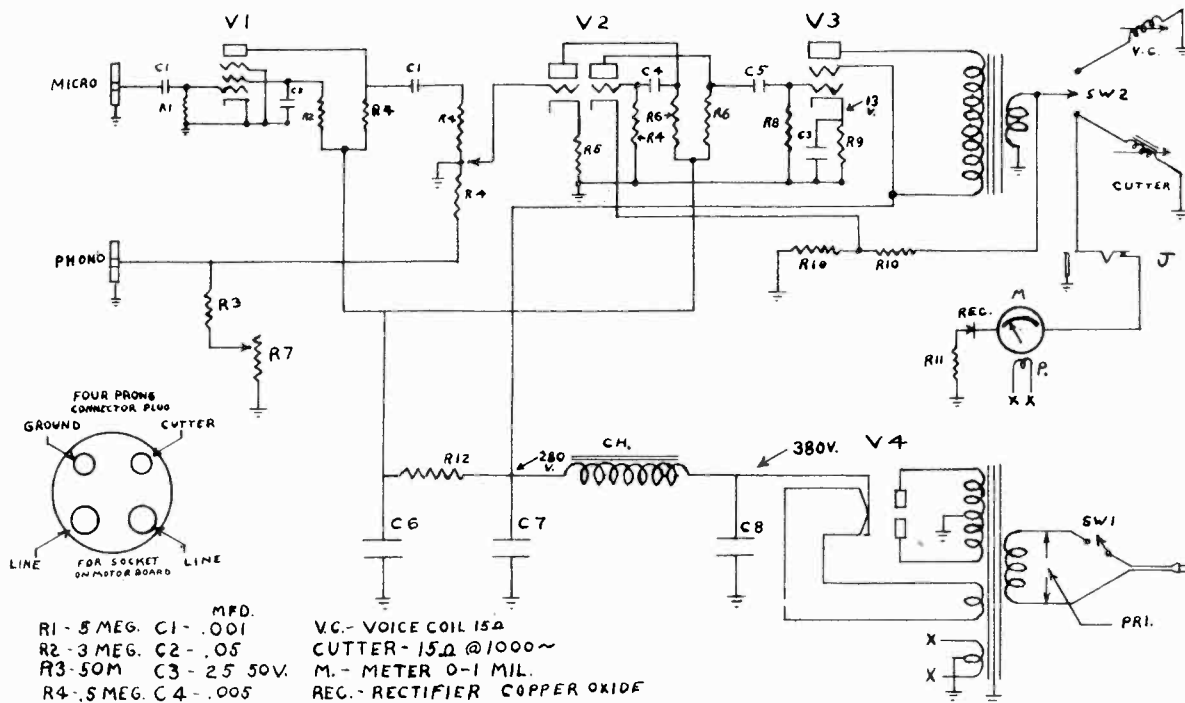
MODEL JR Series
Non-Standard
(Late)

J. P. SEEBURG CORP.

PART NO.	DESCRIPTION	NO. USED	PART NO.	DESCRIPTION	NO. USED
Model "JR" Non-Standard Record Changer with Recorder Mechanism					
JR-70					
J-22179	- Shield Lead	1	J-22179	- Pickup Lead	1
J-22384	- Recorder Arm	1	J-22175	- Pickup Lead Plug	1
JR-70 - Continued					
J-22175	- Pickup Lead Plug	1	J-22382	- Tone Arm	1
J-22382	- Tone Arm	1	J-22177	- Control Knob	2
J-22202	- Pickup Cartridge	1	J-22384	- Recorder Arm	1
J-22827	- Cutter Cartridge	1	J-22202	- Tone Arm Cartridge	1
J-22203	- Cutter Cartridge Plug	1	J-22827	- Cutter Cartridge	1
J-22186	- Chassis Mtg. Spring	5	J-22203	- Cutter Cartridge Plug	1
J-22187	- Chassis Mtg. Stud	4	J-22186	- Chassis Mtg. Spring	5
J-22185	- Motor Plug	1	J-22187	- Chassis Mtg. Stud	4
J-22217	- Switch Knob	1	J-22185	- Motor Plug	1
J-22218	- Switch Assembly	1	J-22348	- Switch Escutcheon	1
J-22379	- Traverse Arm Guide Plate	1	J-22373	- Manual Control Escutcheon	1
H-20198	- Lower Mtg. Spring (omit from Standard List)	4	J-22217	- Switch Knob	1
JR-8A					
J-22206	- Tone Arm	1	J-22379	- Guide Plate	1
J-22205	- Pickup Lead	1	H-20198	- Lower Mtg. Spring (omit from Standard List)	4
J-22826	- Cutter Cartridge	1	JR-11A-150		
J-22383	- Switch Assembly	1	Same as JR-11A except:		
J-22217	- Switch Knob	1	J-22552	- Motor Assembly (115 v. 50 cycles)	1
J-22208	- Traverse Arm Support Bracket	1	JR-13A		
J-22214	- Muting Switch	1	J-22246	- Tone Arm	1
J-22209	- Pickup Arm Locating Bushing	1	J-22252	- Pickup Cartridge	1
J-22210	- Locating Pin	1	J-22383	- Switch Assembly	1
J-22211	- Pickup Extension Shaft	1	J-22177	- Control Knob	2
J-22213	- Extension Shaft Mtg. Bracket	1	J-22189	- Motor Plug	1
J-22212	- Locating Bushing Spring	1	J-22828	- Cutter Cartridge	1
J-22385	- Cable Clamp	1	J-22248	- Recorder Arm	1
H-20199	- Special Nuts (omit from Standard List)	4	J-22249	- Drive Gear Assembly	1
JR-10A					
J-22233	- Motor Lead Plug	1	J-22263	- Drive Gear Stud	1
J-22232	- Pickup Lead	1	JR-15B		
JR-10A-150					
Same as JR-10A except:					
J-22352	- Motor Assembly (115 v. 50 cycles)	1	J-22826	- Cutter Cartridge	1
JR-10A-260					
Same as JR-10A except:					
J-22350	- Motor Assembly (220 v. 60 cycles)	1	J-22829	- Cutter Cartridge	1
JR-18A					
J-22233	- Motor Lead Plug	1	J-22189	- Motor Lead Plug	1
J-22232	- Pickup Lead	1	J-22829	- Cutter Cartridge	1
JR-20A					
J-22352	- Motor Assembly (115 v. 50 cycles)	1	J-22408	- Pickup Cartridge	1
JR-10A-260					
Same as JR-10A except:					
J-22350	- Motor Assembly (220 v. 60 cycles)	1	J-22409	- Motor Plug	1
			J-22798	- Cutter Cartridge	1
			J-22410	- Cutter & Pickup Plug	1
			J-22411	- Shielded Lead	1
			74001	- Terminal	1
			10083	- Terminal Strip	1

MODEL 1-52
MODEL 100

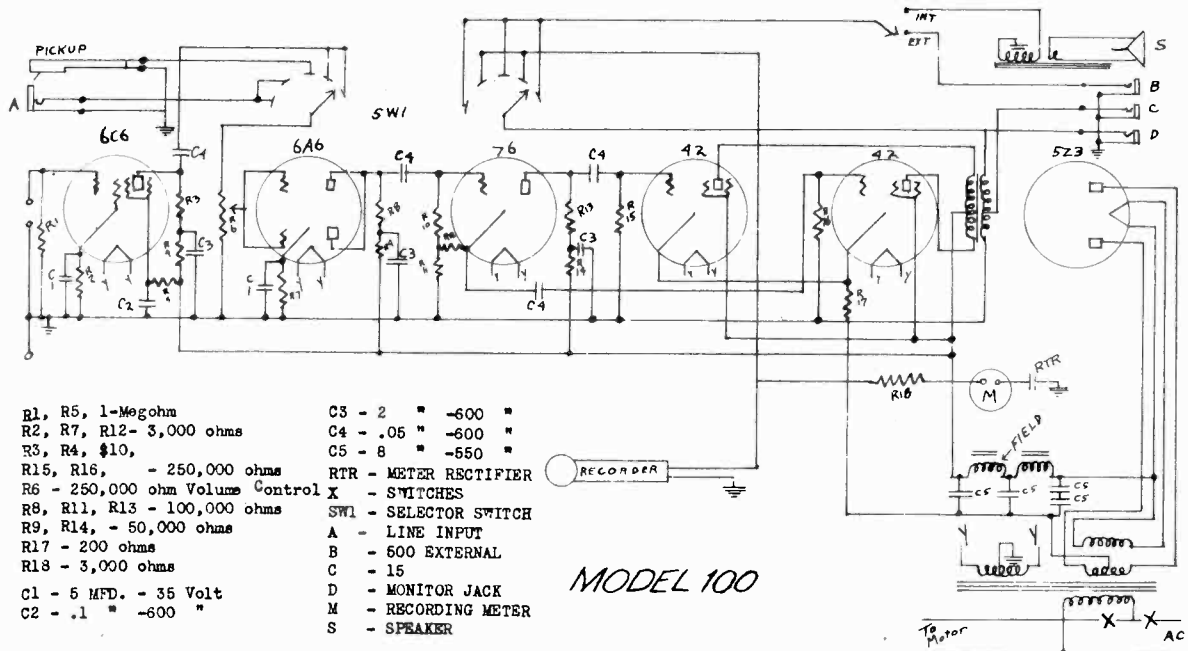
SPEAK-O-PHONE RECORDING & EQUIP. CO.



- R1 - 5 MEG. C1 - .001 MFD.
- R2 - 3 MEG. C2 - .05
- R3 - 50M C3 - 25 50V.
- R4 - 5 MEG. C4 - .005
- R5 - 3 M C5 - .02
- R6 - 1 MEG. C6 - 4 450V.
- R7 - 1 MEG. C7 - 8 450V.
- R8 - 25 MEG. C8 - 12 450V.
- R9 - 250Ω 1W.
- R10 - 6 M
- R11 - 1 M
- R12 - 20 M

- V1 - 6SJ7
- V2 - 6C8G
- V3 - 6V6
- V4 - 5Z4
- SW1 - S.P.S.T. LINE SWITCH
- SW2 - S.P.R.T. V.C. SWITCH
- J - CLOSED CIRCUIT JACK
- V.C. - VOICE COIL 15Ω
- CUTTER - 15Ω @ 1000~
- M. - METER 0-1 MIL.
- REC. - RECTIFIER COPPER OXIDE
- P - PILOT LAMP IN METER
- PRI. - POWER TRANS. PRIMARY 110-120 VOLTS 50-60 CYCLE
- CH. - SPEAKER FIELD 1500Ω

SPEAK-O-PHONE
MODEL-1-52
RECORDER
CIRCUIT DIAGRAM
DESIGNED BY I.J.A.
DRAWN BY I.J.A. 11/20/39
APPROVED BY C.A.A.

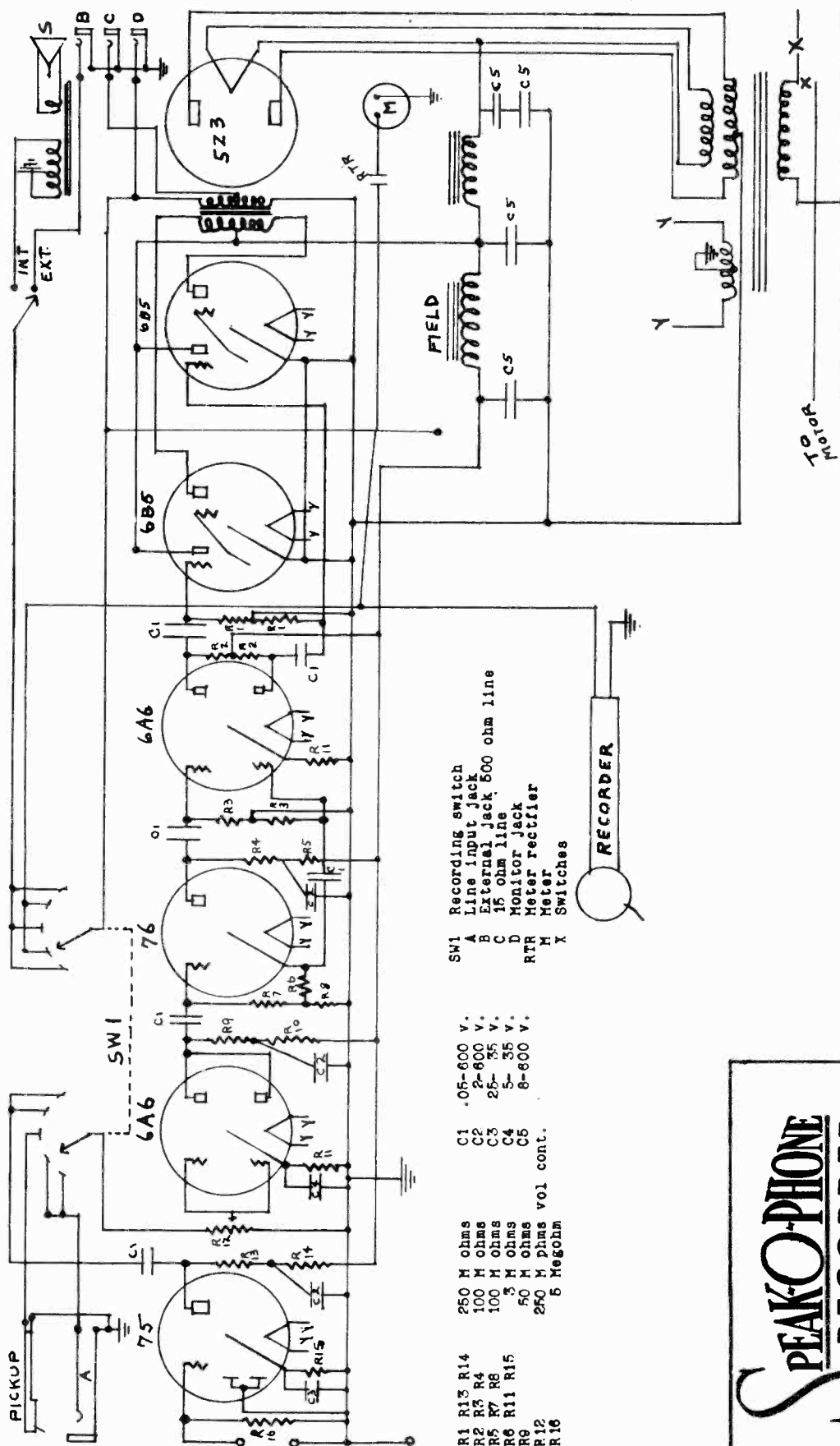


- R1, R5, 1-Megohm
- R2, R7, R12 - 3,000 ohms
- R3, R4, \$10,
- R15, R16, - 250,000 ohms
- R6 - 250,000 ohm Volume Control
- R8, R11, R13 - 100,000 ohms
- R9, R14, - 50,000 ohms
- R17 - 200 ohms
- R18 - 3,000 ohms
- C1 - 5 MFD. - 35 Volt
- C2 - .1 " -600 "
- C3 - 2 " -600 "
- C4 - .05 " -600 "
- C5 - 8 " -550 "
- RTR - METER RECTIFIER
- X - SWITCHES
- SW1 - SELECTOR SWITCH
- A - LINE INPUT
- B - 600 EXTERNAL
- C - 15
- D - MONITOR JACK
- M - RECORDING METER
- S - SPEAKER

MODEL 100

SPEAK-O-PHONE RECORDING & EQUIP. CO.

MODEL 100A



- R1 R13 R14
- R2 R5 R4
- R3 R7 R8
- R4 R11 R15
- R5
- R6
- R7
- R8
- R9
- R10
- R11
- R12
- R16
- C1
- C2
- C3
- C4
- C5
- 250 M ohms
- 100 M ohms
- 100 M ohms
- 3 M ohms
- 50 M ohms
- 250 M ohms vol cont.
- 6 Megohm
- .05-600 V.
- 2-600 V.
- 25-35 V.
- 5-35 V.
- 8-600 V.
- SW1 Recording switch
- A Line input jack
- B External jack 500 ohm line
- C 15 ohm line
- D Monitor Jack
- RTR Meter rectifier
- M Meter
- X Switches

SPEAK-O-PHONE
RECORDER

MODEL 100A

SPEAK-O-PHONE RECORDING AND EQUIPMENT CO.
NEW YORK U.S.A.

Engineering Data for

Stromberg-Carlson No. 2 Type Multi-Record Phonograph Unit

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY
Rochester, New York

The No. 2 Type Multi-Record Phonograph is made in a compact, self-contained unit of a convenient shape to fit into a limited space provided in the top portion of a console radio cabinet or into a special small phonograph cabinet. This allows the complete unit to be removed from the cabinet, and placed on a bench or table where all of the operating parts will be completely accessible for servicing purposes.

Removal of Complete No. 2 Unit from Cabinet.

Proceed as follows:

- (a) Disconnect the cabinet lid, lift stay so as to allow this lid to be turned back providing full accessibility to the phonograph compartment. This can be done from rear of the console radio cabinet by first removing a cotter pin and forcing the lift stay connecting rod from pivot stud, taking care that the counterbalance spring lug does not snap back and pinch the finger.
- (b) Remove the six phonograph chassis mounting screws, located at points marked "A" and "B", Fig. 1.
- (c) Remove turntable by lifting it off the center spindle.
- (d) Disconnect the two cords which connect the No. 2 Phonograph Unit to the radio chassis by pulling out the plug and cord tips from the jacks and receptacle on the back of chassis.
- (e) Slide the No. 2 Phonograph Chassis toward the rear of the cabinet as far as it will go, so as to provide an opening between the front of this chassis and the front inside of the cabinet.
- (f) Now, take two pieces of woven webbing or heavy wrapping cord, pass completely around the No. 2 Phonograph Chassis, one near each end, and tie so as to provide two slings for lifting chassis from the cabinet.
- (g) Lift No. 2 chassis out of cabinet, taking care not to mar the inside finish of the cabinet. Placing several strips of cardboard or heavy paper at front, back, and both ends so as to cover the finished wood surfaces will provide protection against marring.
- (h) Rest the No. 2 Phonograph Chassis on blocks of wood about 7 inches high, located at both ends, put on a level bench or table, so as to give accessibility to working parts. A more satisfactory mounting for servicing is comprised of four metal legs (Stromberg-Carlson SK-3169) designed to be inserted into the four chassis screw mounting holes marked "A", Fig. 1. It will be necessary to push out the rubber bushings that are in these four holes to allow these metal legs to be inserted in the metal frame of the chassis.
- (i) If the servicing operations require accessibility to the top mechanisms, as shown in Fig. 4, it will be necessary to remove the walnut finished motor board and brown enamel finished metal plate as described in Sections 22 and 23.
- (j) To replace the No. 2 Phonograph Unit in the cabinet, follow the above instructions in reverse order, being careful not to mar the finish on the inside of the cabinet when lowering the unit in place.

Servicing Instructions

Outside of damage resulting from rough handling in shipment or in other transportation, this No. 2 Multi-Record Phonograph should require only occasional lubrication service (See Section 26.) See Section 27 for Shipping Precautions which should be followed when making re-shipment or local delivery. In case the operation is faulty from any cause, consult the following detailed suggestions and instructions:

1. Shifting Arm Falls to Pick Up Record.

- (a) Transfer Finger No. 52, Fig. 5, does not fall against its stop, due to binding.
Clean foreign matter or excessive oil from sides of transfer finger by slipping a strip of paper between the finger and the two adjacent sides of its mounting.
- (b) Rubber cam No. 56, Fig. 5, is not pulled back because of weak cam return spring No. 54, Fig. 5.
When the rubber cam is turned forward and released, it should spring back against its stop. If this does not happen the spring tension should be increased by cutting off two or three turns at one end of the spring.
- (c) Transfer Finger No. 52, Fig. 5, does not reach surface of top record.
See Section 18 for remedy.

2. Shifting Arm Falls to Carry Record over to Turntable.

- (a) Transfer Finger No. 52, Fig. 5, releases record part way over.
 1. Rubber cam No. 56, Fig. 5, interfering.
See Section 1-B for remedy.
 2. Adjusting Screws No. 47, Fig. 4, in record shifting head No. 48, Fig. 4, loose.
Tighten securely.
 3. Rail cam No. 45, Fig. 4, set too high.
Lower by using adjusting screws in back of chassis frame.
- (b) Height of turntable spindle No. 18, Fig. 2, is incorrect. Test height. It should be about $\frac{3}{8}$ inch lower than the record slides No. 4, Fig. 1.
- (c) Record is very badly warped.
Straighten records with a warm, flat metal plate.

3. Shifting Arm Transfer Finger Releases Record about One Inch from Turntable Spindle.

- (a) Pickup Head No. 13, Fig. 2, is too high or too low.
See Section 4 for remedy.
- (b) Record is not resting properly on tongue No. 15, Fig. 2, of pickup head No. 13, Fig. 2.
- (c) Pickup shoe No. 14, Fig. 2, too low, not allowing record to pass underneath, or too high allowing record to tilt too much. In this latter case the center hole in record will drop away from the transfer finger No. 52, Fig. 5.
Adjust shoe No. 14 so record will balance when resting on tongue and turntable spindle.

STROMBERG-CARLSON TEL. MFG. CO.

MODEL 2

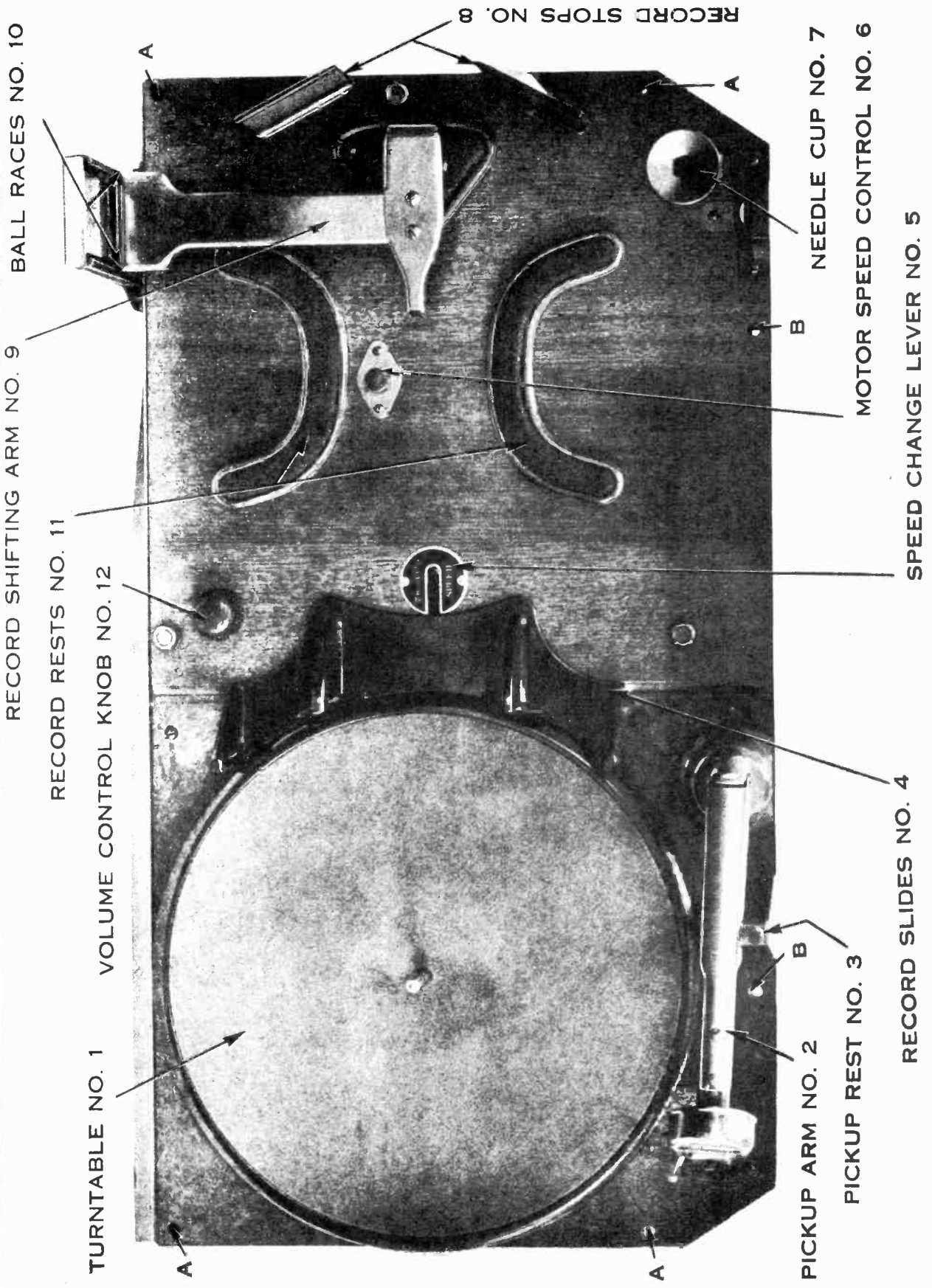


Fig. 1

MODEL 2

STROMBERG-CARLSON TEL. MFG. CO.

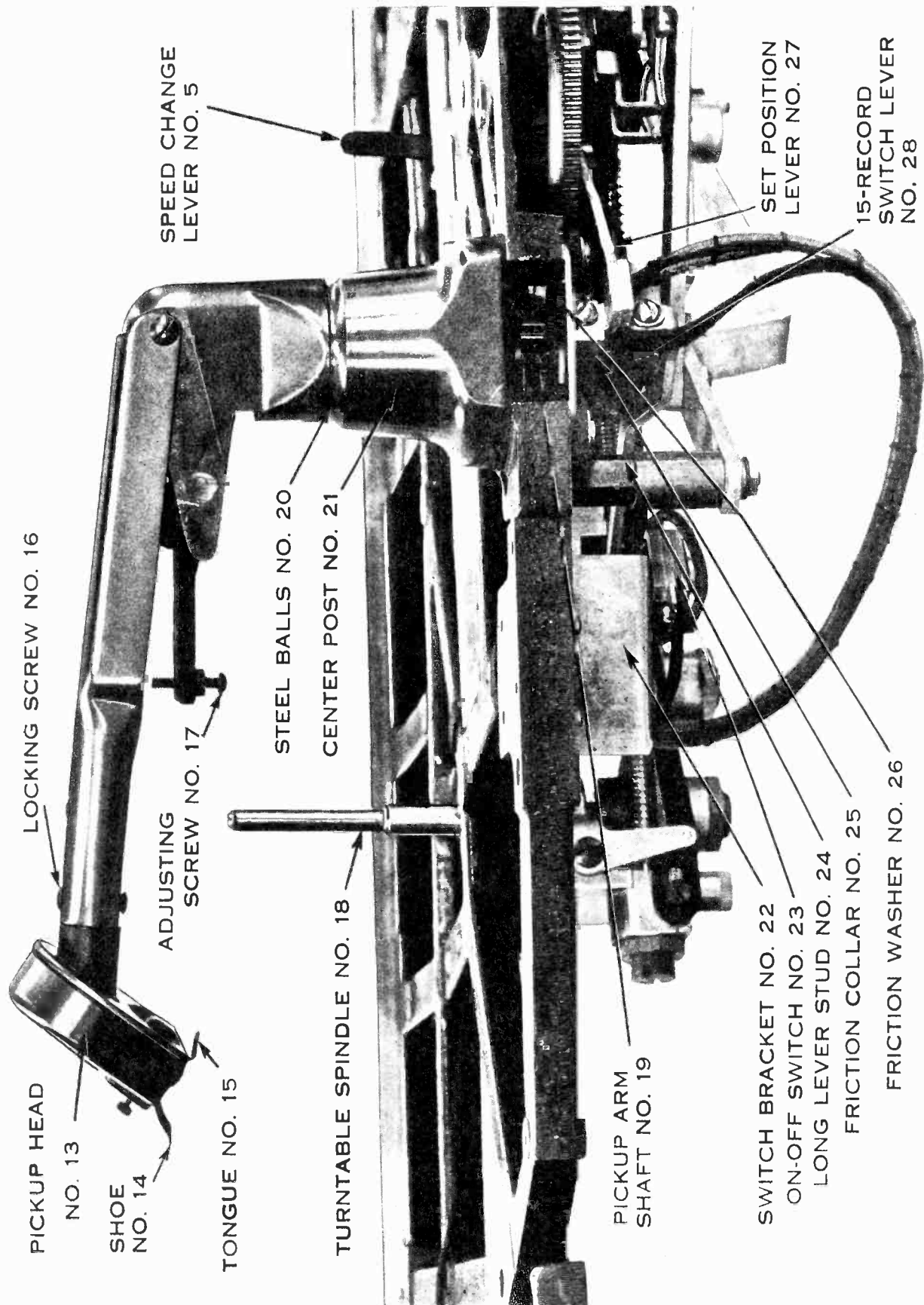


Fig. 2

- 4. Pickup Head Too High or Too Low.**
If the record does not pass over turntable spindle No. 18, Fig. 2, and slides over tongue No. 15, Fig. 2, and under shoe No. 14, Fig. 2, adjust by means of screw No. 17, Fig. 2. The pickup head should be adjusted so that record will pass under its outer edge without striking.
Use a flat, true record for this test.
- 5. Pickup Head Drops Outside Record or Inside Playing Grooves.**
- (a) Locking Screw No. 16, Fig. 2, in top of pickup head is loose or missing. Tighten.
 - (b) Record does not rest on tongue No. 15, Fig. 2.
 - (c) Set Position Lever No. 27, Fig. 2, has been bent.
Replace with new lever, or correct by removing and bending in a bench vise. Bend "in" if needle drops outside record, or "out" if needle drops inside too far.
- 6. Needle Drops in Proper Position But Does Not Carry Into Playing Grooves.**
- (a) Pickup Arm No. 2, Fig. 1, is binding.
Test to be sure pickup arm is not binding. There should be a slight up-and-down play on balls No. 20, Fig. 2, of center post No. 21, Fig. 2. This play can be obtained by adjusting the friction collar No. 25, Fig. 2.
 - (b) Tension too light on springs No. 79 and No. 80, Fig. 7.
Adjust separately for 10-inch and 12-inch records.
- 7. Needle Drops in Proper Position But Jumps Over Several Playing Grooves.**
Springs No. 79 and No. 80, Fig. 7, tension too strong.
Adjust separately for 10-inch and 12-inch records.
- 8. Trip Does Not Operate at Completion of Record.**
- (a) Stop grooves in record are larger than $6\frac{3}{4}$ inches in diameter.
(This is not standard or customary recording practice.)
 - (b) Trip Pawl No. 63, Fig. 6, sticking.
Clean. Pawl should fall down from slightest lift.
 - (c) Pawl Collar No. 57, Fig. 6, on trip shaft loose and working forward on shaft.
Set this collar so that pawl tip just clears top of threads after pickup arm has been brought to outside of record or to the Pickup rest No. 3, Fig. 1. Move arm out slowly when setting.
 - (d) Too much end play in trip worm shaft No. 59, Fig. 6.
Test to make sure shaft end play is slight.
Clean thoroughly.
- 9. Trip Operates Before Completion of Record.**
Loosen screws in shaft collar No. 73, Fig. 6, and worm No. 67, Fig. 6. Advance trip worm shaft by turning in on adjusting screw No. 60, Fig. 6, until the pawl falls clear. Reset worm gear No. 67, Fig. 6, and collar No. 73, Fig. 6. See Section 8c.
- 10. Clutch Fails to Hold at Completion of Cycle (Continuous Tripping).**
- (a) Pawl collar No. 57, Fig. 6, on trip worm No. 76, Fig. 6, set back too far.
See Section 8c for proper setting.
 - (b) Clutch trip lever No. 43, Fig. 4, does not drop.
May be out of position if gear has been taken off. Slide toward back of cabinet.
 - (c) Timing is improper.
See Section 22 for correct "Timing".
 - (d) Clutch spring No. 71, Fig. 6, weak or entirely off.
 - (e) Clutch tooth lever No. 66, Fig. 6, sticking.
Clean thoroughly.
 - (f) Vertical clutch shaft has too much end play.
Adjust screw No. 75, Fig. 6, at bottom of clutch shaft.
- 11. Clicking of Clutch at Completion of Cycle.**
- (a) Timing may be improper if gear has been removed and replaced.
See Section 22 for correct "Timing".
 - (b) Star lever No. 68, Fig. 6, not snapping-in properly, or sticking.
 - (c) Star lever spring No. 70, Fig. 6, weak or missing.
- 12. Speed Variations (Wows) at Slow Speed.**
- (a) Felt pads on governor No. 46, Fig. 4, and friction disc No. 44, Fig. 4, are dry.
Oil these pads.
 - (b) Bearings are dry.
Fill grease cups.
 - (c) Main shafting No. 72, Fig. 6, is tight.
Adjust screw No. 61, Fig. 6.
 - (d) Dirt or grit in gears.
Clean thoroughly.

MODEL 2

STROMBERG-CARLSON TEL. MFG. CO.

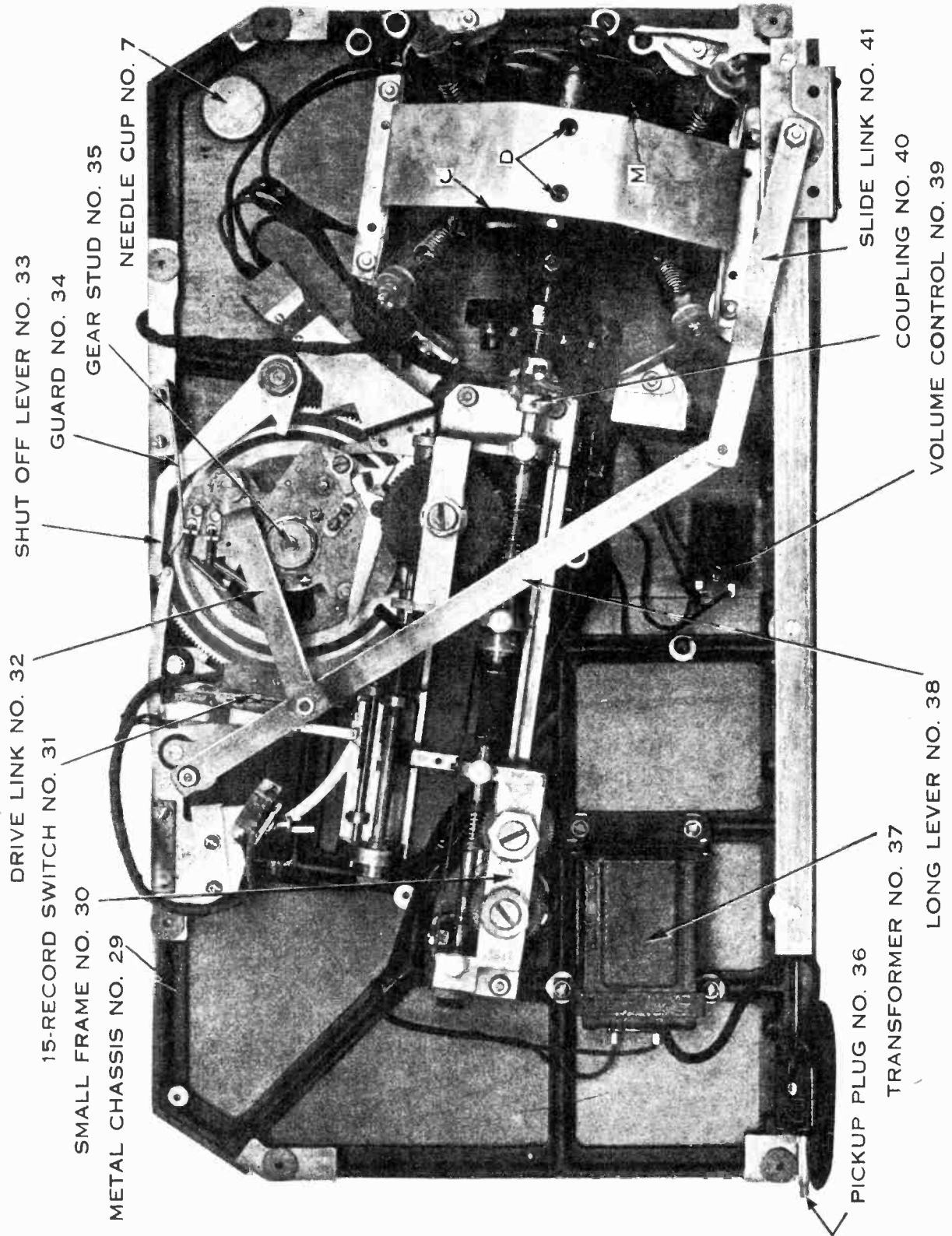


Fig. 3

STROMBERG-CARLSON TEL. MFG. CO.

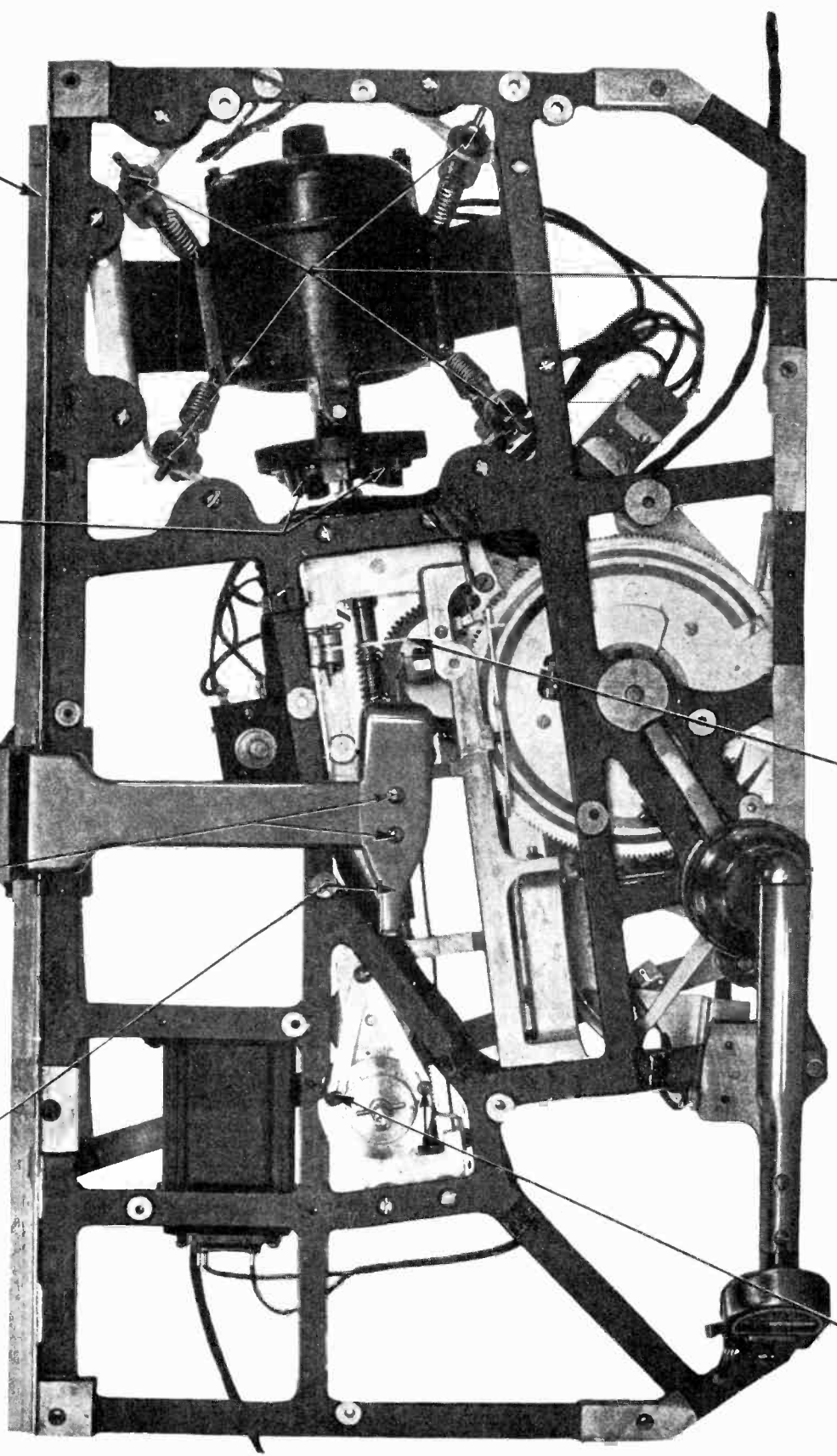
MODEL 2

RAIL CAM
NO. 45

GOVERNOR FELT
PADS NO. 46

ADJUSTING
SCREWS NO. 47

RECORD SHIFTING
ARM HEAD NO. 48



MOTOR ADJUSTING
SCREWS & NUTS NO. 42

CLUTCH TRIP
LEVER NO. 43

FRICTION DISC FELT
PADS NO. 44

Fig. 4

- 13. Failure of Machine to Shut Off After End of Last Record.**
- (a) The On-Off Switch No. 23, Fig. 2, is loose in switch bracket No. 22, Fig. 2, or the switch bracket is loose on the chassis.
Fasten securely.
- (b) Stop Plate No. 82, Fig. 7, has been moved.
Loosen screws and move back slightly until lever No. 81, Fig. 7, engages shut-off lever No. 33, Fig. 3, which throws pickup arm into off position thereby operating switch. Try each new adjustment by rotating drive shaft by hand before turning on power.
- 14. Pickup Goes to Off Position After Dropping Record on Turntable Without Playing It.**
- (a) Lever No. 81, Fig. 7, needs adjusting.
See Section 13b.
- (b) Guard No. 34, Fig. 3, not set closely against edge of cam No. 77, Fig. 7.
Loosen screws, push leg of guard tightly against edge of cam and tighten screws.
- (c) Point of lever No. 81, Fig. 7, touching insulation of 15-Record Switch.
Loosen screws holding switch, force away and tighten.
- 15. Machine Will Play More Than Fifteen 12-Inch Standard 78-R.P.M. Records.**
Bend lug of switch lever No. 28, Fig. 2, for making adjustments. Be sure needle is protruding proper distance from pickup head before making test. See if the records are the thin type.
- 16. Machine Will Not Play Fifteen 12-Inch Standard 78-R.P.M. Records.**
Adjust height of switch lever No. 28, Fig. 2, and see Section 15.
- 17. Rubber Cam No. 56, Fig. 5, Fails to Push Records Back Against Record Stop.**
- (a) Rubber is dirty.
Clean and roughen by scraping with knife or sandpaper. Also clean records.
- (b) Finger No. 52, Fig. 5, sticks and does not fold up during return.
Clean thoroughly (See Section 1a).
- (c) Rubber Cam No. 56, Fig. 5, does not drop down on record.
See Section 18.
- 18. Record Shifting Arm Head No. 48, Fig. 4, Fails to Drop on Records in Magazine After Depositing One on Turntable.**
Ball races No. 10, Fig. 1, sticking.
Clean balls thoroughly and test. They should roll freely.
- 19. Needle Does Not Follow Grooves in Record.**
- (a) Friction collar No. 25, Fig. 2, is too tight against friction washer No. 26, Fig. 2.
Adjust by means of screws. There should be a slight clearance.
- (b) Pickup Arm Shaft No. 19, Fig. 2, needs oiling at plate.
- 20. Record Carrier Arm Chatters During Movement.**
- (a) Slide guides No. 50, Fig. 5, may be too loose.
Close up by carefully bending these guides by means of large pliers.
- (b) Remove the screw connecting slide link No. 41, Fig. 3, to the long lever No. 38, Fig. 3, disengaging slide block No. 51, Fig. 5, and move by hand. See that slide block does not bind at any place on the slide during its movement.
- 21. Record Sticks to Shoe on Pickup Head (Does Not Drop on Turntable Flat).**
- (a) Shoe No. 14, Fig. 2, too low, pinching record tightly between tongue No. 15, Fig. 2, and shoe.
Readjust.
- (b) Pickup arm is too tight to move freely.
Loosen screws on friction collars No. 25, Fig. 2, drop collar slightly and tighten screws again. Do not leave too free.
- 22. Timing of Mechanism.**
If the large gear is removed, it is necessary that it be replaced properly. See that triangular stud No. 65, Fig. 6, is in bottom of the slot in clutch disc No. 62, Fig. 6, and that the large gear is meshed with the smaller one so that the tail of star lever No. 68, Fig. 6, fits in the cutout of ring cam No. 78, Fig. 7. Now turn drive shaft by hand and note that the "tail" comes out of notch and clears ring cam. Rotate back again and see that the triangular piece goes to the bottom of slot in the clutch disc or against stop pin.
- 23. Removal of Motor Board.**
Take out the screws which fasten record stops No. 8, Fig. 1, to metal chassis frame No. 29, Fig. 3. Remove speed control knob No. 6, Fig. 1, by pulling off end of shaft. Remove the volume control No. 39, Fig. 3, by loosening set screw. Now lift motor board just high enough to clear the top of motor speed control shaft No. 6, Fig. 1, and slide motor board to the right out from under the record slides No. 4, Fig. 1.
- 24. Removal of Metal Plate Under Turntable.**
Remove the turntable No. 1, Fig. 1. Take out all the screws on top metal plate. There are three screws locking the record slides No. 4, Fig. 1, to the chassis which must be removed. Two are visible on the under side and the third is under the large gear. Turn the gear around until the large slot in it is under this screw, which now can be removed. Plate will lift up over the turntable spindle No. 18, Fig. 2.

25. Alignment of Motor.

The driving motor "M", Fig. 3, for this No. 2 Multi-Record Phonograph must be accurately aligned with the main shaft No. 72, in order to insure smooth operation and minimum movement. Excessive movement of this motor when operating will cause a fluttering in the audio reproduction of phonograph records. Alignment of this motor is obtained by adjusting the tension on the eight spiral springs that suspend the motor to the metal chassis framework No. 29. This adjustment should never be attempted unless a suitable motor alignment gauge (Stromberg-Carlson ST-31746) is available. Proceed as follows:

- (a) Remove the complete No. 2 Multi-Record Unit from the cabinet as described on page 1.
- (b) Rest the complete No. 2 Multi-Record Phonograph Unit in the same horizontal position it occupies when mounted in its cabinet by resting the two ends on vertical supports (see paragraph "h", page 1), and remove motor board and metal plate as described in Sections 23 and 24.
- (c) Set the Second Shifting Arm No. 9, Fig. 1, in a position over the turntable, so that Long Lever No. 38, Fig. 3, is away from motor end of chassis.
- (d) Remove the brass finished dust cap from end bearing of motor, so as to expose the center hole in the motor shaft. (This dust cap is held in place by friction and can be pried out with any sharp pointed tool).
- (e) Hang the "V" section of the Special Motor Alignment Gauge on the Main Shaft No. 72, Fig. 6, between the shaft bearings, and with the centering pin in line with the center hole in the motor shaft. (Before using this gauge check its accuracy by means of the Master Gauge Shaft to see that the centering pin is in alignment.)
- (f) Loosen all set screws used in holding the Universal Coupling No. 40, Fig. 3, to the Motor Shaft, and to the Main Shaft No. 72, Fig. 6. Slide this coupling back on Main Shaft No. 72 so as to leave motor freely supported on its eight spiral springs.
- (g) Now, check alignment of the motor shaft with the opening in the coupling No. 40, Fig. 3, and the alignment of other end of the motor shaft by means of the centering pin on the Motor Alignment Gauge and the center hole in that end of the motor shaft.

(h) If either or both ends of the motor shaft show considerable misalignment, proceed to realign by turning the motor adjusting nuts No. 42, Fig. 4, a few turns at a time until the alignment of both ends of the motor shaft is obtained. Care must be exercised in making this adjustment to avoid unnecessary work. It is advisable to increase tension on one or more springs by pulling these springs by hand to see whether the motor shaft will be deflected in the desired direction, before making permanent adjustments with the nuts No. 42, Fig. 4.

(i) Test for each adjustment of the realigning nuts No. 42, Fig. 4, by deflecting the motor by tapping it with the fingers to give it about $\frac{1}{4}$ " movement in different directions, allowing it to freely oscillate back to rest. (Forcing the motor in one direction and allowing it to come back slowly to rest may give a false indication.)

(j) After alignment is made correct, as indicated by the gauge and the opening in coupling No. 40, Fig. 3, set the coupling back in place, so as to connect the motor shaft to the main shaft No. 72, Fig. 6. Run the motor for a short time to be sure that it rotates free from oscillation, then make a final check on the alignment of the motor shaft on the free end of motor by means of the special motor aligning gauge, after which the brass dust cover can be pressed into place in shaft opening.

(k) Set up tight all eight jam nuts on the motor adjusting screws No. 42, Fig. 4, to retain the new adjustments just made. Also, be sure that all set screws in coupling No. 40, Fig. 3, are set tight.

(l) Replace motor board and metal plate and install the complete No. 2 Unit in cabinet, as described under heading "Removal of Complete No. 2 Unit from Cabinet" on page 1.

26. Lubrication.

All high speed shafting is supplied with grease cups. Check about every six months and refill with oil or grease. A few drops of oil on slow moving shafts applied at the time greasing is done should be sufficient.

27. Shipping Precautions.

When the No. 2 Multi-Record Phonograph is set up for operation, the motor is suspended by eight spiral spring mountings to avoid mechanical motor noise from being heard outside the cabinet. These springs and the flexible coupling No. 40, Fig. 3, must be protected from mechanical damage during shipment or local delivery as follows:

- (a) Release shaft set screws in two hubs of coupling No. 40, Fig. 3, by turning each screw out several turns.
- (b) Slide complete coupling No. 40 off the motor shaft and on to the end of main shaft No. 72, Fig. 6. The end of motor shaft now should clear the coupling by at least $\frac{1}{8}$ ".
- (c) Tighten all shaft set screws in coupling No. 40 just enough to prevent jarring out and becoming lost in shipment. The motor now is free to be tightly clamped to the metal shipping bracket "C", Fig. 3.
- (d) Insert the red painted flat metal spacing block, which was used in the factory shipment, between the flat lug on the motor casing and the flat portion of the bracket "C", Fig. 3, with the two holes in line with holes "D", Fig. 3.

- (e) Insert the two red painted cap screws, with lock washers, into the two holes "D", Fig. 3, tightening these screws with a wrench so as to hold the motor securely to the bracket "C", Fig. 3. When tightening these cap screws be sure that there is at least $\frac{1}{16}$ " clearance between the end of the motor shaft and the coupling No. 40, which now is slid back over end of main shaft as described in paragraph "b".

In addition to the above, see that the turntable is packed as in the original factory shipment, and that the Pickup Arm No. 2 is tied with tape or cord to Pickup Rest No. 3, Fig. 1. Also block up Record Shifting Arm No. 9 with the Balsa wood block used in original factory shipment, or some equivalent blocking.

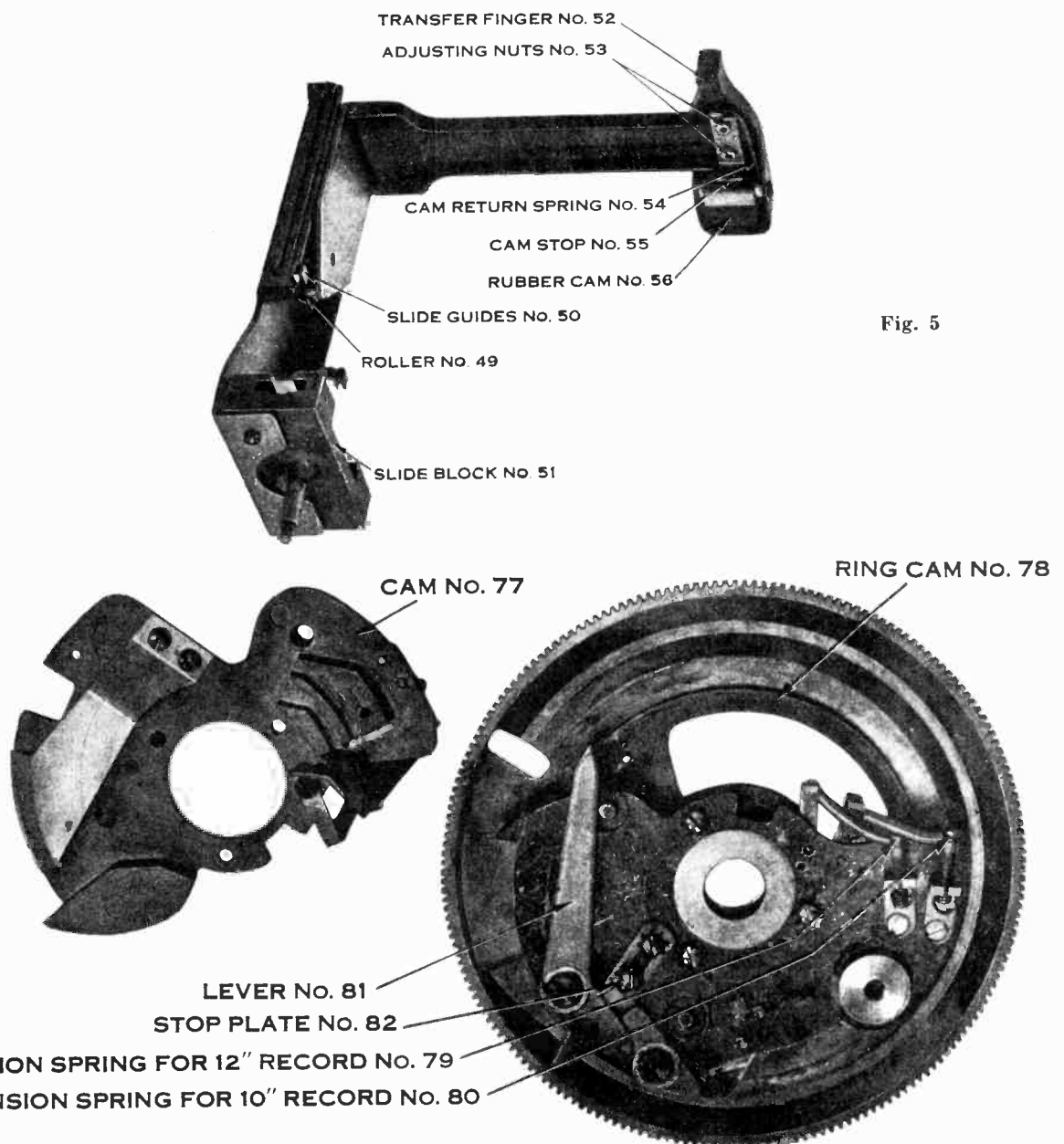


Fig. 5

Fig. 7

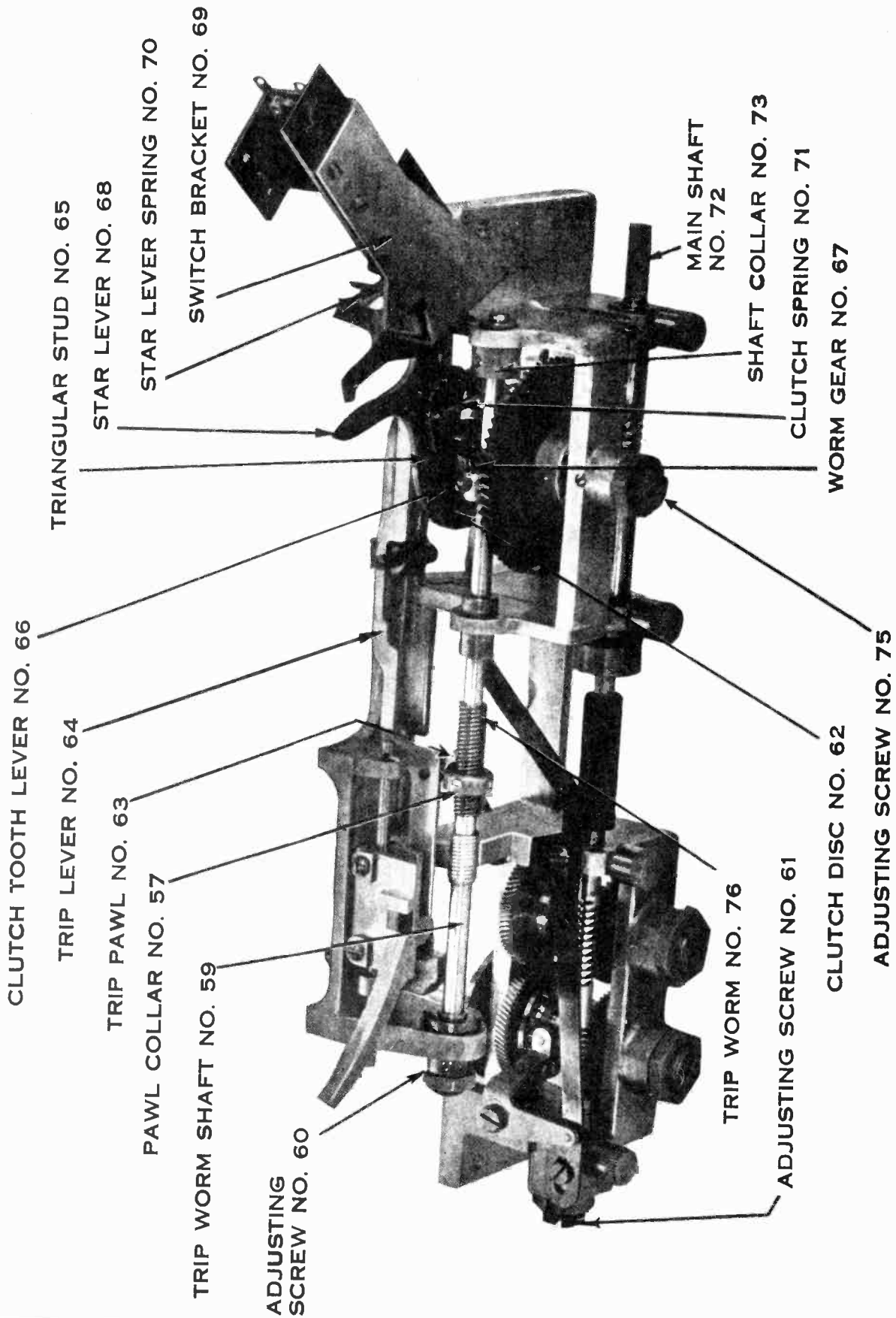


Fig. 6

MODELS 5, 6, 7, 9 STROMBERG-CARLSON TEL. MFG. CO.

CHAPTER 1 - ENGINEERING DATA

The No. 5 Multi-Record Phonograph includes the following mechanical and electrical operating features:

- 1 - Mechanism for carrying standard records of both 10-inch and 12-inch sizes from a horizontally positioned magazine to the turntable.
- 2 - Mechanism for automatically positioning the pickup needle for playing 10-inch and 12-inch records as they come from the magazine.
- 3 - Mechanical automatic tripping of record shifting mechanism at completion of playing of standard 10-inch and 12-inch records having eccentric (Victor) and spiral types of tripping grooves.
- 4 - Excess Record Switch, controlled by number of records on turntable, and adjusted to prevent carrying more than 14 or 15 standard thickness records to the turntable automatically.
- 5 - "Automatic Start" Button for transferring the top record in magazine to the turntable, positioning the pickup needle on this record and starting the "playing".
- 6 - "Reject Record" Button (same as paragraph 5) for "rejecting" any record being "played" by automatically substituting the next record from the magazine on the turntable.
- 7 - Automatic mechanism for returning the Pickup Arm to its Pickup Arm Rest, after the last record from the magazine has been played, making turntable completely accessible for removing the "played" records.
- 8 - Automatic Motor Stopping Switch, actuated by mechanism employed in paragraph 7, for stopping the phonograph after the last record from the magazine has been played.
- 9 - "Single Record" Lever for locking the automatic record shifting mechanism so that pickup arm can be handled freely and without tripping the automatic, when playing "off standard" records singly.
- 10 - Starting and stopping of Phonograph Motor for single record operation, controlled by Pickup Arm. Placing Pickup needle on record "starts" turntable rotation. Returning pickup arm to pickup arm rest "stops" turntable rotation. In order to provide complete freedom in playing odd sizes of records, no automatic tripping mechanism is provided for "single record" operation.
- 11 - Phonograph motor current control switch contacts are provided on the "Phonograph - Radio" switch on the radio chassis of Stromberg-Carlson Nos. 51 and 54 Receivers to allow going from radio to phonograph and vice versa, without raising the lid of the phonograph compartment.
- 12 - Volume Control of Phonograph reproduction employs same circuits as for radio reproduction, thus on Stromberg-Carlson Nos. 51 and 54 Receivers phonograph volume can be regulated without raising lid of cabinet.

Motor, Type.....Single Phase Induction, Governor Regulated

Motor Mounting.....Spiral Spring Suspension (8 springs)

Motor, Voltage Rating.....105-125 Volts

Motor, Frequency Rating.....Code "A", 60 cycles

Motor, Power Consumption (Max. at 125 Volts).....70 Watts

Pickup Type.....Low Impedance, Flexible Armature, P-21778

Pickup Needles.....Victor "Orange Chromium"

Pickup Head Impedance.....70 Ohms at 1000 Cycles

Pickup Transformer (not included with Chassis).....P-23593

MODEL 9 IS IDENTICAL TO THE OTHERS MODELS

WITH THE EXCEPTION OF A CRYSTAL PICK-UP.

Pickup Transformer, Turns Ratio.....	1:60
Pickup Transformer, Impedance Ratio.....	1:3600
Coupling to Audio System.....	Directly to Grid of 1st Audio Amp. Tube with 1/4 megohm shunt resistance.
Power Gain Required in Audio Amplifier System.....	70 db.
Audio Stages Required.....	Two average gain stages feeding a Power Output Stage.
Phonograph Volume Control (not included with chassis).....	Potentiometer of proper audio taper
Turntable Speeds.....	78 R.P.M. and 33-1/3 R.P.M.
Records, Type Handled.....	Standard Lateral Cut
Records, Tripping Grooves.....	Eccentric (Victor) and Spiral
Records, Sizes "Automatic" Operation.....	10 inch or 12 inch 78 R.P.M. or both sizes mixed, also 10 inch 33-1/3 R.P.M.
Records, Sizes "Single" Operation.....	Any 12 inch or smaller at 78 or 33-1/3 R.P.M.
Record Magazine Capacity.....	14 or 15 (Standard Thickness)

CHAPTER 2 - DESCRIPTION OF OPERATION

The operating mechanism of the Stromberg-Carlson No. 5 Multi-Record Phonograph Unit is comparatively simple and easily understood, when each element is considered separately. Thus, this chapter is divided into the following nine sections, each describing a separate element of the complete phonograph unit:

- Section 1 - Turntable Rotating Mechanism
- Section 2 - Record Changing Mechanism
- Section 3 - Pickup Arm Operating Mechanism
- Section 4 - Automatic Tripping Mechanism
- Section 5 - Automatic Start and Record Reject Mechanism
- Section 6 - Single Record Mechanism
- Section 7 - Two-Speed Turntable Mechanism
- Section 8 - Motor Circuit
- Section 9 - Pickup Circuit

In brief, a single electric motor drives all of the No. 5 Phonograph mechanisms, including the automatic shifting of records. With the exception of a large cam wheel, which makes one complete revolution in changing a record on the turntable, all other rotating mechanisms, including the turntable, operates continuously when the instrument is turned "on" and the mechanism is "started".

The rotation of the large cam wheel is controlled by a mechanical dog type clutch, which is held out of engagement at all times, excepting immediately following the tripping operation at the end of a record selection.

In making a complete revolution, this large cam wheel performs all operations of transferring a phonograph record from the magazine to the turntable, setting the pickup needle for entering the first groove of either a 10-inch or a 12-inch record (whichever may be brought over from the magazine) and starting the "playing" of the record.

In case no record comes over from the magazine (last record having been played) the single rotation of the large cam wheel restores the pickup arm to its arm rest and operates a pickup arm switch for stopping the phonograph motor.

These and other operations of the No. 5 Phonograph Unit are described in more detail

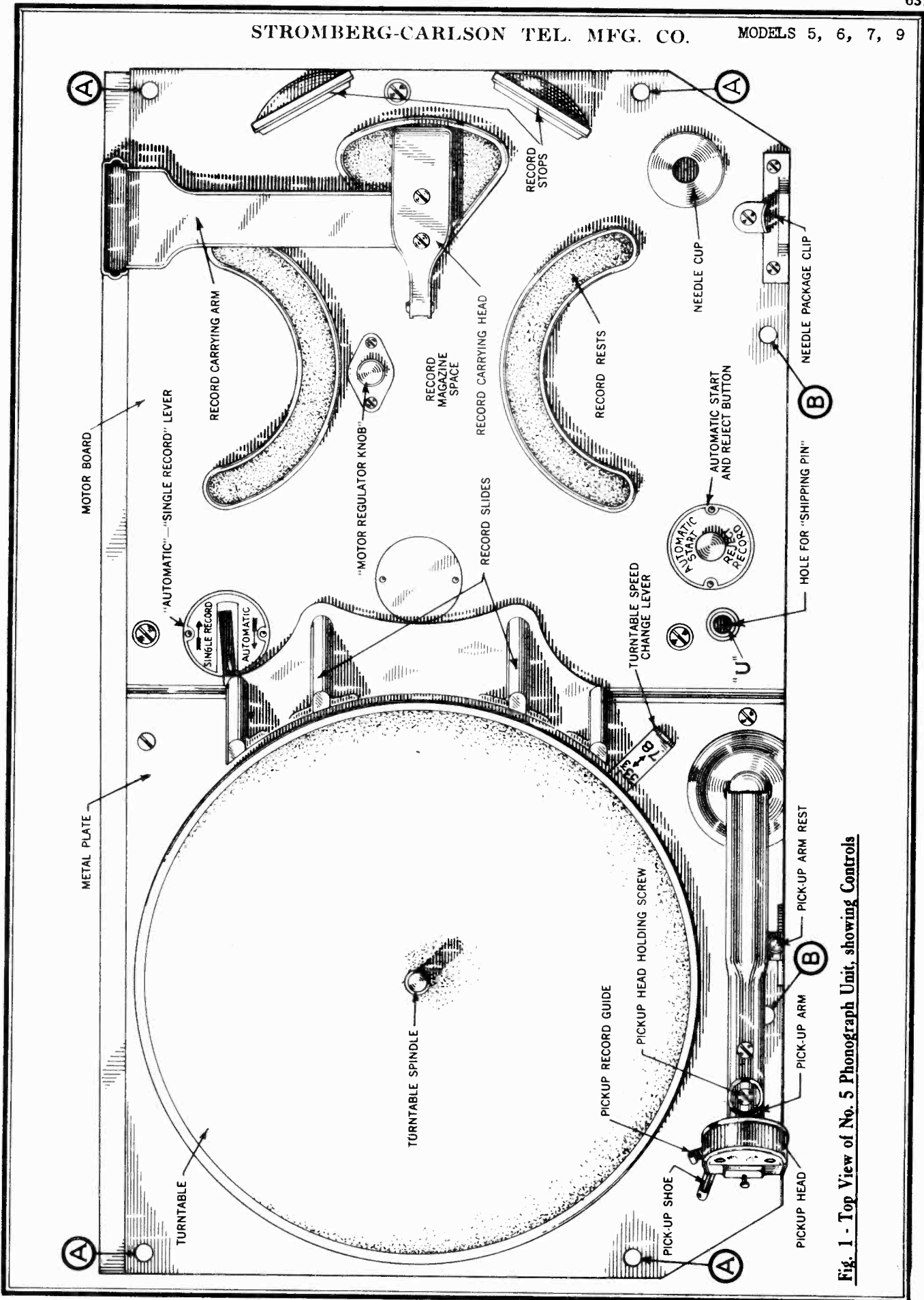
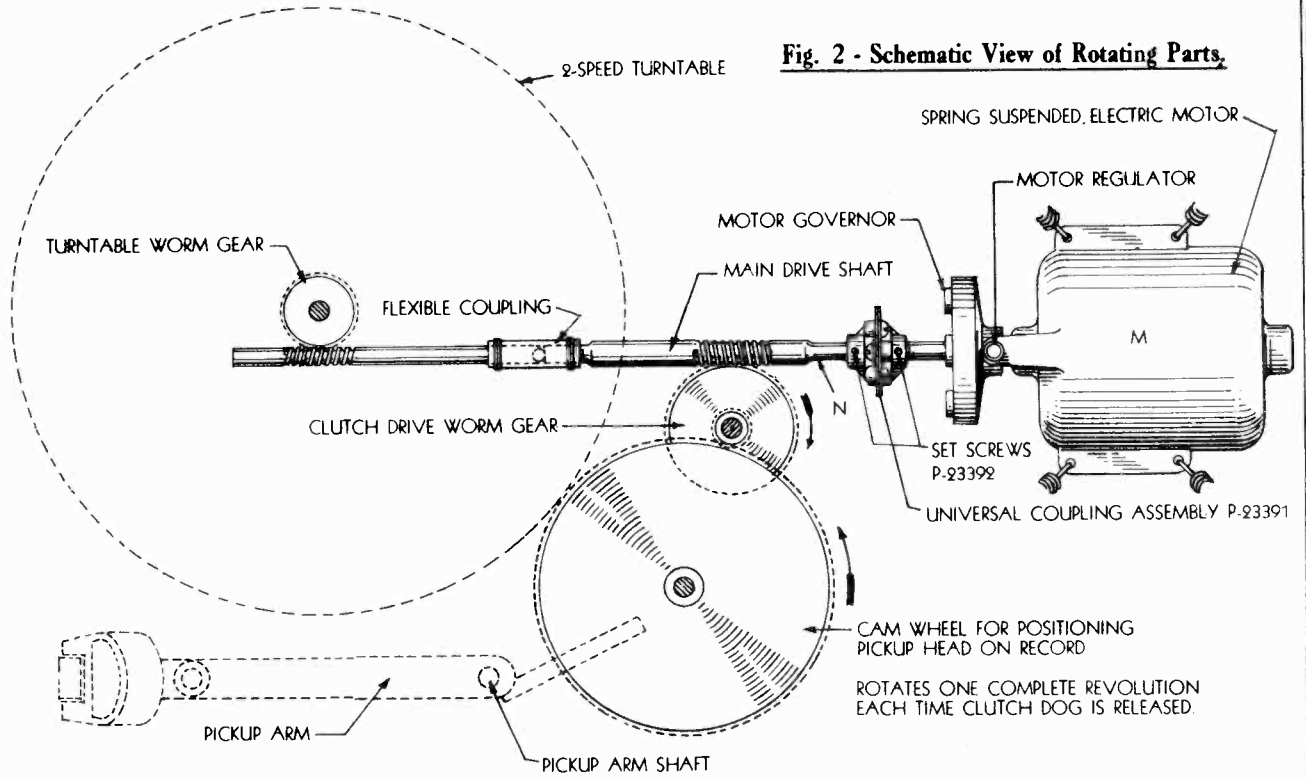


Fig. 1 - Top View of No. 5 Phonograph Unit, showing Controls

MODELS 5, 6, 7, 9 STROMBERG-CARLSON TEL. MFG. CO.

VIEW LOOKING DOWN ON TOP OF UNIT



VIEW LOOKING DOWN ON TOP OF UNIT

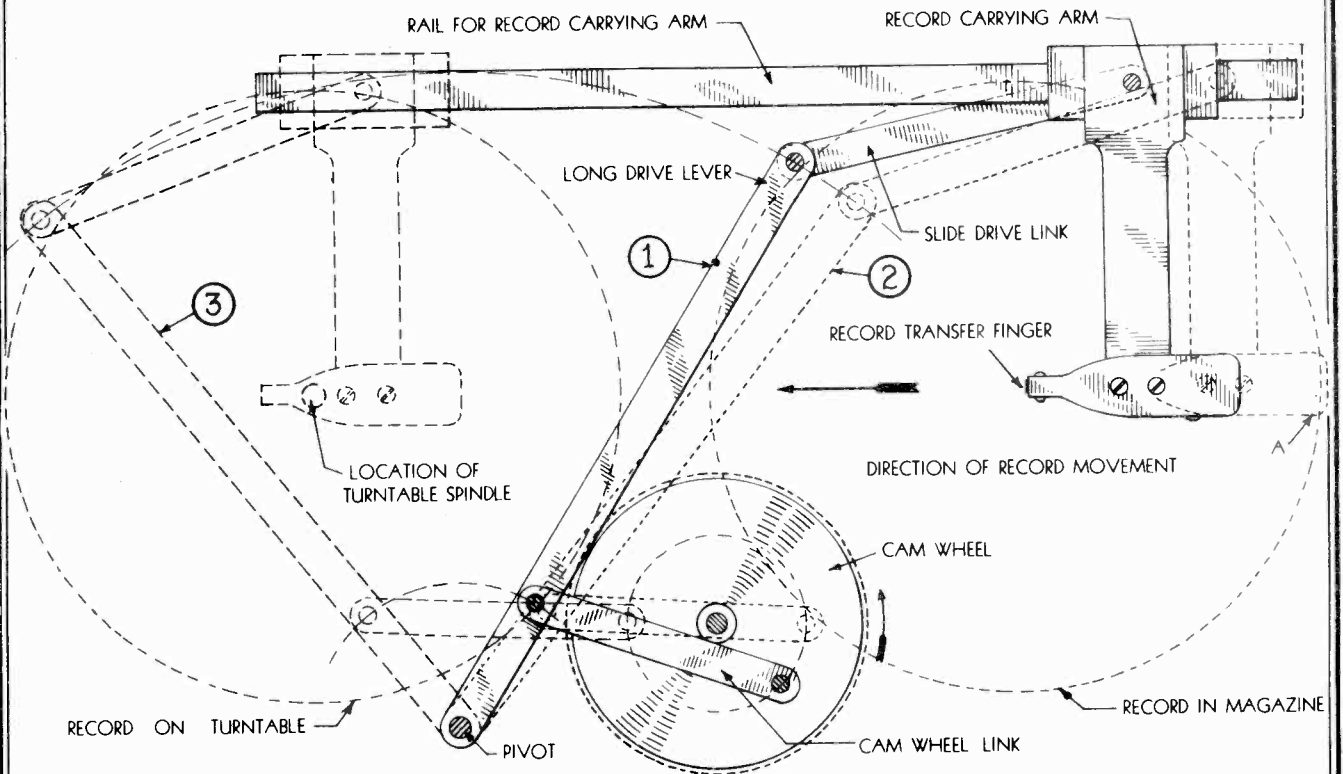


Fig. 3 - Schematic View of Record Carrying Mechanism.

STROMBERG-CARLSON TEL. MFG. CO.

MODELS 5, 6, 7, 9

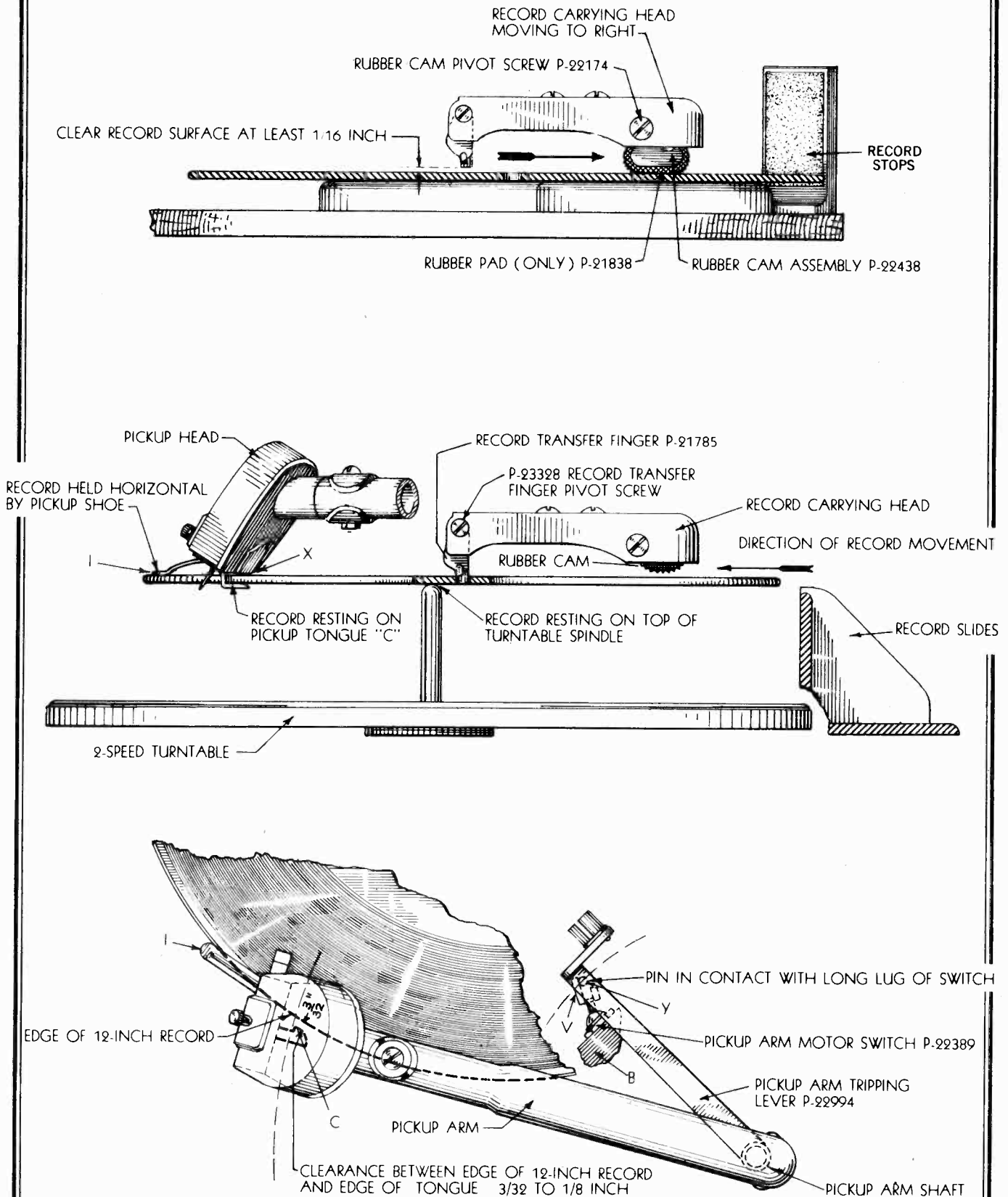


Fig. 4 - Automatic Placing of a Record on Turntable.

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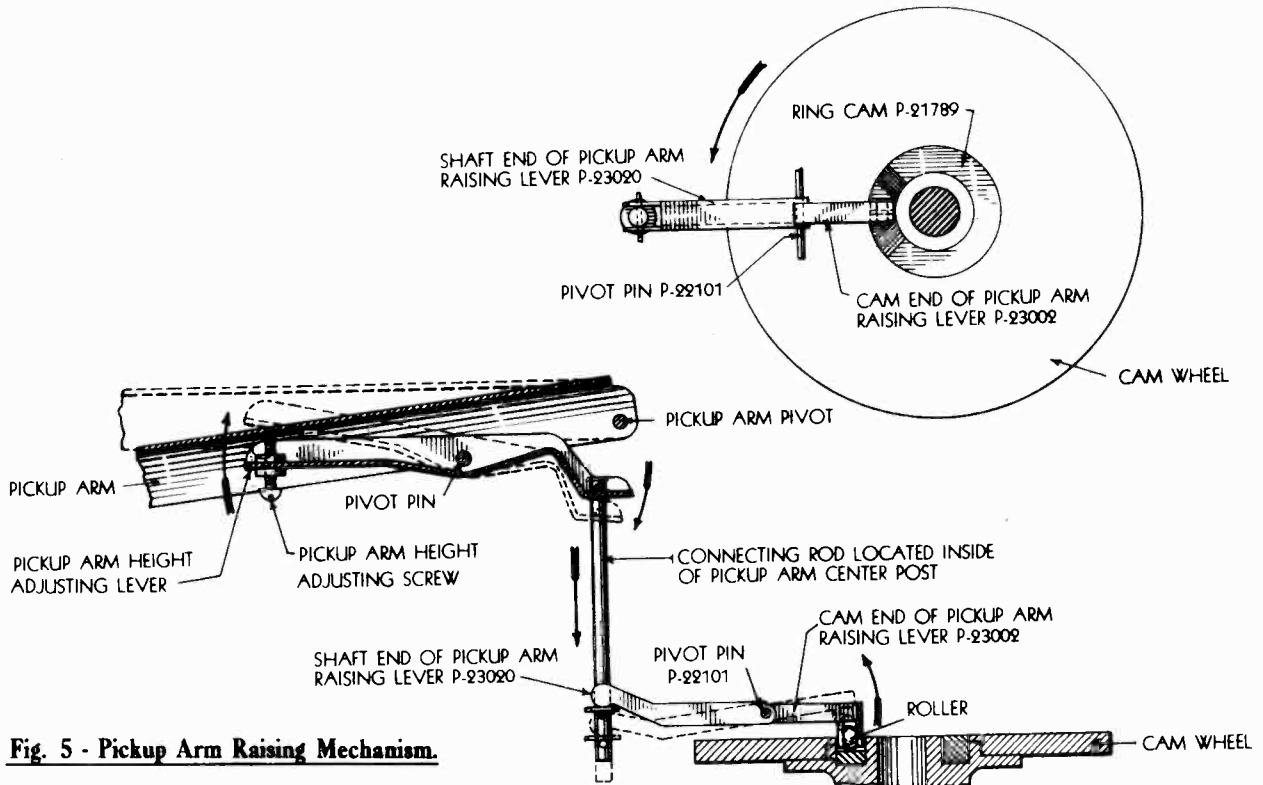


Fig. 5 - Pickup Arm Raising Mechanism.

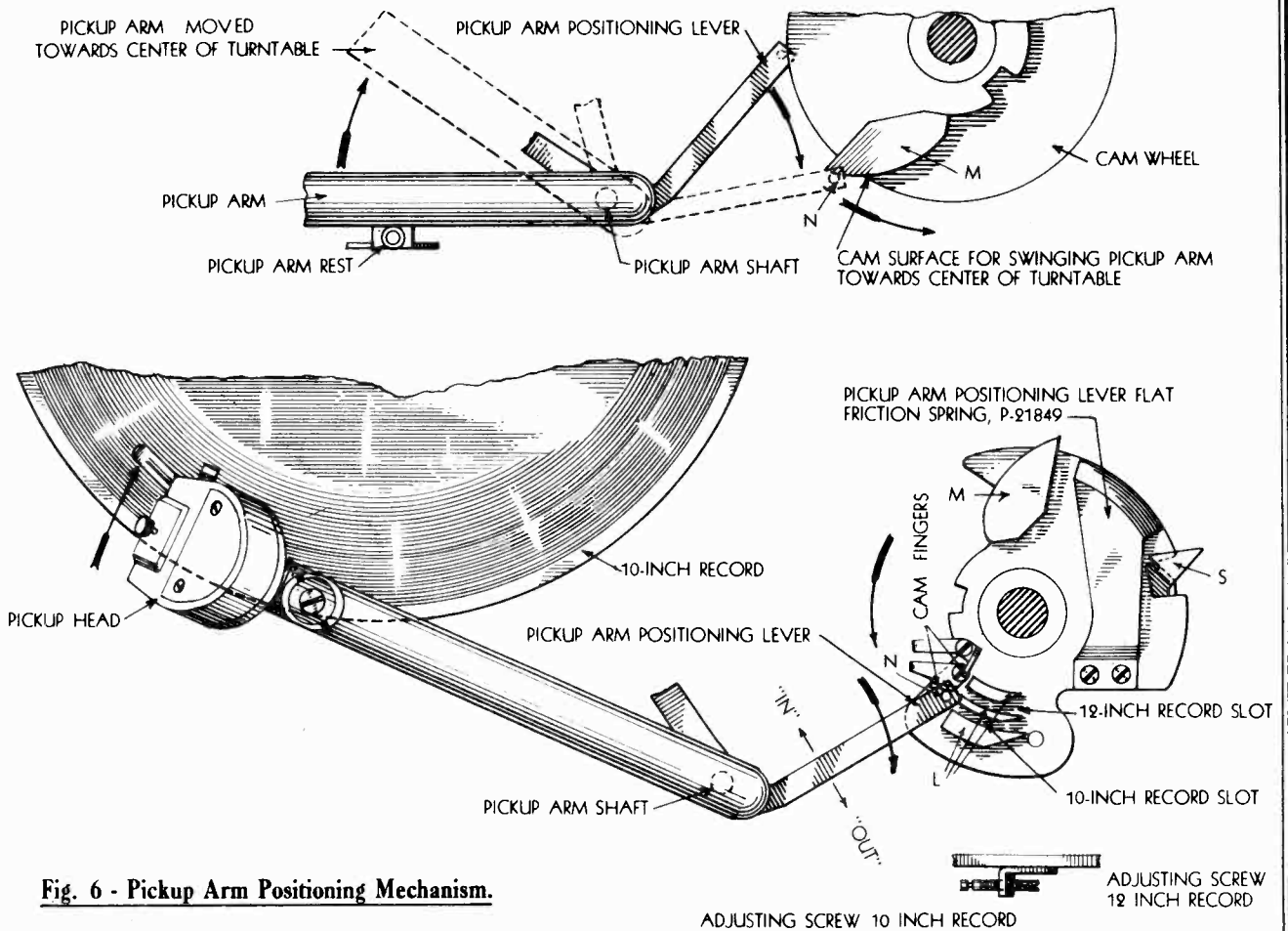


Fig. 6 - Pickup Arm Positioning Mechanism.

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in the following sections:

1 - Turntable Rotating Mechanism

Fig. 2 shows in diagrammatic form the rotating mechanism of the No. 5 Phonograph Unit. A spring suspended governor type single phase induction motor "M" operates through flexible couplings the horizontal main drive shaft "A". At the left hand end of this drive shaft "A" is the worm gearing for rotating the vertical turntable spindle at 78 R.P.M. Additional details of the turntable rotating mechanism are shown in Figs. 22, 27 and 28.

A ball type speed reduction mechanism for 33-1/3 R.P.M. operation is contained in the turntable hub and is described in detail in Section 7 under the heading "Two Speed Turntable Mechanism".

By mounting the motor on eight spiral springs and driving the main shaft through a fabric type of universal coupling, mechanical motor "noise" is prevented from reaching the chassis and the enclosing cabinet. This insures quiet operation.

2 - Record Changing Mechanism

The mechanical movement for carrying a record from the magazine to the turntable is shown in diagrammatic form in Fig. 3. One rotation of the large cam wheel swings the "Long Drive Lever" by means of the "Cam Wheel Link" from the normal position, marked "1" (shown in full lines) to a right hand position, marked "2" (shown in dotted lines) and then to an extreme left hand position, marked "3" (shown in dashed lines).

The free end of this long drive lever, acting through the "Slide Drive Link" moves the "Record Carrying Arm" a short distance to the right "A" (over the record magazine) and immediately reverses its motion and travels to the extreme left so as to be over the turntable, after which it reverses motion and returns to its normal (stopped) position over the magazine. See Fig. 28 for additional mechanical details.

In addition to moving the record carrying arm horizontally, provision is made to raise this arm automatically as it travels towards the turntable. The back of the record carrying arm is supported by ball bearings in a vertical track so as to move freely up and down as shown in Fig. 23. The lower end of the record carrying arm base is provided in a "roller" Fig. 24, which rests on the surface of a "Rail Cam", the latter being shaped, Fig. 21, so as to cause the complete record carrying arm to be raised as it moves towards the turntable. The object of this movement is to relieve the pressure of the record carrying arm from the record as it is raised on the "Record Slides" Fig. 1, in going from the magazine to a position over the turntable spindle.

The "Record Carrying Arm", Fig. 1, is free to be lifted by hand to the top of the vertical track and is held in the raised position by a spring catch. This allows complete freedom of both hands in filling the magazine space with records or in re-arranging the order of records to be played. It is to be noted that the top selection (in full view) is the one to be played next on the turntable. The Record Carrying Arm must be lowered by hand after placing the records in the magazine, in order that the transfer fingers will be in proper position to engage the top record when a record shifting operation occurs.

When the record carrying arm starts its short movement to the right, the soft rubber cam (P-22438) Fig. 4, engages the top record, forcing it back against the two "Record Stops" Fig. 1, so that this record will become "centered" and properly lined up for the "Record Transfer Finger" P-21785. This movement of the arm to the right also causes the rubber cam to rotate just enough to raise the "Record Carrying Head" so that the "Record Transfer Finger" will drop straight down and clear the surface of the top record by about 1/16 inch as shown in the first view of Fig. 4.

Now, when the Record Carrying Arm starts its movement to the left, the rubber cam swings back to its normal position, allowing the record transfer finger to rest on the surface of the top record. This finger slides a short distance on the center portion of the record (not on the record groove portion) until it drops into the center hole in the record. The top record is now moved positively to the left, raising on the inclined record slides so as to pass over the top end of the turntable spindle (Second view of Fig. 4).

Just prior to the carrying of the record to the top of the "Record Slides" the

Pickup Arm has been raised and moved to a position over the turntable as described in Section 3, entitled "Pickup Arm Operating Mechanism". This makes it possible for the front edge of the record coming from the magazine to engage the Pickup Head Tongue "C" Fig. 4, forcing the pickup arm ahead of the record. The record is held in a horizontal position by the top of the turntable spindle, the hooked portion of the pickup tongue "C" and the extending arm of the pickup "shoe" (shown in the middle view of Fig. 4) until it comes directly over the top of the turntable spindle, when it drops down of its own weight to the turntable.

The record carrying arm continues its movement to the left for a short distance, after depositing a record on the turntable, then reverses its movement and travels back to its normal position over the record magazine. Just before coming to a stop the rubber cam of the record carrying arm engages the surface of the top record in the magazine, forcing this record back against the record stops (First view of Fig. 4) for centering purpose, preparatory for the next record change.

3 - Pickup Arm Operating Mechanism

All of the automatic movements of the pickup arm are obtained by one complete revolution of the large cam wheel shown in Fig. 26. This is the same wheel that provides the record carrying arm movement, described in Section 2.

Normally, this large cam wheel remains stationary, it making one complete revolution following a tripping action at the completion of the playing of a record. See Section 4, covering "Automatic Tripping Mechanism" for details regarding the rotation of this cam wheel. The large cam wheel also makes a complete revolution following the pressing of the "Automatic Start" and "Record Reject" Button as described in Section 5, entitled "Automatic Start and Record Reject" mechanism.

One complete revolution of the large cam wheel provides the following sequence of movements of the pickup arm:-

First: Pickup Arm is raised by a cam surface on the large cam wheel, acting through a lever and connecting rod as shown in Fig. 5, so as to bring the lower edge of the pickup head just high enough (about 1/8 inch above top of turntable spindle as shown in second view of Fig. 4) to clear the top edge of a record coming from the magazine and allow the pickup tongue "C" to be engaged by the edge of this record.

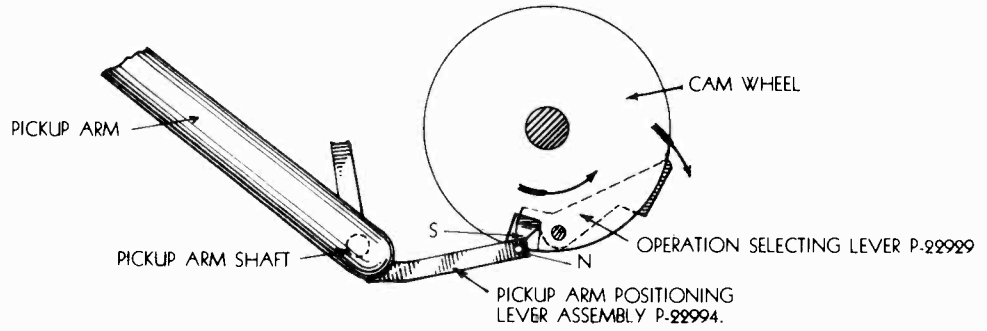
Second: If the Pickup Arm is located on the Pickup Arm Rest when the cam wheel starts to rotate (condition at start of playing a magazine full of records), a cam surface "M" Fig. 6 engages pin "N" on Pickup Positioning Lever, forcing the arm towards the center of the turntable, as shown by the dotted lines in the first view of Fig. 6, so that the Pickup head will be in position to meet a record coming from the magazine. This movement does not take place if the pickup arm is already near the center of the turntable, which is the condition immediately following the playing of a record.

Third: Further rotation of the large cam wheel accurately positions the pickup arm with respect to the outer edge of the record as shown in the second view of Fig. 6. This operation is obtained by the pin "N", on end of Pickup Arm Positioning Lever, entering a 10-inch or a 12-inch record positioning slot on the cam wheel, the slot used being determined by the size of the record brought over from the magazine.

Fourth: Continued movement of the large cam wheel causes the Pickup Head to be lowered gently so that the needle engages the outer clear surface of the record, between the edge and first playing groove. The ring cam, lever and connecting rod shown in the first and second views of Fig. 5 perform this operation.

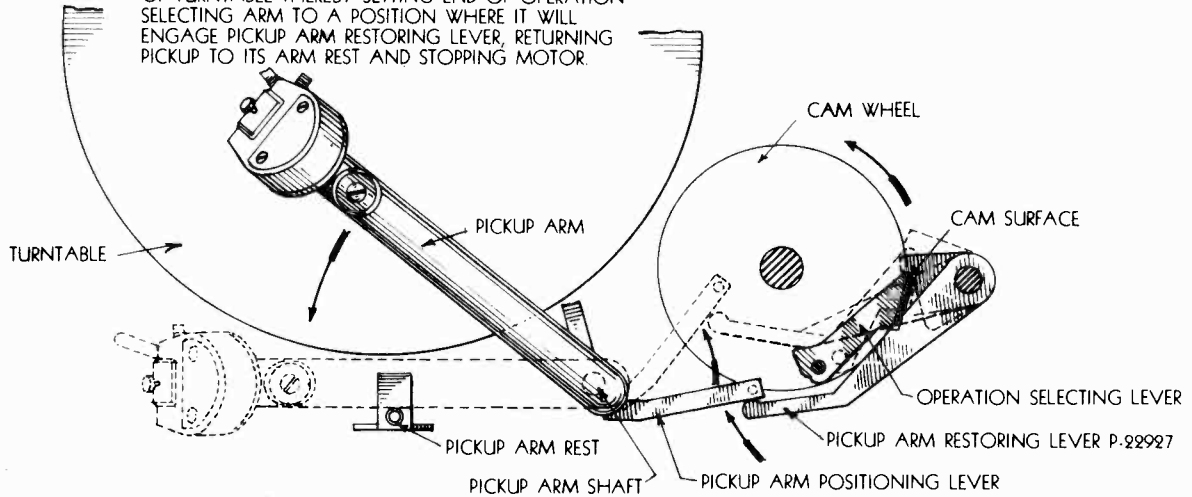
Fifth: Quickly following the lowering of the needle on to the record surface, the pickup head is gently moved towards the center of the turntable so that the needle will enter the first playing groove of the record and then immediately this side pressure is removed, before the record starts playing. This action is obtained by the pressure of the spring actuated 10-inch or 12-inch "First Groove Cam Fingers" coming into contact with pin "N" of the Pickup Arm Positioning Lever, as shown in the second view of Fig. 6, and in the right hand view of Fig. 26.

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AFTER LAST RECORD IS PLAYED OR FAILURE OF NEXT RECORD IN MAGAZINE TO BE DEPOSITED ON TURNTABLE, PICKUP ARM REMAINS NEAR CENTER OF TURNTABLE THEREBY SETTING END OF OPERATION SELECTING ARM TO A POSITION WHERE IT WILL ENGAGE PICKUP ARM RESTORING LEVER, RETURNING PICKUP TO ITS ARM REST AND STOPPING MOTOR.

Fig. 7 - Pickup Arm Restoring Mechanism.



TOP RECORD ON TURNTABLE
ADDITIONAL RECORDS, SHOWN BY DOTTED LINES,
WILL OPEN RECORD LIMITING SWITCH.

PICKUP HEAD HOLDING
SCREW P-23359

PICKUP HEAD HOLDING
WASHERS P-23326

PICKUP HEAD HOLDING
NUT P-22219

PIVOT PIN

PICKUP ARM PIVOT

TURNTABLE SPINDLE

CONNECTING ROD LOCATED INSIDE
OF PICKUP ARM CENTER POST

COUNTER WEIGHT TO
BALANCE PICKUP ARM

SWITCH CONTACTS "G"

2-SPEED TURNTABLE

SWITCH CONTACTS OPENED WHEN
PICKUP ARM IS IN THIS POSITION

SWITCH CONTACTS CLOSED WHEN
PICKUP ARM IS IN THIS POSITION

PICKUP ARM MOTOR SWITCH P-22389

COMPLETE CYCLE SWITCH

RECORD LIMITING SWITCH LEVER

PIVOT FOR SWITCH LEVER

PHONOGRAPH MOTOR

TO 110-VOLTS A.C.

Fig. 8 - Automatic Record Limiting Switch.

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notched clutch disc so as to rotate with it.

Thus, when the tripping action occurs, the phonograph motor positively rotates the large cam wheel, the initial movement bringing a raised cam surface under the end "G" of the long tripping lever, so as to hold the Automatic Clutch Pawl out of engagement with the rotating end "K" of the clutch dog for a complete revolution of the large cam wheel, as shown in the third view of Fig. 10.

The initial rotation of the "Clutch Disc" causes the complete cycle lever to be operated, the triangular shaped stud "A", Fig. 12, mounted on one of the arms of this lever being forced out of the notch in the clutch disc to provide this action. Immediately, arm "B" of the complete cycle lever engages the "Complete Cycle Cam Surface" - "C" of the large cam wheel, holding this lever in its operated position until the large cam wheel has completed its rotation.

When the Complete Cycle Lever, Fig. 12, is actuated, it in turn operates lever "D" and closes the complete cycle switch contacts "W", insuring a continuation of rotation of the phonograph motor until the large cam wheel completes its cycle. This means that the record carrying arm will complete its cycle of record changing operations, once it has started.

At the completion of a rotation of the large cam wheel, a notch is reached in a raised cam surface, this raised surface serving to hold the end "G", Fig. 10, of long tripping lever in its actuated position during rotation of cam wheel. This notch allows the hooked end "H" (first view of Fig. 10) of the Clutch Dog Pawl to fall and engage the end "K" of the Clutch Dog and when the triangular stud "A" on one arm of the complete cycle lever drops into the notch in the clutch disc, Fig. 12, (this can occur only when arm "B" of the Complete Cycle Lever comes in line with the notch "C" in the large cam wheel at the completion of a revolution) the raised lug "J" on another arm of this lever forces the hooked end "H" of the automatic clutch pawl against the end "K" of the clutch dog. This forces the clutch dog into a position where the clutch dog tooth, shown in Fig. 11, will clear the ends of the teeth of the notched wheel of the clutch and prevent the large cam wheel from making further rotation.

5 - Automatic Start and Record Reject Mechanism

A push button, marked "Automatic Start" and "Reject Record". See Fig. 1, is provided on the No. 5 Phonograph Unit and operates as follows:

For Automatic Start Operation - After placing the records to be played automatically in the magazine space, and lowering the record carrying arm so as to rest on the top record, the starting button is pressed and held down for about two seconds. The first part of the movement of the button closes contacts "O" causes lever "I" to full over the phonograph motor. Further movement of the button raises the other end of this lever "J", which in turn raises end "F" of the Automatic Clutch Pawl, the same as when automatically tripped at the completion of the playing of a record.

The holding down of this button for two seconds allows time for the clutch to actuate and the large cam wheel to rotate far enough to cause the Complete Cycle Lever to operate and close the contacts "P" Fig. 12 of the complete cycle switch. From this point of rotation of the cam wheel, contacts "P" will keep the phonograph motor circuit closed until the record shifting cycle is completed.

For Record Reject Operation - If at any time it is desired to operate the record shifting mechanism, such as "rejecting" a record being played on the turntable in favor of the next record in the magazine, or to demonstrate the operation of the instrument to a friend (or customer) the pressing of the "Reject Record" Button will instantly start the large cam wheel to rotating without waiting two seconds as for the "Automatic Start" operation. In this case, the phonograph motor is already rotating so that the pressure on the button need trip the clutch holding pawl only.

6 - Single Record Mechanism

Briefly this mechanism consists of a second latch, known as the "Single Record

The completion of a single rotation of the cam wheel does not cause any further movements of the Pickup Arm. The Pickup Arm, however, does not always follow the sequence of operations just enumerated, the exception being as follows:

After the last record from the magazine has been played or when (for any accidental reason) the Record Carrying Arm does not carry a record to the turntable, the pickup head remains near the center of the turntable (not being forced over by a 10-inch or 12-inch record to the edge of the turntable) allowing the pin "N" at the end of Pickup Positioning Lever to engage the short end "S" of the "Operation Selecting Lever", when the large cam wheel rotates, as shown in the first view of Fig. 7. This action throws out the long end of this Selecting Lever which engages the cam surface on the "Pickup Arm Restoring Lever" as the cam wheel continues its rotation as shown in the second view of Fig. 7. Further rotation of the cam wheel causes the Pickup Arm Restoring Lever to engage the Pickup Arm Positioning Lever and swing the Pickup Arm back to the Pickup Arm Rest position in dotted lines in the second view of Fig. 7. Incidentally, this last movement of the Pickup Arm causes the pickup arm switch, shown at "E" in Fig. 8, to open the electric motor circuit at that point, and upon the completion of the rotation of the large cam wheel, to turn off the motor (See Circuit Diagram Fig. 17).

In order to prevent bringing over more records from the magazine than the height of the turntable spindle will accommodate a "Record Limiting Switch" is provided as shown in Fig. 8. The contacts of this switch are mechanically operated by a lever engaging the pickup arm connecting rod shown in Figs. 5 and 8. The contacts of this switch are so adjusted that when the surface of a top record on the turntable comes within 1/4 inch of the top of the turntable spindle, these contacts open and prevent rotation of the phonograph motor. Thus, if at any time the pickup arm is raised by hand to a position above the top of the turntable spindle, the phonograph motor is stopped and the turntable rotation ceases.

4 - Automatic Tripping Mechanism

The rotation of the large cam wheel is controlled by the automatic record tripping mechanism shown in Figs. 9, 10, 11 and 27.

When the pickup arm is carried towards the center of the turntable by the action of the needle in following the playing grooves of the record, the tripping pawl pivoted on the end of the Pickup Arm Tripping Lever will move along on the fine teeth of the "Ratchet Plate" as shown in Fig. 9. Now, if the motion of the Pickup Arm is reversed, as when the needle enters an eccentric (Victor) type tripping groove in a record, the "Long Tripping Lever" will be raised as shown by the dotted lines in Fig. 9.

In case the motion of the Pickup Arm is continued towards the center of the record by a spiral type of tripping groove (instead of an eccentric type of tripping groove) the "Permanent Stop Stud" on the end of the Pickup Arm Tripping Lever will come into contact with the inclined surface of the "Permanent Stop Lug" on the Ratchet Plate. The location of this Permanent Stop Lug is adjustable and is set at the factory for tripping on records having 3-3/4 inch diameter tripping grooves.

Before the "tripping" action occurs, the hooked end "H" of the Automatic Clutch Pawl is in engagement with end "K" of the Clutch Dog as shown in the first view of Fig. 10. A lug "J" on one of the arms of the "Complete Cycle Lever" (Fig. 12) forces the automatic clutch pawl against the end "K" (first view of Fig. 10) of the clutch dog, so as to force this dog into a position where the "Clutch Dog Tooth" (Fig. 11) will clear the ends of the teeth in the notched wheel of the clutch and avoid "clicking" sounds when the phonograph is operating.

When "tripping" occurs, the end "G" (Fig. 9) of the long tripping lever raises end "P" of the "Automatic Clutch Pawl", causing lug "H" to disengage end "K" of the clutch dog, as shown in the second view of Fig. 10. The clutch dog tooth now enters one of the notches in the notched clutch wheel, shown in second view of Fig. 11, causing the clutch disc, to which the clutch dog is pivoted, to rotate.

It is necessary here to mention that the vertical clutch shaft is continuously rotated at all times when the phonograph motor is turned "on", and that the notched clutch disc, to which the clutch dog is attached, is only rotated when the clutch dog tooth engages the notched wheel at the top of this vertical clutch shaft. Also, that the pinion for driving the large cam wheel gear is permanently attached to the

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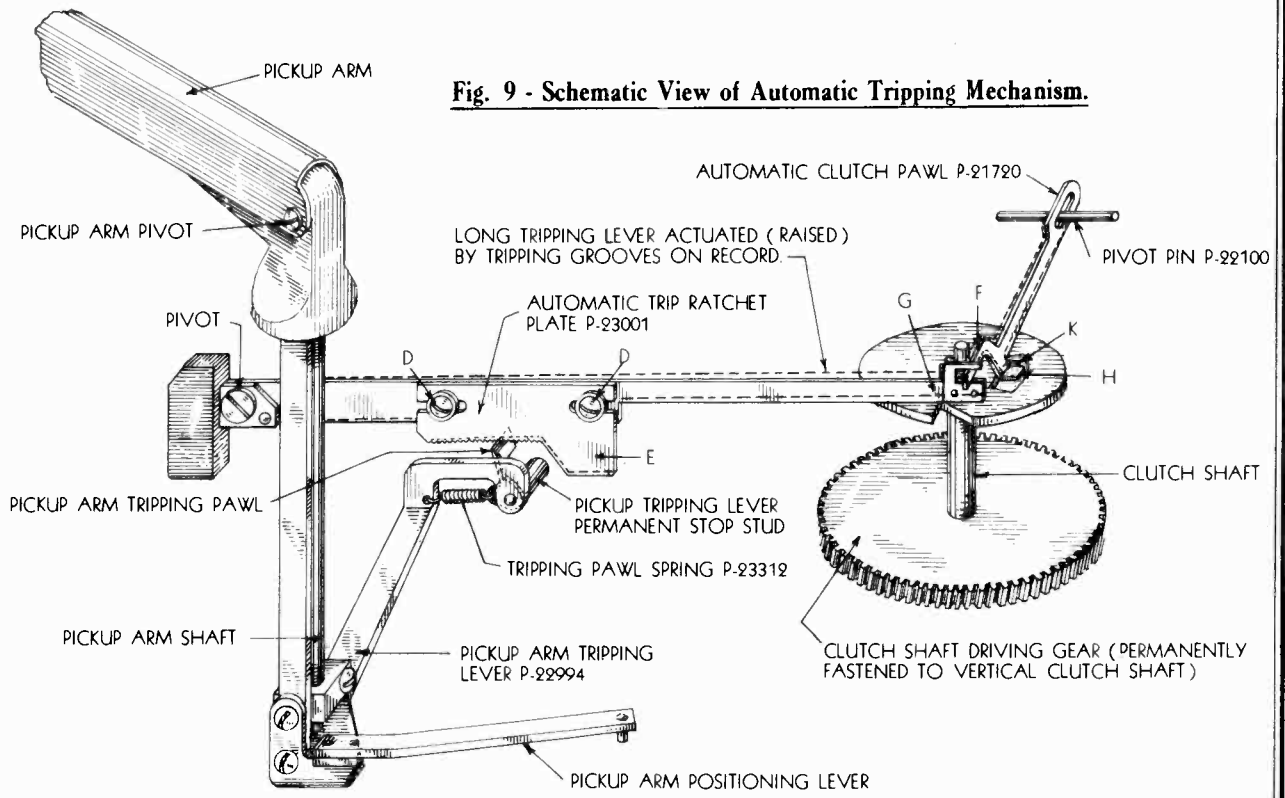


Fig. 9 - Schematic View of Automatic Tripping Mechanism.

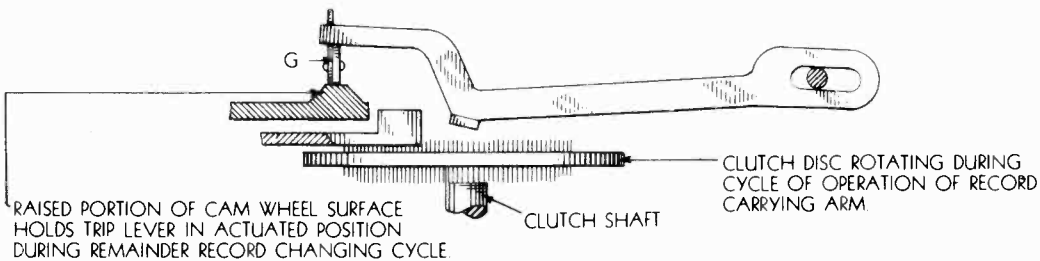
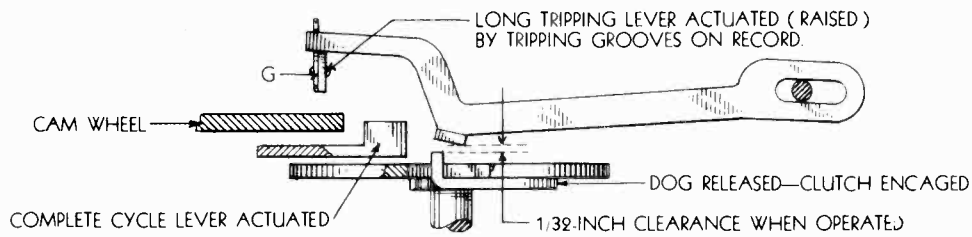
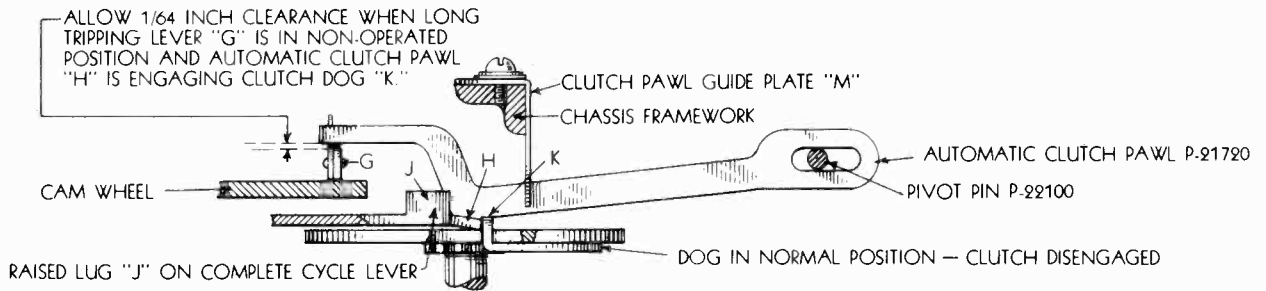


Fig. 10 - Automatic Clutch Pawl Operation.

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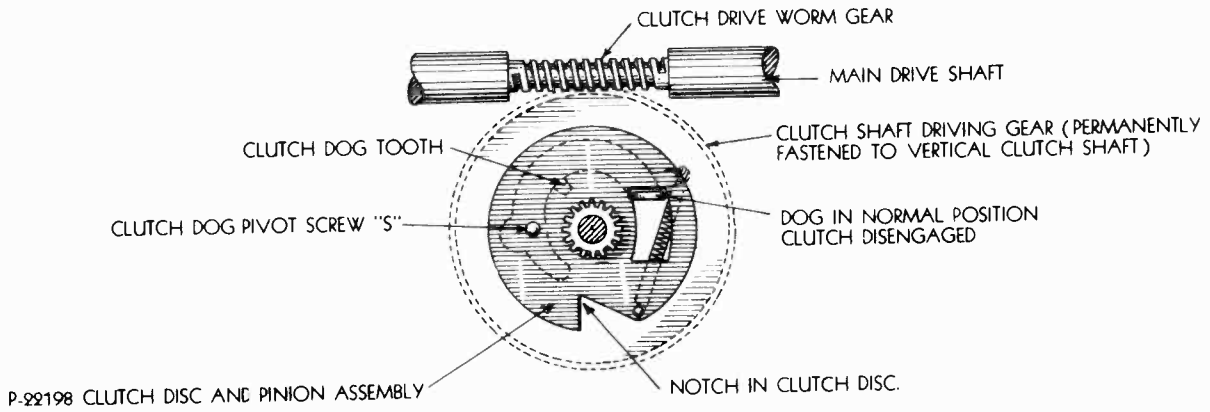


Fig. 11 - Automatic Clutch Dog Operation.

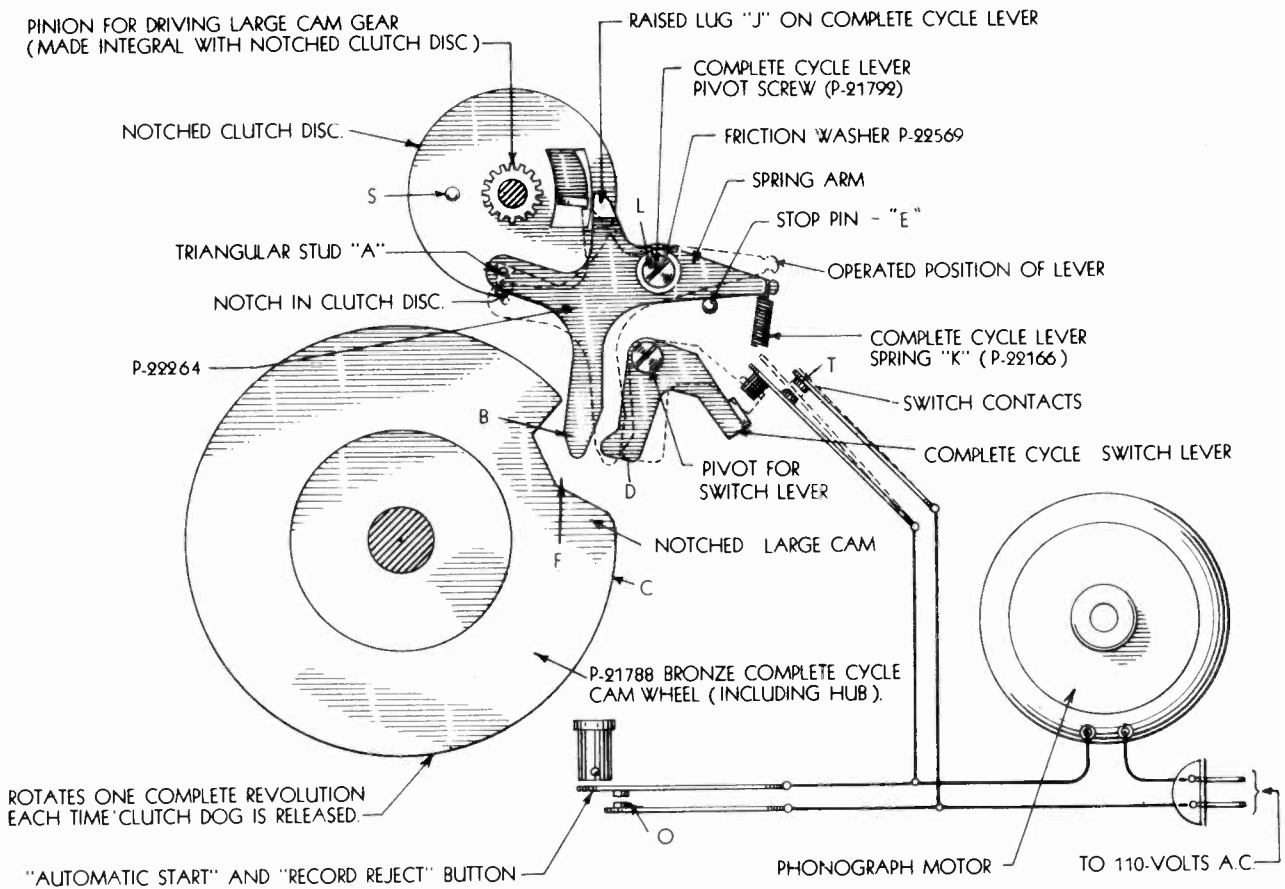
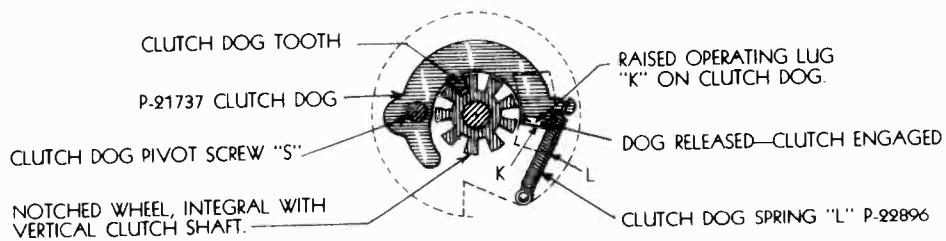


Fig. 12 - Complete Cycle Lever and Switch Operation.

Clutch Pawl (See Fig. 15) for holding the "Clutch Dog" from being released when the first latch, known as the "Automatic Clutch Pawl" (See Fig. 10) is released by the automatic tripping mechanism. The operation of this second latch is controlled by a lever, the end of which extends up through a slot in the motor board and is designated "Single Record" and "Automatic" on a finishing escutcheon, shown in Fig. 1 and Fig. 14.

When the end of this shifting lever is set at the left hand or "Automatic" position, the other end "w" of the lever engages lug "A" of the single record clutch pawl, raising the latter so as to clear of the end "K" of the clutch dog. This allows complete "Automatic Operation" of the No. 5 Phonograph Unit.

When the end of this shifting lever is set at the right hand or "Single Record" position, the Single Record Pawl is held down by a spring so that its hooked end "L" engages end "K" of the clutch dog, securely locking the clutch mechanism against tripping. This allows complete freedom of movement of the Pickup Arm in playing records singly on the turntable, without any possibility of tripping the record shifting mechanism.

7 - Two-Speed Turntable Mechanisms

The No. 5 Phonograph Unit provides for 33-1/3 speed by a ball speed reducing mechanism 9 - Pickup Circuit; contained in the hub of the turntable, as shown in Fig. 16. The turntable shaft rotates at 78 R.P.M., regardless of the speed of the turntable. A pin extending through this shaft engages a key slot in the hardened steel inner hub of the turntable so as to provide a positive drive to that member. The outer surface of this hub is accurately ground to a definite size and forms the inner race for the three equally spaced hardened steel balls, which are held tightly between this inner race and a hardened steel ring which has an accurately ground inner surface to form an outer ball race. A notched steel "Ball Locating Ring", which is permanently fastened to the turntable, forms the spring member for the three balls.

The outer ball race is free to rotate independent of the turntable or the turntable spindle, its rotation, however, being controlled by a latch "B" which is pivoted to the outer ball race as shown in Fig. 16. A spiral spring normally holds one end of this latch "B" against a "Notched Disc", which latch "B" is permanently fastened to the under side of the turntable. Thus, when latch "B" is in its normal position, it engages one of the notches "A" of the turntable disc, locking the outer ball race to the turntable, which is equivalent to locking the ball races together as the ball locating ring also is fastened to the turntable. In this way the 78 R.P.M. rotation of the turntable shaft is imparted to the turntable.

A sliding type of speed change lever is mounted on the framework of the phonograph and so designed that its notched inner end will engage the lower end of the turntable latch "B" when this lever is forced in to its 33-1/3 speed position. When the lower end of latch "B" is engaged by the speed change lever, the upper end of this latch is forced out of engagement with the notches "A" of the turntable disc, and at the same time the outer ball race is kept from rotating. The inner ball race is rotated by the turntable shaft at 78 R.P.M. and as the outer ball race is held stationary, the "Ball Locating Ring" and turntable is rotated at a reduced speed, which in the design of this turntable is made exactly 33-1/3 R.P.M.

It will be noted that the spring actuated turntable latch member "B" engages "w" shaped notches "A" in the notched turntable disc when the sliding speed change lever is in its "out" or 78 R.P.M. position. These "w" shaped notches are designed to drive the turntable positively at 78 R.P.M. after the turntable gains momentum, but allow the latch member "B" to ratchet around the disc a few notches when starting and until full speed is reached.

8 - Motor Circuit

This circuit, shown in Fig. 17, connects the 110-volt A.C. operating current to the phonograph motor through a number of switching contacts as follows:

First - The main on-off switch contacts in the radio chassis, which also control all A.C. operating current used in the radio chassis. This insures that the phonograph motor will be shut off when the radio chassis is turned off.

Second - Special contacts on the phonograph switch in the Stromberg-Carlson Nos. 51 and 54 Receivers, which extend the A.C. operating current circuit to the No. 5 Phonograph chassis when this phonograph switch is turned to the "Phonograph On" position and which open this A.C. circuit when this phonograph switch is set at the "Phonograph Off" position. This insures that the phonograph motor will be shut off when switching from phonograph to radio reproduction.

Third - A snap type switch "u" in the phonograph chassis which closes its contacts for operating the motor when the pickup arm is moved to a position over the turntable (See third view of Fig. 4) and which opens its contacts for stopping the motor when the pickup arm is returned to its arm rest. This insures that the motor will be shut off after the last record is played.

Fourth - A pair of normally closed contacts "g" which are opened for stopping the motor when too many records are placed on the turntable. See Fig. 8.

Fifth - A pair of normally opened contacts "r" which are closed by the Complete Cycle Lever (Fig. 12) to insure a complete revolution of the large cam wheel, even though Pickup Arm Switch "u" is opened.

Sixth - A pair of normally opened contacts "o", operated when the Automatic Start and Record Reject Button (Fig. 13) is pressed, for starting the motor when contacts "r" and "u" are open. This allows all records to be placed in the magazine space and for the first record to be carried to the turntable and played without touching the pickup arm.

9 - Pickup Circuit

This circuit shown in Fig. 18 connects the pickup head winding to the P-23393 pickup transformer, which latter is located near the bottom of the cabinet to avoid electrical "noise" pickup. The core of this pickup transformer, and the frame of the phonograph chassis are both connected to "ground" through the radio chassis so as to avoid high pitched "hum" which otherwise would be present in the loud speaker when the phonograph is turned on.

The audio circuit of the radio chassis, included in Fig. 18, shows that the same volume control employed for regulating the volume of radio reproduction is used for regulating the volume of phonograph reproduction.

The magnetic pickup head, used on this No. 5 Phonograph Unit is the Stromberg-Carlson No. 21778 which is of the low impedance, flexible armature type. The "power gain" required in the audio amplifying system, with high volume setting, is 70 d.b. This is obtained in the Stromberg-Carlson Nos. 51 and 54 Radios by using two average gain stages, feeding a power output stage.

The No. 21778 Pickup Head has an impedance of 70 ohms at 1000 cycles and works directly through the P-23393 Pickup Transformer which has a turns ratio of 1 to 60, giving an impedance ratio of 1 to 3600. This high impedance ratio is provided so that the coupling to the audio amplifier system can be made directly to the grid of the first audio amplifier tube with a 1/4 megohm shunt resistance as shown in Fig. 18.

CHAPTER 3 - SERVICING INSTRUCTIONS

The Stromberg-Carlson No. 5 Multi-Record Phonograph Unit is designed to give maximum performance with minimum of service. Outside of periodical lubrication and the replacing of the rubber cam surface on the record carrying arm (which can wear out in time) servicing should consist only of minor adjustments, such as are necessary on any mechanical device of similar design.

A thorough understanding of the mechanism involved will greatly simplify any servicing operations, therefore, the service man should read Chapter 2, of this book covering "Description of Operation", before attempting to service a No. 5 Multi-Record Phonograph.

In order to quickly diagnose service complaints and make correct adjustments, the following servicing instructions are presented. A list of replacement parts is contained in Section 32.

1 - Removal of Complete No. 5 Phonograph Unit from Cabinet

Proceed as follows:

- (a) Disconnect the cabinet lid lift stay so as to allow top lid to be turned completely back on its hinges, providing full accessibility to the phonograph compartment. This can be done from the rear of the console radio.

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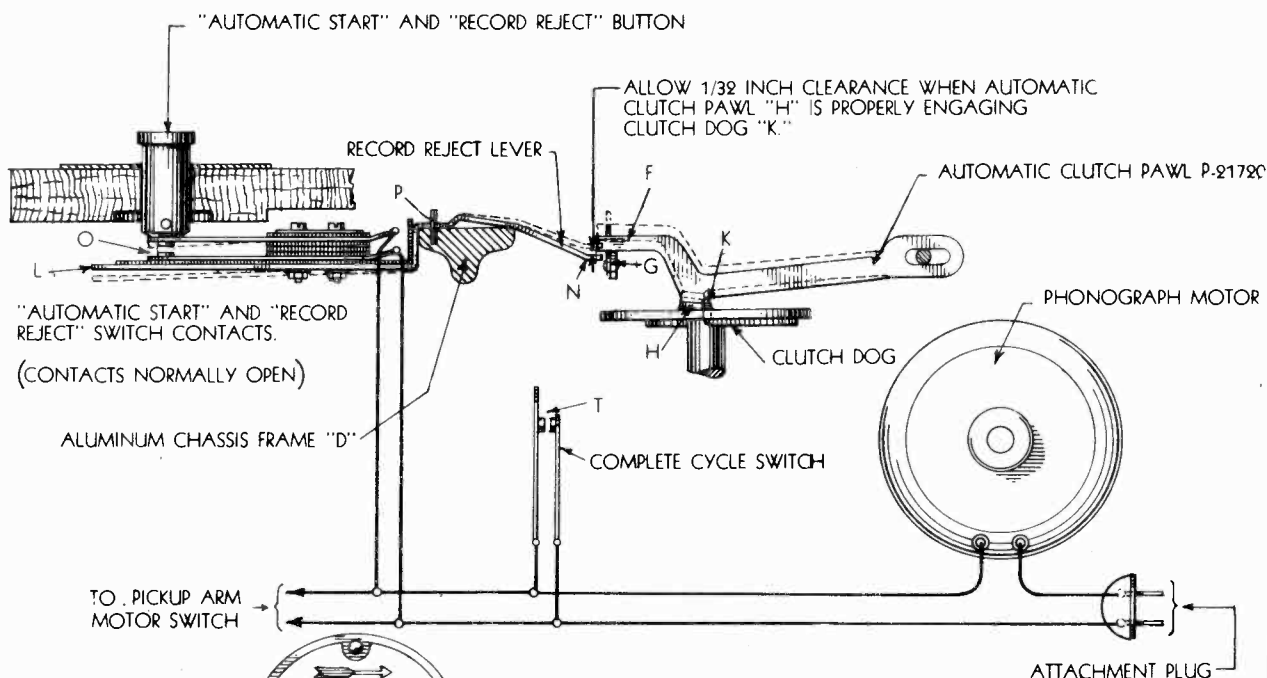


Fig. 13 - Automatic Start and Reject Record Button

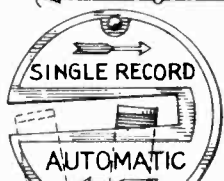
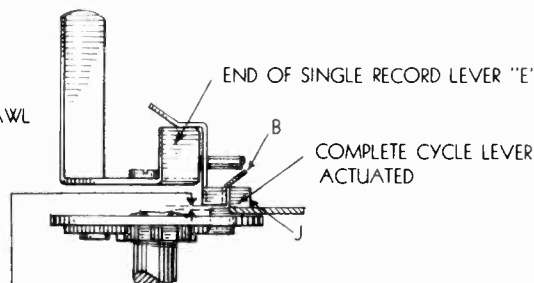
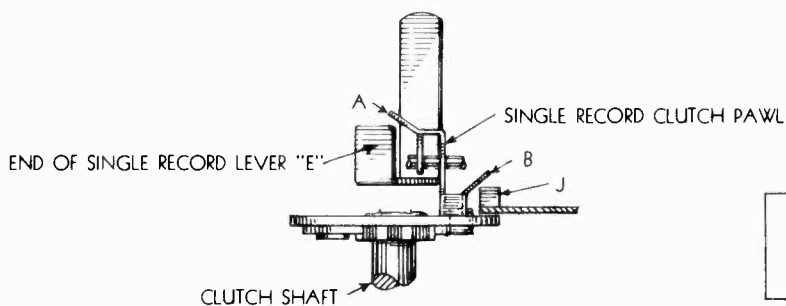
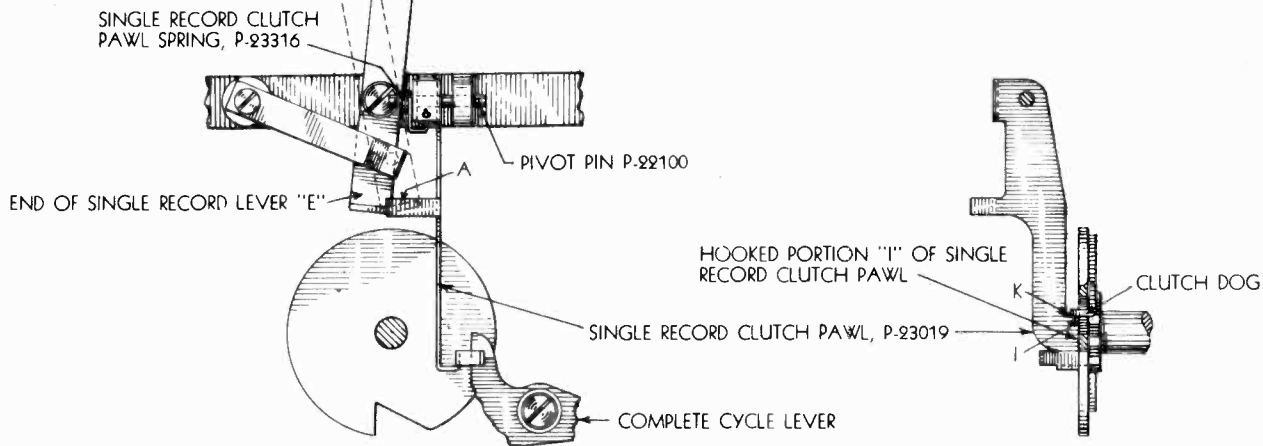


Fig. 14 - Single Record Lever Operation.



ALLOW 1/32 INCH CLEARANCE BETWEEN HOOKED PORTION "I" OF SINGLE RECORD CLUTCH PAWL AND END "K" OF CLUTCH DOG, WHEN RAISED END "J" OF COMPLETE CYCLE LEVER IS ACTUATED BY OPERATION OF LARGE CAM WHEEL.

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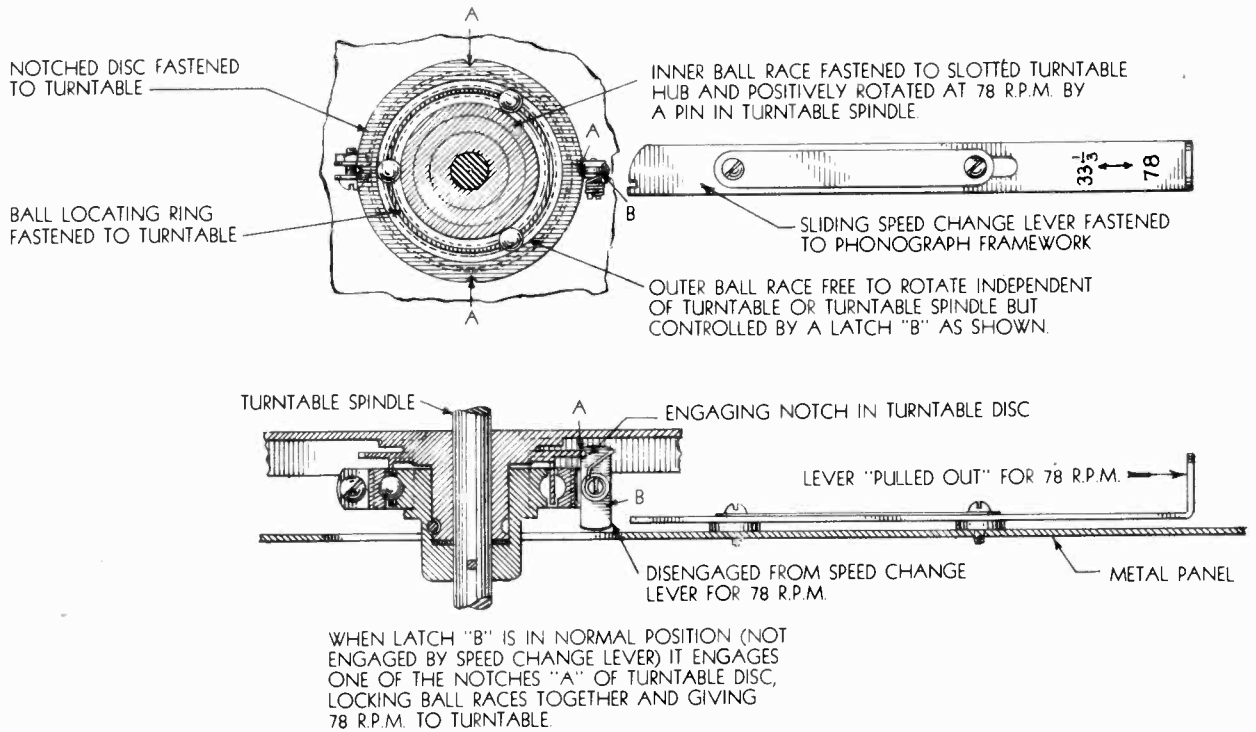


Fig. 15 - Single Record Clutch Pawl Operation.

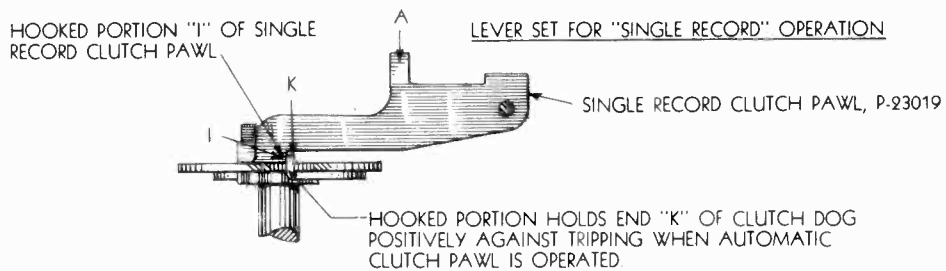
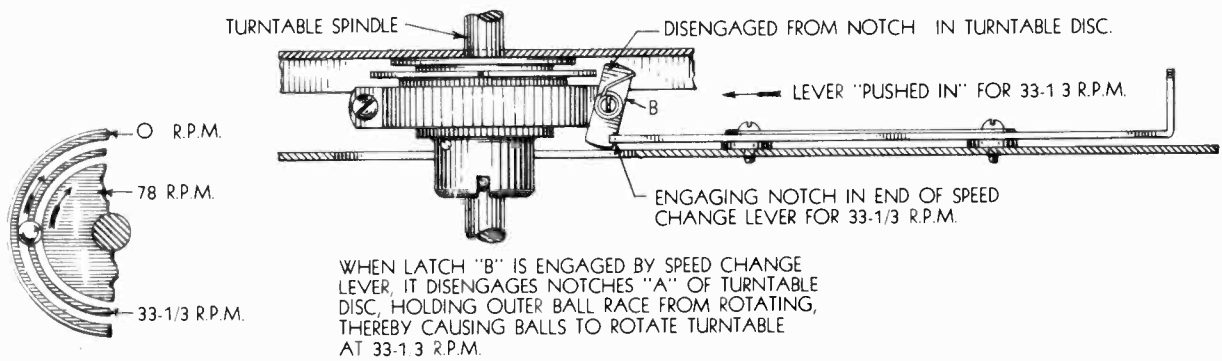
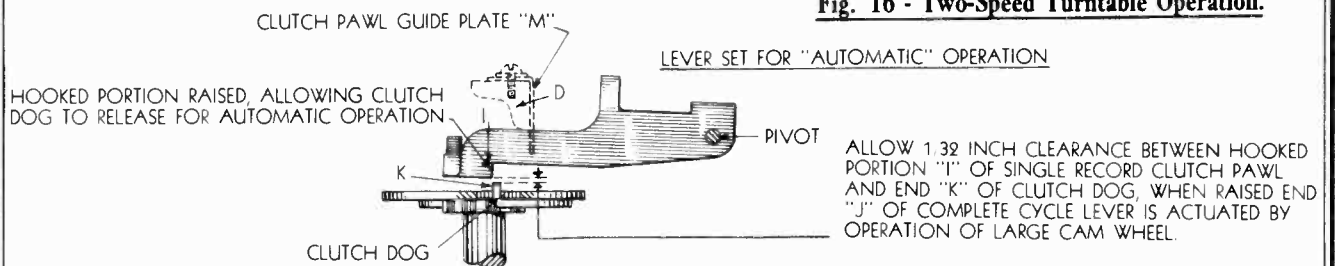


Fig. 16 - Two-Speed Turntable Operation.



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2 - Record Carrying Arm Fails to Pick Up Record.

- (a) Record Transfer Finger, Fig. 23, does not fall against its stop, due to binding.
- Remove Transfer Finger Pivot Pin (held in place by a hexagonal nut), wipe clean and replace. Lubrication should not be used on this pivot.
- (b) Rubber cam, Fig. 23, is not pulled back because of weak cam return spring.
- When the rubber cam is turned forward and released, it should spring back against its stop. If this does not happen the spring tension should be increased by cutting off two or three turns at one end of the spring.
- (c) Burrs thrown up on edge of center hole of record.
- This defect in the record can be remedied by cutting away the burr with a sharp knife so as to give a smooth surface for the record transfer finger to slide on.
- (d) Record Transfer Finger, Fig. 23, does not reach surface of top record.
- See Section 20 for remedy.
- (e) Record does not center correctly on "Record Stops".
- Loosen Screws "S" Fig. 28, that hold Record Stops (Fig. 1) and adjust position of these stops so that P-21785 Record Transformer Finger will line up accurately with the center hole in a 10-inch and a 12-inch record. Check with several records as one particular record might have a defective center hole.
- cabinet by first removing a cotter pin and forcing the lift stay connecting rod from the pivot stud, taking care that the counterbalance spring lug does not snap back and pinch the finger. See Fig. 19.
- (b) Remove the six phonograph chassis mounting screws, located at points marked "A" and "B", Fig. 1.
- (c) Remove turntable by lifting it off the center spindle.
- (d) Disconnect the two cords which connect the No. 5 Phonograph Unit to the radio chassis circuits. One of these cords terminates in a plug which is inserted in a power receptacle on the back of the radio chassis, while the other cord terminates in pin tips which are inserted in pin jacks on the pick-up transformer located near the bottom of the cabinet. See Fig. 18.
- (e) Slide the No. 5 Phonograph Chassis toward the rear of the cabinet as far as it will go, so as to provide an opening between the front of this chassis and the front inside of the cabinet.
- (f) Now, take two pieces of woven webbing or heavy wrapping cord, pass completely around the No. 5 Phonograph Chassis, one near each end, and tie so as to provide two slings for lifting chassis from the cabinet. See Fig. 20.
- (g) Lift No. 5 chassis out of cabinet, taking care not to mar the inside finish of the cabinet. Placing several strips of cardboard or heavy paper at front, back, and both ends inside of cabinet, so as to cover the finished wood surfaces will provide protection against marring. See Fig. 20.
- (h) Rest the No. 5 Phonograph Chassis on blocks of wood about 7 inches high, located at both ends, and placed on a level bench or table, so as to give accessibility to working parts. A more satisfactory mounting for servicing consists of four metal legs (Stromberg-Carlson Sk. 3169) designed to be inserted into the four chassis screw mounting holes marked "A", Fig. 1. It will be necessary to push out the rubber bushings that are in these four holes to allow these metal legs to be inserted in the metal frame of the chassis. See Fig. 21 for No. 5 chassis mounted on these metal legs.
- (i) If the servicing operations require accessibility to the top mechanisms, as shown in Fig. 22, it will be necessary to remove the walnut finished motor board and brown enamel finished metal plate as described in Sections 24 and 25.
- (j) To replace the No. 5 Phonograph Unit in the cabinet, follow the above instructions in reverse order, being careful not to mar the finish on the inside of the cabinet when lowering the unit in place. See paragraph "g".

3 - Record Carrying Arm Fails to Carry Record over to Turntable.

- (a) Record Transfer Finger, Fig. 23, releases record part way over.
- (1) Rubber cam, Fig. 23, interfering.
- See Section "2b" for remedy.
- (2) P-16164 Retaining Screws, Fig. 22, in record shifting head, loose.
- Tighten securely, being sure that record transfer finger is lined up with center of turntable spindle. Run record changing mechanism through its cycle to check this important adjustment.
- (3) Rail cam surface, Figs. 21 and 24, set too high.
- Lower by using adjusting screws in back of chassis frame as shown in Fig. 24.
- (b) Height of turntable spindle is incorrect. Test height. It should be about 1/32 inch lower than the top of record slides as shown in Fig. 24.
- (c) Record is very badly warped.
- Straighten records with a warm, flat metal plate.
- (d) Rail Cam Surface, Figs. 21 and 24, set too low.
- Raise by using adjusting screws in back of chassis frame as shown in Fig. 24.
- 4 - Record Carrying Arm Transfer Finger Releases Record about One Inch from Turntable Spindle.
- (a) Pickup Head is too high or too low.
- See Section 5 for remedy.
- (b) Record is not resting properly on Pickup Head tongue, Fig. 4.
- See Section 5 for remedy.
- (c) Pickup shoe, Fig. 4, too low, not allowing record to pass underneath, or too high allowing record to tilt too much. In this latter case the center hole in record will drop away from the record transfer finger.
- Adjust pickup shoe so record will balance in a horizontal position when resting on top of pickup tongue and top of turntable spindle as shown in second view of Fig. 4. After making this adjustment, see that end Pickup Shoe does not contact surface of a single record on turntable when "playing" with proper needle.
- 5 - Pickup Head Too High or Too Low.
- If the record passes over turntable spindle but does not slide over pickup tongue and under pickup shoe, adjust for correct position by means of pickup arm height adjusting screw as shown in second view of Fig. 5. The pickup head should be adjusted so that record will pass under its outer edge "X" Fig. 4, without striking. Use a flat, true record for this test.
- 6 - Pickup Head Needle Lowers Outside of Record Edge or Inside of Flaying Grooves.
- (a) Pickup Head Holding Screw, Fig. 1, is not correctly adjusted.
- Loosen this screw and adjust pickup head so that needle will contact record surface about 1/16 inch from outer edge. Check adjustment on both 10 inch and 12 inch records.
- (b) Record interferes with pickup tongue forcing pickup arm out of correct position.
- See Section 5.
- (c) Pickup arm positioning lever, Fig. 6, has been bent.
- Replace with new lever, or correct by removing and bending in a bench vise. Bend "in" if needle lowers outside record, or "out" if needle lowers inside too far. A special gage is employed in the factory adjustment of this lever.

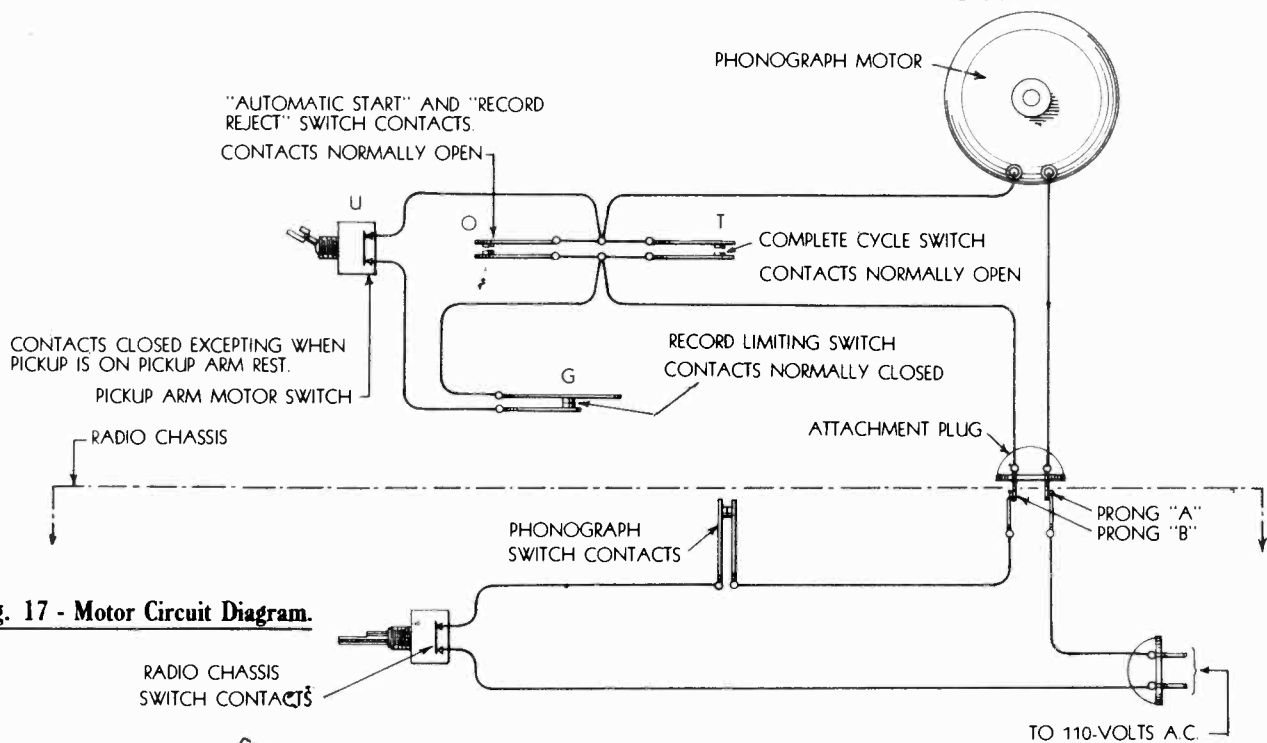


Fig. 17 - Motor Circuit Diagram.

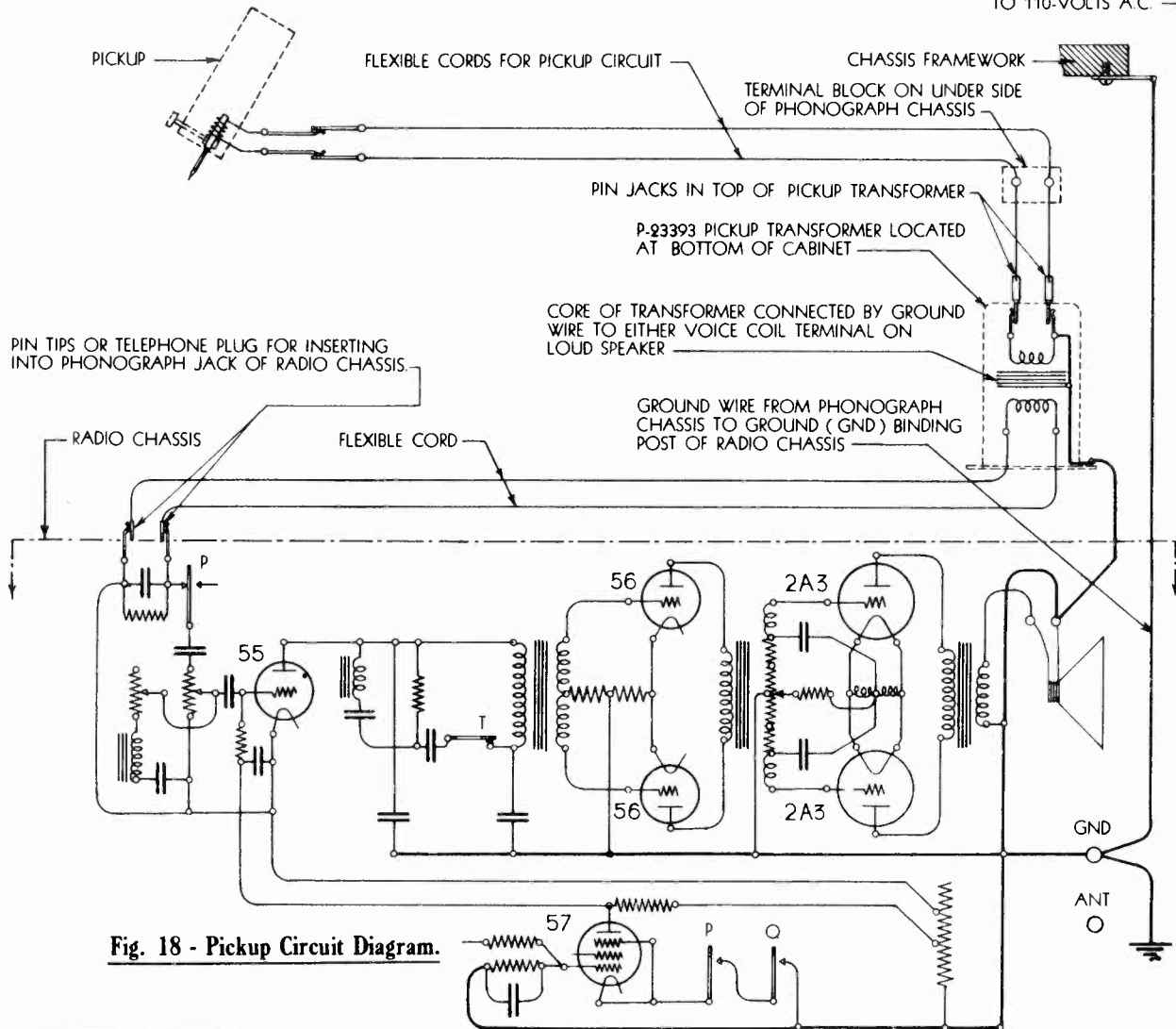


Fig. 18 - Pickup Circuit Diagram.

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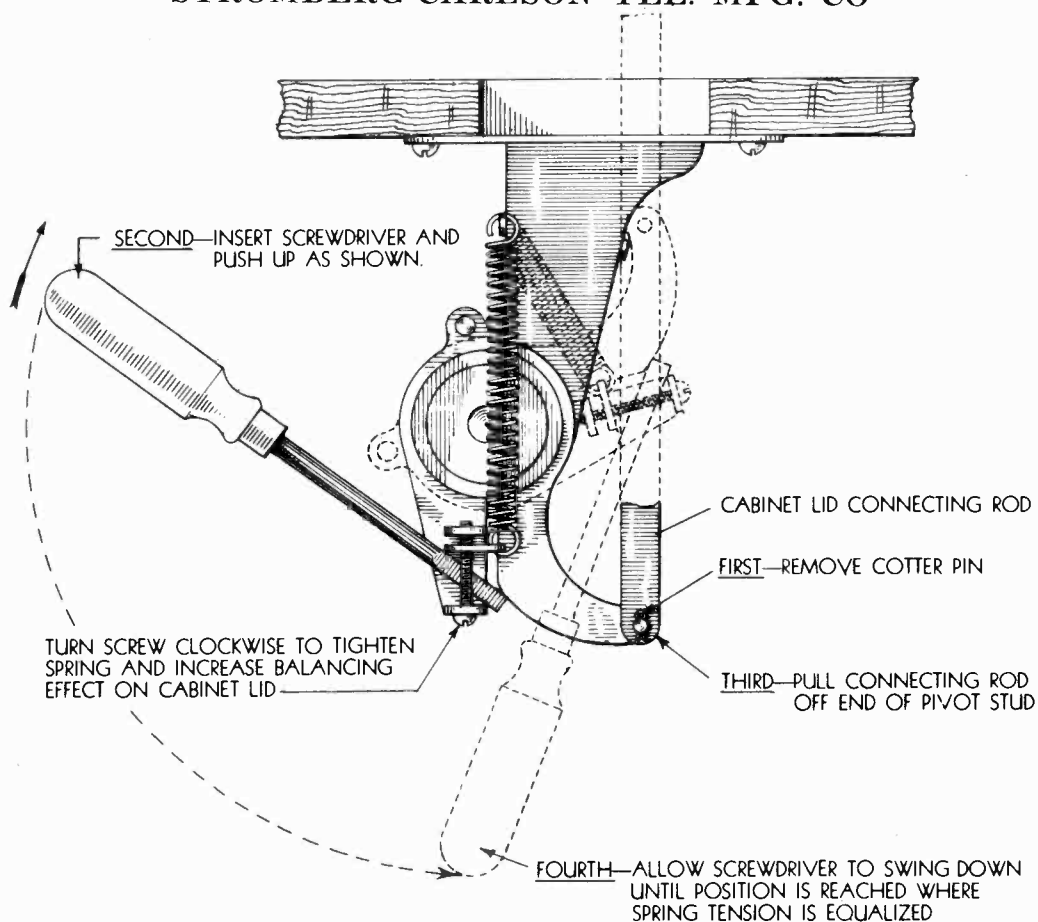


Fig. 19 - Releasing Cabinet Lid Stay.

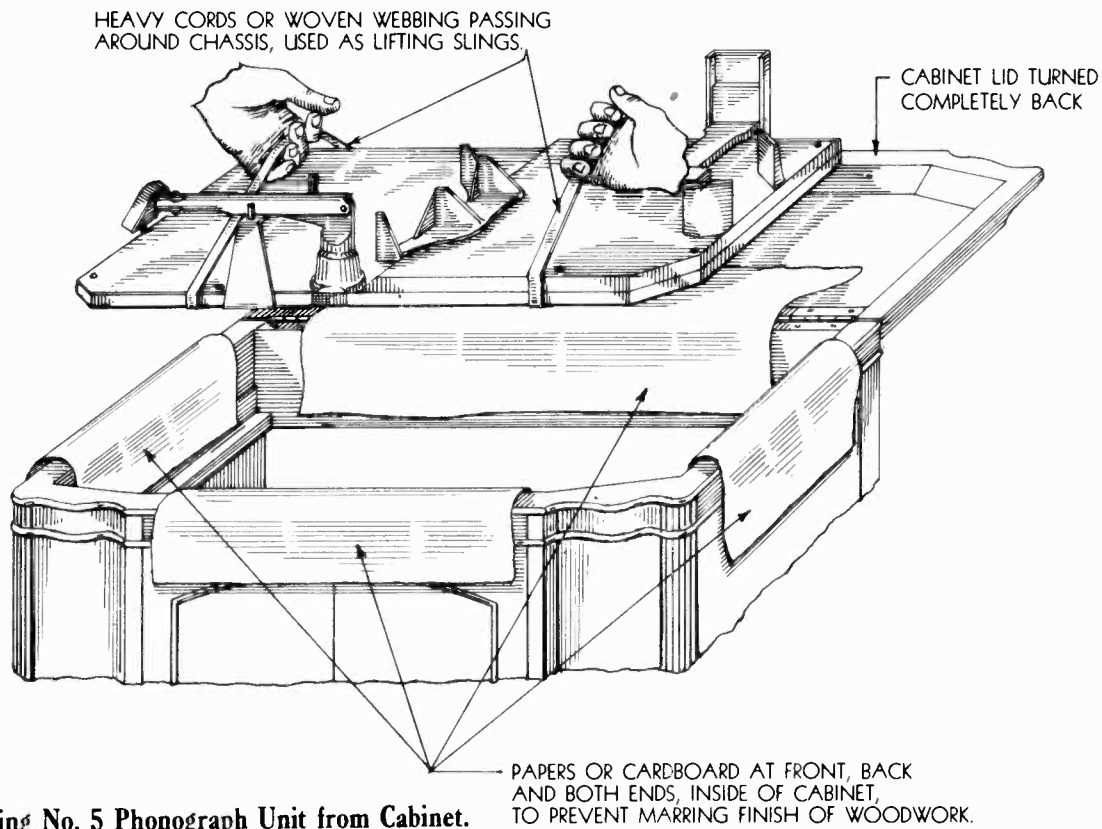


Fig. 20 - Removing No. 5 Phonograph Unit from Cabinet.

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(d) Pickup Positioning Lever, Fig. 6, incorrectly adjusted.

- Loosen Screws "C" and "E", Fig. 25, and move pickup arm positioning lever to right for bringing needle towards starting groove of record. Moving this lever to left brings needle towards edge of record. Tighten screws after each adjustment.

7 - Needle Lowers in Proper Position on Record Edge But Does Not Carry Into Playing Grooves.

(a) Pickup Arm, Fig. 1, is binding.

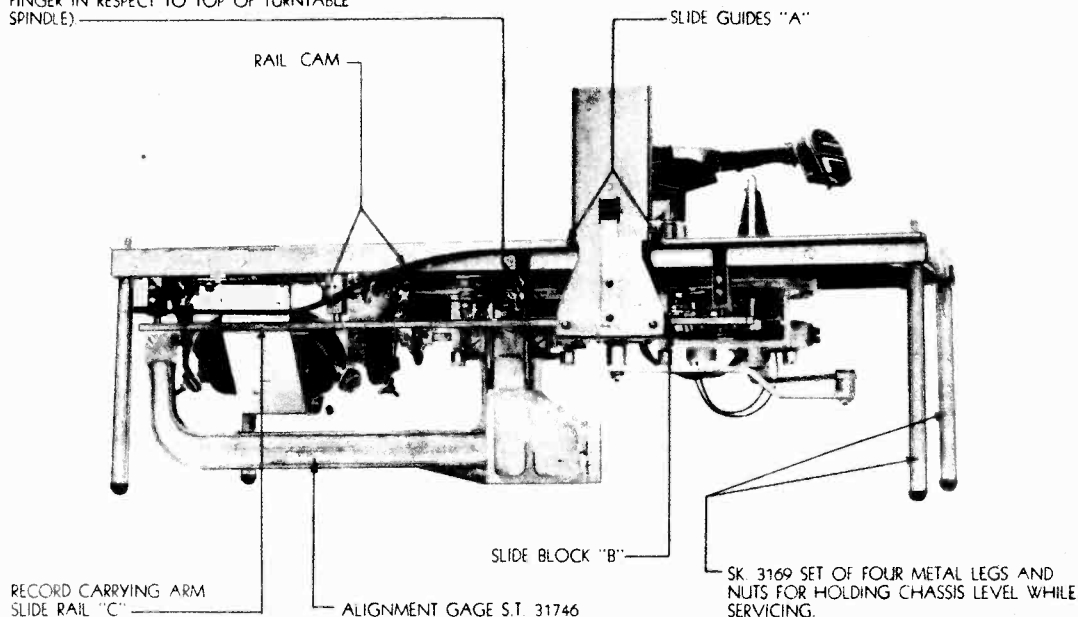
- Test to be sure pickup arm swings freely on its bearings and is not binding. There should be a slight up-and-down play on ball bearing, Fig. 25. This play can be obtained by adjusting pickup arm thrust collar as described in paragraph "a" Section 21.

(b) Tension too light on "First Groove" springs. See Fig. 26.

- Increase tension separately for 10-inch and 12-inch records by turning adjusting screws Fig. 26 in clockwise direction (looking at slotted end of screws) so that needle is positively forced over surface of record and just enters first groove in record. Have turntable rotating when adjustment is tested. Too much tension will cause needle to jump over several grooves.

SCREWS FOR ADJUSTING HEIGHT OF RAIL CAM SURFACE (HEIGHT OF RECORD TRANSFER FINGER IN RESPECT TO TOP OF TURNABLE SPINDLE)

Fig. 21 - No. 5 Chassis mounted on Sk. 3169 Testing Legs.



8 - Needle Lowers in Proper Position But Jumps Over Several Playing Grooves.

First Groove Springs, Fig. 26, tension too strong.

- Adjust separately for 10-inch and 12 inch records as described in Section "7b".

9 - Record Changing Trip Does Not Operate at Completion of Record.

- (a) Tripping grooves in record are larger in diameter than customary or standard recording practice. Records having "eccentric" type (Victor) tripping grooves larger than 7-inches in diameter or "spiral" type tripping grooves larger than 3-3/4 inches in diameter are "special" for automatic record changers and should not be mixed with records to be played "automatically". This phonograph is provided with a "Single Record" setting for playing singly "off standard" records.

(b) Spiral Spring on Tripping Pawl, Fig. 9, missing.

- Replace with new P-23312 Spring (See Section 32 for list Replacement Parts).

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(c) Pickup Arm Tripping Lever, Fig. 9, too low at Tripping Pawl End.

- Raise this arm bodily by first loosening the two retaining screws "C" and "E", Fig. 25, setting to the correct position and then tightening the two screws. The correct height is checked by observing the movement of the lug "H" Figs. 9 and 10 on the Automatic Clutch Pawl. When the pickup head is swung in close to turntable spindle, lug "H" should be raised so as to clear the end "K" of the clutch dog at least 1/32 inch. End of long tripping lever "G" Fig. 9 should not be raised high enough to bind on end "F" of Automatic Clutch Pawl. When making adjustments of pickup arm tripping lever, Fig. 9, be sure that other branch of this lever (pickup arm positioning lever, Fig. 6) is correctly positioned with respect to the cam wheel surfaces before tightening the two lever retaining screws "C" and "E", Fig. 25. The end of this positioning lever should pass over the tops of lugs "L" Fig. 6, without touching. (About 1/32" clearance).

10 - Trip Operates Before Completion of Record.

- (a) Diameter of playing grooves in center portion of record is less than customary or standard recording practice (less than 3-3/4 inches diameter).

- Play "Off Standard" records singly, with phonograph set at "Single Record" position.

- (b) Permanent Stop Lug "E" Fig. 9 of ratched plate, out of adjustment.

- Loosen two screws "D" Fig. 9 and adjust plate to trip the clutch dog "K" Fig. 9 when needle in pickup head is moved towards center of turntable and just reaches a point 1-7/8 inches from center of turntable spindle. Set two screws "D" Fig. 9 tight after this adjustment.

11 - Clutch Fails to Hold at Completion of Cycle (Continuous Tripping).

- (a) Incorrect timing of large cam gear, if gear has been taken off.

- See Section 27 for "Timing of Mechanism".

- (b) Clutch dog spring "L" Fig. 11 weak or missing.

- Readjust tension to cause clutch dog to operate positively.

- (c) Shouldered screw "S" Fig. 11, used for holding clutch dog lever to notched clutch disc, is loose so as to allow end "K" Fig. 10 of this dog to drop down nearly flush with surface of disc.

- Set this screw "S" just tight enough to hold clutch dog in proper

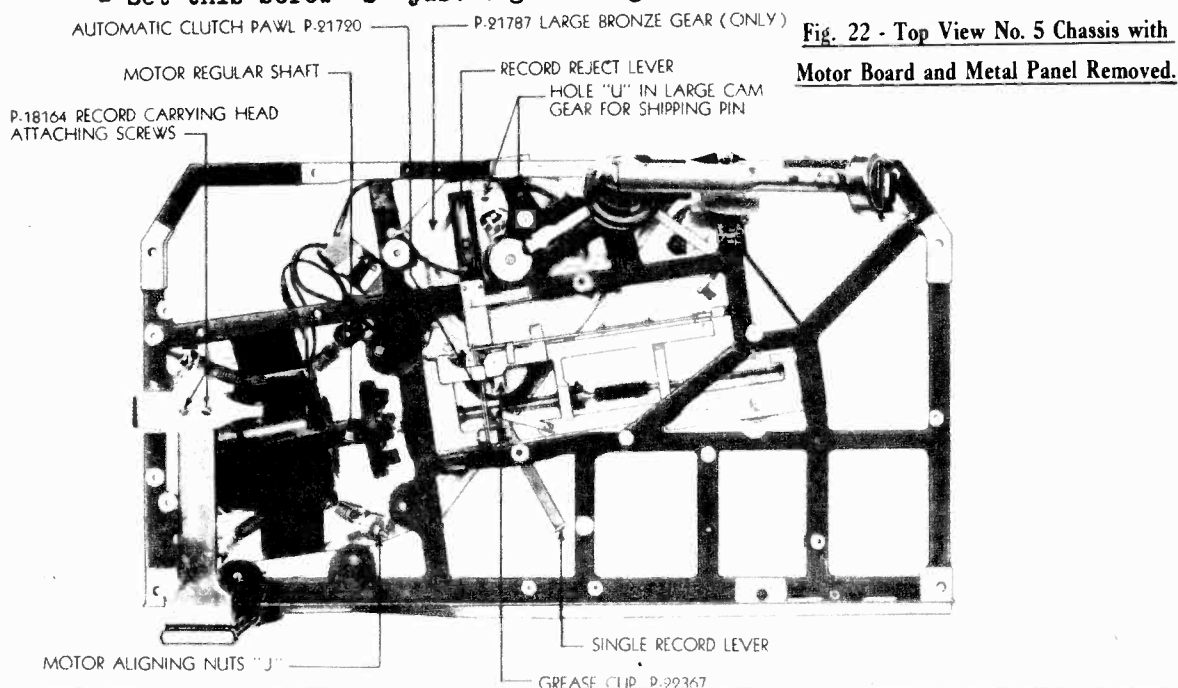


Fig. 22 - Top View No. 5 Chassis with Motor Board and Metal Panel Removed.

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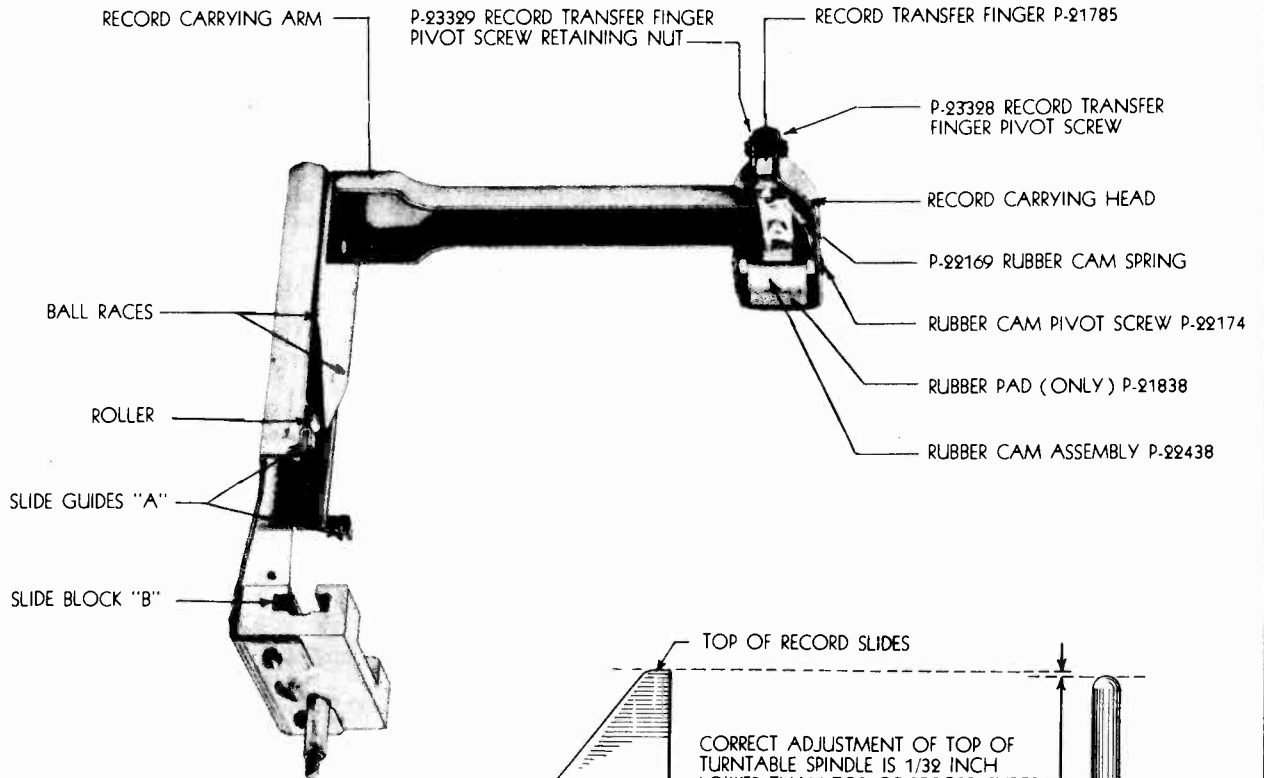


Fig. 23 - Record Carrying Arm Assembly.

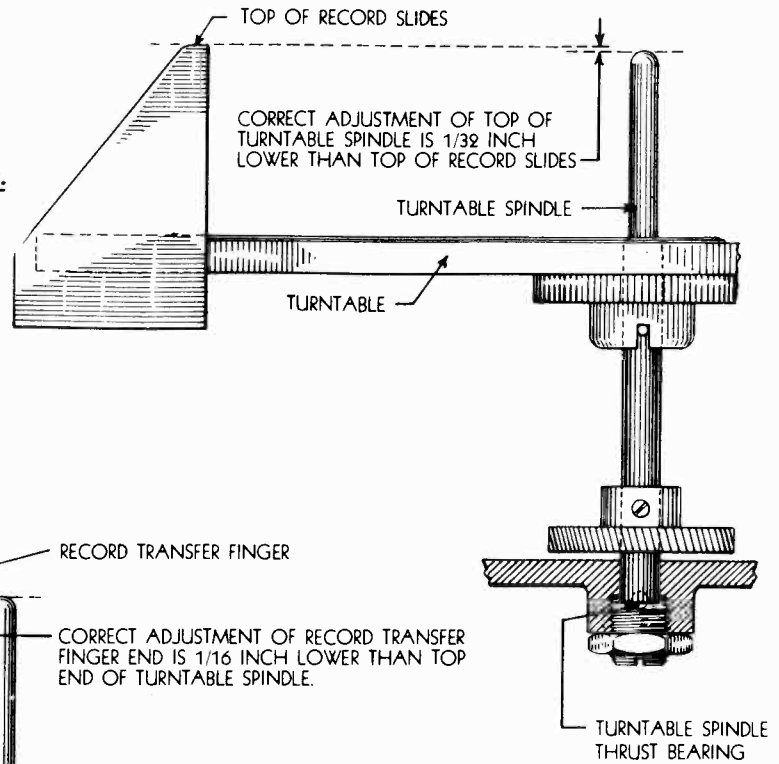


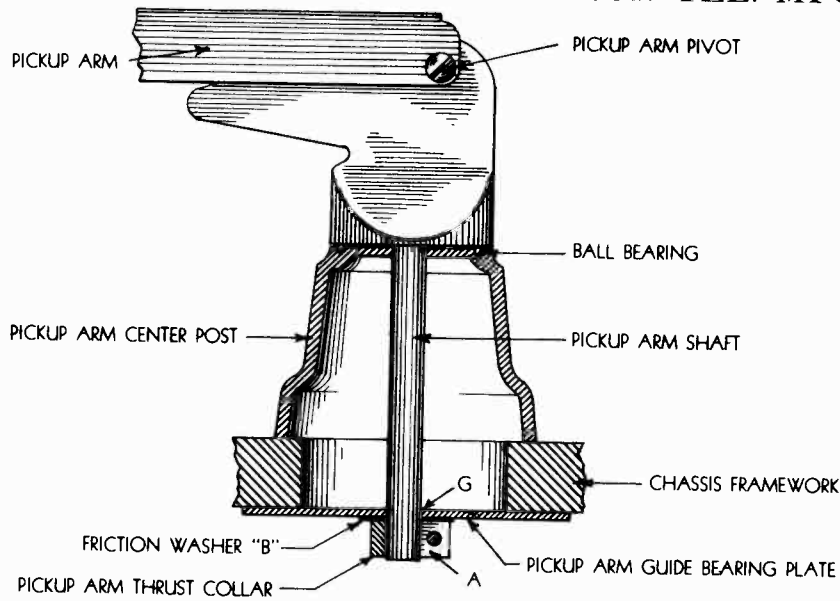
Fig. 24 - Diagram Showing Correct Turntable Spindle Adjustment.

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- position, but not tight enough to bind. Stake over end of screw "S" with a center punch to prevent loosening. Check freedom of movement of clutch dog after latter operation.
- (d) Automatic Clutch Pawl "F" Figs. 9 and 10, not dropping down properly.
- See that Automatic Clutch Pawl is not binding in slot of pawl guide plate "M" Fig. 10.
 - See that end of long tripping lever "G" Fig. 9 is not preventing clutch dog holding pawl "F" from returning to its normal position. A clearance of at least 1/64 inch should be provided between ends of levers G and F when both of these levers are in their normal positions, as shown in first view of Fig. 10.
 - See that end "N" Fig. 13, of record reject lever clears end "F" Fig. 9 of automatic clutch pawl by about 1/32 inch, when both levers are in their normal positions.
- (e) Vertical Clutch Shaft has too much end play.
- Adjust clutch shaft thrust bearing screw "R" Fig. 28, located at bottom of clutch shaft, just enough to remove excess end play but not enough to cause binding.
- 12 - Single Record Lever Fails to Operate.
- (a) Single record clutch pawl binding in clutch pawl guide plate "M" Fig. 15.
- Readjust, being sure that Automatic Clutch Pawl "F", Fig. 10, which is served by this same guide plate "M", is not misaligned.
- (b) End "B" Fig. 14, of Single Record Lever not properly contacting with lug "A" of Single Record Clutch Pawl so as to raise this pawl sufficiently high to clear end "K" Fig. 15 of clutch dog, when single record lever is set for "automatic" operation.
- Bend down lug "A" Fig. 14, so that end of single record clutch pawl will come up against aluminum chassis frame at "D" Fig. 15, when set for "Automatic" operation.
- (c) Lug "B" Fig. 14, at end of single record clutch pawl, not engaging raised end "J" Figs. 12 and 14 of complete cycle lever properly, during rotation of large cam wheel.
- Bend lug "B" so that it will raise and hold hooked portion "I" of single record clutch pawl above end "K" of clutch dog, as shown in second view of Fig. 15, so as to allow rotation without interference,
- 13 - "Clicking" of Clutch at Completion of Cycle.
- (a) Timing may be improper if large cam gear has been removed and replaced.
- See Section 27 for "Timing of Mechanism".
- (b) Complete Cycle Lever, Fig. 12, not restoring to normal properly or sticking.
- See that spiral restoring spring "K" Fig. 12 is in place and has ample tension to restore complete cycle lever.
 - See that shouldered pivot screw "L" is in place and not binding complete cycle lever.
 - See that triangular stud "A" Fig. 12 drops to bottom of notch in clutch disc, or that spring arm of complete cycle lever comes into contact with stop pin "G" Fig. 12, when parts are in non-operated (normal) position.
- 14 - Speed Variations (Wons) at Slow Speed.
- (a) Felt pads on governor "Z", Fig. 28, are dry.
- Oil these pads as described in Section 29.
- (b) Bearings are dry.
- Lubricate as described in Section 29.
- (c) Main Drive Shafting, Fig. 2, is tight.
- Adjust main drive shaft thrust bearing "W" Fig. 28 to allow free rotation without noticeable end play of shaft.
- (d) Dirt or grit in Gears.
- Clean thoroughly and lubricate as described in Section 29.
- 15 - Failure Of Phonograph Motor to Shut Off After End of Last Record.
- (a) Pickup Arm Switch, Fig. 28, is loose in switch bracket, or the switch bracket is loose on the chassis.
- Fasten switch securely on bracket by tightening hexagonal retaining nut.
- (b) Readjust Switch Bracket "B" Figs. 4 and 28 so that when pin "V" Fig. 4 of pickup arm tripping lever is in contact with the long lug "W" of forked end of switch lever, the hooked edge of pickup tongue "C" Fig. 4 will clear edge of a 12-inch record by 3/32 inch to 1/8 inch. This clearance is necessary to allow a 12-inch record to fall freely on to turntable.
- (b) Single Record Lever Fig. 14 is set in "Single Record" position.
- This phonograph is designed to shut off automatically only when set for "Automatic" operation.
- 16 - Pickup Arm Goes to Off Position After Depositing Record on Turntable, Without Playing It.
- Cam wheel guard, Fig. 28 not set closely against edge of cam surface.
- Loosen two screws "H" Fig. 28, fastening this guard to the chassis frame and adjust position of guard so as to come within 1/16 inch from cam surface, then retighten screws.
- 17 - Phonograph Will Play More Than Fifteen 12-Inch Standard 78 R.P.M. Records.
- Record Limit Switch Fig. 8, incorrectly adjusted.
- Readjust as follows:
 - First, set the Single Record Lever Fig. 14 to "Single Record" position. Second, have a needle of specified type in pickup head. Third, stack enough records (14 or more) on turntable so that top surface of upper record is 1/4 inch from top of turntable spindle as shown in Fig. 8.
 - Fourth, when needle is resting on surface of top record, the record limit switch should be so adjusted that its contacts "G" are closed, allowing the motor to operate the turntable.
 - Fifth, adding one more record (standard thickness) to stack of records on turntable should open contact "G" Fig. 8 when pickup needle is resting on surface of this top record, preventing motor from operating.

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LOOSEN SCREWS "C" AND "D," THEN ADJUST THRUST COLLAR "UP" TO TIGHTEN BEARING AND "DOWN" TO LOOSEN BEARING.

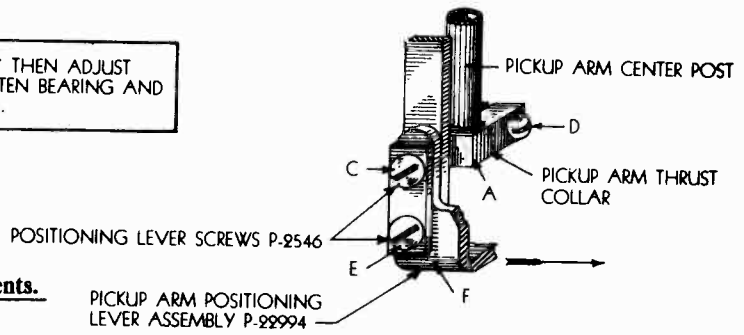


Fig. 25 - Diagram of Pickup Arm Adjustments.

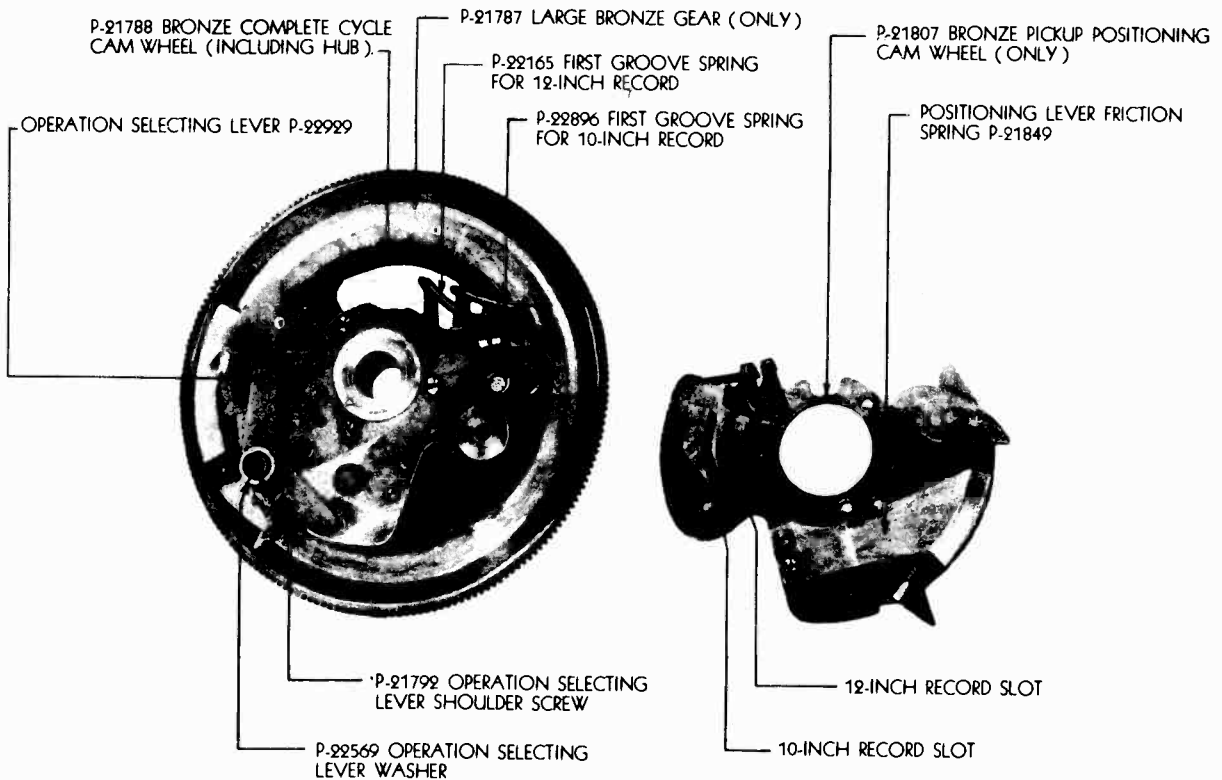


Fig. 26 - Cam Wheel Assembly and Details.

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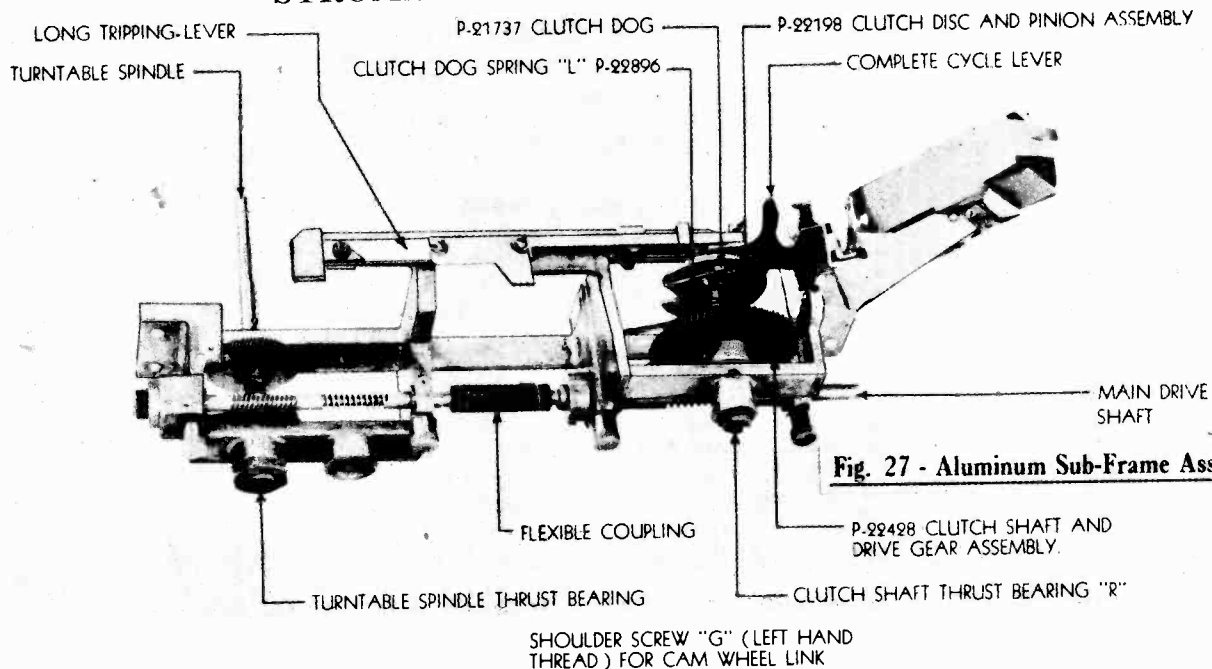


Fig. 27 - Aluminum Sub-Frame Assembly.

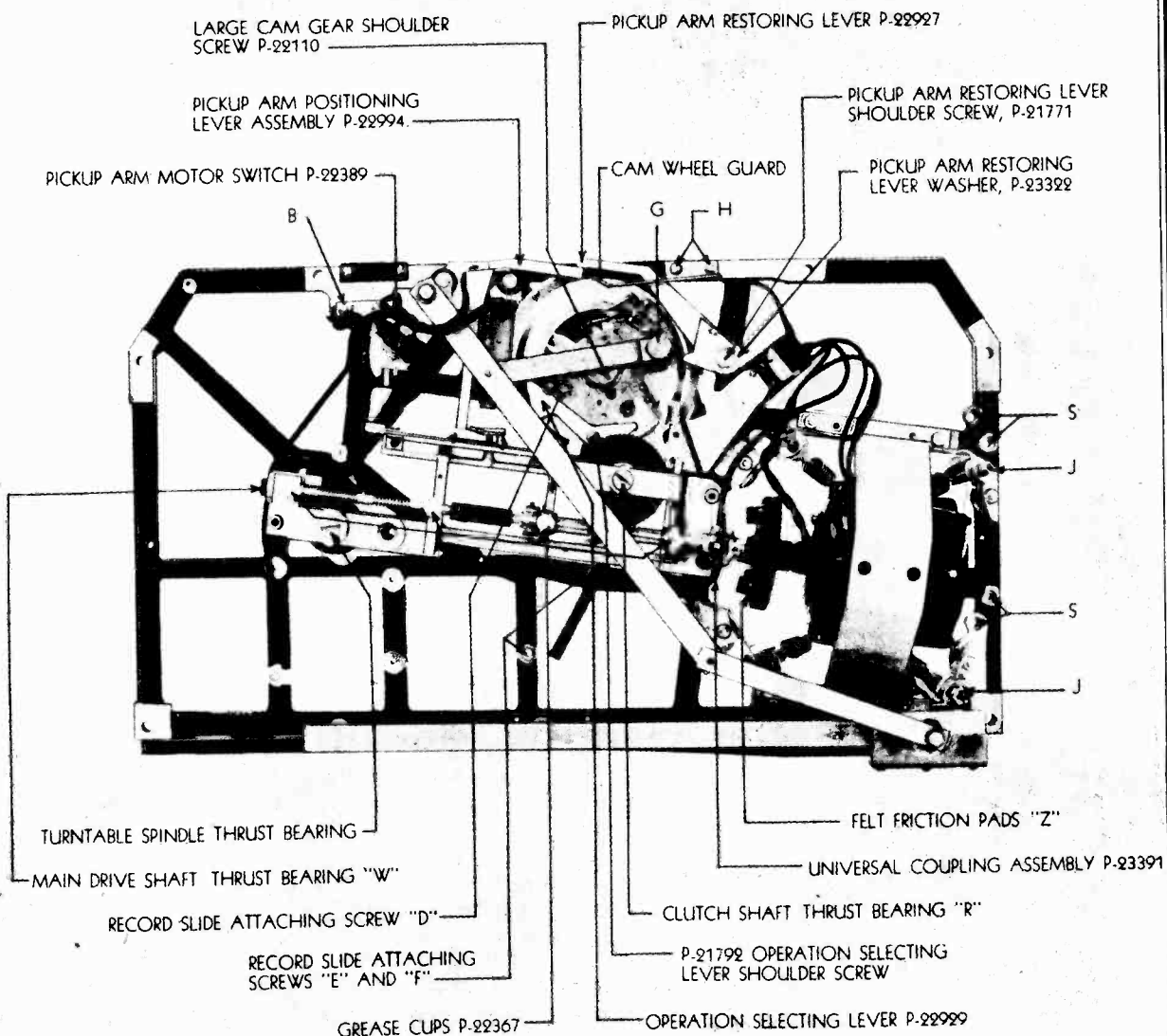


Fig. 28 - Bottom View of No. 5 Chassis.

- Sixth. If record limit switch fails to operate as specified in paragraphs marked "Fourth" and "Fifth", adjust switch by bending the lever at point "P", Fig. 8.
- 18 - Phonograph Will Not Play Fifteen 12-Inch Standard 78 R.P.M. Records.
Adjust Record Limit Switch Lever at point "P", Fig. 8, as described in Section 17.
- 19 - Rubber Cam, Fig. 23, Fails to Push Records Back Against Record Stops.
(a) Rubber surface has become glazed over.
- Clean rubber surface and roughen by scraping with knife or sandpaper. Also, wipe surface of records clean from lubricating materials which may be picked up from surface of records. If rubber is old or worn, replace with new rubber pad P-21838.
(b) Record Transfer Finger, Fig. 23, sticks and does not operate freely during return of record carrying arm to position on surface of top record in magazine.
- Clean thoroughly as described in paragraph "a" Section 2.
(c) Rubber Cam, Fig. 23, does not come in contact with surface of top record in magazine.
- If this is due to ball bearings sticking in vertical ball grooves, remove and clean ball bearings as described in next Section (20).
- 20 - Record Carrying Arm Head, Fig. 23, Fails to Lower on Records in Magazine After Depositing One on Turntable.
Ball races, Fig. 29, sticking.
- Remove record carrying arm as described in Section 26, clean balls thoroughly and lubricate with phonograph grease (See Section 29). They should roll freely when replaced.
- 21 - Needle Does Not Follow Grooves in Record.
(a) Pickup arm thrust collar "A", Fig. 25, is too tight against friction washer "B", Fig. 25.
- Adjust thrust collar "A" Fig. 25 so as to allow a slight clearance. In making this adjustment first loosen screws "C" and "D" so as to release thrust collar "A". Be sure to leave screw "E" tight so as not to change adjustments of Pickup Arm Positioning Lever "F" Fig. 25. Do not leave bearing too free.
(b) Pickup arm shaft needs lubrication at guide bearing "G" Fig. 25.
- Lubricate with oil as described in Section 29.
- 22 - Record Carrying Arm Chatters During Movement.
(a) Slide guides "A", Fig. 23, may be too loose.
- Close up by carefully pinching together these guides by means of large parallel jaw pliers.
(b) Slide block "B" Fig. 23 may be binding on Record Carrying Arm Slide Rail "C" Fig. 21.
- Test for freedom of movement of slide block on slide rail by disconnecting "Cam Wheel Link", Fig. 3, at large cam wheel (remove hexagonal shoulder "C" Fig. 28) and then moving the record carrying arm back and fourth the full length of the slide rail by hand. Correct any binding that may be found. (See Section 29 for lubrication of slide).
- 23 - Record Sticks to Shoe on Pickup Head (Does Not Deposit Properly on Turntable).
(a) Pickup Shoe "I", Fig. 4, adjusted too low, causing record edge to be pinched tightly between pickup tongue "C", Fig. 4, and this shoe.
- Readjust pickup shoe "I", bending its end up slightly so as to avoid holding edge of record tightly.
(b) Pickup arm bearing too tight to move freely, thus holding record on lip of pickup tongue "C" Fig. 4 when center hole in record engages the top end of turntable spindle.
- Adjust bearing to obtain free movement as described in paragraph "a" of Section 21. Do not leave bearing too free.
- 24 - Removal of Motor Board.
Take out the four screws marked "S", Fig. 28, which fasten record stops (See Fig. 1) to metal chassis frame. Remove "Motor Regulator Knob", Fig. 1, by pulling off end of shaft. Remove needle cap and swing "Single Record" lever to "Automatic" position. Now lift motor board just high enough to clear the top of "motor regulator" shaft, Fig. 22, and slide motor board to the right, out from under the record slides, Fig. 1.
When replacing this motor board, be sure to lift the head of the "Record Reject" button by hand so that the lower end of this button will not catch on the sides of the record reject switch contact springs, Fig. 13.
- 25 - Removal of Metal Panel Under Turntable.
Remove the turntable, Fig. 1, by lifting it directly up. Take out the nine round head screws showing on top of metal plate. There are three screws attaching the record slides, Fig. 1, to the chassis, which must be removed. Two are visible on the under side of the chassis frame at points "R" and "S" Fig. 28 and the third is under the large gear at position "D" Fig. 28. Turn the large gear around until the large slot in it is under this screw, which now can be removed. Metal panel now will lift off by raising it up over the turntable spindle.
Reverse the above operations, when replacing metal panel.
- 26 - Removal of Record Carrying Arm.
Remove two screw stop pins "A" and "B" Fig. 29, allowing record carrying arm assembly to be raised upward and completely out of vertical channel member "Q", taking care to hold the two ball races "C" and "D" against sides of carrying arm base, so as not to fall out and become lost. Remove screw "A" by raising top surface of carrying arm 2-3/4 inches from top of channel member "Q", so that hole in ball race guard will come in line with screw head "A". Remove screw "B" by raising top surface of carrying arm 1/4 inch from top of channel member "Q", so that hole in lower end of record carrying arm base will come in line with screw head "B". Use a special screwdriver that will grip a screw slot so that screw studs can be withdrawn through openings "A" and "B" without falling down into phonograph mechanism. If no special screwdriver is available, use a small amount of beeswax on end of screwdriver blade.
When replacing these parts, reverse the order of above operations, holding the ball races "C" and "D" Fig. 29 against the base member of the record carrying arm before inserting this assembly into top of vertical channel member "Q".
After screw stop pins "A" and "B", Fig. 29, are replaced, check freedom of operation by raising and lowering the record carrying arm several times. This arm should fall freely of its own weight so as to rest on top record in magazine and to follow this record properly when being carried to the turntable spindle.
- 27 - Timing of Mechanism.
If at any time the large cam gear, Fig. 26, is removed, it is necessary that it be replaced properly. Proceed as follows:
First, rotate "Notched Clutch Disc", Fig. 12, to the position where

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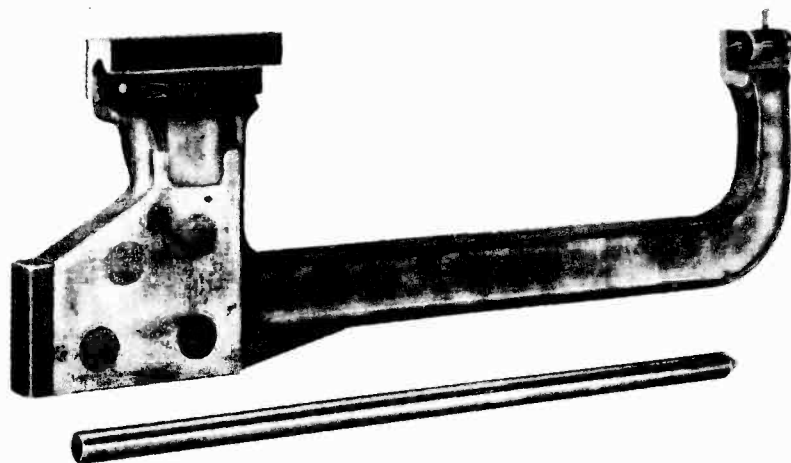
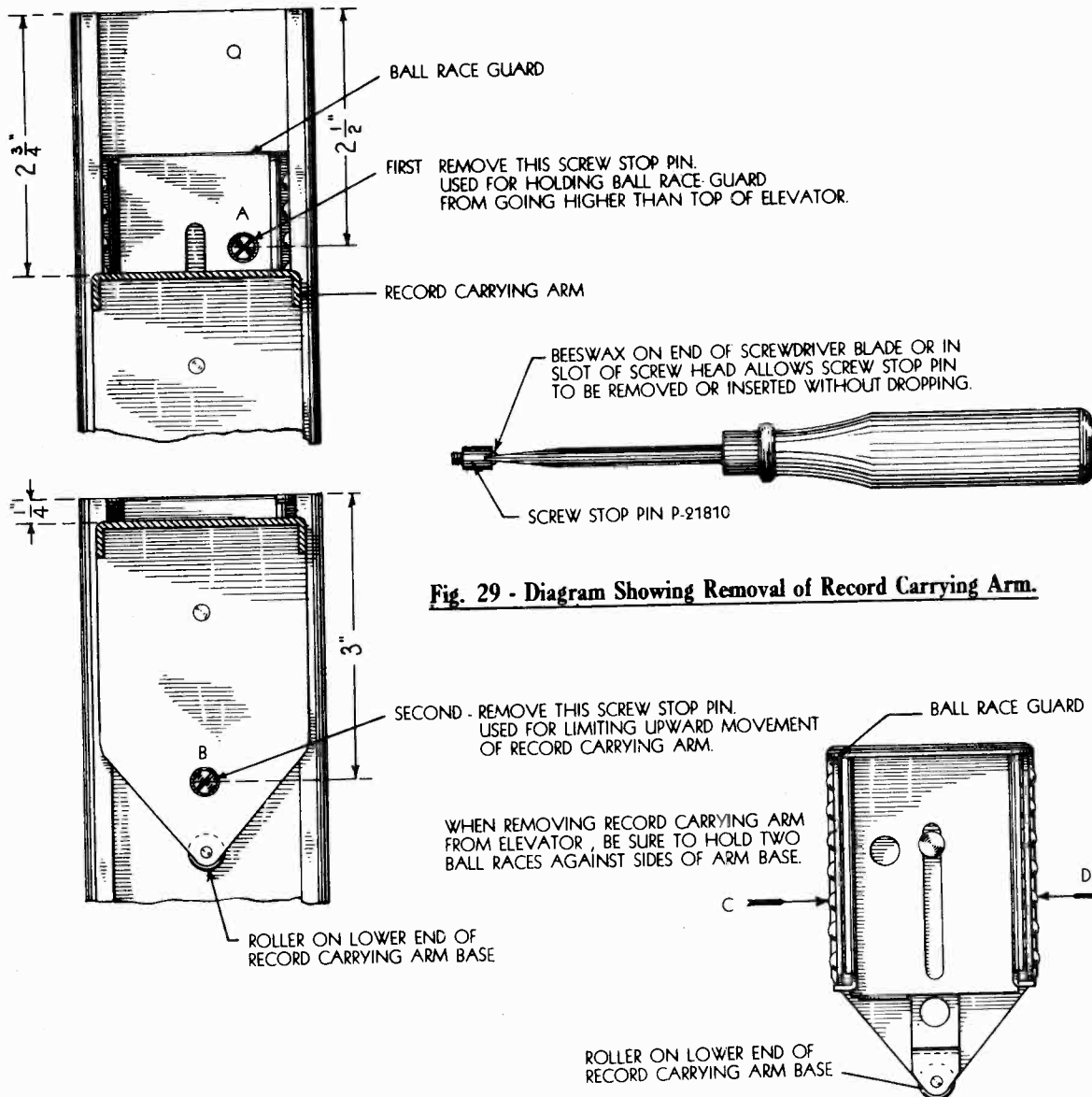


Fig. 30 - Photograph of St-31746 Motor Aligning Gage.

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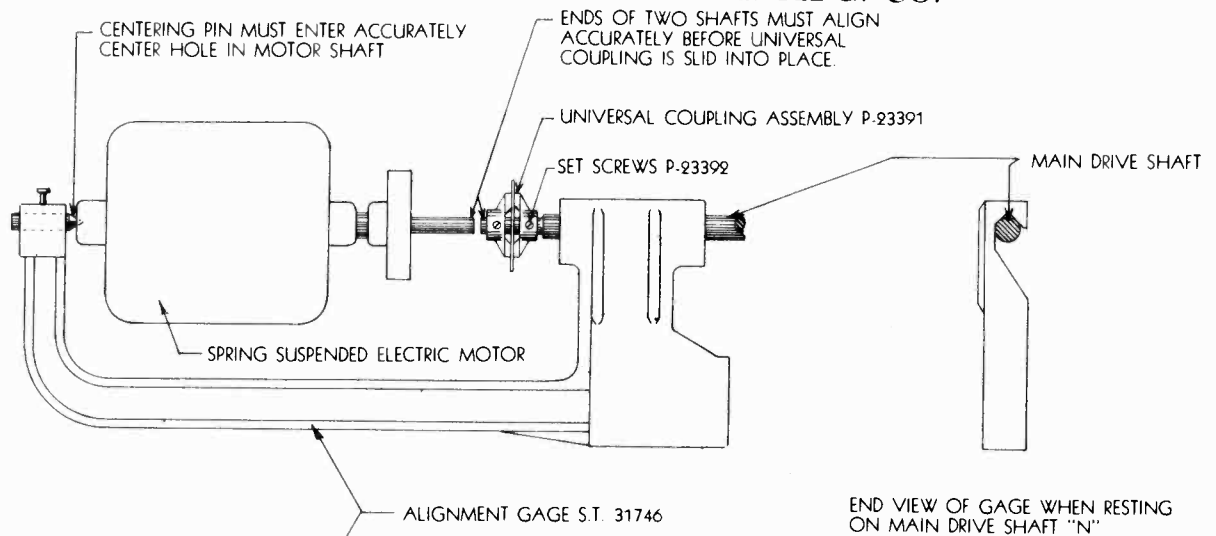


Fig. 31 - Diagram Showing Use of Motor Aligning Gage.

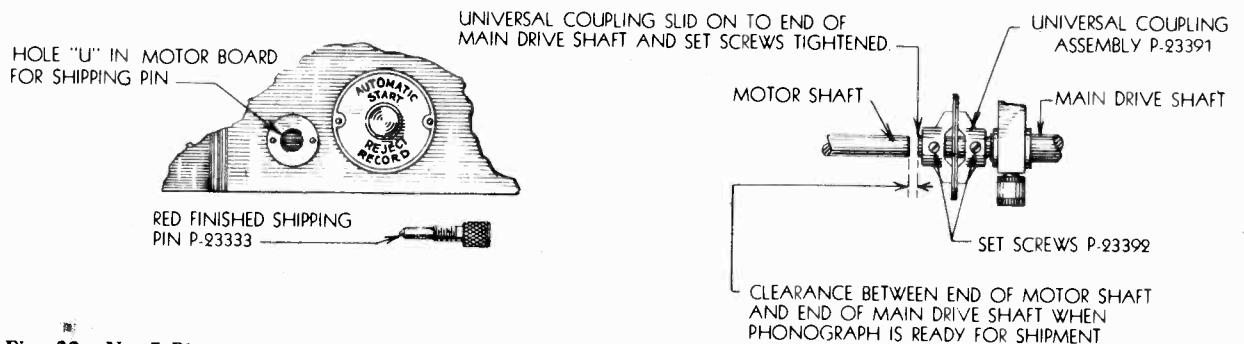
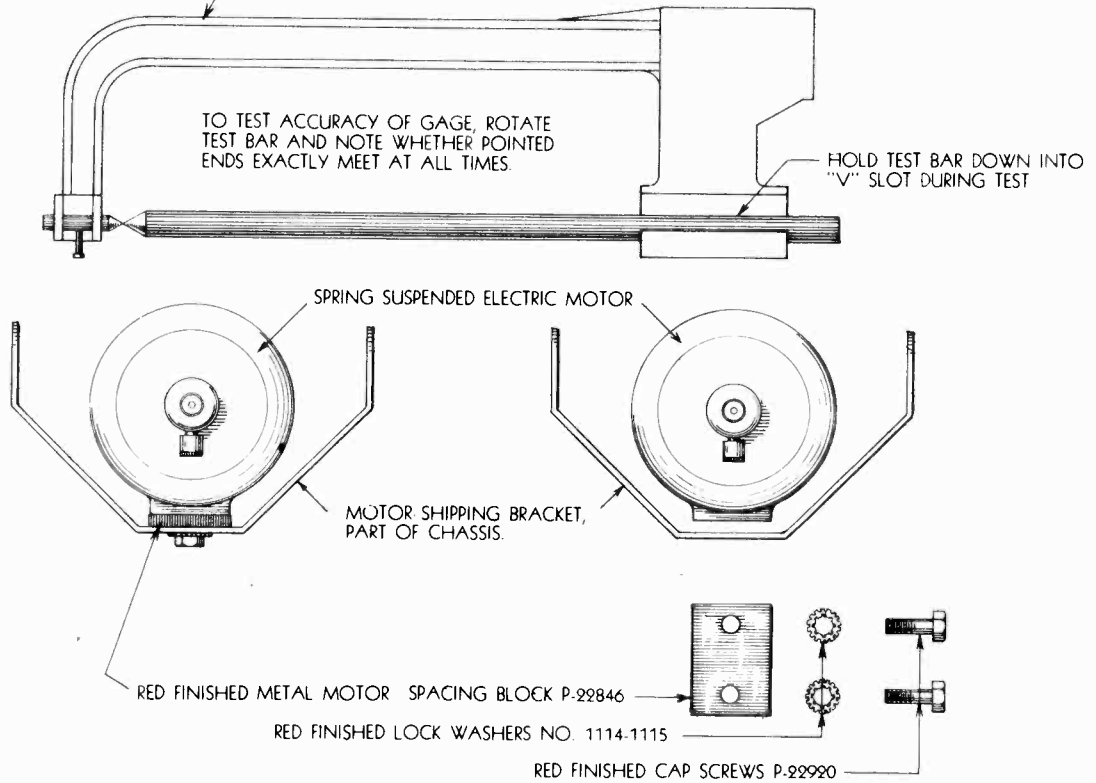


Fig. 32 - No. 5 Phonograph Unit Shipping Details.

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Eighth, test for each adjustment of the realigning nuts "J", by deflecting the motor by tapping it with the fingers to give it about 1/4 inch movement in different directions, allowing it to freely oscillate back to rest. (Forcing the motor in only one direction and allowing it to come back slowly to rest may give a false indication).

Ninth, after alignment is made correct, as indicated by the gauge and the opening in Universal Coupling, Fig. 31, set the Universal Coupling back in place, so as to connect the motor shaft to the main shaft. Run the motor for a short time to be sure that it rotates free from noticeable vibration, then make a final check on the alignment of the motor shaft on the free end of motor by means of the special motor aligning gauge.

Tenth, set up tight all eight jam nuts on the motor adjusting screws "J", Figs. 22 and 28, to retain the new adjustments just made. Also, be sure that all set screws in Universal Coupling, Fig. 28, are set tight.

Eleventh, replace motor board as described in second paragraph of Section 24 and make a final operating test of automatic record changing mechanism.

Twelfth, install No. 5 Phonograph Unit in Cabinet as described in Section 1.

29 - Lubrication.

Correct lubrication of the bearings of any rotating mechanical device is essential for freedom of operation, as well as to avoid undue wear. In order to insure safety in lubrication, the No. 5 Phonograph is fitted with grease cups on all high speed shafting. These cups contain sufficient lubricant to last for at least a year of average service. Slow moving shafts are lubricated with a few drops of oil. There are some moving parts that should never be lubricated as a film of oil or grease may cause sluggish or incorrect action. Follow lubricating chart of Fig. 38 for location of places requiring lubrication and kinds of lubricant to use for each bearing.

30 - Circuit Precautions.

There are two separate electrical circuits employed in the No. 5 Phonograph Unit, one for the 110-volt A.C. motor circuit and the other for the magnetic pickup head circuit. Both of these circuits are completely insulated from the metal framework of the phonograph and of course, are insulated from each other.

(a) Electric Motor Circuit, Fig. 17

- Test this circuit as follows:

First, with pickup arm on pickup arm rest and record carrying arm at completion of its cycle as shown in Fig. 1, there should be no electrical circuit completed between prong "A" and prong "B" of attachment plug. See Fig. 17. Also, there should be no circuit between the metal chassis framework and either prong "A" or prong "B" of attachment plug.

Second, moving pickup arm to the edge of turntable, closes a contact in Pickup Arm Switch "U", establishing a circuit from prong "A" to prong "B" of the attachment plug, including electric motor and contacts, "U" Figs. 8 and 17.

Third, while pickup arm is in position of previous paragraph, raise pickup head vertically so as to be about 3-inches above turntable, thus opening contacts "G" of "Record Limiting Switch", See Figs. 8 and 17. Now, no circuit will exist between prong "A" and prong "B" of attachment plug.

Fourth, return pickup arm to pickup arm rest, so as to open circuit from prong "A" to prong "B" of plug and then press "Automatic Start" button. See Figs. 1, 13 and 17. This latter operation again closes circuit from prong "A" to prong "B" of plug through motor and contacts "O" Figs. 13 and 17, while the button is held closed by hand.

the triangular stud "A" of the complete cycle lever is in the bottom of the notch in the clutch disc.

Second, mesh the teeth of the large cam gear, Fig. 26, with the teeth of the clutch disc, so that the arm "B" of the complete cycle lever fits into notch "A" of ring cam as shown in Fig. 12.

Third, check accuracy of above operations by inserting the red colored Shipping Pin through the hole "U" Fig. 22 provided for this pin in the chassis frame. If done correctly, the end of this pin will pass freely through hole "U" Fig. 26, in the large cam wheel, and the triangular stud "A", Fig. 12, will remain in the notch in the edge of clutch disc.

Fourth, now operate the "Reject Record" lever Fig. 13 and turn drive shaft by hand (being sure that red colored shipping pin is removed) and note that lever arm "B", Fig. 12, comes out of notch "A" and clears ring cam. Complete rotation of large Cam Wheel and see that the triangular stud "A" goes to the bottom of notch in the clutch disc and that the "spring arm" presses against the complete cycle lever stop pin "E", Fig. 12, when this large cam wheel finishes its single rotation.

28 - Alignment of Motor.

The driving motor "M", Fig. 2, for this No. 5 Phonograph must be accurately aligned with the main shaft "S", in order to insure smooth operation and minimum vibration. Excessive vibration of this motor when operating will cause a fluttering in the audio reproduction of phonograph records. Alignment of this motor is obtained by adjusting the tension on the eight spiral springs that suspend the motor to the chassis framework. This adjustment should never be attempted unless a suitable motor alignment gauge shown in Fig. 30 (Stromberg-Carlson ST-31746) is available. Proceed as follows:

First, remove the No. 5 Phonograph Unit from the cabinet as described in Section 1.

Second, rest the No. 5 Phonograph Unit in the same horizontal position it occupies when mounted in its cabinet, by resting the two ends on vertical supports (see paragraph "h", Section 1), and remove motor board only, as described in Section 24.

Third, set the Record Carrying Arm, Fig. 1, in position marked "3", Fig. 3, over the turntable, so that Long Drive Lever is away from motor end of chassis as shown by dotted lines.

Fourth, hang the "V" section of the Special Motor Alignment Gauge on the Main Drive Shaft, between the shaft bearings, as shown in Figs. 21 and 31, with the centering pin in line with the center hole in the motor shaft. Before using this gauge check its accuracy by means of the Master Gauge Shaft as shown in Fig. 31, to see that the centering pin is in alignment.

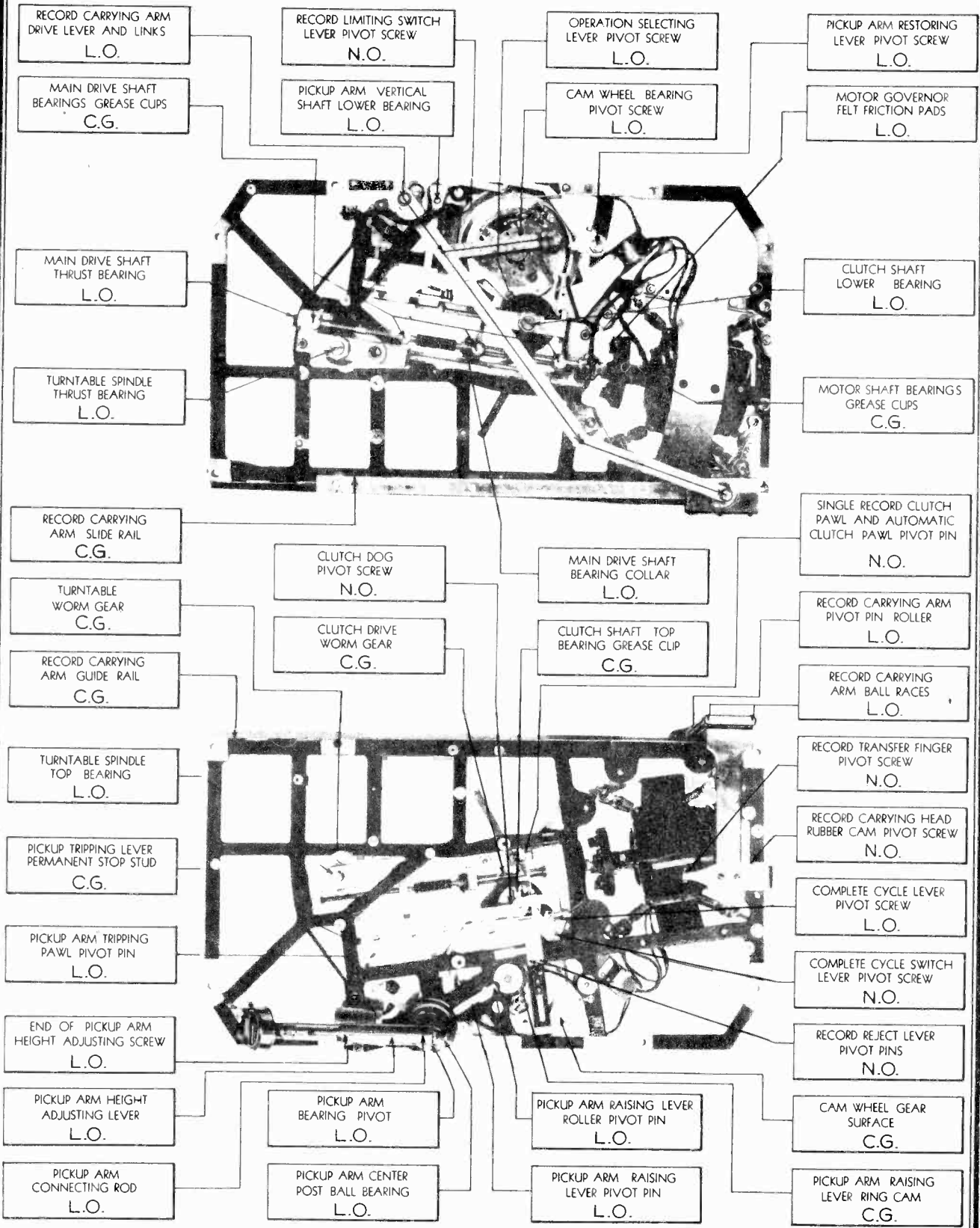
Fifth, loosen all set screws used in holding the Universal Coupling, Fig. 31, to the Motor Shaft and to the Main Drive Shaft. Slide this coupling back on Main Shaft so as to leave motor freely supported on its eight spiral springs.

Sixth, now check alignment of the end of motor shaft with the opening in the Universal Coupling and the alignment of other end of the motor shaft by means of the centering pin on the Motor Alignment Gauge and the "center" hole in that end of the motor shaft.

Seventh, if either or both ends of the motor shaft show considerable misalignment, proceed to realign by turning the motor adjusting nuts "J" Figs. 22 and 28, a few turns at a time until the alignment of both ends of the motor shaft is obtained. Care must be exercised in making this adjustment to avoid unnecessary work. It is advisable to increase tension on one or more springs by pulling these springs by hand to see whether the motor shaft will be deflected in the desired direction, before making permanent adjustments with the nuts "J".

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L. O. = LIGHT OIL
 C. G. = CUP GREASE
 N. O. = NO LUBRICATION

Fig. 33 - Lubricating Chart.

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Fifth, with all operating parts in their normal positions, as shown in Fig. 1, press "Automatic Start" button and rotate main drive shaft "N" Fig. 2, about six complete revolutions, closing "Complete Cycle Switch" Contacts "T", Figs. 12 and 17. Remove pressure from "Automatic Start" button (opening starting contacts "O" Figs. 13 and 17) and it will be found that a circuit exists from prong "A" to prong "B" of plug, including contact "T" and motor.

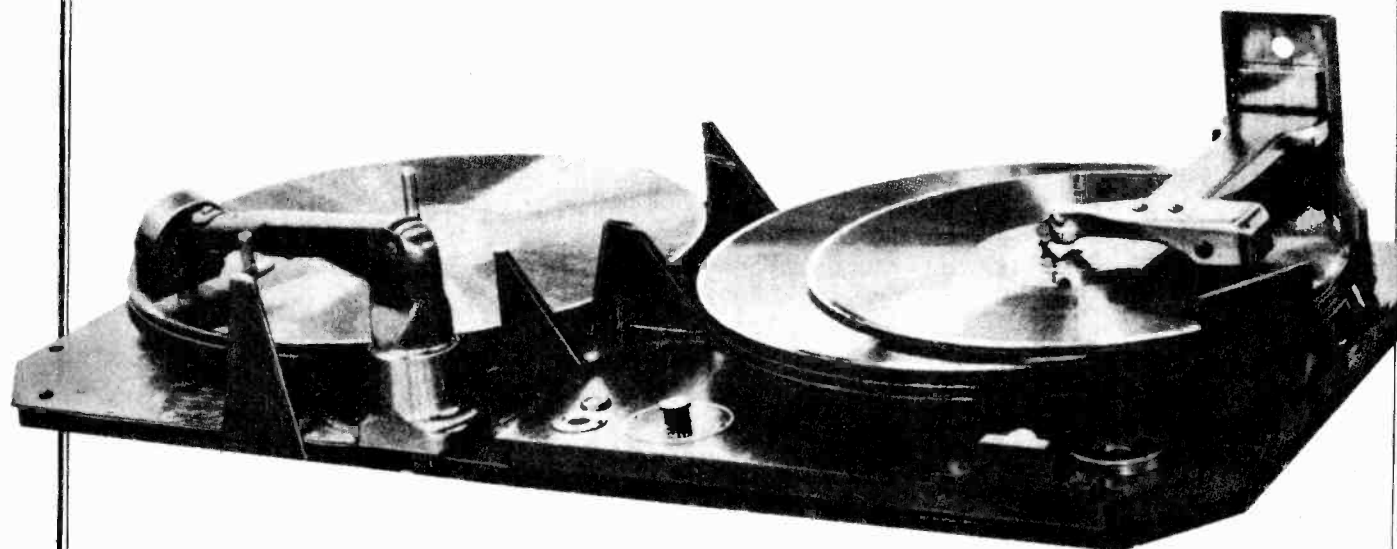
Pickup Head Circuit, Fig. 18

- (b) The winding of the pickup head is connected to a terminal block (mounted on under framework of phonograph chassis) by two flexible cords, completely insulated from all metal work of the phonograph. A plug connector is provided in the pickup head stem and a jack connector is provided in the end of pickup arm, thus allowing pickup head to be completely removed by first loosening pickup holding screw (See Fig. 1) and then pulling the head directly out from end of pickup arm.

When replacing pickup head, check for correct adjustment by following instructions given in paragraph "a" Section 6.

Note that flexible pickup cord Fig. 18 connects to pin jacks in top of "Pickup Transformer", the latter being located near bottom of cabinet. The frame of this pickup transformer must be connected to "ground" by means of a wire extending to either terminal of the voice coil of the dynamic speaker (when No. 5 Phonograph is mounted in a radio cabinet). High pitched "hum" will result if this "grounding" circuit is omitted or is accidentally disconnected.

Another "grounding" connection should be provided, and maintained, from the metal framework of the No. 5 Phonograph chassis and the ground (GND) binding post of the radio receiver chassis. If this connection is omitted or accidentally opened, high pitched hum will result.



STROMBERG-CARLSON NO. 5 MULTI-RECORD PHONOGRAPH UNIT

Stromberg-Carlson Telephone Mfg. Co.
Rochester, New York.

MODELS 5, 6, 7, 9 STROMBERG-CARLSON TEL. MFG. CO.

31 - Shipping Precautions.

Before transporting the No. 5 Phonograph when mounted in a cabinet by truck or rail, be sure to protect the operating mechanism by using the special red colored packing material (found in the canvas pocket inside of cabinet) and following instructions in the order given below. This precaution applies also when making deliveries from the dealer's store to a customer's home.

- First - Run motor through its complete record changing cycle without any records in magazine and immediately remove A.C. plug from house outlet.
 - Second - Insert "Shipping Pin" in hole "U", Fig. 32, provided for it, immediately at left of "AUTOMATIC START" button on the record magazine wooden panel. Force this pin into place, screwing the threaded portion in a clockwise rotation until it is securely held against dropping out in shipment.
 - Third - Remove turntable from turntable spindle (See paragraph 10).
 - Fourth - Remove motor regulator knob from motor speed control shaft by lifting up. (See paragraph 10).
 - Fifth - Be sure that needle holding thumb screw in pickup head is tightened to prevent loss in shipment.
 - Sixth - Loosen set screws which lock Universal Coupling to motor shaft and main drive shaft. Slide this coupling off motor shaft on to drive shaft until clear of motor shaft at least 1/16 of an inch, then lock set screws to prevent coupling from sliding off drive shaft. See Fig. 32.
 - Seventh - Slide metal motor spacing block (colored red) in between bottom of motor and motor bracket. Line up holes in bracket, motor plate and bottom of motor and screw in the two cap screws, with one lock washer on each screw, and fasten tight, as shown in Fig. 32.
 - Eighth - With all records out of magazine, force record carrying arm down on record rests. Take one piece of red cotton tape and wind once around this arm, in close to upright bracket. Drop both ends of this tape down through the space between chassis and back of cabinet, with one end on each side of upright. Equalize the lengths of the free ends of this tape. Pull both ends down and pass over, back and under block to motor bracket. Pass left side end of tape through inside of motor bracket and right side end of tape through bracket to left side. Inspect position of tape on top of record shifting arm before drawing tight. Fasten with a secure knot.
 - Ninth - With pickup arm on pickup arm rest, take another piece of red cotton tape and wind once around pickup arm, close to bracket, then criss-cross tape around pickup rest bracket, back over arm again and tie tight.
 - Tenth - Wrap separately and carefully Turntable (Paragraph 3), Motor Regulator Knob (Paragraph 4), Package of Needles, Stroboscopic Disc and Envelope containing Operating Instructions and enclose all of these items in a box or carton. If the instrument cabinet is to be packed in its original shipping box, this carton containing phonograph parts can be safely transported by securely fastening it to the upper side of the cabinet shipping skid by heavy wrapping cord in the same manner used for the factory shipment.
- Important - When shipping the No. 5 Phonograph chassis only (not mounted in a cabinet) be sure to use the special rigid shipping skid and packing box furnished for this purpose by the factory. This special packing is designed to avoid damage to mechanism and to operating adjustments.

32 - Replacement Parts.

A list of replacement parts is provided on page 40, for the convenience of the dealer service department.

REPLACEMENT PARTS FOR NO. 5 MULTI-RECORD PHONOGRAPH UNIT

Part No.	Description of Part	See Cut	Reqd. Per Photo.	Base Price Each
22846	Black Bushing	Fig. 32	1	.20
19667	Shouldered Soft Rubber, Mtg.	Figs. 6 & 26	6	.05
21807	Brass Pickup Positioning Rubber (Assem.) for Record Arm	Figs. 4 & 23	1	3.00
22438	Large Bronze Wheel (only)	Figs. 22 & 26	1	2.75
21787	Steel, Pickup Arm Raising Pin, Complete Cycle	Figs. 12 & 26	1	3.25
21788	Brone, Complete Cycle For Clutch Disc.	Fig. 27	1	2.25
21737	Clutch Dog	Figs. 11 & 27	1	1.00
22428	Drive Gear, Assembly	Fig. 27	1	4.00
23391	Universal, Assembly	Figs. 2 & 28	1	.20
21785	Record Transfer	Figs. 4 & 23	1	.25
22367	For Shaft Bearings	Figs. 22 & 28	1	1.25
22927	Pickup Arm Restoring (Assem.)	Figs. 7 & 28	1	.45
22864	Complete Cycle (Assem.)	Fig. 12	1	.50
23020	Pickup Arm Raising, Cam End	Fig. 5	1	.60
22929	Pickup Arm Raising, Shaft End	Figs. 7 & 26	1	1.25
22994	Operation Selecting (Assem.)	Figs. 7 & 28	1	.05
22319	Pickup Head Holding	Fig. 8	1	.30
23329	Record Transfer Finger	Fig. 23	1	.30
21720	Automatic Clutch	Figs. 9, 10 & 22	1	.30
23019	Single Record Clutch Assembly inc. Holding Bolt	Figs. 14 & 15	1	10.50
21778	Red Colored Shipping Lever	Fig. 1	1	.25
23333	Pickup Arm Raising Lever	Fig. 5	1	.15
22101	Pivot Pin	Figs. 9, 10 & 14	1	.20
22100	Automatic Trip	Fig. 9	1	.25
23001	Ratchet Plate For P-22438 Cam	Figs. 4 & 23	1	.01
18164	Screw For Record Carrying Head	Fig. 22	2	.04
21792	Complete Cycle Lever	Fig. 12	1	.45
22110	Large Cam Gear	Fig. 28	6	.03
19764	For Mtg. Photo. in Cabinet	-	2	.03
22920	Motor Spacing Block	Fig. 32	2	.03
21792	Operation Selecting Lever	Fig. 26	1	.25
21771	Pickup Arm Restoring Lever	Fig. 28	1	.05
23359	Pickup Head Holding	Fig. 8	1	.01
2542	For Attaching Positioning Lever	Fig. 26	2	.01
2542	Ratchet Plate	Fig. 9	2	.10
23328	Record Transfer Finger	Figs. 4 & 23	1	.04
22174	Rubber Cam Pivot	Figs. 4 & 23	4	.01
23392	Universal Coupling	Fig. 32	2	.03
21810	Record Carrying Arm Clutch Dog	Figs. 11 & 27	1	.17
22896	First Groove, 10" Record	Fig. 26	1	.05
23166	Complete Cycle Lever	Fig. 12	1	.05
22165	First Groove, 12" Record	Fig. 26	1	.05
21849	Positioning Lever Friction Rubber Cam	Figs. 6 & 26	1	.07
23316	Single Record Clutch Pawl Tripping Pawl	Fig. 14	1	.05
23312	Spring	Fig. 9	1	2.00
22389	Pickup Arm	Figs. 8 & 28	1	3.50
23393	Transformer Complete inc. 33-1/3 mechanism	Fig. 8	1	.02
22943	Turntable	Figs. 1 & 16	1	.02
22569	Washer	Fig. 26	1	.01
14315	Washer	Fig. 9	2	.03
19745	Washer	For Ratchet Plate Screws	6	.10
23326	Washer	Metal, For Mtg. Photo in Cabinet	2	.10
23322	Washer	Pickup Head Holding	1	.07
19968	Washer	Pickup Arm Restoring Lever	6	.02
1114	Washer	Flat Rubber for Photo. Mtg.	2	.07
ST 31745	Gauge for Alignment of Motor	Shakeproof for P-22920	31	12.00
SK 3169	Set of Legs for Chassis Servicing	Figs. 21	2	2.25
23542	Light Oil	Fig. 33	1	.70
23643	Cup Grease	For Lubricating Photo. Bearings	1	.50

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For the Service Man

This Chart is designed for the use of the Service Mechanic only, and is intended to facilitate as far as possible his work of caring for the Changer mechanism, whether he is called in for the purpose of insuring its continued satisfactory operation, or to remedy some difficulty which has appeared. For his convenience, the "Operating Instructions," supplied to each user by the factory, may be summarized as follows:

The Changer plays twelve "10" or ten "12" records. . . . To reload, revolve the two posts slightly, grasping them underneath the Shelf Plates. Turn them back after the played records are removed; they will fall and lock when in proper position. Then place the new records on the Shelf Plates, and push "R" button to put Changer in operation. . . . To play the other size records, turn the knob at top of each post until proper figure is opposite pointer, and press the "10" or "12" button, to agree with pointer setting. . . . To reject a record (or to start a change cycle as for testing purposes) simply press the "R" (Release or Reject) button at any time while needle is upon a record. . . . To play manually, turn plates out of the way as for reloading, and press "M" button.

Oiling

The changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 6 points. All points can be reached from above, through holes in the mounting plate, as follows:

- No. 1) Three oil holes on motor gear housing. Reach all three through toward the trigger for earlier tripping, or away from it for later tripping. This Changer does not depend, for automatic tripping, on the records being provided with any special grooves at end; it trips whenever needle comes within a certain distance of Record Pin. The factory adjustment is for 1-7/8" from center of Record Pin. This is the most generally satisfactory distance; no modern record will then be cut off before playing is finished, and none will fail to trip at end. For certain records of early manufacture, it may not be possible to find an adjustment that will always trip and never cut off.
- No. 2) Through hole marked "B", drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 3) Through holes marked "C", see felt wick, and drop the oil directly upon it.
- No. 4) Through hole marked "D", see felt wick, and drop the oil directly upon it.

To Check Oiling

If squeaks are heard compare the squeak with and with a load of records; stacked records themselves sometimes squeak against a center pin. See that all five wicks are in position, including three 1/4" wicks in frame of Motor. See that each wick is thoroughly saturated (as it may not be if insufficient oil or too heavy oil has been used). Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil). If necessary, clean gummed-up wicks with kerosene. See that each is saturated with good oil; then, before replacing them, drop a little good oil into the holes.

Adjustments

There are three adjustments that can be made. All are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to remake any of these adjustments, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. (See Top View. This adjustment is made with a screwdriver from above—does not require removing Changer from cabinet.) If needle comes down too far from edge of record, playing of records will not start at their beginning. Turn Needle-Landing Adjusting Screw very slightly counter-clockwise. If needle comes down too close to edge of record, needle may slip off edge of record. Turn the adjusting screw clockwise. Compare also Paragraph 12 below.

Compare also Paragraph 12 below.

B. ADJUSTING DISTANCE FROM RECORD PIN AT WHICH TRIGGER WILL TRIP AND CHANGE CYCLE WILL BEGIN. Turn Trip Adjusting Screw 1/8, toward the trigger for earlier tripping, or away from it for later tripping. This Changer does not depend, for automatic tripping, on the records being provided with any special grooves at end; it trips whenever needle comes within a certain distance of Record Pin. The factory adjustment is for 1-7/8" from center of Record Pin. This is the most generally satisfactory distance; no modern record will then be cut off before playing is finished, and none will fail to trip at end. For certain records of early manufacture, it may not be possible to find an adjustment that will always trip and never cut off.

C. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES.

The arm should rise during the change cycle, high enough so that it clears by only 1/8" the record above it, next to be played. (Be careful, before deciding that adjustment is necessary, to see that the record at bottom of stack is not a warped one.) To make this adjustment, loosen and turn the Sleeve 22 (see photographs) and turn the Sleeve to lengthen or shorten Pickup Plunger 21. When correct adjustment is found, tighten lock nut again.

Replacing Motor

The service mechanic may be called upon to adapt the Changer to a different power supply. For this purpose, or in case of any service fault within Motor, remove entire Motor (with Record Pin and connecting gear drive) from the Changer, and replace it with a suitable new Motor. (In ordering a replacement Motor, specify the power supply and model number of phono-radio or other type of installation.)

When mounting replacement Motor, it is most important to see that Record Pin is centered between the two Posts of the Changer, and that it stands perpendicular to Main Plate 53, and that it has not become bent so as to wobble. Even though the Posts are stout and not easy to bend, it is well to check them also, with a 12" combination square laid clear across the concave upper surface of Main Plate. When the new Motor has been attached, with three screws through Grommet Sleeves 51 (spacers) into its frame, and Record Pin is seen to revolve without appreciable wobble (a wobble would indicate that it has been bent in transit from factory) the correct position of Pin midway between the Posts can be accurately checked in this way: Place a single 12" record on the Shelf Plates, press "R" button, and turn turntable forward by hand. Immediately after the Shelf Plates open and let it fall, turn Turntable slightly backward, and with other hand support the record between the Shelf Plates; it can then be readily seen whether Record Pin is off center. If it is, remove the record and Turntable, and loosen slightly the screw or screws nearest the Shelf Plate to which record appeared closest. This should improve evenness of operation. However, unless the unevenness was very slight, it will be necessary for a permanent repair

to insert a shim or two on one or more of the three screws (or change shims from one screw to another). The shims used are shaped like an ordinary washer, cut out at one side (see cut-away view at 52 on photo, showing a shim in place upon one of the Grommet Sleeves). Shims can be cut out with shears and punch from thin metal or cardboard—or an assortment of shims of different thicknesses can be had from factory (order "Assortment of P-1897 Shims"). They should be inserted, loosened between Motor Frame and metal Grommet Sleeve. Do not insert shims next to Rubber grommet. Consult wiring diagram for particular installation. Use only Underwriters' approved wire.

Trouble Shooting

Cases of failure to operate well, will generally be found due to neglect of proper lubrication, or to tampering with mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. There is always the possibility that a spring may "go dead" even though the utmost factory precautions are taken against it—or that set-screws may work loose due to external vibration. Damage from tampering may take the form of bent parts; never bend any part during examination. Be careful never to push upward from below on Cam Connecting Rod Lift 37 while mechanism is operating; bending may result, and even slight bending here might interfere with correct timing of the cycle operations. Among the principal trouble symptoms to which such causes may give rise, are:

1. MECHANISM IS SLOW IN STARTING, OR STALLS DURING A CHANGE CYCLE, BUT A SLIGHT FORWARD PUSH WITH THE HAND STARTS IT AGAIN. May be caused by
 - a. Failure to lubricate properly. Oil thoroughly, per instructions above.
 - b. Loose setscrews.
 - c. Weakness of drive: line voltage may be abnormally low, or motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement. See above: "Replacing Motor."
2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS. This indicates trouble

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in Motor windings. Unless damage is easily seen and repaired, replace Motor.

3. MOTOR IS SLOW IN STARTING.

a. Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.

b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up, before concluding that Motor is defective, and proceeding as in Paragraph 2 above.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

a. Check oiling, as directed above. (If squeaks are heard, they will usually be found to come from the records--not from the mechanism).

b. See that all setscrews are tight.

c. Examine Motor windings; especially the shading coils (not visible in photos) which encircle a portion of each laminated pole and make the Motor self-starting. If coils have been jarred loose at any point, they may be tightened accordingly.

5. CHANGER IS NOISY WHEN IN CYCLE. Check oiling.

6. MOTION OF PICKUP TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM.

a. It may be found that, instead of trigger being actuated, there is stretching of Swivel Spring 95 (joining the lugs at ends of Swivel Spreaders 90 and 91), allowing the spreaders to open. Increase tension of Spring 95, by bending slightly the lug on either Spreader. If this increased tension causes needle to jump across the record, needle may be a little out of vertical, radially--it may "lean" toward center of record. To remedy this, grasp Pickup arm and twist it, very slightly, in a clockwise direction, so that it stands vertical, or even leans a little in outward direction.

b. If trigger is being properly actuated, probably Cam Lever 39 is binding against Sub-Plate 41. Look for dirt or obstructions; see that rivets are working freely. If the Lever engages Cam Lever Pawl 34, so that Lift 37 forces its roller up into the groove on Cam Gear 82, and if setscrews are tight, the change cycle must operate, as Cam Gear turns.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

a. Check Key Control Unit 75: see whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel.

b. Examine Reject Rod 78. If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be re-stored in same way. Grasp the two ends and twist it slightly.

c. If Trigger 16 is being properly actuated but without starting a change cycle, see directions above, Paragraph 6-b.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION. Check Key Control Unit as in preceding paragraph. First see that button goes clear down; then follow its action through Manual Rod 77.

9. MOTOR STOPS IMMEDIATELY WHEN CHANGER SWITCH IS TURNED OFF DURING A CHANGE CYCLE (instead of continuing to run, as it should, until needle is again upon a record, and then stopping). Or--

10. TURNING CHANGER SWITCH OFF FAILS TO STOP CHANGER AT ALL. Either of these two conditions would indicate failure of Cycling Switch 85. Cycling Switch operates normally to short-circuit the manual Changer Switch (which may be located in position shown at 54, or elsewhere) during change cycle only. Such damage to Cycling Switch (not likely to occur) would necessitate returning the entire Changer to factory.

11. CHANGER FAILS TO REPEAT LAST RECORD. See Paragraph 6, above.

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE. Pickup arm is normally impelled toward center of records by Lead Spring 97. Should a slight increase in its tension be found necessary, this can be easily obtained by bending the lug, to which it is attached, down against Main Plate. If tendency then appears for needle to jump across record, check angle of needle (see Paragraph 6-a above).

13. RECORDS FALL UNEVENLY UPON TURNTABLE. Seldom objectionable, this is due to Record Pin not being correctly centered between Posts. If necessary, it can be corrected as described above; see "Replacing Motor."

14. LAST RECORD DROPS ON ONE SIDE ONLY. This suggests a Post bent out of perpendicular to Main Plate. Test with square as directed (see "Replacing Motor"). If Post must be straightened, be careful not to bend other parts.

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MODEL 11

15. **CHANGER CONTINUES CYCLING.** Due to failure of Lift 37 to fall back out of engagement with Cam Gear. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.

16. **RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME.** See that Pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type, or 0.5 volt if of magnetic type. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. **SELECTOR PLATE FAILS TO SEPARATE BOTTOM RECORD FROM STACK.** This is due either to a badly warped condition of the record, or to its being of a thickness very considerably different from those now in standard use. The design of both Selector and Shelf Plates is such as to accommodate a maximum variation in thickness and flatness of records, but certain records may be found which are so far out as to be impracticable for use in automatic changers.

If Necessary to Disassemble the Changer

Before attempting to remove Sub-Plate Assembly 83, detach Key Control Unit 75 from Main Plate. To do this, start with Control Unit Truss Bar 80. Then take out the screw which holds left end of Adjusting Rod Lever 94. Next remove Adjusting Rod 92 and Adjusting Rod Extension 79. Take out the screw holding Spring 73; then the screws holding Key Control Unit 75 to Main Plate. Rods 77 and 78 can then, with due care, be extracted without bending. Free the Cam

Connecting Rod 58 by loosening setscrew holding Spreader and Hub Assembly 59. Sub-Plate Assembly can then be detached without bending parts. In reassembling, reverse the procedure.

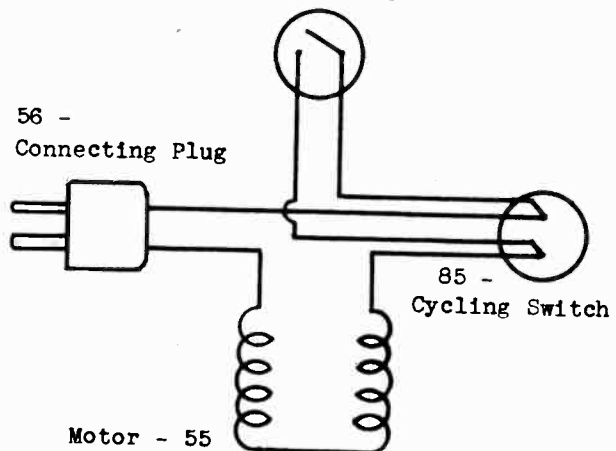
Replacement Parts

When spare parts or sub-assemblies are required, order them direct from factory, by number and name as given on photos. Where no number is given, order by FULL AND EXACT description, specifying model on which part is to be used.

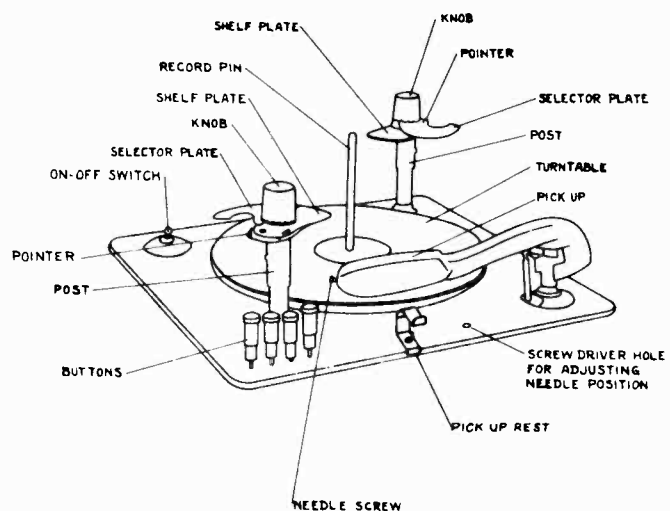
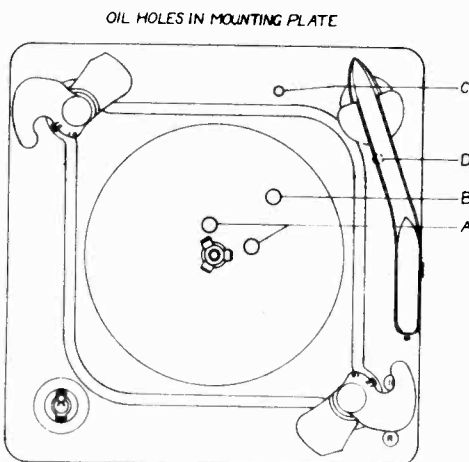
Questions Not Covered

The service mechanic should not hesitate to inquire of the factory regarding any difficulty encountered which does not seem to be covered by this Servicing Chart.

54 - Changer Switch

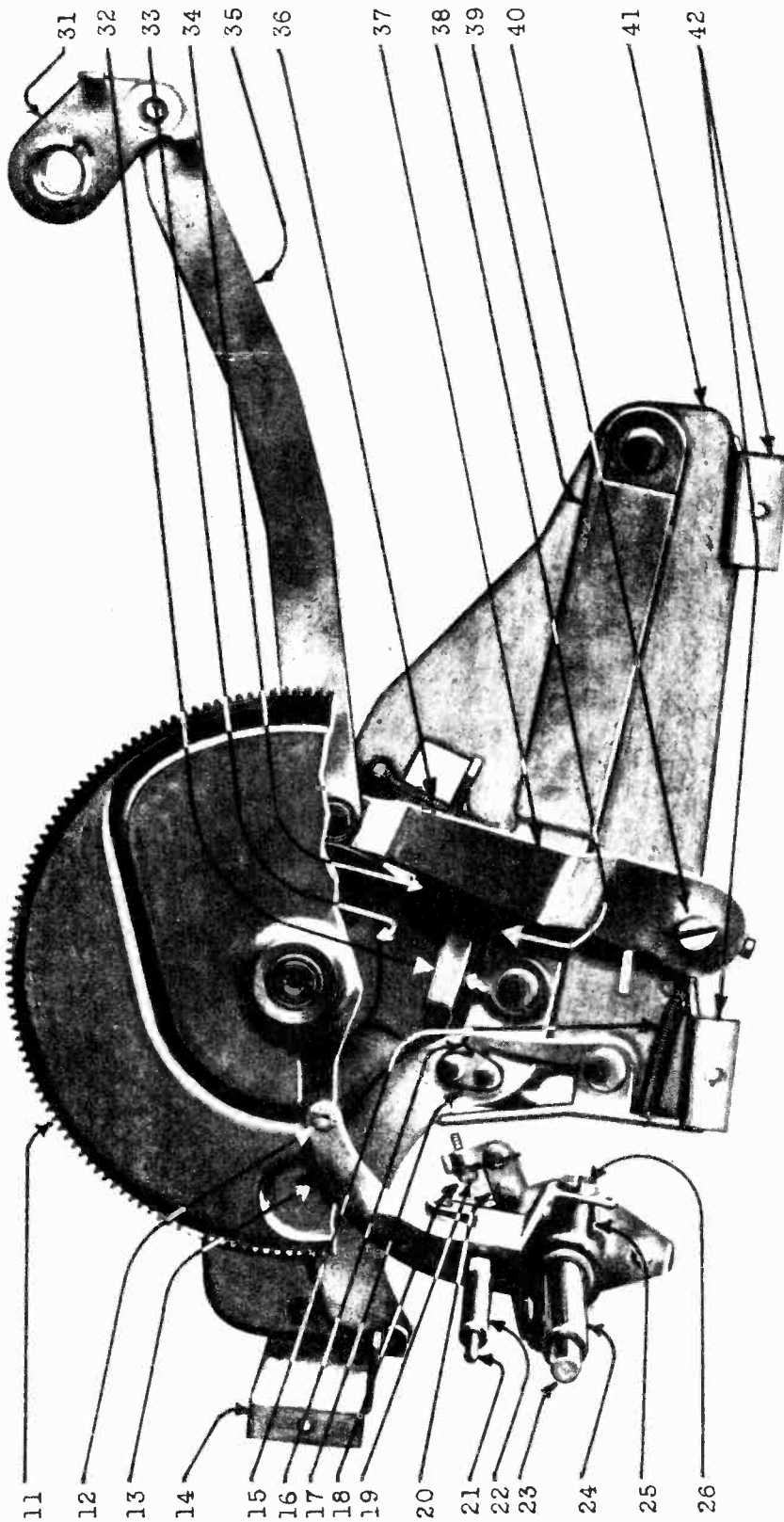


Typical Wiring Diagram



MODEL 11

WEBSTER-CHICAGO CORP.

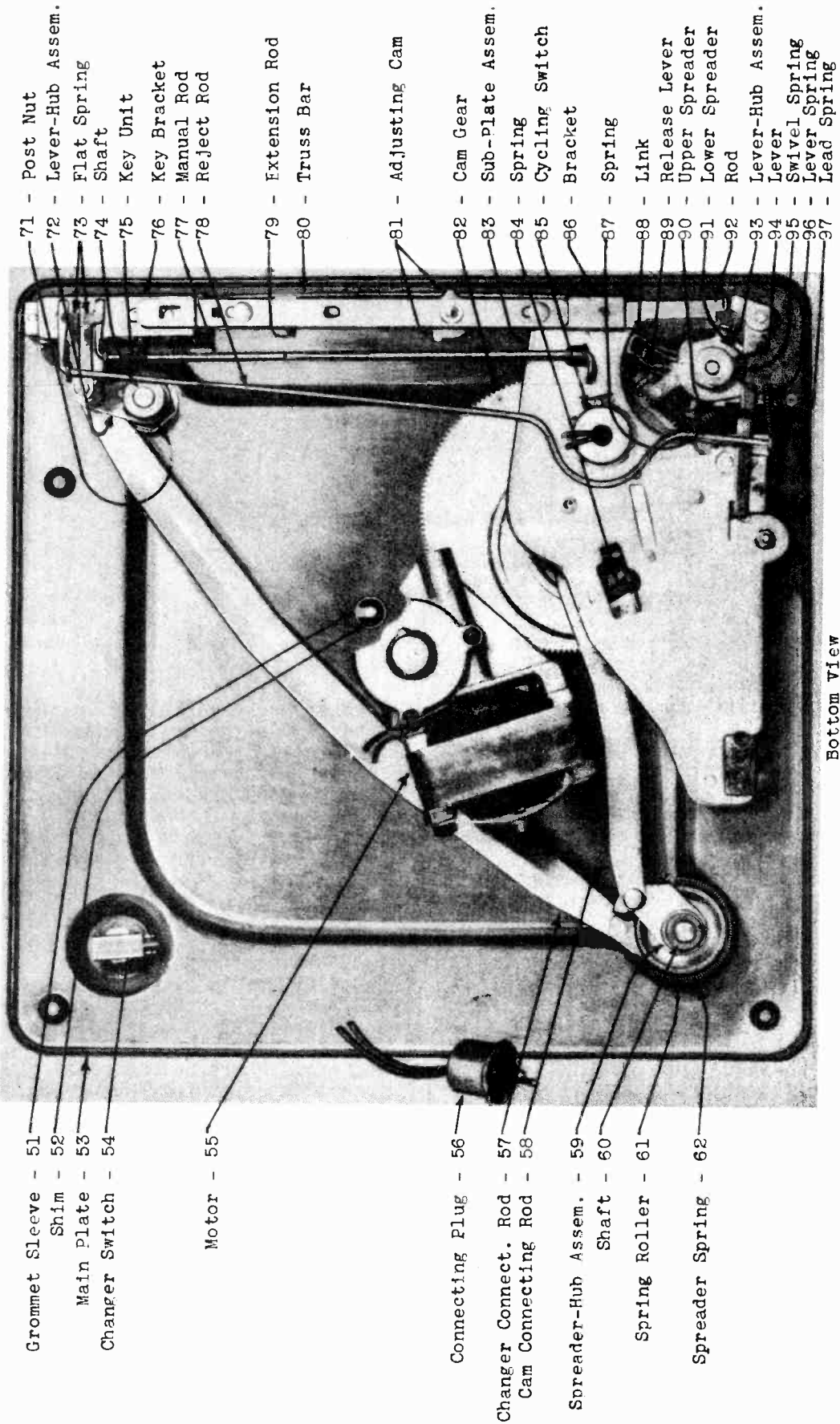


Sub-Plate Assembly

- | | | | |
|----------------------|----------------------|--------------------------|---------------------|
| Cam Gear - 11 | Release Lever - 20 | 31 - Spreader-Hub Assem. | 37 - 1ft |
| Stud - 12 | Pickup Plunger - 21 | 32 - Bridge | 38 - Spring |
| Guide Arm - 13 | Pickup Sleeve - 22 | 33 - Lifter Cam | 39 - Cam Lever |
| Bracket - 14 | Swivel Shaft - 23 | 34 - Pawl | 40 - Shoulder Screw |
| Trigger Spring - 15 | Swivel Tube - 24 | 35 - Cam Connecting Rod | 41 - Sub-Plate |
| Trigger - 16 | Swivel Trunnion - 25 | 36 - Cam Spring | 42 - Bracket |
| Trigger Catch - 17 | Shoulder Screw - 26 | | |
| Trip Adj. Screw - 18 | | | |
| Lock Spring - 19 | | | |

WEBSTER-CHICAGO CORP.

MODEL 11



Bottom View

MODELS 21, AC-21,
AC-DC 21J

WEBSTER-CHICAGO CORP.

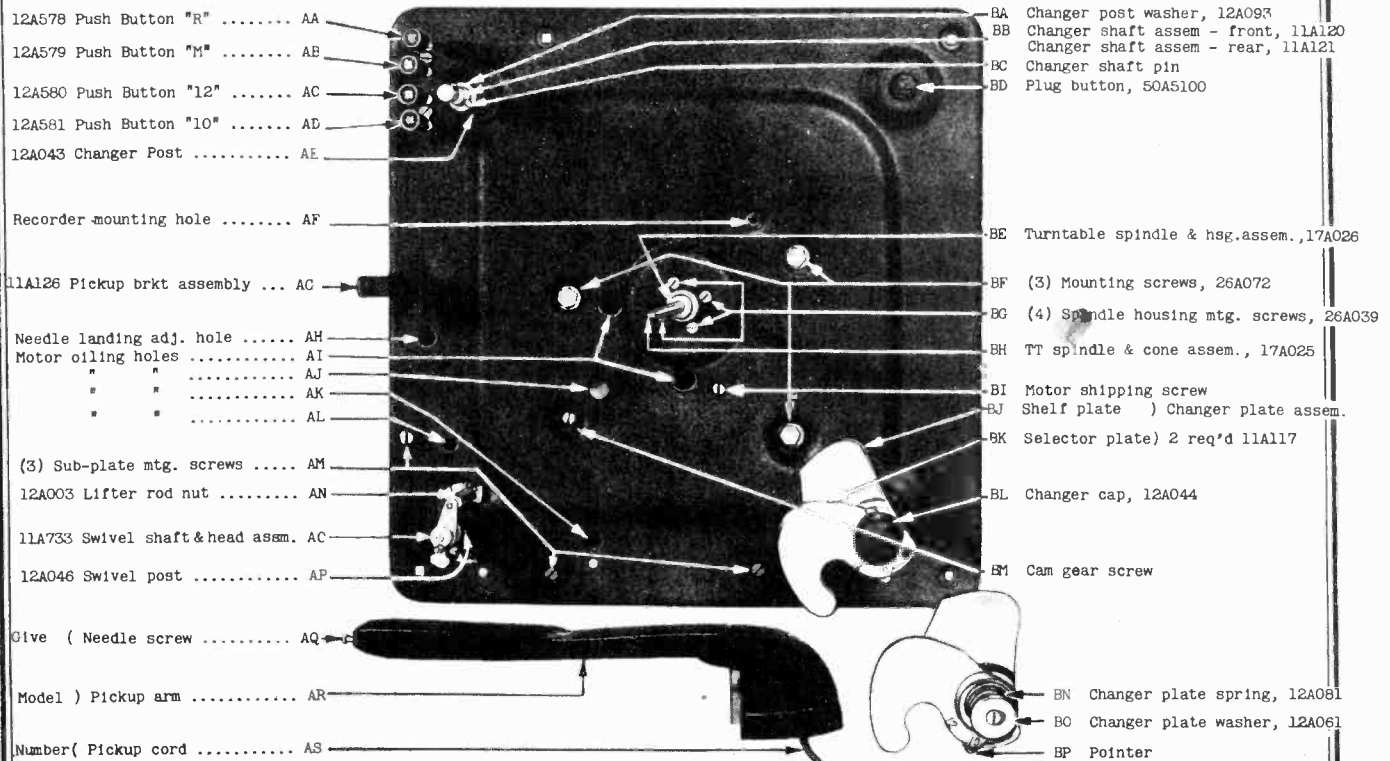


PHOTO A-B. Top View.

For the Service Man

This Manual is designed for the use of the service mechanic only, and is intended to facilitate as far as possible his work of caring for the changer mechanism, whether he is called in for the purpose of assuring its continued satisfactory operation, or to remedy some difficulty which has appeared. For his convenience, the "Operating Instructions", supplied to user by the factory, may be summarized as follows:

The Changer plays twelve 10" or ten 12" records. . . . To reload, revolve the two posts slightly, grasping them underneath the Shelf Plates. Turn them back after the played records are removed; they will fall and lock when in proper position. Then place the new records on the Shelf Plates and push "R" button to put Changer in operation. . . . To play the other size records, turn the knob at top of each post until proper figure is opposite pointer, and press the "10" or "12" button, to agree with pointer setting. . . . To reject a record (or to start a change cycle as for testing purposes), simply press the "R" (Release or Reject) button, at any time while needle is upon a record. . . . To play manually, turn plates out of the way as for reloading, and press "M" button.

(What are here called the "plates" of the Changer are frequently known among mechanics as "blades" -- a name best avoided when talking with users because it may convey to some an exaggerated impression of danger in the movement of these parts.)

Illustrations

The three photos illustrate all vital parts of the Changer. Letters are used alphabetically, to refer to points on the photos; thus, Motor Oiling Holes "AI" are found by simply glancing down Column A (left side of photo A-B) to letters AI. Reference letters must NOT be used for ordering parts: Order only by the factory numbers. Where no number is given, part cannot be separately supplied; order the Assembly containing it.

Oiling (reprinted from Operating Instructions)

The Changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 6 points. All points can be reached from above, through holes in the mounting plate as follows:

- No. 1) Three oil holes on motor gear housing. Reach all three through two holes AI.

WEBSTER-CHICAGO CORP.

- No. 4 Through hole marked AJ, drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 5 Through hole marked AK, see felt wick, and drop the oil directly upon it.
- No. 6 Through hole marked AL, see felt wick, and drop the oil directly upon it.

To Check Oiling

If squeaks are heard, compare the squeak with and without a load of records; any stack of records in motion is likely to squeak a little against a pin through their center. This can be corrected by rubbing a little wax on record pin. See that all five wicks are in position, including three 1/4" round wicks in frame of motor, one washer-shaped wick ("No. 5") on Lift DK, and one ("No. 6") on Cam Lever DI. See that each wick is thoroughly saturated (as it may not be if insufficient oil or too heavy oil has been used.) Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil or low viscosity oil). If necessary, clean gummed-up wicks with kerosene. See that each is saturated with good oil; then, before replacing them, drop a little good oil into the holes. The gear box of the Motor is packed with a semi-fluid grease at the factory, and it should never be necessary to take it apart for lubrication purposes.

General Description of the Change Cycle

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, inter-connected and built together, but largely separate in their operation.

(1) The record-changing mechanism--brought into operation originally by the contact of Lifter Cam DH with Pawl DJ--is the simplest of the three. It is driven by the cam groove (visible on under side in photo E-F) of Cam Gear DC. As Cam Lever DI is forced, by the Pawl, out underneath Lift DK (which is shown revolved to the right for visibility) the Lift rises and forces roller DE into the under groove in Cam Gear. The motion is transferred to Rear Changer Shaft (at ED) through Cam Connecting Rod DB (EH), thence through Changer Connecting Rod FG to Front Changer Shaft BB.

(2) The pickup-operating mechanism--likewise brought into operation originally by the cam-and-pawl action upon Cam Lever DI--is driven in part by the groove in upper (visible) side of Cam Gear DC. As cam Lever is forced out, at the beginning of the change cycle, against Link FO, it causes the Link to push upward upon Pickup

Plunger CA, thus lifting needle from record. The same pressure upon Link FO works, through Guide Arm CJ, to force Stud down into the groove on the Cam Gear. This rotates the pickup arm, while Pickup Plunger CA holds it up off of record. It is rotated first out beyond the turntable until Selector Plates BK have dropped the next record, then rotated back to proper position to start playing.

(3) The mechanism for bringing needle in to correct starting position must operate accurately for both 10" and 12" records. Partly due to this requirement, the starting position is not determined by the cam action. The upper groove on Cam Gear is designed so that it, acting alone, would carry the needle farther back toward record pin than would ever be desirable as a starting adjustment. Travel of pickup arm toward Record Pin is then stopped, at proper point for lowering onto the record, by action of Lever Hub CQ. The stopping takes place as lug CQ (upon the Lever Hub) strikes the shoulder on Rod FP. This enables the entire mechanism rotated by cam action on Guide Arm CJ to travel on past the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to Lever Hub CQ, is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires, therefore, only correct adjustment of Rods FL and FP; the radial difference of 1" between correct starting position for 10" and 12" records is taken care of by exact dimensioning, at the factory, of surfaces at right end of Rod FL which stop against the "10" and "12" key stems. Due to this, when Adjusting Cam at FM is turned (as directed below under Adjustment A) the starting position of needle is simultaneously altered for both 10" and 12" records.

Adjustments

There are two adjustments that can be made, FROM ABOVE: CHANGER NEED NOT BE REMOVED FROM CABINET. All adjustments are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to readjust, due to accident or tampering, proceed as follows:

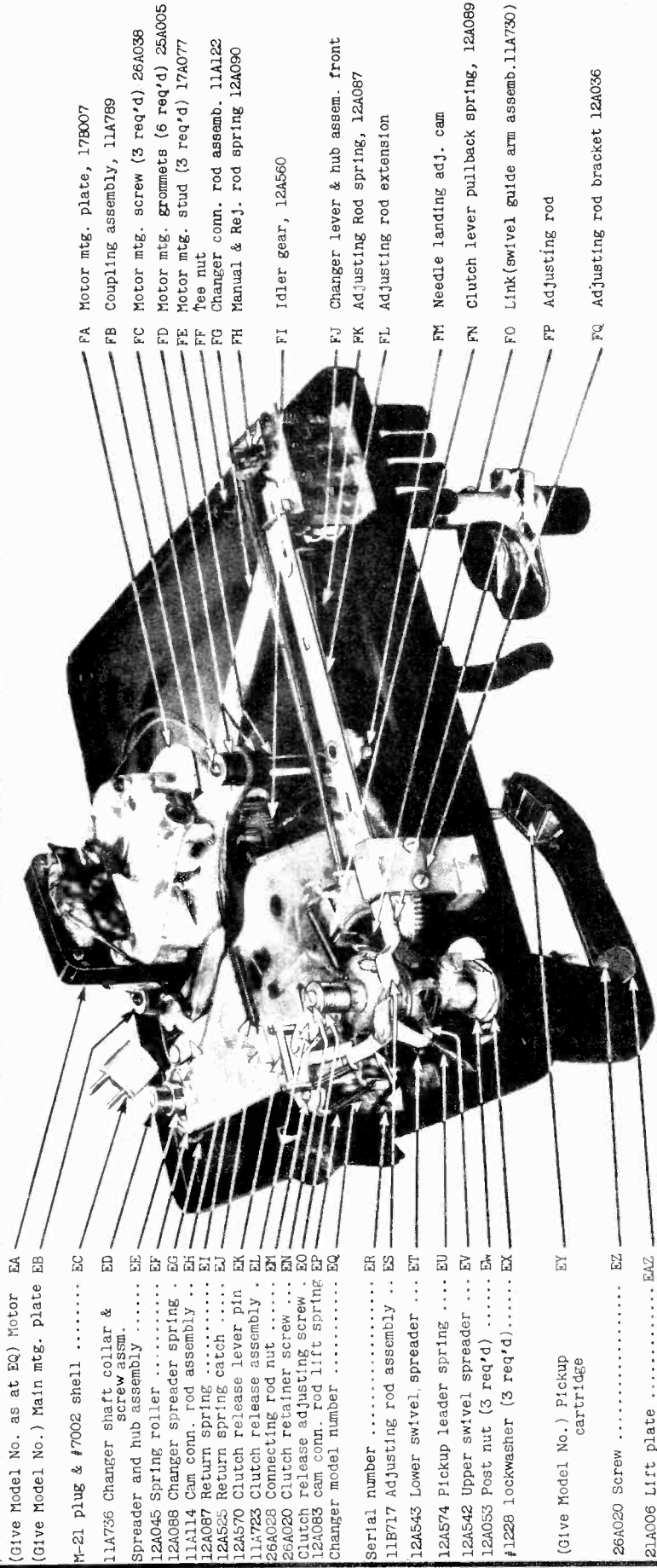
A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. If needle comes down on the sound track, playing of records will not start at their beginning. Insert screw driver through hole AH. Turn Screw head on Needle Landing Adjusting Cam FM very slightly counter-clockwise. If needle comes down too close to outer edge of record, or out beyond edge of record, turn Adjusting Cam clockwise.

The factory adjustment of needle landing is 1/8" in from outer edge of record.

Compare also Paragraph 12 below.

B. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES. The arm should rise, during the

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- (Give Model No. as at EQ) Motor EA
- (Give Model No.) Main mtg. plate EB
- M-21 plug & #7002 shell EC
- 11A736 Changer shaft collar & screw assm. ED
- Spreader and hub assembly EE
- 12A045 Spring roller EF
- 12A088 Changer spreader spring EG
- 11A114 Cam conn. rod assembly EH
- 12A087 Return spring EI
- 12A525 Return spring catch EJ
- 12A570 Clutch release lever pin EK
- 11A723 Clutch release assembly EL
- 26A028 Connecting rod nut EM
- 26A020 Clutch retainer screw EN
- Clutch release adjusting screw EO
- 12A083 cam conn. rod lift spring EP
- Changer model number EQ
- Serial number ER
- 11B717 Adjusting rod assembly ES
- 12A543 Lower swivel spreader ET
- 12A574 Pickup leader spring EU
- 12A542 Upper swivel spreader EV
- 12A053 Post nut (3 req'd) EW
- 12A053 Post nut (3 req'd) EX
- 1228 lockwasher (3 req'd) EX
- (Give Model No.) Pickup cartridge EY
- 26A020 Screw EZ
- 21A006 Lift plate EAZ

change cycle, high enough so that it clears by only 1/4" the record above it, next to be played. (Be careful, before deciding that readjustment is necessary, to see that the record at bottom of stack is not a warped one.) To make this adjustment, loosen Lock Nut "AN" and turn Pickup Sleeve "CI" to lengthen or shorten Pickup Plunger "CA". However, if Pickup is made to rise too close to bottom record, Stud on Guide Arm CJ may never clear the groove in Cam Gear. In making this adjustment, therefore, care must be taken to see that Pickup Arm does not keep moving back and forth continuously (due to Stud remaining in engagement with groove). When correct adjustment is found, tighten Lock Nut securely.

Trouble Shooting

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the mechanism

after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it--or that set screws may work loose due to some external vibration. For tightening set screws, a No. 8 size Allen (hexagon) wrench is required: Be sure that set screws are properly seated on the holes or flat provided. Damage from tampering is likely to take the form of bent parts; never bend

any part during examination. Among the principal trouble symptoms to which such causes may give rise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT. May be caused by:

- a. Failure to lubricate properly. Oil thoroughly. See oiling instructions.
- b. Check voltage. Line voltage may be abnormally low or high.
- c. Motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement.

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AC-DC 21J

a. First see that "M" button goes clear down; then follow its action through Manual Rod "OC".

b. Probably caused by the manual rod being bent and not projecting up through sub-plate DG and stopping cam lever DI when it is released from the trigger.

9. TRIPS TOO SOON OR BEFORE RECORD HAS FINISHED PLAYING. This can be caused by too little clearance between the trigger DO and the clutch lever assembly CR. To get more clearance on this adjustment, turn the adjusting screw DP in a clock-wise direction a half-turn or whatever is necessary to make tone arm trip on 1/4" motion.

10. TONE ARM FALLS OFF RECORD. Needle sits down too close to edge of records not adjusted in far enough, or needle landing adjusting cam FH is reversed. Should contact lug on adjusting rod extension FL on the long side of cam. Check pickup leader spring EU. It may have become loose; more tension can be given it by bending down lug.

11. TONE ARM SITS DOWN TOO FAR IN. Due to adjusting rod FP binding and not measuring properly. If found to be bent, should be straightened to correct shape so that it will operate freely.

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE. Pickup arm is normally impelled toward center of records by Lead Spring EU. Should a slight increase in its tension be found necessary, this can be easily obtained by slightly bending the lug, to which it is attached, down against Main Plate.

13. "WOW" IN RECORD REPRODUCTION. a. Record is warped or otherwise defective or instrument is not being operated at normal room temperature. 70°F.

b. Motor mounting plate FA being bent will cause "wow". Straighten it if possible or replace with new plate if too badly bent to warrant straightening. This is only found where rough handling is evident.

c. Motor shaft out of alignment with the turntable shaft (also due to rough handling). To correct, move the motor EA on its mounting until motor shaft is parallel to the turntable shaft and the Universal coupling FB is exactly at right angles to motor and turntable shafts, then tighten motor mounting screws securely.

14. LAST RECORD DROPS ON ONE SIDE ONLY. a. This suggests a Changer Post bent out of perpendicular to Main Plate. If Post must be straightened, be careful not to bend other parts.

b. One recorder set for 10" while playing 12" records.

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS. This indicates trouble in motor windings. Unless the damage is easily seen and repaired, replace motor, as above described.

3. MOTOR IS SLOW IN STARTING. a. Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.

b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that motor is defective, and proceeding as in Paragraph 2 above.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS. Check oiling, as directed above. (If squeaks are heard, they will usually be found to come from the records—not from the mechanism.) See "To Check Oiling".

5. CHANGER IS NOISY WHEN IN CYCLE. Check oiling. Also see if any part has become loose or bent and is rubbing against a moving part such as the swivel Guide Arm, CJ against the Cam Gear, DC.

6. MOTION OF PICKUP TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM. See that the manual button is not pressed down. If trigger is being properly actuated, probably Cam Lever "DI" is binding against Sub-Plate DG. Look for dirt or obstructions. See that Pawl "DJ" and trigger "DO" are working freely on their rivets. If the Lever engages the Pawl so that Lift "DK" forces roller "DE" up into the under groove on Cam Gear, and if set screws are tight, the change cycle must operate as Cam Gear turns.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

a. Due to shipping bolts not being removed, causing a bind on manual rod, or manual button is down.

b. Check Key Control Unit "CE". See whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel.

c. Examine Reject Rod CH. If it does not trip, even when properly revolved by complete depressing of "R" button, the Rod has probably been bent, and must be restored in same way. Grasp the two ends and twist it slightly.

d. If Trigger "DO" is being properly actuated but without starting a change cycle, see directions above, Paragraph 6.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION.

15. CHANGER CONTINUES CYCLING.

a. Probably due to failure of Lift DK to be drawn back out of engagement with Cam Gear CD. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.

b. Make sure that trigger spring is not disconnected. Also that clearance between trigger DO and clutch lever CR is sufficient. A sticking pawl DJ will also cause this condition.

16. RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME. See that pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup cartridge EV, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type, or 0.5 volts if or magnetic type. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. RECORD JAMS. Most slicing trouble (record jams) is due to off-size or defective records, and is no fault of the record changer or record changer adjustments. Properly manufactured records have a uniform semi-circular edge and can be successfully handled by record changers, even though the records vary considerably in thickness.

Good

Irregular

Fin

Cross section of record edge showing a perfect record and three imperfect edges.

Records that prove troublesome in the selecting or slicing process can usually be corrected by using a piece of fine sand paper or emery cloth to touch up the edge.

18. AUDIO HOWL. Record changer not floating on cushions or spring mounting. See that shipping bolts are removed. If unit still does not float, loosen the nuts or mounting assembly allowing unit to rise and float.

19. TURNTABLE IS TIGHT. This turntable is assembled to the turntable shaft with a taper lock fit in the center. To remove, grasp turntable with both hands, turn slightly forward and backward, at the same time pulling upward, or run motor and grasp the turntable while it is revolving, and pull up.

20. THUMP HEARD IN RECORD REPRODUCTION. Probably caused by the motion of the friction clutch CR when it is momentarily released by the motion of the release lever, EL, which in turn is actuated by the 4 raised portions on the cam gear, DC. If thump is objectionable, it can be lessened by adjusting the clutch lever, EL, so that the motion of the clutch lever is lessened to allow only a slight amount of motion of the clutch assembly, CR. Also if the clutch spring CS, is too strong, replace with a new spring or cut one-quarter of the length of the old spring or whatever is necessary to assure satisfactory operation. Also be sure that clutch assembly parts are free from dirt and burrs and work freely without binding.

If Necessary to Disassemble the Changer

First detach the entire changer mechanism (except Changer Connecting Rod Assembly FM and Cam Connecting Rod Assembly EH from Main Plate EB. To do this, first take out Shoulder Screw DL, to free the rest of the mechanism from Assembly EH. Then remove the three screws AF, which hold Sub-plate Assembly DG to Main Plate EB. Also remove Screw EM to Main Plate EB which holds Cam Gear DC. Pull off the four Key Control Hold Key Control Unit GJ to Main Plate. Now remove Clutch Release Bracket DM, and Adjusting Rod Bracket PQ — this means taking out five screws. Remove Flat Spring FH, by taking out one screw. Rods CG and CH can then, with due care, be extracted without bending. Free the cam connecting Rod Assembly EH, by loosening set screw in collar ED holding Spreader Rub EE to rear Changer Shaft. In reassembling, reverse the procedure, taking care to get all springs properly connected as shown in the photos, without stretching any of them, also readjust if necessary any assemblies thrown out of adjustment by this operation.

Replacement Parts

When spare parts of sub-assemblies are required, order them direct from the factory, by factory number and name as given on photos — not by reference letters. Where no number is given, order by full and exact description. Always specify Serial Number as seen at EH, and Model Number as seen at EQ. Parts shown in above photographs, but not given factory numbers, are furnished only in assemblies as shown with factory numbers. Refer to replacement parts list.

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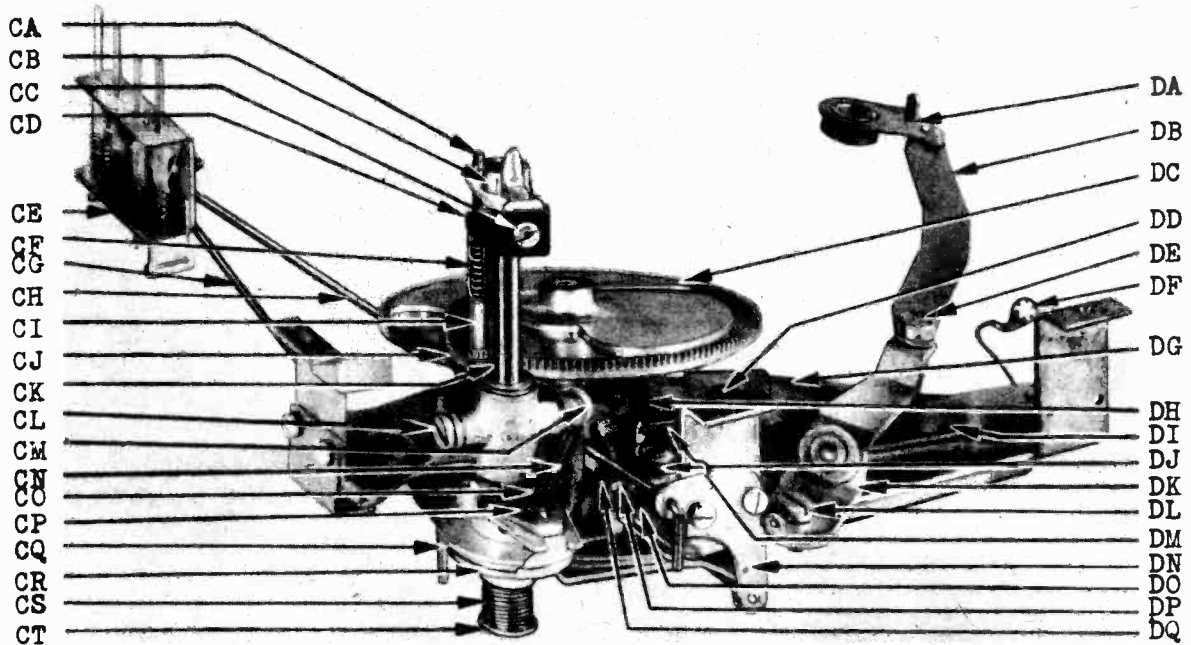


PHOTO C-D. View of Sub-Plate Assembly, Together with Certain Other Assemblies.

12A568 Pickup plunger	CA	DA Spreader hub assem. lower
12A537 Lifter guide	CB	DB Cam connecting rod
26A020 Hinge spring screw	CC	DC Cam gear
21A004 Hinge spring	CD	DD Cam lever spring, 12A572
		DE Roller
		DF Ground lead, 20A262
11A718 Key control assembly	CE	DG Sub-plate(Sub-plate,levers&gear assem.11C729)
12A097 Pickup plunger spring	CF	
12A077 Manual key rod	CG	DH Lifter cam (cam gear assem. 11A715)
12A565 Rejection rod	CH	DI Cam lever
12A096 Pickup plunger sleeve	CI	DJ Cam lever pawl
Swivel guide arm	CJ	DK Cam conn. rod lift
11A714 Swivel tube & trunnion assem.	CK	DL Shoulder screw, 12A007
12A072 Trunnion should.screw (2)..	CL	DM Pawl spring, 12A084
Clutch release roller	CM	DN Clutch release brkt, 12A521
12A573 Guide arm spring	CN	DO Release trigger
12A089 Swivel spreader spring	CO	*DP Clutch screw, 26A037
12A709 Spring	CP	DQ Clutch lever spring, 12A584
11A726 Clutch assembly	CQ	
11A724 Clutch Lever & sleeve assem .	CR	
12A593 Clutch lever & sleeve spg ..	CS	
12A547 Clutch spring retainer	CT	

Replacing Motor

The service mechanic may be called upon to adapt the Changer to a different power supply. For this purpose, or in case of any serious fault within Motor, remove entire Motor EA from the Changer, and replace it with a suitable new Motor. See that Motor Frame is well grounded by wire, DF, (in photo C-D) soldered to lug on Sub-Plate DG. (In ordering a replacement Motor, specify the power supply and give Model Number at EQ; also make and model number of phono-radio or other type of installation.)

WEBSTER-CHICAGO CORP.

MODELS 21 Series
MODEL 22**AUTOMATIC RECORD CHANGER****Operating Instructions**

Your — **WEBSTER-CHICAGO** — Automatic Record Changer will multiply many-fold your enjoyment of recorded music. These instructions are written for the purpose of enabling you to get the benefits this equipment affords. With proper care, it should give many years of satisfactory service. With it, you can enjoy from 15 minutes to nearly an hour of your favorite music without interruption, and without attention to the instrument.

MODERN RECORDING

Modern records are made by electrical processes and the bringing out of their full tonal perfection requires a well-designed electrical pickup such as is provided in this Record Changer.

Fully as remarkable is the wide variety of selections that are obtainable. They range from the latest hit tunes played by the most popular bands, to complete operas and symphonies recorded by the world's leading artists. These longer works are to be had in the form of a set of double sided records so arranged that the first half of the work is heard by playing one side of all the records, and the last half by playing the other side.

MOTOR AND POWER SUPPLY

The Changer is equipped with a constant-speed self-starting motor. Under all normal conditions it starts automatically and runs at correct speed.

Each Changer is designed to operate on a certain voltage and frequency (cycles) only. Be sure to look at your nameplate and see that the instrument you have conforms to your power supply before plugging in cord.

SETTING FOR RECORD SIZE

This mechanism plays up to twelve 10" records or ten 12" records at one set-up. All records must be the same size for each set-up.

On each post you will see two plates (shown in large drawing). The lower one, on which the records rest, is the shelf plate. The upper one is the selector plate, which takes from the bottom of the stack the next record to be played.

To set for record size two things must be done.

(1) Clasp one of the posts just underneath the shelf plate, with thumb and finger of left hand. With right hand, lift knob and turn the selector plate until figure 10 or 12 (whichever size you want to play) is opposite the pointer. Do the same with the other post.

(2) Push button marked 10, or 12, as required.

LOADING

See that both shelf plates are turned toward center of turntable. If they are not, again grasp the post just below shelf plate, and rotate post until it falls into proper position, with both shelf plates correctly turned toward center of turntable. Place the stack of records over center pin so they will rest on the two shelf plates.

ADJUSTING NEEDLE SO THAT PLAYING WILL START AT BEGINNING OF RECORD

The correct adjustment is made at the factory, and thereafter no further adjustment may be necessary. Should need arise, the position at which needle lowers to record can be adjusted by inserting small screw driver thru the hole shown in the illustration. Turn very slightly either way. Clockwise turn moves needle in; counter-clockwise moves needle out.

STARTING THE MECHANISM

To start motor and turntable:

(1) Turn the switch to "on" position. (On some models the switch is located in a different place from that shown in illustration.) Motor will then start.

(2) Push button "R". This will release the first record and start the record-changing mechanism.

REJECTING A RECORD YOU DON'T WANT TO HEAR

Merely press the "R" button. You can do it any time after the needle has come into contact with that record.

REMOVING PLAYED RECORDS

First switch off motor. Then take hold of both posts, just below the shelf plates, and turn them out of the way. Lift the played records from the turntable. Taking hold of posts as before (below shelf plate) move plates until post again falls into playing position. The changer may then be loaded with a new stack of records: see directions above, for loading.

MANUAL OPERATION

To play records one at a time as in an ordinary phonograph—

(1) Remove any records remaining on the turntable: see directions just preceding.

(2) Leave plates turned outward, as for removing played records. Do not turn them back toward center of turntable.

(3) Press button marked "M". Then place a record on turntable, switch on motor, and lift pickup into position.

OILING (MODEL 21 ONLY)

The changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 6 points. All points can be reached from above, thru holes in the mounting plate, as follows:

- No. 1 } Three oil holes on motor gear housing. Reach
- No. 2 } all three thru two holes marked "A" on draw-
- No. 3 } ing.
- No. 4 Thru hole marked "B", drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 5 Thru hole marked "C", see felt wick, and drop the oil directly upon it.
- No. 6 Thru hole marked "D", see felt wick, and drop the oil directly upon it.

OILING (MODEL 22 ONLY)

The changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 3 points. All points can be reached from above, thru holes in the mounting plate, as follows:

- No. 1. Thru hole marked "A", drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 2. Thru hole marked "B", see felt wick, and drop the oil directly upon it.
- No. 3. Thru hole marked "C", see felt wick, and drop the oil directly upon it.

TONE AND VOLUME CONTROL

If the radio or amplifier through which this changer is being played has a tone control, adjustments may be made for various types of musical selections and acoustical conditions.

If it is desirable to control volume by means of the control on the changer, the volume control on the radio or amplifier should be set slightly higher than necessary for the maximum volume level required. If the user prefers to control volume by means of the control on the radio or amplifier, the control on the changer should be set at approximately a "half-way" position. This latter method is not recommended, however, because of the necessity of changing the control setting each time the changer is stopped for reloading.

MODELS 21 Series
MODEL 22

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tonal qualities of the kind of records being played.

quality of manufacture, and care given the records but also to the kind of music recorded.

TURNING OFF

- (1) Throw Changer switch to "off" position.
- (2) Lift pickup arm, place it on the pickup rest. (If you happen to turn off the Changer switch while the mechanism is going through a "change cycle," you will notice that it does not stop until the cycle has been completed, and pickup is again in playing position ready to be lifted over onto the pickup rest. If you prefer to turn off your Changer by the use of any other switch than the one on the Changer itself, be sure to turn it off while needle is resting upon a record; otherwise pickup cannot be returned to its rest).
- (3) To avoid warping of records, never leave records resting on the shelf plates.

IF CHANGER IS LEFT RUNNING

No damage will be done if you forget to turn off Changer after it has played its entire load of records. It will simply repeat the last record until stopped or reloaded.

IF CHANGER WILL NOT GO ON TO NEXT RECORD ABOVE

An old record may occasionally be found (made before the introduction of automatic changers) which does not carry the needle close enough to center-pin of turntable, to set the changer mechanism in operation. Should one of these old records be found in the stack, a touch of the "R" button will instantly set the Changer mechanism in action again. Any need for doing this can be avoided by placing the old record at top of stack to be played, so that it will come into position last.

WHEN NOISE DEVELOPS

Noisy scratching indicates worn records. Poor tone is evidence of a worn needle. Some records will wear longer than others, even if kept equally clean. This is due not only to

CARE OF RECORDS

To insure long life for your records requires only slight effort. Do not expose them to heat from the sun, nor to heat from nearby stoves or radiators. Store them preferably in albums, but in any case keep them always in a cool, dry place, resting vertical or flat horizontal. Remove dust and dirt, using soft cloth and light circular motion. If fluids are used for lubricating record surfaces, keep in mind that these often tend to attract dust, and extra effort is necessary to clean it off. Dust is much more troublesome in some localities than in others.

Records may safely be left stacked directly upon each other (as on the turntable) but should never be left resting on the shelf plates of the Changer. This two-point support, while best for its purpose, is not at all suitable for record storage.

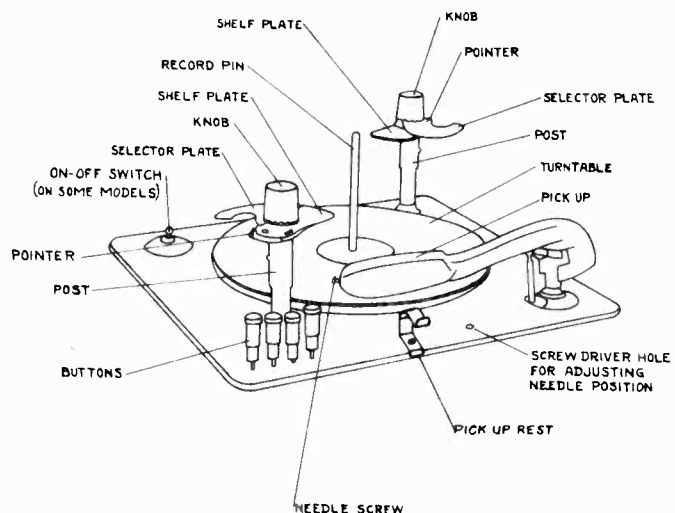
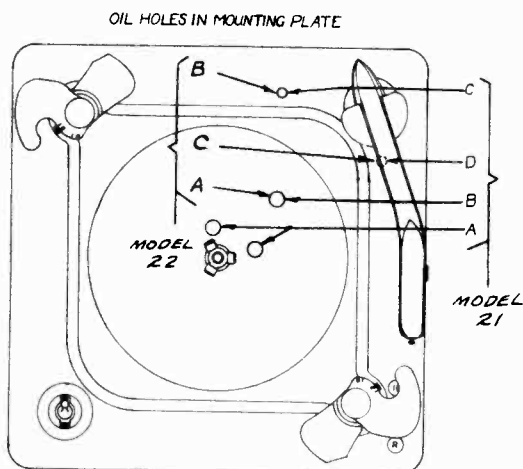
RECORD NEEDLES

Various types and kinds of needles are available for use in phonograph pickups. All have their virtues, as well as their faults, for use in ordinary phonographs, where needles can be changed after each record. For playing ten or more records at one set-up, as with this Changer, no attempt should be made to use ordinary steel or fibre points, since continued use of worn points will be likely to ruin both quality of reproduction and the records as well. Any kind of needle can be used, which has a point durable enough to play ten records or more without damaging them.

Automatic Record Changer unit is constructed of a minimum number of working parts, and in operation is simple and reliable. As with all mechanical articles, minor adjustments may be necessary at times. Should additional information be required, particulars will be given upon application to the manufacturer.

RIGHT: General Illustration Showing Name and Location of Parts

BELOW: Oil Holes As Seen in Mounting Plate After Lifting Off Turntable



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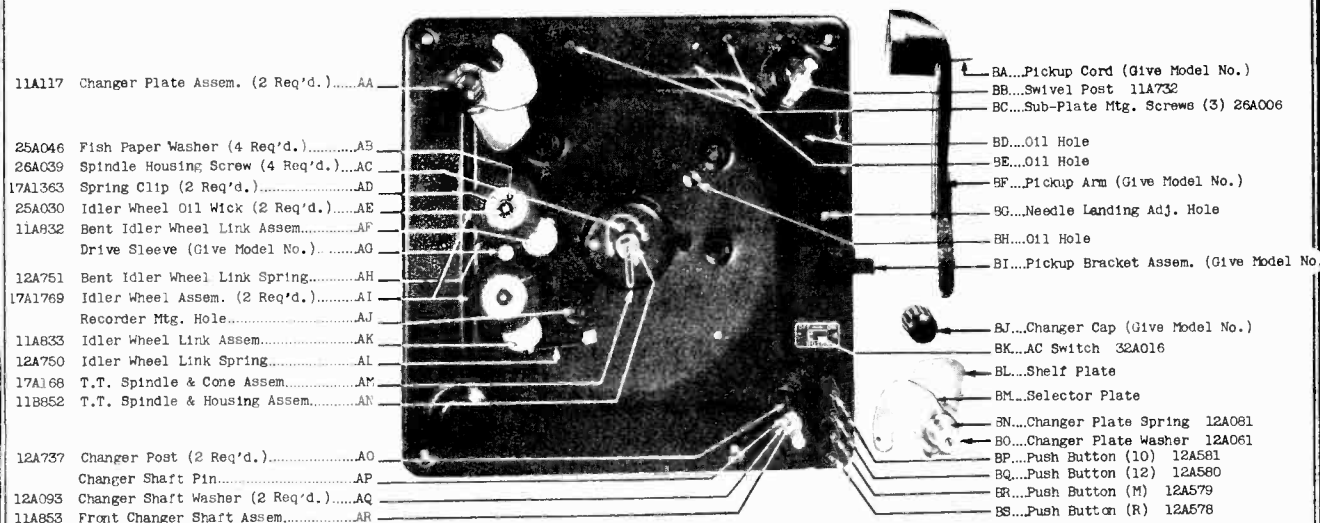


Photo A-B. Top View

Model 24 is similar to Models 22 and 23 except for the following: The trip circuit is similar to that used in model 22. The changer posts are similar to those used in model 23, the rear record post having been changed from two plate assembly to a stationary single plate, i.e.

On Model 22, Omit	11A117 Changer Plate Assembly	(2 required)
For Model 24, Add	11A117 Changer Plate Assembly	(1 required)
	12A737 Stationary Changer Post	(1 required)
	11A836 Stationary Changer Plate Assembly	(1 required)
On Model 22, Omit	17A168 TT Spindle & Cone Assem.	
	11B852 TT Spindle & Housing Assem.	
For Model 24, Add	17A026 TT Spindle & Cone Assem.	
	11B835 TT Spindle & Housing Assem.	

FOR THE SERVICE MAN

This Manual is designed for the use of the Service Mechanic only, and is intended to facilitate as far as possible his work of caring for the changer mechanism, whether he is called in for the purpose of assuring its continued satisfactory operation, or to remedy some difficulty which has appeared. For his convenience, the "Operating Instructions", supplied to user by the factory may be summarized as follows:

The Changer plays twelve 10" or ten 12" records. . . . To reload, revolve the two posts slightly, grasping them underneath the Shelf Plates. Turn them back after the played records are removed; they will fall and lock when in proper position. Then place the new records on the Shelf Plates and push "R" button to put Changer in operation. . . . To play the other size records, turn the knob at top of each post until proper figure is opposite pointer, and press the "10" or "12" button, to agree with pointer setting. . . . To reject a record (or to start a change cycle as for testing purposes), simply press the "R" (Release or Reject) button, at any time while needle is upon a record. . . . To play manually, turn plates out of the way as for reloading, and press "M" button.

(What are here called the "plates" of the Changer are frequently known among servicemen as "blades" -- a name best avoided when talking with users because it may convey to some an exaggerated impression of danger in the movement of these parts.)

ILLUSTRATIONS

The three photos illustrate all vital parts of the Changer. Letters are used alphabetically, to refer to points on the photos. Reference letters must NOT be used for ordering parts: Order only by the factory numbers. Where no number is given, part cannot be separately supplied; order the assembly containing it.

OILING (REPRINTED FROM OPERATING INSTRUCTIONS)

The Changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 3 points. All points can be reached from above, through holes in the mounting plate, as follows:

- No. 1. Through hole marked (BH), drop the oil upon flat surface of cam. It will distribute itself to proper points.

- No. 2. Through hole marked (BE), see felt wick, and drop the oil directly upon it.
- No. 3. Through hole marked (BD), see felt wick, and drop the oil directly upon it.

TO CHECK OILING

If squeaks are heard, compare the squeak with and without a load of records, any stack of records in motion is likely to squeak a little against a pin through their center. This can be corrected by rubbing a little wax on the turntable spindle. See that all four felt washer-shaped wicks are in position, including two washer-shaped wicks (AE) on Idler Wheels (AI), one wick ("No. 2") on lifter lever and one ("No. 3") on Cam Lever (DG). See that each wick is thoroughly saturated (as it may not be if insufficient oil or low grade or low viscosity oil has been used). ("CAUTION". Do not over saturate the two Idler Wheel oil wicks (AE) as centrifugal force will throw the excessive oil out over the edge of Idler Wheel (AI) and cause loss of traction to turntable, therefore always wipe excess oil off Idler Wheels before starting motor.) Also check the two oil wicks on the motor at (EA) to see that they are thoroughly saturated. Also check lubrication on Turntable Spindle bearings. The top bearings can be oiled by removing turntable and oiling at (AN) then oil lower bearing from below, also check lubrication at all other bearing points.

GENERAL DESCRIPTION OF THE CHANGE CYCLE

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, interconnected and built together, but largely separated in their operation.

(1) The record-changing mechanism -- brought into operation originally by the contact of Lifter Cam (DE) with Pawl (DH) is the simplest of the three. It is driven by the cam groove (visible on under side in Photo E-F) of Cam Gear (DC). As Cam Lever (DG) is forced, by the Pawl, out underneath Lift, it rises and forces roller into the groove in underside of Cam Gear. The motion is transferred to rear Changer Shaft (at EC) through Cam Connecting Rod (EF), thence through Changer Connecting Rod (FG) to Front Changer Shaft (AR).

(2) The pickup-operating mechanism -- like-wise brought into operation originally by the cam-and-pawl action upon Cam Lever (DG) -- is driven in part by the groove in upper (visible) side of Cam Gear (DC). As Cam Lever is forced out, at the beginning of the change cycle, against Link (FN), it causes the Link to push upward upon Pickup

Plunger (CB), thus lifting needle from record. The same pressure upon Link (FN) works, through Guide Arm (CK), to force Stud down into the groove on the Cam Gear (DC). This moves the pickup arm with a swinging movement while Pickup Plunger (CA) holds it up off of record. It first swings out beyond the turntable until Shelf Plates have released a record, then swings back to proper position to start playing.

(3) The mechanism for bringing needle in to correct starting position must operate accurately for both 10" and 12" records. Partly due to this requirement, the starting position is not determined by the cam action. The upper groove on Cam Gear is designed so that it, acting alone, would carry the Pickup Arm farther toward the Turntable spindle than would ever be desirable as a starting adjustment. Travel of pickup arm toward Turntable Spindle is then stopped at proper point for lowering onto the record, by action of Stop Lever (CP). The stopping takes place as lug (CP) (on the Stop Lever) strikes the shoulder on Rod (FP). This enables the entire mechanism, rotated by cam action on Guide Arm (CK), to travel on past the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to Stop Lever (CP) is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires, therefore, only correct adjustment of Rods (FL and FP); the radial difference of 1" between correct starting position for 10" and 12" records is taken care of by exact dimensioning, at the factory, of surfaces at right end of Rod (FL) which stop against the "10" and "12" key stems. Due to this, when Adjusting Cam (FM) is turned (as directed below under Adjustment A) the starting position of needle is simultaneously altered for both 10" and 12" records.

ADJUSTMENTS

There are two adjustments that can be made, FROM ABOVE: CHANGER NEED NOT BE REMOVED FROM CABINET. All adjustments are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to readjust, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. If needle comes down on the sound track, playing of records will not start at their beginning. Insert screw driver through hole (BG). Turn Screw head on Needle Landing Adjusting Cam (FM) very slightly counter-clockwise. If needle comes down too close to outer edge of record, or out beyond edge of record, turn Adjusting Cam clockwise.

The factory adjustment of needle landing is 1/8" in from outer edge of record.

Compare also Paragraph 12.

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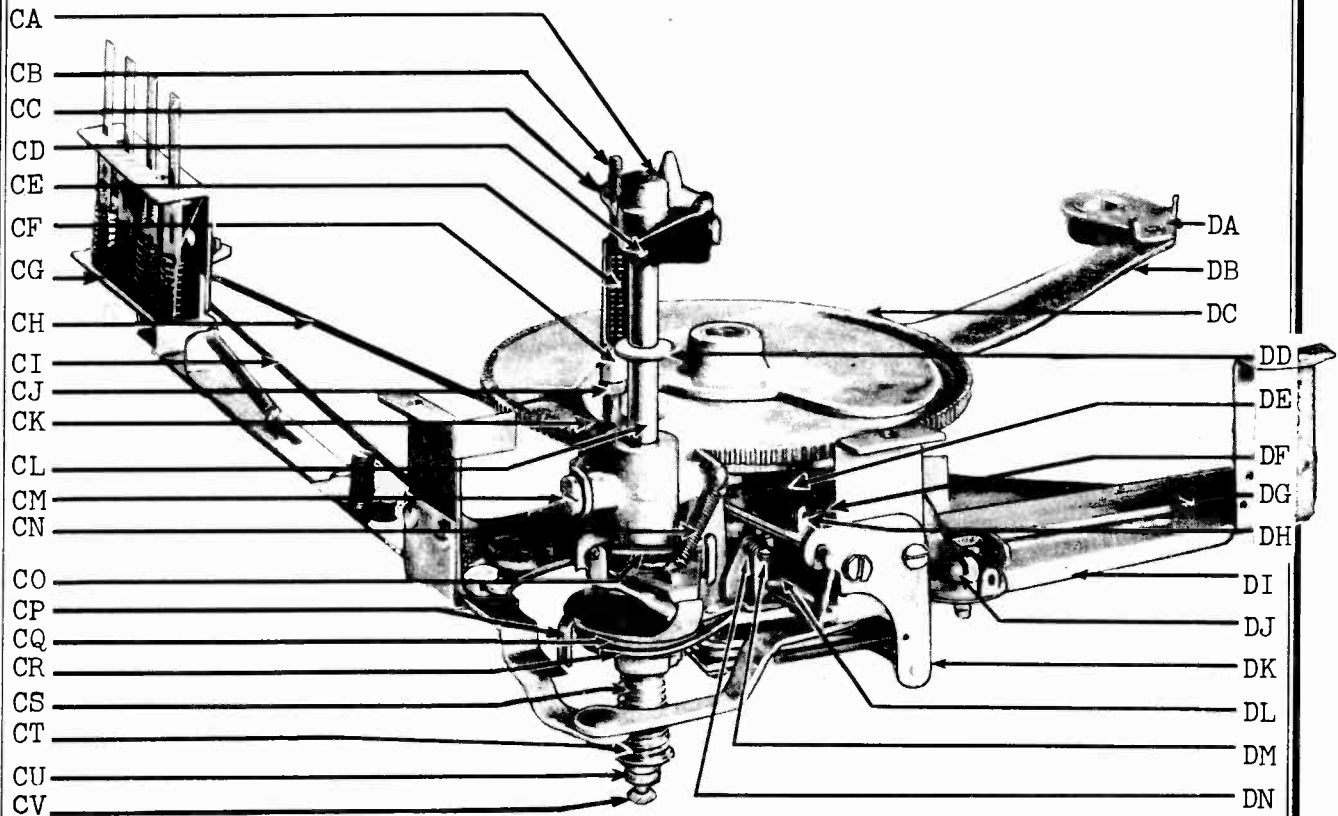


Photo C-D. Subplate and other Assemblies

CA	11A733	Swivel Shaft & Head Assem.	CS	12A734	Clutch Lever Sleeve Spring.
CB	12A796	Pickup Plunger.	CT	12A547	Clutch Spring Retainer.
CC	12A537	Lifter Guide.	CU	26A028	Lock Nuts.
CD	21A004	Hinge Spring.	CV	26A161	Clutch Retainer Adj. Screw.
CE	12A097	Pickup Plunger Spring.	DA	-----	Spreader Hub Assem.
CF	12A096	Pickup Plunger Sleeve.	DB	-----	Cam Connecting Rod.
CG	11A718	Key Control Assem.	DC	-----	Cam Gear.
CH	12A565	Rejection Rod.	DD	-----	Washers or Ball Retainer (Give Model #1).
CI	12A077	Manual Key Rod.	DE	-----	Lifter Cam (Cam Gear Assem.)11A715.
CJ	12A003	Lifter Rod Nut.	DF	12A084	Pawl Spring.
CK	-----	Swivel Guide Arm.	DG	-----	Cam Lever.
CL	-----	Swivel Trunnion Assem. (Give Model No.).	DH	-----	Cam Lever Pawl.
CM	12A072	Trunnion Shoulder Screws (2).	DI	11C729	Sub-Plate, Gear & Lever Assem.
CN	-----	Guide Arm Spring (Give Model No.).	DJ	12A007	Shoulder Screw.
CO	-----	Swivel Spreader Spring (Give Model No.).	DK	12A521	Clutch Release Bracket.
CP	11A856	Clutch & Lever Assem.	DL	-----	Release Trigger.
CQ	12A766	Cork Clutch Disc.	DM	26A037	Clutch Screw.
CR	11A863	Clutch Lever Assem.	DN	12A584	Clutch Lever Spring.

B. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES. The arm should rise, during the change cycle, high enough so that it clears by only 1/4" the record above it, resting on shelf plates. (Be careful, before deciding that readjustment is necessary, to see that the record at bottom of stack is not a warped one.) To make this adjustment, loosen Lock Nut (CJ) and turn Pickup Sleeve (CF) to lengthen or shorten Pickup Plunger (CB). However, if Pickup is made to rise too close to bottom record, Stud on Guide Arm (CK) may never clear the Cam Gear. In making this

adjustment, therefore, care must be taken to see that Pickup Arm does not keep moving back and forth continuously (due to Stud remaining in engagement with groove). When correct adjustment is found, tighten Lock Nut securely.

REPLACING MOTOR

The service man may be called upon to adapt the Changer to a different power supply. For this purpose, or in case of any serious fault within Motor, remove entire

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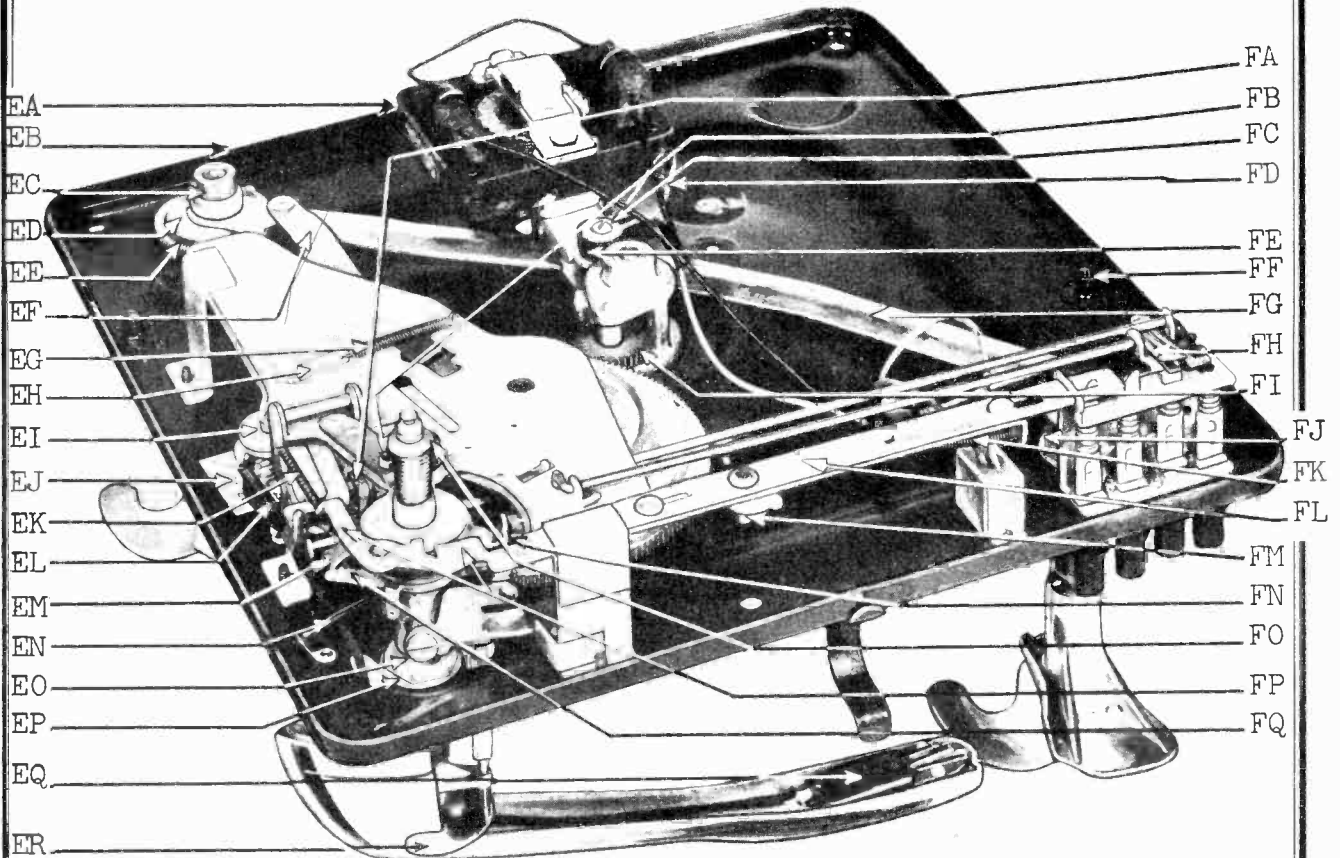


Photo E-F. Bottom View

EA	-----	Motor. (Give Model No.)	FA	-----	Clutch Lever Stop.
EB	-----	Main Mtg. Plate (Give Model No.).	FB	26A051	Clutch Adjusting Screw.
EC	11A736	Changer Shaft Collar & Screw Assem.	FC	25A039	Washer.
ED	12A045	Spring Roller.	FD	20A295	Ground Lead Assem.
EE	12A088	Changer Spreader Spring.	FE	25A032	Rubber Grommet.
EF	11A114	Cam Con. Rod Assem.	FF	-----	Tee Nut.
EG	12A087	Return Spring.	FG	11A122	Changer Conn. Rod Assem.
EH	12A525	Return Spring Catch.	FH	12A090	Manual & Rej. Rod Spring.
EI	26A028	Connecting Rod Nut.	FI	12A560	Idler Gear.
EJ	-----	Changer Serial Number & Model No.	FJ	-----	Changer Lever & Hub Assem. Front.
EK	12A577	Adj. Rod Lever Spring.	FK	12A087	Adjusting Rod Spring.
EL	12A083	Cam Connecting Rod Lift Spring.	FL	-----	Adjusting Rod Extension.
EM	12A543	Lower Swivel Spreader.	FM	-----	Needle Landing Adj. Cam.
EN	-----	Pickup Leader Spring (Give Model No.)	FN	-----	Link (Swivel Guide Arm Assem.).
EO	12A053	Post Nut (3 Req'd.).	FO	12A530	Clutch Release Jack.
EP	#1228	Lockwasher (3 Req'd.).	FP	11B717	Adjusting Rod Assem.
EQ	-----	Pickup Cartridge. (Give Model No.)	FQ	12A542	Upper Swivel Spreader.
ER	-----	Lift Plate. (Give Model No.)			

Motor (EA) from the Changer and replace it with a suitable new Motor. See that Motor Frame is well grounded by wire, (FD) (in photo E-F). (In ordering a replacement Motor, specify the power supply and give Model Number at EJ; also Make and Model Number of Phono-radio or other type of installation).

TROUBLE SHOOTING

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of

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some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it -- or that set screws may work loose due to some external vibration. For tightening set screws, a No. 8 size Allen (hexagon) wrench is required: Be sure that set screws are properly seated on the holes or flats provided. Damage from tampering is likely to take the form of bent parts; never bend any part during examination.

Among the principal trouble symptoms to which such causes may give rise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT.

May be caused by:

- a. Failure to lubricate properly. Oil thoroughly. See oiling instructions.
- b. Check voltage. Line voltage may be abnormally low or high.
- c. Motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement.

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS.

- a. This indicates trouble in Motor windings. Unless the damage is easily seen and repaired, replace motor, as above described.
- b. Check motor rotor by turning the drive sleeve with finger and thumb if it seems to bind slightly it can usually be corrected by lightly tapping the bottom bearing bridge, this will align the two self aligning shaft bearings and allow the rotor to turn freely.

3. MOTOR IS SLOW IN STARTING.

- a. Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.
- b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that Motor is defective, and proceed as described above (see paragraph 2.).

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

Check oiling, as directed above. (If squeaks are heard, they will usually be found to come from the records---not from the mechanism.)

See "To Check Oiling".

5. CHANGER IS NOISY WHEN IN CYCLE.

Check oiling. Also see if any part has become loose or bent and is rubbing against

a moving part, such as the swivel Guide Arm, (CK) against the Cam Gear, (DC).

6. MOTION OF PICKUP TOWARD TURNABLE SPINDLE WILL NOT TRIP CHANGER MECHANISM.

- a. See that the manual button is not pressed down. See that shipping bolts are removed.
- b. If trigger (DL) is being properly actuated, probably Cam Lever (DG) is binding against Sub-Plate (DI). Look for dirt or obstructions: such as the manual rod (CI) binding in hole in Sub-Plate; See that Pawl (DH) and trigger (DL) are working freely on their rivets.
- c. Check to see that there is not too much clearance between the trigger (DL) and the clutch lever assembly (CS). To correct, turn clutch adjusting screw (DM) counter clockwise until clearance is approximately 1/64" between trigger and "U" shaped bracket on clutch lever assembly (CS).
- d. Check clutch release jack (FO) to see that it has returned to a neutral position as it may be sticking and holding clutch open. If clutch is held open, clutch lever assembly (CR) will not be actuated to trip trigger (DL) and change cycle will not start.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

- a. Probably due to shipping bolts not being removed, causing a bind on manual rod (CI) or manual button is down.
- b. Check Key Control Unit (GG). See whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel.
- c. Examine Reject Rod (CH). If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be restored in same way. Grasp the two ends and twist it slightly.
- d. If Trigger (DL) is being properly actuated but without starting a change cycle, see directions above, Paragraph 6.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION.

- a. First see that "M" button goes clear down; then follow its action through Manual Rod (CI).
- b. Probably caused by the manual rod being bent and not projecting up through sub-plate (DI) and stopping cam lever (DG) when it is released from the trigger (DL).

9. TRIPS TOO SOON OR BEFORE RECORD HAS FINISHED PLAYING.

- a. This can be caused by too little clearance between the trigger (DL)

and the clutch lever assembly (CS). To get more clearance on this adjustment, turn the adjusting screw (DM) in a clockwise direction a half-turn or whatever is necessary to make tone arm trip on 1/4" motion.

- b. If friction clutch (CR) is not being opened momentarily by the motion of release lever at (FB) which is actuated by the four raised portions on cam gear (DC), then normal tracking of tone arm on record will cause clutch lever (CR) to trip trigger. To correct, adjust screw (FB) so that clutch opens momentarily approximately 1/64", thereby allowing "U" bracket on clutch lever to be reset to normal each time clutch opens.

10. TONE ARM FALLS OFF RECORD. Needle sits down too close to edge of records, not adjusted in far enough, or needle landing adjusting cam (FM) is reversed. Should contact lug on adjusting rod extension (FL) on the long side of cam. Also check pickup leader spring (EN). It may have become loose; more tension can be given it by bending down lug.

11. TONE ARM SITS DOWN TOO FAR IN.

- a. Probably due to adjusting rod (FP) binding and not measuring properly. If found to be bent, it should be straightened to correct shape so that it will operate freely. Read Item #3 on General Description of Change Cycle.

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE.

Pickup arm is normally impelled toward center of records by Lead Spring (EN). Should a slight increase in its tension be found necessary, this can be easily obtained by slightly bending the lug, to which it is attached, down against Main Plate.

13. "WOW" IN RECORD REPRODUCTION.

- a. Record is warped or otherwise defective or instrument is not being operated at normal room temperature, 70°F.
- b. Also may be caused by oil on Idler wheels, or inside rim of turntable. (See "To Check Oiling" Caution note.)

14. RECORD DROPS ON ONE SIDE ONLY.

- a. This suggests a Changer Post bent out of perpendicular to Main Plate. If Post must be straightened, be careful not to bend other parts.
- b. One selector set for 10" while playing 12" records.

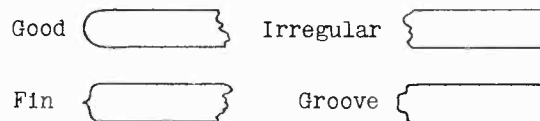
15. CHANGER CONTINUES CYCLING.

- a. Probably due to failure of Lift to be drawn back out of engagement with Cam Gear (DC). Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.
- b. Make sure that trigger spring is not disconnected. Also that clearance between trigger (DL) and clutch lever (CR) is approximately 1/64" max. A sticking pawl (DH) will also cause this condition.

16. RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME. See that pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble

is still suspected in pickup cartridge (EQ), test its output with a vacuum-tube voltmeter. Average voltage at 1000 C.P.S. using an Audio Test Record No. 1 should read from .5 volts to 2.5 volts depending upon type of crystal cartridge used. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. RECORD JAMS. Most slicing trouble (record jams) is due to off-size, defective or warped records and is no fault of the record changer or record changer adjustments. Properly manufactured records have a uniform semi-circular edge and can be successfully handled by record changers, even though the records vary considerably in thickness.



Cross section of record edge showing a perfect record and three imperfect edges.

Records that prove troublesome in the selecting or slicing process can usually be corrected by using a piece of fine sand paper or emory cloth to round up the edges.

18. AUDIO HOWL. Record changer not floating on cushions or spring mounting. See that shipping bolts are removed. If unit still does not float, loosen the nuts or mounting assembly allowing unit to rise and float.

19. TURNTABLE IS TIGHT. This turntable is assembled to the turntable spindle with a taper lock fit in the center. To remove, grasp turntable with both hands, turn slightly forward and backward, at the same time pulling upward. When replacing turntable, care should be taken not to injure Rubber Idler Drive wheels (AI).

CAUTION:

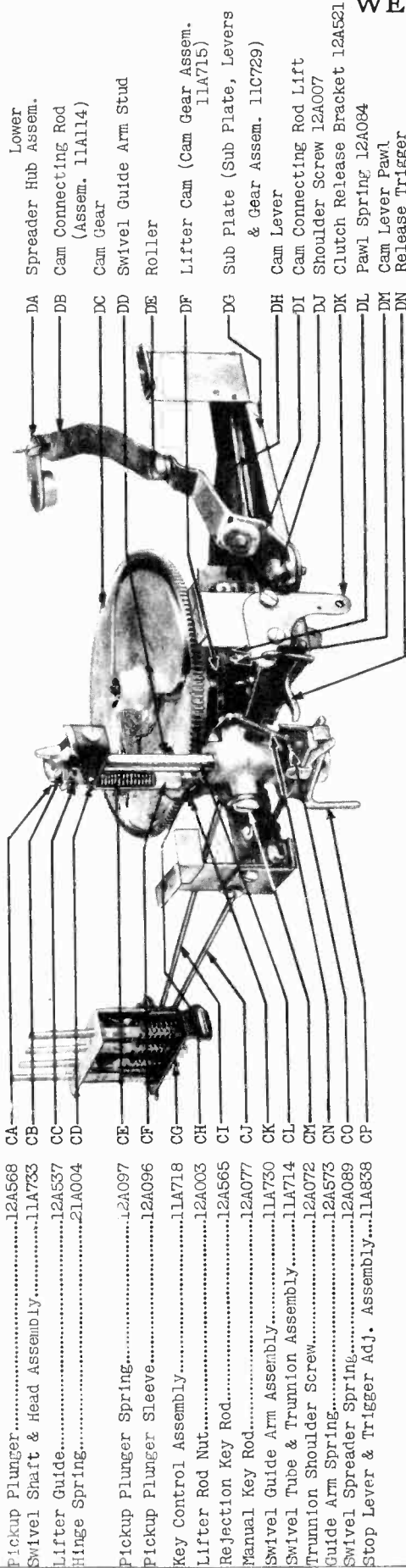
If Pickup cartridge has a permanent point sapphire needle, utmost care must be taken to avoid breakage. Should the needle be broken it is necessary to replace the entire cartridge. Never attempt to remove permanent point sapphire needle from the cartridge since it is an integral part and cannot be removed without damaging the cartridge. Needles can only be replaced in cartridges having a needle screw.

REPLACEMENT PARTS

When spare parts or sub-assemblies are required, order them direct from the factory, by factory number and name as given on photos -- not by reference letters. Where no number is given, order by full and exact description. Always specify Serial Number and Model Number as seen at (EJ). Parts shown in above photographs, but not given factory numbers, are furnished only in assemblies as shown with factory numbers. Refer to replacement parts list.

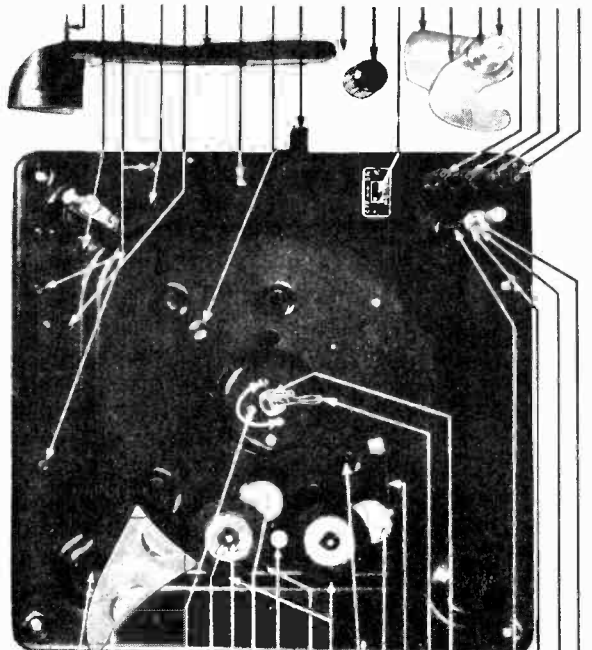
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MODEL 23



- CA Pickup Plunger.....12A568
- CB Swivel Shaft & Head Assendly.....11A733
- CC Lifter Guide.....12A537
- CD Hinge Spring.....21A004
- CE Pickup Plunger Spring.....12A097
- CF Pickup Plunger Sleeve.....12A096
- CG Key Control Assembly.....11A718
- CH Lifter Rod Nut.....12A003
- CI Rejection Key Rod.....12A565
- CJ Manual Key Rod.....12A077
- CK Swivel Guide Arm Assembly.....11A730
- CL Swivel Tube & Trunnion Assembly.....11A714
- CM Trunnion Shoulder Screw.....12A072
- CN Guide Arm Spring.....12A573
- CO Swivel Spreader Spring.....12A089
- CP Stop Lever & Trigger Adj. Assembly.....11A838

- DA Lower Spreader Hub Assem.
- DB Cam Connecting Rod (Assem. 11A114)
- DC Cam Gear
- DD Swivel Guide Arm Stud
- DE Roller
- DF Lifter Cam (Cam Gear Assem. 11A715)
- DG Sub Plate (Sub Plate, Levers & Gear Assem. 11C729)
- DH Cam Lever
- DI Cam Connecting Rod Lift
- DJ Shoulder Screw 12A007
- DK Clutch Release Bracket 12A521
- DL Pawl Spring 12A084
- DM Cam Lever Pawl
- DN Release Trigger

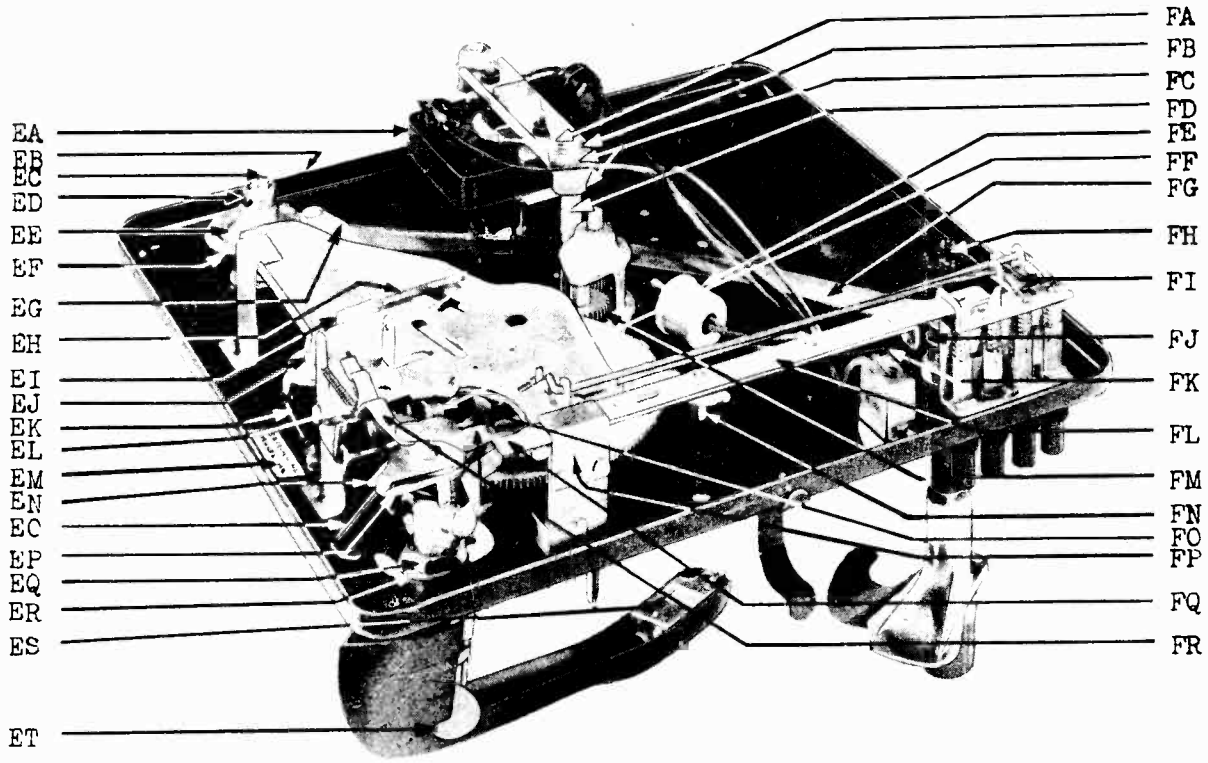


- AA Stationary Changer Post.....12A737
- AB Stationary Changer Plate Assembly.....11A836
- AC (4) Spindle Housing Mounting Screws.....26A039
- AD Spring Clip.....17A1363
- AE Idler Wheel Oil Wick.....25A030
- AF Bent Idler Wheel Link Assembly.....11A832
- AG Drive Sleeve (Give Model No.).....
- AH Bent Idler Wheel Link Spring.....12A751
- AI (2) Idler Wheel Assembly.....17A1769
- AJ Recorder Mtg. Hole.....
- AK Idler Wheel Link Assembly.....11A833
- AL Idler Wheel Link Spring.....12A750
- AM Turntable Spindle & Housing Assembly.....11B835
- AN Turntable Spindle & Cone Assembly.....17A026
- AO Front Changer Post.....12A043
- AP Changer Shaft Pin.....
- AQ Changer Post Washer.....25A045
- AR Front Changer Shaft Assembly.....11A853

- BA Pickup Cord (Give Model No.)
- BB Trip Adjusting Hole
- BC (3) Sub-plate Mtg. Screws 26A006
- BD Oil Hole
- BE Oil Hole
- BF Pickup Arm Assem. (Give Model No.)
- BG Needle Landing Adjusting Hole
- BH Oil Hole
- BI Pickup Arm Brkt. 11A766
- BJ Needle Screw
- BK Changer Cap 12A044
- BL A.C. Switch (Give Model No.)
- BM A.C. Switch (Give Model No.)
- BN Selector Plate..... } Assembly 11A117
- BO Changer Plate Spring 12A081
- BQ Changer Plate Washer 12A061
- BR Push Button (10) 12A581
- BS Push Button (12) 12A580
- BT Push Button (R) 12A579

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- (Give Model No. as at EM) Motor..... EA
- (Give Model No.) Main Mtg. Plate..... EB
- Stationary Changer Shaft Assem.....11A840 EC
- Changer Shaft Collar & Screw Assem...11A736 ED
- Spring Roller.....12A045 EE
- Changer Spreader Spring.....12A088 EF
- Cam Connecting Rod Assembly.....11A114 EG
- Return Spring.....12A087 EH
- Return Spring Catch.....12A525 EI
- Connecting Rod Nut.....26A028 EJ
- Cam Connecting Rod Lift Spring.....12A083 EK
- Adj. Rod Lever Spring.....12A577 EL
- Changer Serial & Model No..... EM
- Lower Swivel Spreader.....12A543 EN
- Pickup Leader Spring.....12A574 EC
- Upper Swivel Spreader.....12A542 EP
- (3) Post Nut.....12A053 EQ
- (3) Lockwasher.....#1228 ER
- (Give Model No.) Pickup Cartridge..... ES

- (Give Model No.) Lift Plate..... ET

- FA Ground Lead 20A295
- FB Washer 25A2519
- FC Rubber Grommet 25A032
- FD Motor Mounting Stud 12A739
- FE M-21 Plug & #7002 Shell
- FF Trip Adjusting Cam
- FG Changer Connecting Rod Assem. 11A842
- FH Tee Nut
- FI Manual & Rejecting Rod Spring 12A090
- FJ Changer Lever & Hub Assem. - Front
- FK Adjusting Rod Spring 12A087
- FL Adjusting Rod Extension
- FM Idler Gear 12A560
- FN Needle Landing Adjusting Cam
- FO Link (Swivel Guide Arm Assem. 11A730)
- FP Adjusting Rod Bracket 12A036
- FQ Adjusting Rod
- FR Adjusting Rod Assembly 11B717

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FOR THE SERVICE MAN

This Manual is designed for the use of the Service Mechanic only, and is intended to facilitate as far as possible his work of caring for the changer mechanism, whether he is called in for the purpose of assuring its continued satisfactory operation, or to remedy some difficulty which has appeared. For his convenience, the "Operating Instructions", supplied to user by the factory, may be summarized as follows:

The Changer plays twelve 10" or ten 12" records. . . . To reload, revolve the two posts slightly, grasping them underneath the Shelf Plates. Turn them back after the played records are removed; they will fall and lock when in proper position. Then place the new records on the Shelf Plates and push "R" button to put Changer in operation. . . . To play the other size records, turn the knob at top of front post until proper figure is opposite pointer, also raise and turn rear stationary changer plate until proper figure is facing turntable spindle, and press the 10" or 12" button, to agree with pointer setting. . . . To reject a record (or to start a change cycle as for testing purposes), simply press the "R" (Release or Reject) button, at any time while needle is upon a record. . . . To play manually, turn plates out of the way as for reloading, and press "M" button. (What are here called the "plates" of the Changer are frequently known among servicemen as "blades" — a name best avoided when talking with users because it may convey to some an exaggerated impression of danger in the movement of these parts.)

ILLUSTRATIONS

The three photos illustrate all vital parts of the Changer. Letters are used alphabetically, to refer to points on the photos. Reference letters must NOT be used for ordering parts: Order only by the factory numbers. Where no number is given, part cannot be separately supplied; order the assembly containing it.

OILING (REPRINTED FROM OPERATING INSTRUCTIONS)

The Changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 3 points. All points can be reached from above, through holes in the mounting plate, as follows:

No. 1. Through hole marked (BH), drop the oil upon flat surface of cam. It will distribute itself to proper points.

No. 2. Through hole marked (BE), see felt wick, and drop the oil directly upon it.

No. 3. Through hole marked (BD), see felt wick, and drop the oil directly upon it.

TO CHECK OILING

If squeaks are heard, compare the squeak with and without a load of records; any stack of records in motion is likely to squeak a little against a pin through their center. This can be corrected by rubbing a little wax on the turntable spindle. See that all four felt washer-shaped wicks are in position, including two washer-shaped wicks on Idler Wheels (AH), one wick ("No. 2") on Lift (DI) and one ("No. 3") on Cam Lever (DH). See that each wick is thoroughly saturated (as it may not be if insufficient oil or low grade or low viscosity oil has been used. ("CAUTION". Do not over saturate the two Idler Wheel oil wicks (AE) as centrifugal force will throw the excessive oil out over the edge of Idler Wheel (AH) and cause loss of traction to turntable, therefore always wipe excess oil off Idler Wheels before starting motor.) Also check the two oil wicks on the motor at (EA) to see that they are thoroughly saturated. Also check lubrication on Turntable Spindle bearings. The top bearings can be oiled by removing turntable and oiling at (AN) then oil lower bearing from below, also check lubrication at all other bearing points.

GENERAL DESCRIPTION OF THE CHANGE CYCLE

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, interconnected and built together, but largely separated in their operation.

(1) The record-changing mechanism — brought into operation originally by the contact of Lifter Cam (DF) with Pawl (DM) — is the simplest of the three. It is driven by the cam groove (visible on under side in Photo E-F) of Cam Gear (DC). As Cam Lever (DH) is forced, by the Pawl, out underneath Lift (DI) (which is shown revolved to the right for visibility) the Lift rises and forces roller (DE) into the under groove in Cam Gear. The motion is transferred to Stationary Changer Shaft (at EC) through Cam Connecting Rod (DB) or (EG), thence through Changer Connecting Rod (FG) to Front Changer Shaft (AR).

(2) The pickup-operating mechanism — like-wise brought into operation originally by the cam-and-pawl action upon Cam Lever (DH) — is driven in part by the groove in upper (visible) side of Cam Gear (DC). As Cam Lever is forced out, at the beginning of the change cycle, against Link (FO), it causes the Link to push upward upon Pickup Plunger (CA), thus lifting needle from

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record. The same pressure upon Link (FO) works, through Guide Arm (CK), to force Stud (DD) down into the groove on the Cam Gear (DC). This moves the pickup arm with a swinging movement while Pickup Plunger (CA) holds it up off of record. It first swings out beyond the turntable until Shelf Plates have released a record, then swings back to proper position to start playing.

(3) The mechanism for bringing needle in to correct starting position must operate accurately for both 10" and 12" records. Partly due to this requirement, the starting position is not determined by the cam action. The upper groove on Cam Gear is designed so that it, acting alone, would carry the Pickup Arm farther toward the Turntable spindle than would ever be desirable as a starting adjustment. Travel of pickup arm toward Turntable Spindle is then stopped at proper point for lowering onto the record, by action of Stop Lever (CP). The stopping takes place as lug (CP) (on the Stop Lever) strikes the shoulder on Rod (FQ). This enables the entire mechanism, rotated by cam action on Guide Arm (CK), to travel on past the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to Stop Lever (CP) is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires, therefore, only correct adjustment of Rods (FL and FQ); the radial difference of 1" between correct starting position for 10" and 12" records is taken care of by exact dimensioning, at the factory, of surfaces at right end of Rod (FL) which stop against the "10" and "12" key stems. Due to this, when Adjusting Cam (FN) is turned (as directed below under Adjustment A) the starting position of needle is simultaneously altered for both 10" and 12" records.

ADJUSTMENTS

There are three adjustments that can be made, FROM ABOVE: CHANGER NEED NOT BE REMOVED FROM CABINET. All adjustments are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to readjust, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. If needle comes down on the sound track, playing of records will not start at their beginning. Insert screw driver through hole (BG). Turn Screw head on Needle Landing Adjusting Cam (FN) very slightly counter-clockwise. If needle comes down too close to outer edge of record, or out beyond edge of record, turn Adjusting Cam clockwise.

The factory adjustment of needle landing is 1/8" in from outer edge of record.

Compare also Paragraph 12.

B. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES. The arm should rise, during the change cycle, high enough so that it clears by only 1/4" the record above it, resting on shelf plates. (Be careful, before deciding that readjustment is necessary, to see that the record at bottom of stack is not a warped one.) To make this adjustment, loosen Lock Nut (CH) and turn Pickup Sleeve (CF) to lengthen or shorten Pickup Plunger (CA). However, if Pickup is made to rise too close to bottom record, Stud (DD) on Guide Arm (CK) may never clear the Cam Gear. In making this adjustment, therefore, care must be taken to see that Pickup Arm does not keep moving back and forth continuously (due to Stud remaining in engagement with groove). When correct adjustment is found, tighten Lock Nut securely.

C. ADJUSTING DISTANCE FROM TURNTABLE SPINDLE AT WHICH TRIGGER WILL TRIP AND CHANGE CYCLE WILL BEGIN. Insert screwdriver through trip adjusting hole (BB). Turn screw head on Trip Adjusting Cam (FF) clockwise for earlier tripping, or counter-clockwise for later tripping. (Effect is to alter position of the Cam which strikes Trigger (DN). It may be found that Cam has been revolved through a half-turn; in this case, above directions would apply only after Cam has been returned to correct position by revolving screw head one-half turn).

This Changer does not depend, for automatic tripping, on the records being provided with any special grooves at end; it trips whenever needle comes within a certain distance of T.T. Spindle.

The factory adjustment is for 1-13/16" to 1-15/16" from center of T.T. Spindle. This is generally the most satisfactory adjustment; no modern record will then be cut off before playing is finished, and none will fail to trip at end. For certain records of early manufacture, it may be impossible to find an adjustment that will always trip and never cut off, but these records may always be played manually.

REPLACING MOTOR

The service man may be called upon to adapt the Changer to a different power supply. For this purpose, or in case of any serious fault within Motor, remove entire Motor (EA) from the Changer and replace it with a suitable new Motor. See that Motor Frame is well grounded by wire, (FA) (in photo E-F). (In ordering a replacement Motor, specify the power supply and give Model Number at EM; also Make and Model Number of phonograph or other type of installation.)

TROUBLE SHOOTING

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the

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mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it -- or that set screws may work loose due to some external vibration. For tightening set screws, a No. 8 size Allen (hexagon) wrench is required: Be sure that set screws are properly seated on the holes or flats provided. Damage from tampering is likely to take the form of bent parts; never bend any part during examination.

Among the principal trouble symptoms to which such causes may give rise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT.

May be caused by:

- a. Failure to lubricate properly. Oil thoroughly. See oiling instructions.
- b. Check voltage. Line voltage may be abnormally low or high.
- c. Motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement.

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS.

- a. This indicates trouble in Motor windings. Unless the damage is easily seen and repaired, replace motor, as above described.
- b. Check motor rotor by turning the drive sleeve with finger and thumb, if it seems to bind slightly it can usually be corrected by lightly tapping the bottom bearing bridge, this will align the two self aligning shaft bearings and allow the rotor to turn freely.

3. MOTOR IS SLOW IN STARTING.

- a. Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.
- b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that Motor is defective, and proceeding as in Paragraph 2 above.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

Check oiling, as directed above. (If squeaks are heard, they will usually be found to come from the records -- not from the mechanism.)

See "To Check Oiling".

5. CHANGER IS NOISY WHEN IN CYCLE.

Check oiling. Also see if any part has become loose or bent and is rubbing against a moving part, such as the swivel Guide Arm, (CK) against the Cam Gear, (DC).

6. MOTION OF PICKUP TOWARD TURNTABLE SPINDLE WILL NOT TRIP CHANGER MECHANISM.

- a. See that the manual button is not pressed down. See that shipping bolts are removed.
- b. If trigger (DN) is being properly actuated, probably Cam Lever (DH) is binding against Sub-Plate (DG). Look for dirt or obstructions: such as the manual rod (CJ) binding in hole in Sub-Plate; See that Pawl (DM) and trigger (DN) are working freely on their rivets. If the Lever engages the Pawl so that Lift (DI) forces roller (DE) up into the under groove on Cam Gear (DC), and if set screws are tight, the change cycle must operate as Cam Gear turns.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

- a. Due to shipping bolts not being removed, causing a bind on manual rod (CJ) or manual button is down.
- b. Check Key Control Unit (CG). See whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel.
- c. Examine Reject Rod (CI). If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be restored in same way. Grasp the two ends and twist it slightly.
- d. If Trigger (DN) is being properly actuated but without starting a change cycle, see directions above, Paragraph 6.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION.

- a. First see that "M" button goes clear down; then follow its action through Manual Rod (CJ).
- b. Probably caused by the manual rod being bent and not projecting up through sub-plate (DG) and stopping cam lever (DH) when it is released from the trigger (DN).

9. TRIPS TOO SOON OR BEFORE RECORD HAS FINISHED PLAYING.

- a. Adjust as described in adjustment "C". (Refer to adjustments).
- b. If satisfactory adjustment cannot be made then check stop lever (CP). It may be loose on Swivel Shaft (CB). If so, reset and tighten set screws.

10. TONE ARM FALLS OFF RECORD. Needle sits down too close to edge of records, not adjusted in far enough, or needle landing adjusting cam (FN) is reversed. Should contact lug on adjusting rod extension (FL) on the long side of cam. Also check pickup leader spring (EO). It may have become loose; more tension can be given it by bending down lug.

11. TONE ARM SITS DOWN TOO FAR IN.

- a. Properly due to adjusting rod (FQ) binding and not measuring properly. If found to be bent, it should be straightened to correct shape so that it will operate freely. Read Item #3

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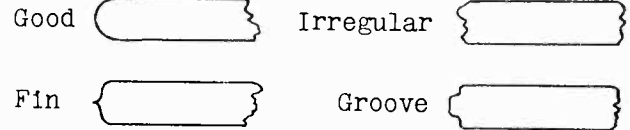
on General Description of Change Cycle.

- b. Refer to Paragraph #9, Item #2 above.

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE.

Pickup arm is normally impelled toward center of records by Lead Spring (EO). Should a slight increase in its tension be found necessary, this can be easily obtained by slightly bending the lug, to which it is attached, down against Main Plate.

a uniform semi-circular edge and can be successfully handled by record changers, even though the records vary considerably in thickness.



Cross section of record edge showing a perfect record and three imperfect edges.

13. "WOW" IN RECORD REPRODUCTION.

- a. Record is warped or otherwise defective or instrument is not being operated at normal room temperature, 70° F.

- b. Also may be caused by oil on Idler wheels (See "To Check Oiling" Caution note. Records that prove troublesome in the selecting or slicing process can usually be corrected by using a piece of fine sand paper or emory cloth to round up the edges.

14. RECORD DROPS ON ONE SIDE ONLY.

- a. This suggests a Changer Post bent out of perpendicular to Main Plate. If Post must be straightened, be careful not to bend other parts.
- b. Selector Plate set for 12" while playing 12" records, but stationary plate is set for 10".
18. AUDIO HOWL. Record changer not floating on cushions or spring mounting. See that shipping bolts are removed. If unit still does not float, loosen the nuts or mounting assembly allowing unit to rise and float.

15. CHANGER CONTINUES CYCLING.

- a. Probably due to failure of Lift (DI) to be drawn back out of engagement with Cam Gear (DC). Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.
- b. Make sure that trigger spring is not disconnected and that trigger (DN) holds cam lever (DH) in a neutral position. More tension can be given trigger spring by bending lug to stretch spring. A sticking pawl (DM) will also cause this condition.
19. TURNTABLE IS TIGHT. This turntable is assembled to the turntable spindle with a taper lock fit in the center. To remove, grasp turntable with both hands, turn slightly forward and backward, at the same time pulling upward, or run motor and grasp the turntable while it is revolving, and pull up. When replacing turntable, care should be taken not to injure Rubber Idler Drive Wheels (AH).

REPLACEMENT PARTS

When spare parts of sub-assemblies are required, order them direct from the factory, by factory number and name as given on photos -- not by reference letters. Where no number is given, order by full and exact description. Always specify Serial Number and Model Number as seen at EM. Parts shown in above photographs, but not given factory numbers, are furnished only in assemblies as shown with factory numbers. Refer to replacement parts list.

16. RECORD IS DRIVEN, BUT NOT HEARD, OR NOT HEARD WITH PROPER VOLUME. See that pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup cartridge (ES), test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type, or 0.5 volts if of magnetic type. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. RECORD JAMS. Most slicing trouble (record jams) is due to off-size, defective or warped records and is no fault of the record changer or record changer adjustments. Properly manufactured records have

Form SM 23-2.5-100

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Operating Instructions

Your — **WEBSTER-CHICAGO** — Automatic Record Changer will multiply many-fold your enjoyment of recorded music. These instructions are written for the purpose of enabling you to get the benefits this equipment affords. With proper care, it should give many years of satisfactory service. With it, you can enjoy from 35 minutes to nearly an hour of your favorite music without interruption, and without attention to the instrument.

MODERN RECORDING

Modern records are made by electrical processes and the bringing out of their full tonal perfection requires a well-designed electrical pickup such as is provided in this Record Changer.

Fully as remarkable is the wide variety of selections that are obtainable. They range from the latest hit tunes played by the most popular bands, to complete operas and symphonies recorded by the world's leading artists. These longer works are to be had in the form of a set of double sided records so arranged that the first half of the work is heard by playing one side of all the records, and the last half by playing the other side.

MOTOR AND POWER SUPPLY

The Changer is equipped with a constant-speed self-starting motor. Under all normal conditions it starts automatically and runs at correct speed.

Each Changer is designed to operate on a certain voltage and frequency (cycles) only. Be sure to look at your nameplate and see that the instrument you have conforms to your power supply before plugging in cord.

SETTING FOR RECORD SIZE

This mechanism plays up to twelve 10" records or ten 12" records at one set-up. **All records must be the same size for each set-up.**

On each post you will see two plates (shown in large drawing). The lower one, on which the records rest, is the **shelf plate**. The upper one is the **selector plate**, which takes from the bottom of the stack the next record to be played.

To set for record size **two** things must be done.

(1) Clasp one of the posts just underneath the shelf plate, with thumb and finger of left hand. With right hand, lift knob and turn the selector plate until figure 10 or 12 (whichever size you want to play) is opposite the pointer. Then raise and turn rear shelf plate until proper figure is facing turntable spindle.

(2) Push button marked 10, or 12, as required to agree with pointer setting.

LOADING

See that both shelf plates are turned toward center of turntable. If they are not, again grasp the post just below shelf plate, and rotate post until it falls into proper position, with both shelf plates correctly turned toward center of turntable. Place the stack of records over center pin so they will rest on the two shelf plates.

ADJUSTING NEEDLE SO THAT PLAYING WILL START AT BEGINNING OF RECORD

The correct adjustment is made at the factory, and thereafter no further adjustment may be necessary. Should need arise, the position at which needle lowers to record can be adjusted by inserting small screw driver thru the hole shown in the illustration. Turn very slightly either way. Clockwise turn moves needle in; counter-clockwise moves needle out.

STARTING THE MECHANISM

To start motor and turntable:

(1) Turn the switch to "on" position. (On some models the switch is located in a different place from that shown in illustration.) Motor will then start.

(2) Push button "R". This will release the first record and start the record-changing mechanism.

REJECTING A RECORD YOU DON'T WANT TO HEAR

Merely press the "R" button. You can do it any time after the needle has come into contact with that record.

REMOVING PLAYED RECORDS

First switch off motor (see turning off instructions). Then take hold of both posts, just **below** the shelf plates, and turn them out of the way. Lift the played records from the turntable. Taking hold of posts as before (**below** shelf plate) move plates until post again falls into playing position. The changer may then be loaded with a new stack of records: see directions above, for loading.

MANUAL OPERATION

To play records one at a time as in an ordinary phonograph—

(1) Remove any records remaining on the turntable: see directions just preceding.

(2) Leave plates turned outward, as for removing played records. Do **not** turn them back toward center of turntable.

(3) Press button marked "M". Then place a record on turntable, switch on motor, and lift pickup into position.

OILING

The changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 3 points. All points can be reached from above, thru holes in the mounting plate, as follows:

- No. 1 Thru hole marked "A", drop the oil upon flat surface of cam. It will distribute itself to proper points.
- No. 2 Thru hole marked "B", see felt wick, and drop the oil directly upon it.
- No. 3 Thru hole marked "C", see felt wick, and drop the oil directly upon it.

TONE AND VOLUME CONTROL

If the radio or amplifier through which this changer is being played has a tone control, adjustments may be made for various types of musical selections and acoustical conditions.

If it is desirable to control volume by means of the control on the changer, the volume control on the radio or amplifier should be set slightly higher than necessary for the maximum volume level required. If the user prefers to control volume by means of the control on the radio or amplifier, the control on the changer should be set at approximately a "half-way" position. This latter method is not recommended, however, because of the necessity of changing the control setting each time the changer is stopped for reloading.

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TURNING OFF

- (1) Move Changer switch to "off" position.
- (2) Lift pickup arm, place it on the pickup rest. Always be sure to turn off while needle is resting upon a record: otherwise pickup cannot be returned to its rest due to unit being in a changed cycle.
- (3) To avoid warping of records, never leave records resting on the shelf plates.

IF CHANGER IS LEFT RUNNING

No damage will be done if you forget to turn off Changer after it has played its entire load of records. It will simply repeat the last record until stopped or reloaded.

IF CHANGER WILL NOT GO ON TO NEXT RECORD ABOVE

An old record may occasionally be found (made before the introduction of automatic changers) which does not have an eccentric oscillating groove, to set the changer mechanism in operation. Should one of these old records be found in the stack, a touch of the "R" button will instantly set the Changer mechanism in action again. Any need for doing this can be avoided by placing the old record at top of stack to be played, so that it will come into position last.

WHEN NOISE DEVELOPS

Noisy scratching indicates worn records. Poor tone is evidence of a worn needle. Some records will wear longer than others, even if kept equally clean. This is due not only to quality of manufacture, and care given the records, but also to the kind of music recorded.

CARE OF RECORDS

To insure long life for your records requires only slight effort. Do not expose them to heat from the sun, nor to heat from nearby stoves or radiators. Store them preferably in albums, but in any case keep them always in a cool, dry place, resting vertical or flat horizontal. Remove dust and dirt, using soft cloth and light circular motion. If fluids are used for lubricating record surfaces, keep in mind that these often tend to attract dust, and extra effort is necessary to clean it off. Dust is much more troublesome in some localities than in others.

Records may safely be left stacked directly upon each other (as on the turntable) but should never be left resting on the shelf plates of the Changer. This two-point support, while best for its purpose, is not at all suitable for record storage.

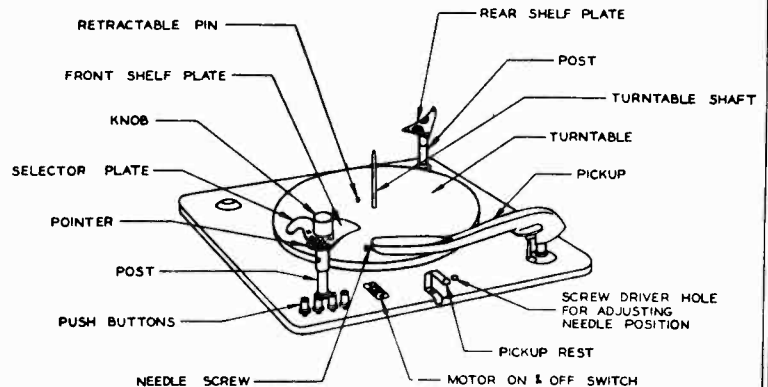
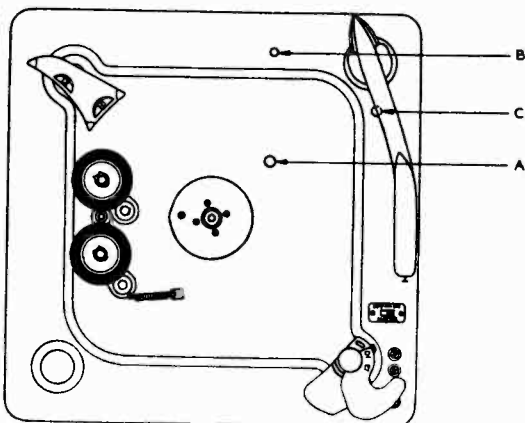
RECORD NEEDLES

Various types and kinds of needles are available for use in phonograph pickups. All have their virtues, as well as their faults, for use in ordinary phonographs where needles can be changed after each record. For playing ten or more records at one set-up, as with this Changer, no attempt should be made to use ordinary steel or fibre points, since continued use of worn points will be likely to ruin both quality of reproduction and the records as well. Any kind of needle can be used, which has a point durable enough to play 15 records or more without damaging them.

THE—**WEBSTER-CHICAGO**—Automatic Record Changer unit is constructed of a minimum number of working parts and in operation is simple and reliable. As with all mechanical articles, minor adjustments may be necessary at times. Should additional information be required, particulars will be given upon application to the manufacturer.

RIGHT: General Illustration Showing Name and Location of Parts.

BELOW: Oil Holes As Seen in Mounting Plate After Lifting Off Turntable.



OPERATING THE RECORDER: It is important to note that the cutting needle must be inserted in the recording head in the proper manner to insure the necessary cutting action. A close inspection of the cutting needle will show it to have a flat spot on the shank opposite the cutting face. It is important that the needle be inserted in the cutting head with the flat spot toward the front of the cutting head so that the needle holding screw bears against the flat on the needle shank.

First be sure that volume level and recording level settings are satisfactory, then lift the recording arm off the rest and place the cutting needle on the record approximately 1/4 inch in from the outside edge of the record, allow the recorder to operate and cut several grooves for the beginning of the record, then turn the volume control up to a previous established setting for proper recording level and give signal that the record is being cut. It is important that a constant level be maintained by carefully watching the volume level indicator. The recording process can be continued until the recording head comes to within approximately 1 1/2" of the center pin. at which time the volume control should be turned back to "0" and allow several blank grooves to be cut. This completes the recording. Then raise recording arm and return to rest.

This recorder is designed for using a short type of needle having a length of approximately 5/8". The length of time required for cutting the various size records at 78 r.p.m. is as follows:

6"	diameter	- 1.3 minutes
8"	"	- 2.6 "
10"	"	- 4.0 "
12"	"	- 5.2 "

The figures given above are conservative, and slight additional time can be added to compensate for the unmodulated grooves at the start and finish of the record.

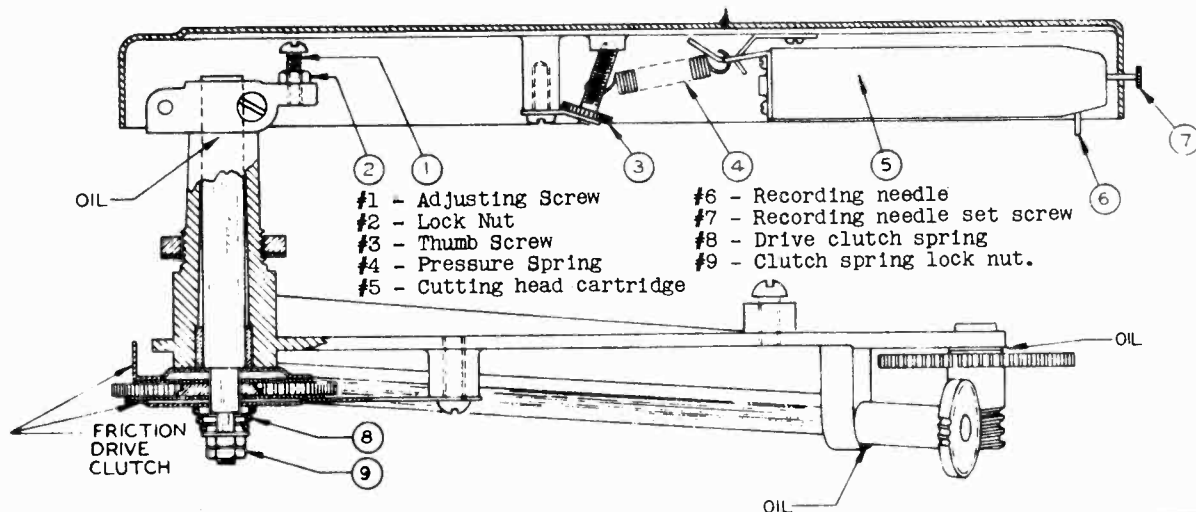
It will be noted after the first recording has been made, that the thread which has been cut out of the groove by the recording needle is a certain thickness. All recorders are adjusted to cut grooves approximately .0015 inches deep, and it will be found that records of various materials or the shapes and types of the needles used will change the depth of the groove. While there is not always a micrometer handy to measure the thickness of the thread cut, we refer you to a very fine human hair as the approximate thickness of the thread when cut at .0015.

ADJUSTING HEIGHT OF RECORDING ARM: The adjusting screw and nut No. 1 and No. 2 are for adjusting the height of the recording arm above the turntable. The height of the tip of the needle, No. 6, is approximately 1/8" from the record surface when the cartridge, No. 5, is held by the screw, No. 7, in the "up" position. This is adjusted at the factory, and under ordinary circumstances, does not require re-adjusting unless recording needles vary from standard. If, under certain conditions, it is necessary to raise the arm to provide a final adjustment of the cutting needle pressure, loosen lock nut, No. 2, with a screw driver, turn adjusting screw, 1" counter-clockwise to raise the arm or clockwise to lower the arm, locking it by tightening the lock nut, No. 2.

OILING: The recorder mechanism should be lubricated once a year with a few drops of good light machine oil at each of the bearing points as shown on sketch, also place a little light grease on each of the gears (caution:- NEVER OIL THE FRICTION CLUTCH AT ANY TIME AS IT WILL CAUSE SLIPPAGE).

ADJUSTING DEPTH OF RECORDING NEEDLE CUT: All recorder mechanisms are properly adjusted and tested before leaving the factory, with a steel cutting needle, but there will probably be need for a slight adjustment of the needle pressure, which can be made in the following manner referring to sketch below showing a cross-sectional view of the recording arm: The adjustment for depth of cut or needle pressure is thumb screw #3. This adjustment regulates the spring tension of pressure spring #4 on the pivoted cutting head, No. 5, and by turning the thumb screw to the left or right will increase or decrease the pressure on the needle.

Turning this screw so that the spring moves away from the thumb screw and to the top of the recording arm, increases the pressure on the recording needle, allowing a deeper cut in the recording blank; turning the screw to bring the spring toward the thumb screw decreases the pressure on the recording needle and will provide a more shallow groove in the record blank.



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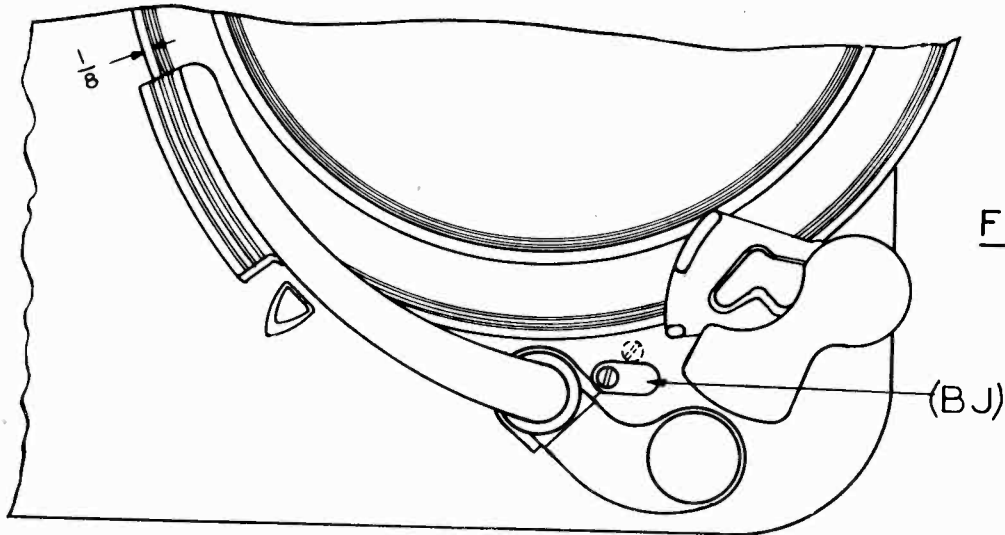


FIG. 1

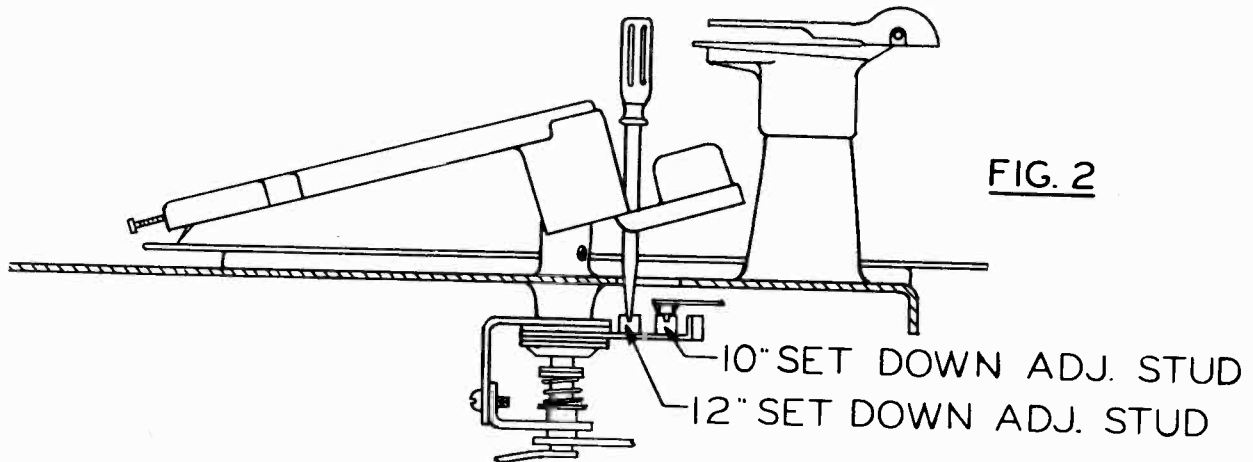


FIG. 2

ADJUSTMENT NO. 1

ADJUSTMENTS

Adjustments Nos. 1, 2 and 3 can be made from above. Changer need not be removed from cabinet. All adjustments are correctly made at the factory and ordinarily need

never be altered. However, should it become necessary to re-adjust due to accident or tampering, proceed as follows:

Adjustment #1. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD.

The position at which needle lowers to record can be adjusted by inserting screw driver through hole (BJ) just in back of tone arm (shown in Fig. 1). For adjusting the 10" setdown, insert screw driver into the inside eccentric adjusting stud. For adjusting the

12" set-down, insert screw driver into the outside slotted stud (see Fig. 2). Turn very slightly clockwise or counter-clockwise to move needle landing in or out. The factory adjustment of the needle landing is 1/8" in from the outer edge of the record.

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ADJUSTMENT NO. 2

Insert screw driver through hole (BI) in main plate and locate it into slotted stud. Adjust eccentric cam so that the distance between the trip lever (BG) and trip arm (BH) is approximately .005. This can best be done by first adjusting the trip eccentric cam at (BI) so that there is no clearance or gap, then back off very slightly until trip lever (BG) is free to pulsate with the clutch motion or

ADJUSTMENT 2

ADJUSTING THE TRIP ECCENTRIC CAM FOR CORRECT CLEARANCE BETWEEN THE TRIP LEVER AND TRIP ARM

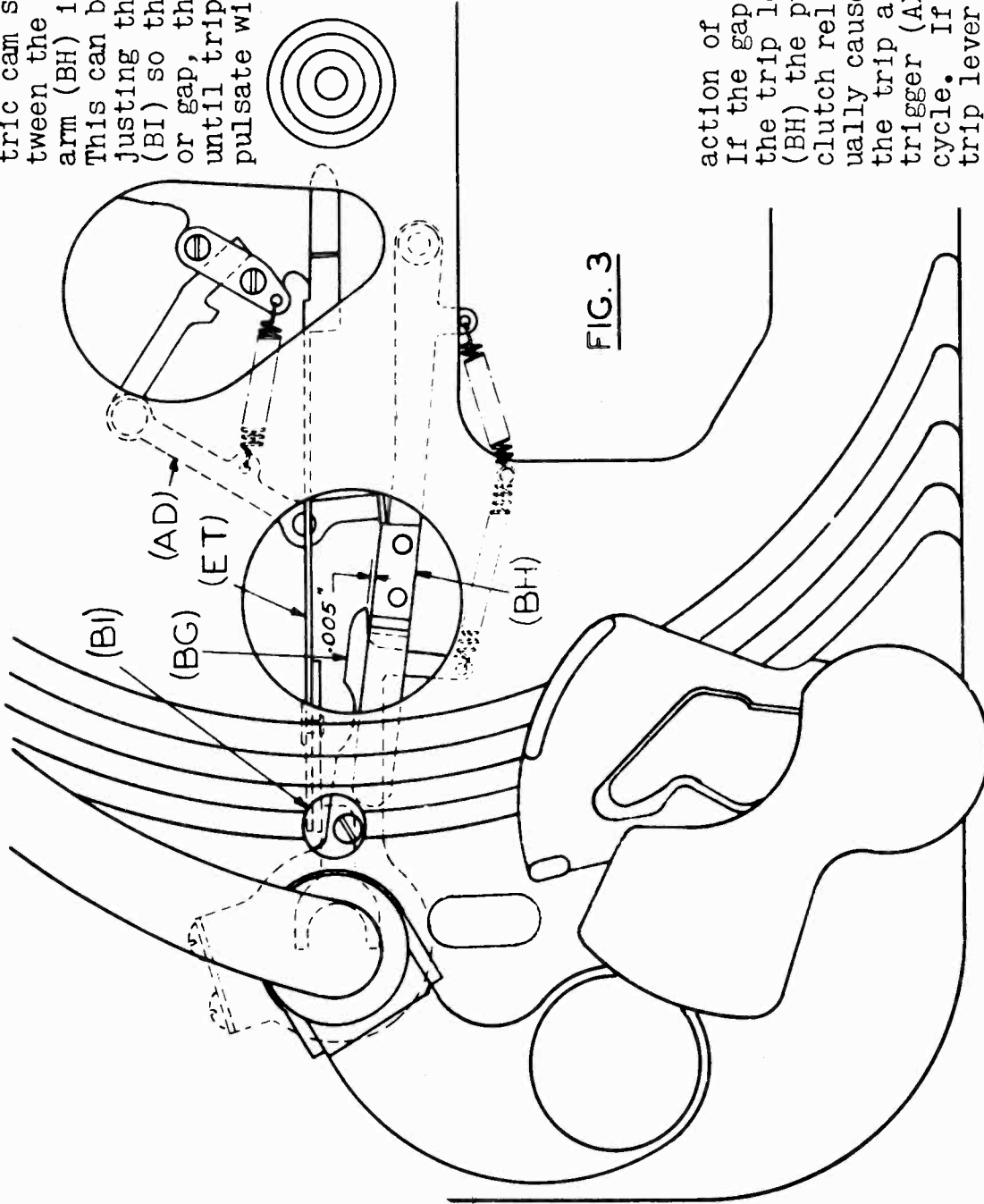


FIG. 3

action of the release lever (ET). If the gap is not sufficient between the trip lever (BG) and trip arm (BH) the pulsating motion of the clutch release lever (ET) will gradually cause the trip lever to move the trip arm enough to trip the trigger (AD) and start a change cycle. If gap is too great the trip lever will not move far enough to start a change cycle at the end of a record.

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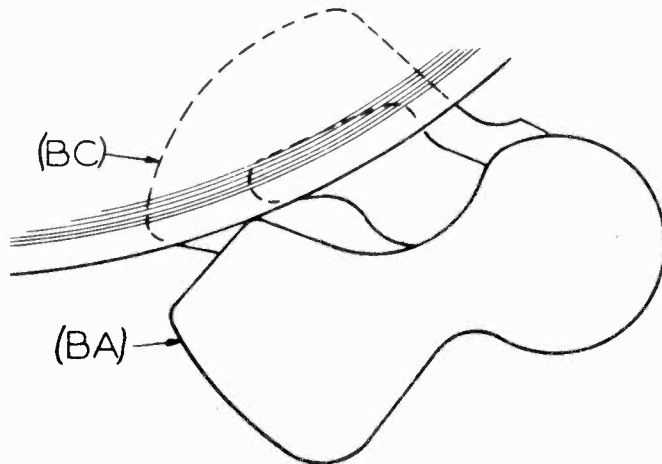


FIG. 4

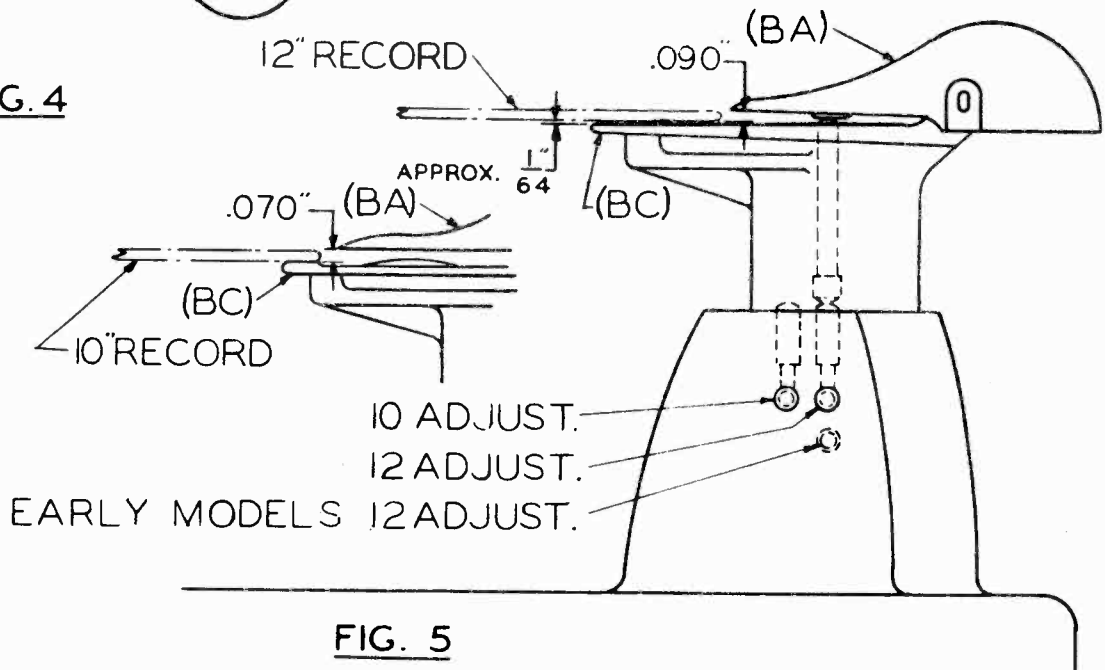


FIG. 5

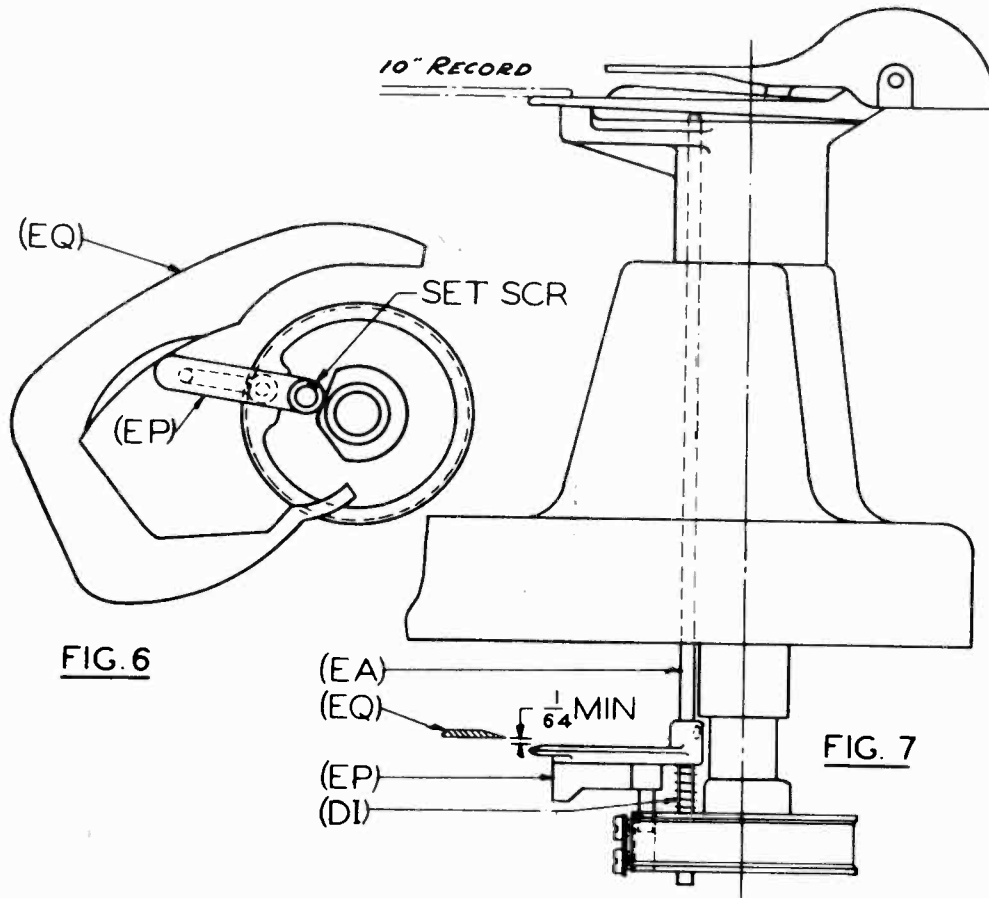
Adjustment #3. ADJUSTMENT FOR CHANGER PLATES.

To adjust the distance between the selector plate (BA) and the shelf plate (BC) for 10" records, first select a 10" record that is approximately .070" thick. Then position it on changer and start a change cycle to revolve changer plates. Stop the turntable by hand just as the selector plate (BA) is about to touch the record, and shut off the motor (see fig. 4). Then slowly revolve the turntable by hand, allowing selector plates to contact edge of record so that it just slides over record, touching the surface lightly. Check all three

selector plates and if any adjustment is necessary, it can be done by inserting a No. 10 Allen wrench in the set screw holes located in the sides of the changer posts. Turn set screw slightly clockwise to raise the selector plate and counter-clockwise to lower it. The set screw for adjusting the 10" record setting, and the one for 12" record setting is shown above in fig. 5. To adjust for 12" records, select a 12" record that is approximately .090" thick, than follow same procedure as for adjusting 10" records.

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ADJUSTMENT NO. 4



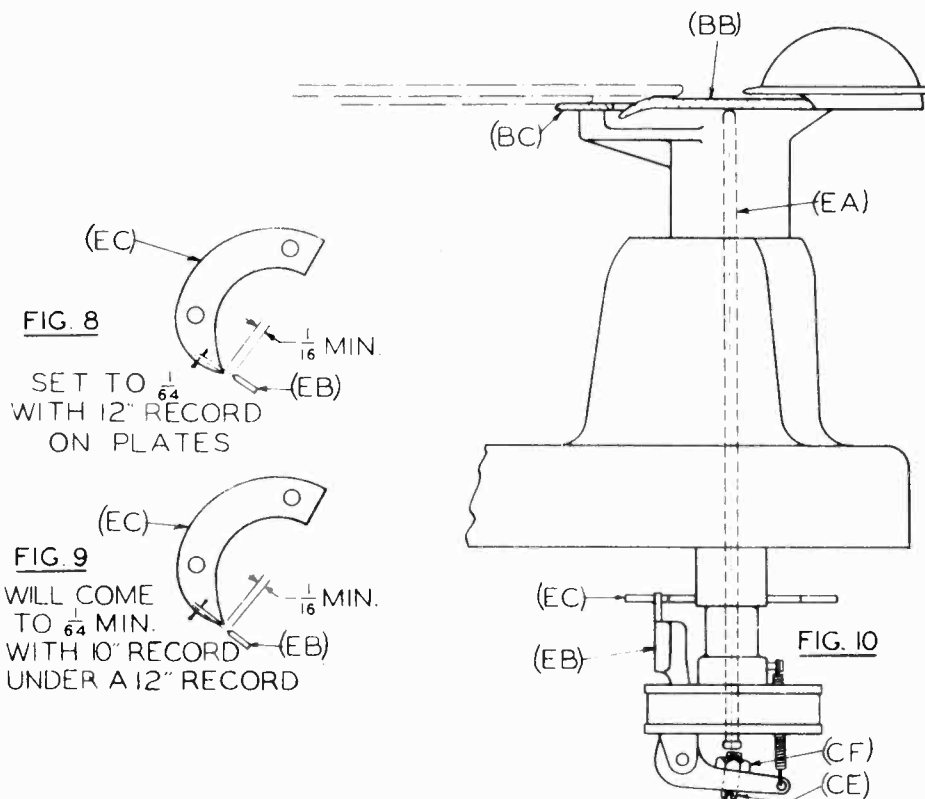
The following adjustments cannot be made from above, and therefore it may be necessary due to position of changer to remove it from cabinet.

Adjustment #4. NO-RECORD SELECTING LEVER ADJUSTMENT

First be sure that spring tension on spring (DI) is strong enough to lift the center blade raising pin (EA) properly and fully, but not so strong that one 10" record will not fully depress pin and lever (see fig. 7). Then with set screw loose in no-record selecting lever (EP) see fig. 6, and pin held down by weight of one 10" record, slide no-record selecting lever (EP) into position so that it will just clear under lower edge of the lower cam

setting lever (EQ) by approximately 1/64" clearance (see fig. 7). Then tighten set screw and check adjustment with and without a record, also be sure that without a record, the fin on no-record selecting lever (EP) swings above cam setting lever (EQ) and portion of lever (EP), indicated by arrow on fig. 7, sweeps stop lever (EQ) on cam setting lever into position shown in Fig. 16.

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ADJUSTMENT NOS. 5 and 6



Adjustment #5. LIFTER LEVER DIFFERENTIAL ADJUSTMENT.

Place a 12" record over the turntable spindle so that the record rests on the shelf plates. Then check the center plate lifter lever (EB) and see that point of this lever will just slide inside of center arm lifter cam (EC) see Fig. 8. Then place a 10" record under the 12" record so that the 10" record will rest on shelf plate (BC) and the 12" record will then touch center plate (BB) which presses down center pin (EA) and moves lifter plate (EB) closer to

outside face of lifter cam (EC) than it would be without the 12" record on top of the 10" record (see fig. 10). The lever (EB) should then follow the outside of the center arm lifter cam (EC) see Fig. 9. If it is necessary to re-adjust this can be done by means of adjusting screw (CE) and lock nut (CF) to balance out the contact of lever (EB) on both sides of cam (EC) in relation to starting point of cam (see fig. 10).

Adjustment #6. LIFTER LEVER CLEARANCE ADJUSTMENT.

Check the distance between the leading edges of the center plate lifter lever (EB) and center arm lifter cam (EC) with a 12" record resting on the shelf plates. It should be a minimum of 1/16". See Fig. 8. It should not be necessary to check this adjustment unless the tape clamp screws on the pulley (FG) have been loosened. See Fig. 11. To re-adjust after screws have

been loosened, first set pulley so that when the slack in the tape line is taken up in the direction of forward motion of the tape segment (CH), there will be the necessary 1/16" clearance as mentioned above.

Note: If this adjustment is "Off" most likely changer plate synchronization will also be off. Check Adjustment No. 7.

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Adjustment #7.

Changer Plate Synchronization.

The synchronization of changer plates can be checked by placing one 10" record on the shelf plates. Then start a change cycle allowing it to continue until plates are just about ready to release the record. It can then be determined which plate is either slow or fast (see fig. 12). This plate can then be adjusted by loosening the screws on the tape clamp which hold the tape (DD) from slipping in the pulley (FG) see fig. 11. Then slightly move changer plate whatever is necessary to synchronize it with the other two plates so that record will drop evenly. Then tighten tape clamp screws securely. (Also check adjustment #6.) Note - tape line should have a very slight amount of slack. Check by grasping tape line with thumb and index finger and moving it in and out approximately 5/8" with a moderate pressure.

ADJUSTMENT NO. 7

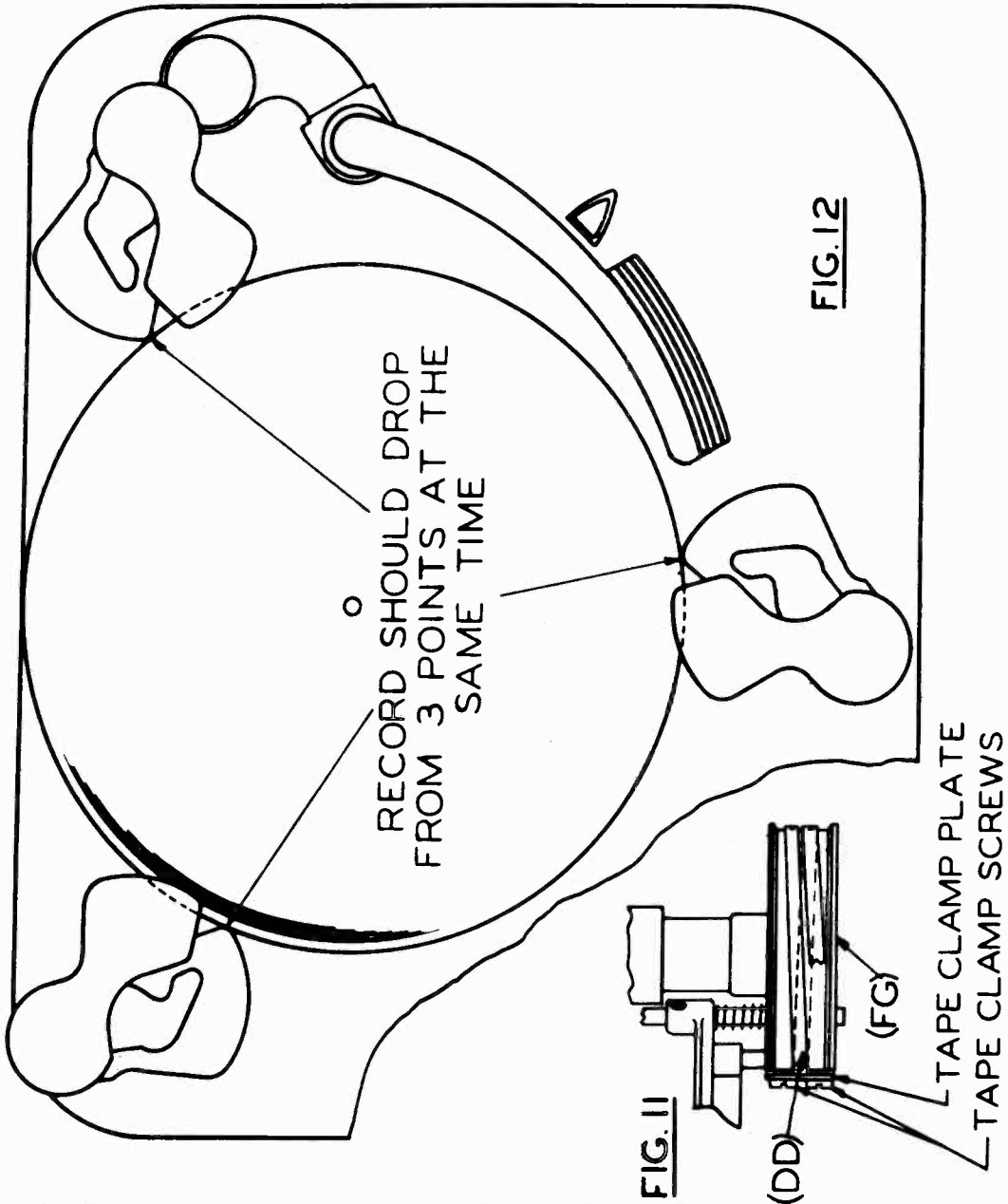


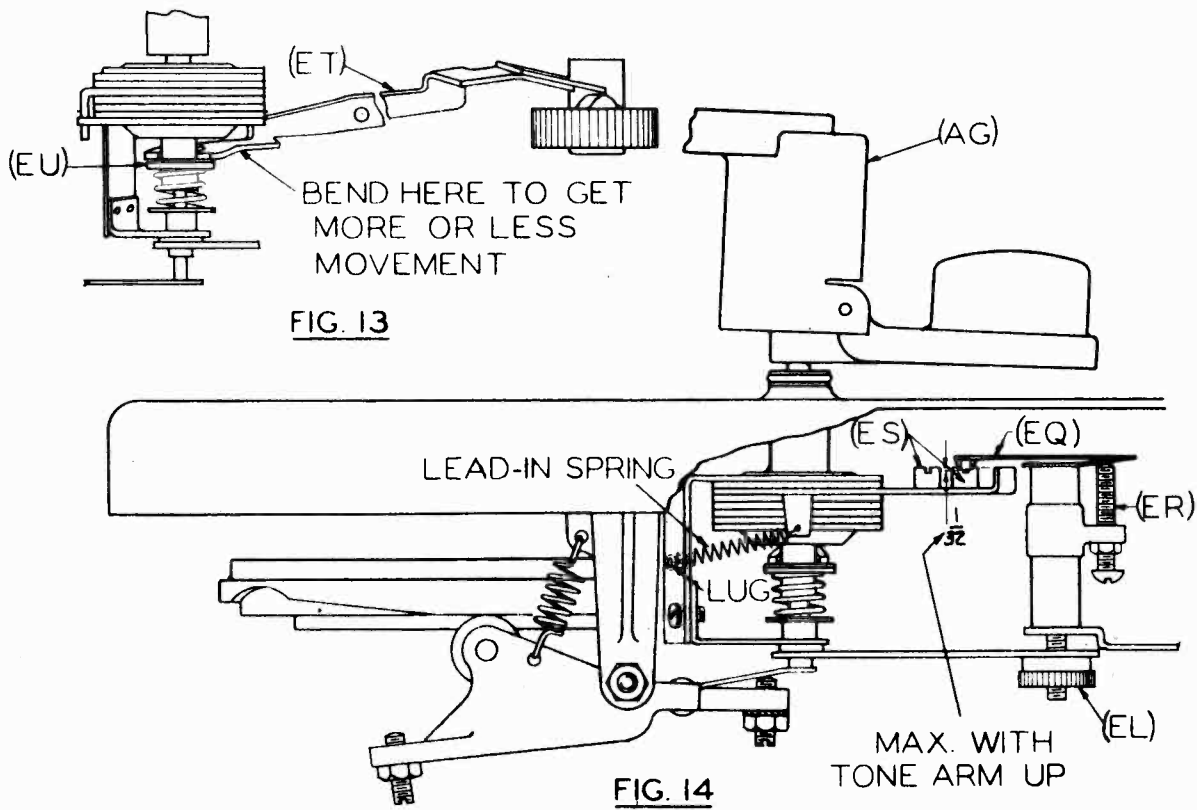
FIG. 12

FIG. II

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ADJUSTMENT NOS. 8 and 9



Adjustment #8. CLUTCH RELEASE LEVER ADJUSTMENT.

The fork on clutch release lever (ET) should be adjusted so that it only slightly moves the friction clutch with a sharp kick rather than a wavy movement. To get more or less movement of the clutch, bend the release lever (as shown Fig. 13).

Also be sure that both prongs of fork on release lever (ET) contact the pressure release sleeve (EU) simultaneously. At no time should fork ride the pressure release sleeve between impulses, as the clutch would then be held open and changer would not trip.

Adjustment #9. SETTING CAM ADJUSTMENT.

By means of the adjusting screw (ER) set stop lever (EQ) so that there will be 1/32" maximum overlap on eccentric studs (ES). If there is not enough overlap, the stop

lever (EQ) will slide off instead of holding on eccentric studs (ES) on stop lug, while measuring set-down of tone arm (AG).

SLIDE-IN ADJUSTMENT.

To adjust the power of the Tone Arm Lead-in, bend the lug on Lead-in spring to give it more or less tension, too much tension may cause needle to slide in on record. (See Fig. 14). The knurled nut (EL) adjusts the distance Tone Arm will

swing in, before clutch is disengaged. If clutch is still engaged after needle lands on record it may cause slide-in. Turning nut (EL) clockwise should correct "slide-in" if lead-in spring tension is correct.

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ADJUSTMENT NO. 10

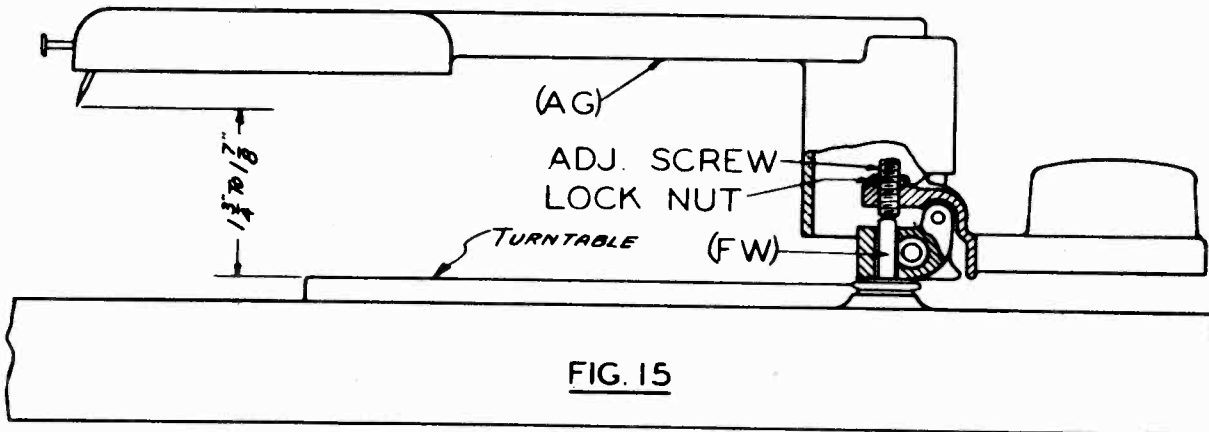


FIG. 15

Adjustment #10. TONE ARM HEIGHT ADJUSTMENT.

This can be adjusted by means of an adjusting screw in the tone arm assembly (AG). The tone arm elevating pin (FW) presses against this screw which should be adjusted so that the distance between the point of needle

(in tone arm AG) and the turntable is 1-3/4" to 1-7/8", which is the equivalent of approximately seventeen 10" records. When correct height adjustment is made, tighten lock nut on adjusting screw securely.

ADJUSTMENT NOS. 11 and 12

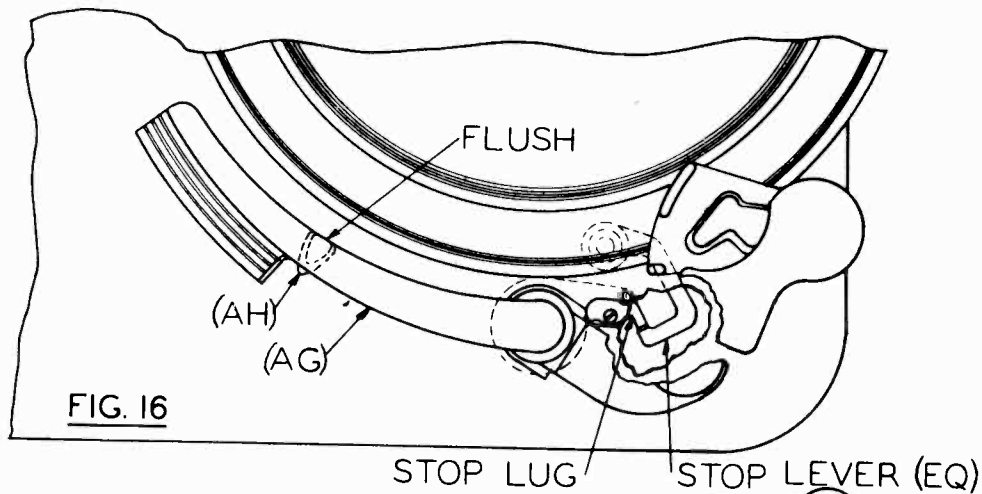


FIG. 16

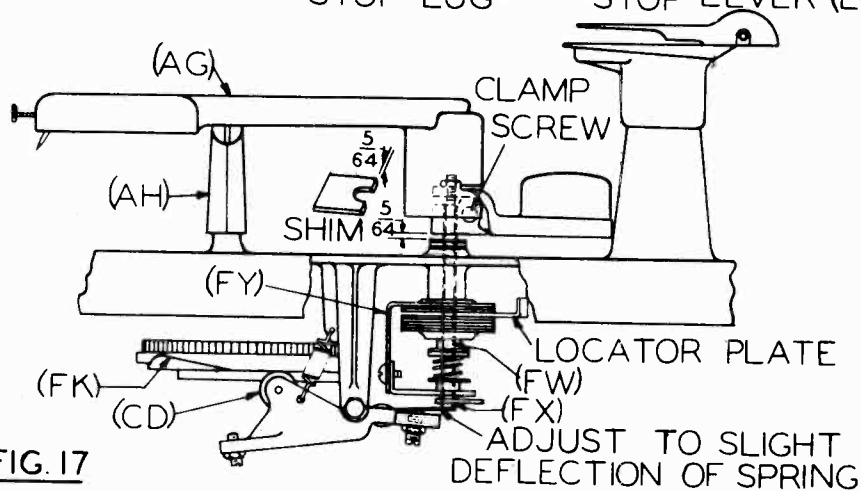


FIG. 17

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Adjustment #11. TONE ARM SWING ADJUSTMENT

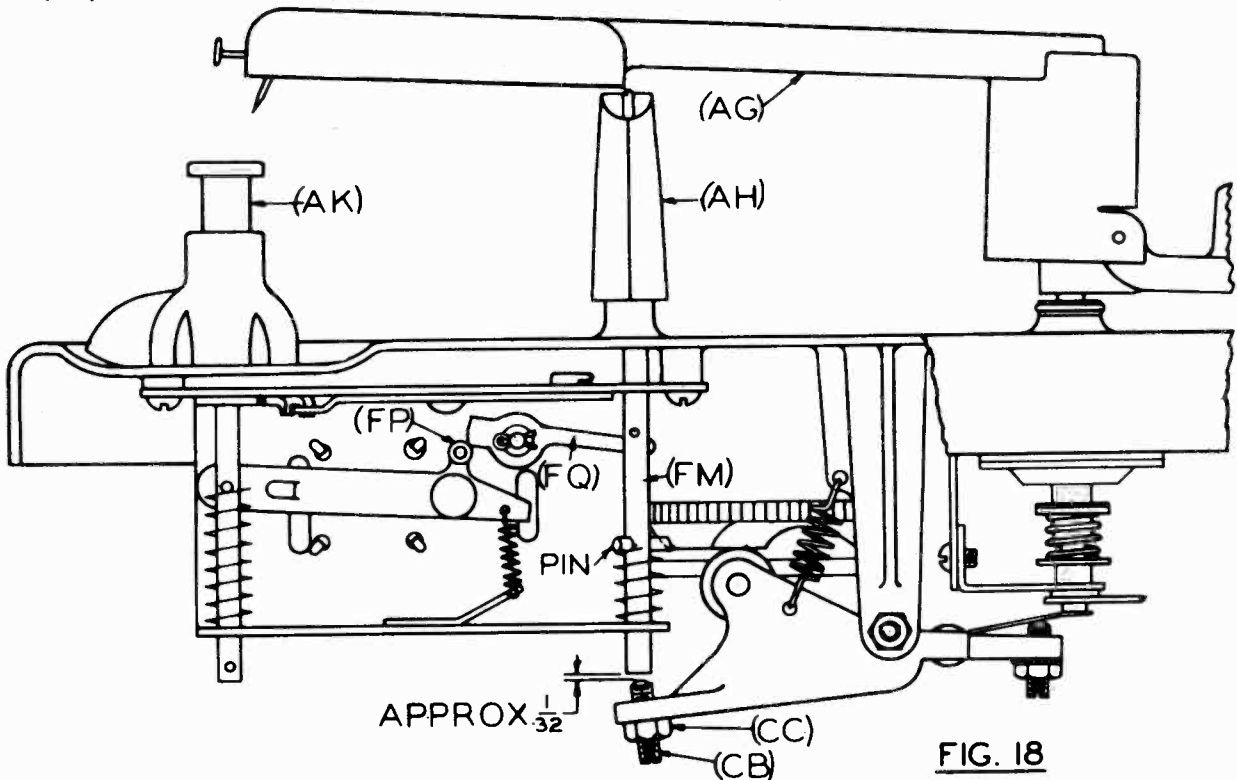
First raise tone arm (AG) by hand and slightly loosen clamp screw on tone arm shaft head (see fig. 17). Then start a change cycle and shut off power supply to motor when tone arm (AG) is being held in stop position above the tone arm rest (AH) and stop lever (EQ) (on setting cam assem.) is contacting stop lug on locator plate (which is part of the tone arm shaft assem.) see fig. 16. Then insert a 5/64" shim between tone arm

shaft head and bearing race to set vertical clearance (which must be approx. 5/64") so that clutch will be engaged for moving trip lever when tone arm is down on record and align tone arm (AG) flush with tone arm rest (AH) as shown in fig. 16. Tighten clamp screw securely and remove 5/64" shim, then check action of tone arm and adjust needle landing as in adj. #1, if necessary.

Adjustment #12. RAISING LEVER PRESSURE ADJUSTMENT.

To make this adjustment first put unit into change cycle, then stop it when roller (CD) is at the highest point on the cam (FK), then loosen lock nut and turn screw under flat lifter spring clockwise until tone arm elevating pin (FW) and shaft (FX) are completely

raised and flat springs contacts the tone arm shaft (FX) holding clutch assembly firmly in the high position against tone arm swing bracket (FY) and only slightly deflecting the flat spring (see fig.17). Then tighten lock nut securely.



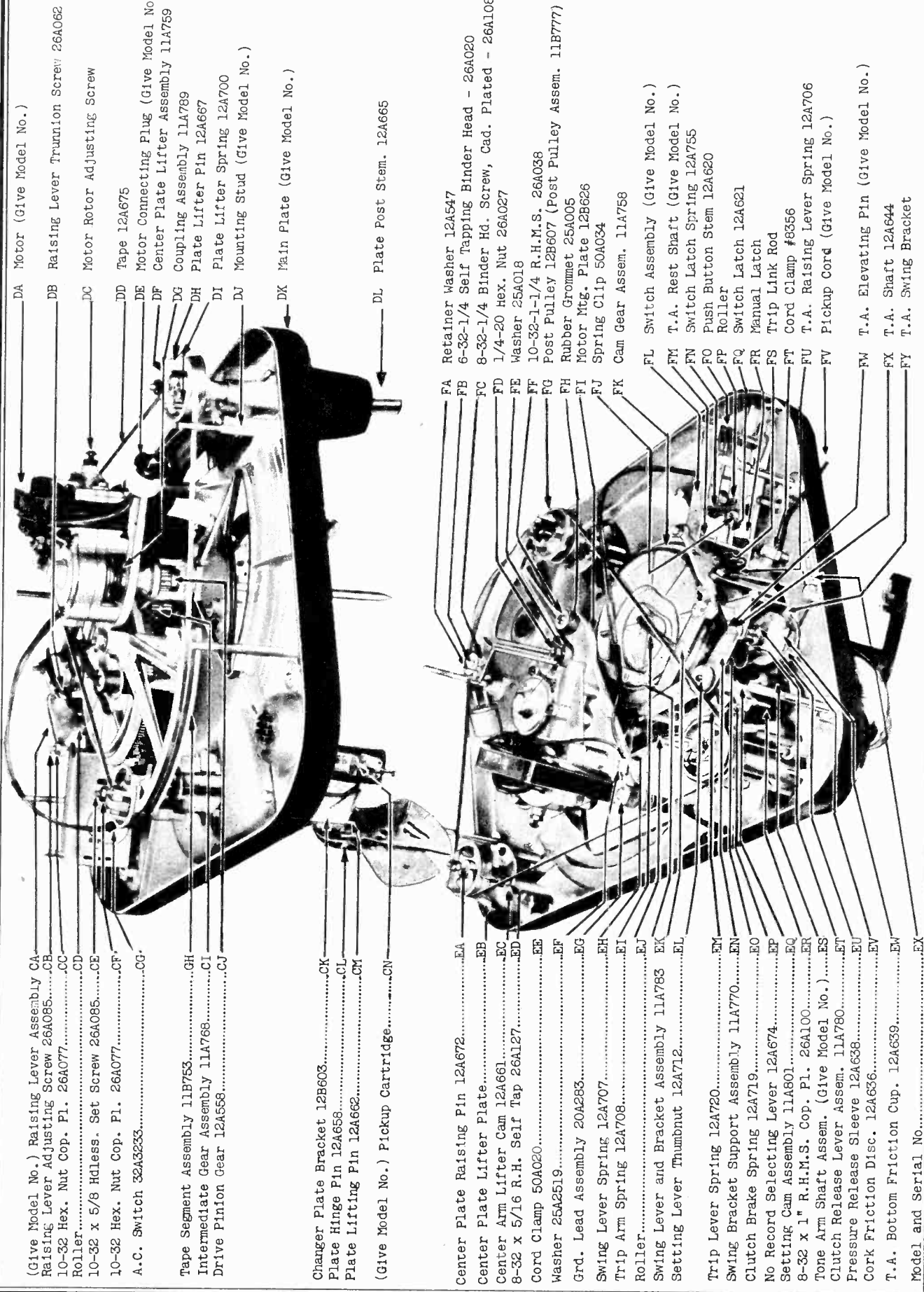
Adjustment #13. SWITCH SHUT-OFF ADJUSTMENT.

Start a change cycle by pressing push button (AK) so that roller (FP) holds switch latch (FQ) in a loaded position. Then stop turntable by hand when cam gear is in position (shown above) and pin on rest shaft is sliding down decline from shoulder on cam gear, allow the rest

shaft (FM) to come down gradually and when switch latch (FQ) trips, hold rest shaft in that position and adjust screw (CB) to within approx. 1/32" from end of shaft (FM), tighten lock nut (CC) securely and check operation.

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- DA Motor (Give Model No.)
- DB Raising Lever Trunnion Screw 26A062
- DC Motor Rotor Adjusting Screw
- DD Tape 12A675
- DE Motor Connecting Plug (Give Model No.)
- DF Center Plate Lifter Assembly 11A759
- DG Coupling Assembly 11A789
- DH Plate Lifter Pin 12A667
- DI Plate Lifter Spring 12A700
- DJ Mounting Stud (Give Model No.)
- DK Main Plate (Give Model No.)
- DL Plate Post Stem. 12A665

- FA Retainer Washer 12A547
- FB 6-32-1/4 Self Tapping Binder Head - 26A020
- FC 8-32-1/4 Binder Hd. Screw, Cad. Plated - 26A108
- FD 1/4-20 Hex. Nut 26A027
- FE Washer 25A018
- FF 10-32-1/4 R.H.M.S. 26A038
- FG Post Pulley 12B607 (Post Pulley Assem. 11B777)
- FH Rubber Grommet 25A005
- FI Motor Mtg. Plate 12B626
- FJ Spring Clip 50A034
- FK Cam Gear Assem. 11A758
- FL Switch Assembly (Give Model No.)
- FM T.A. Rest Shaft (Give Model No.)
- FN Switch Latch Spring 12A755
- FO Push Button Stem 12A620
- FP Roller
- FQ Switch Latch 12A621
- FR Manual Latch
- FS Trip Link Rod
- FT Cord Clamp #8356
- FU T.A. Raising Lever Spring 12A706
- FV Pickup Cord (Give Model No.)
- FW T.A. Elevating Pin (Give Model No.)
- FX T.A. Shaft 12A644
- FY T.A. Swing Bracket

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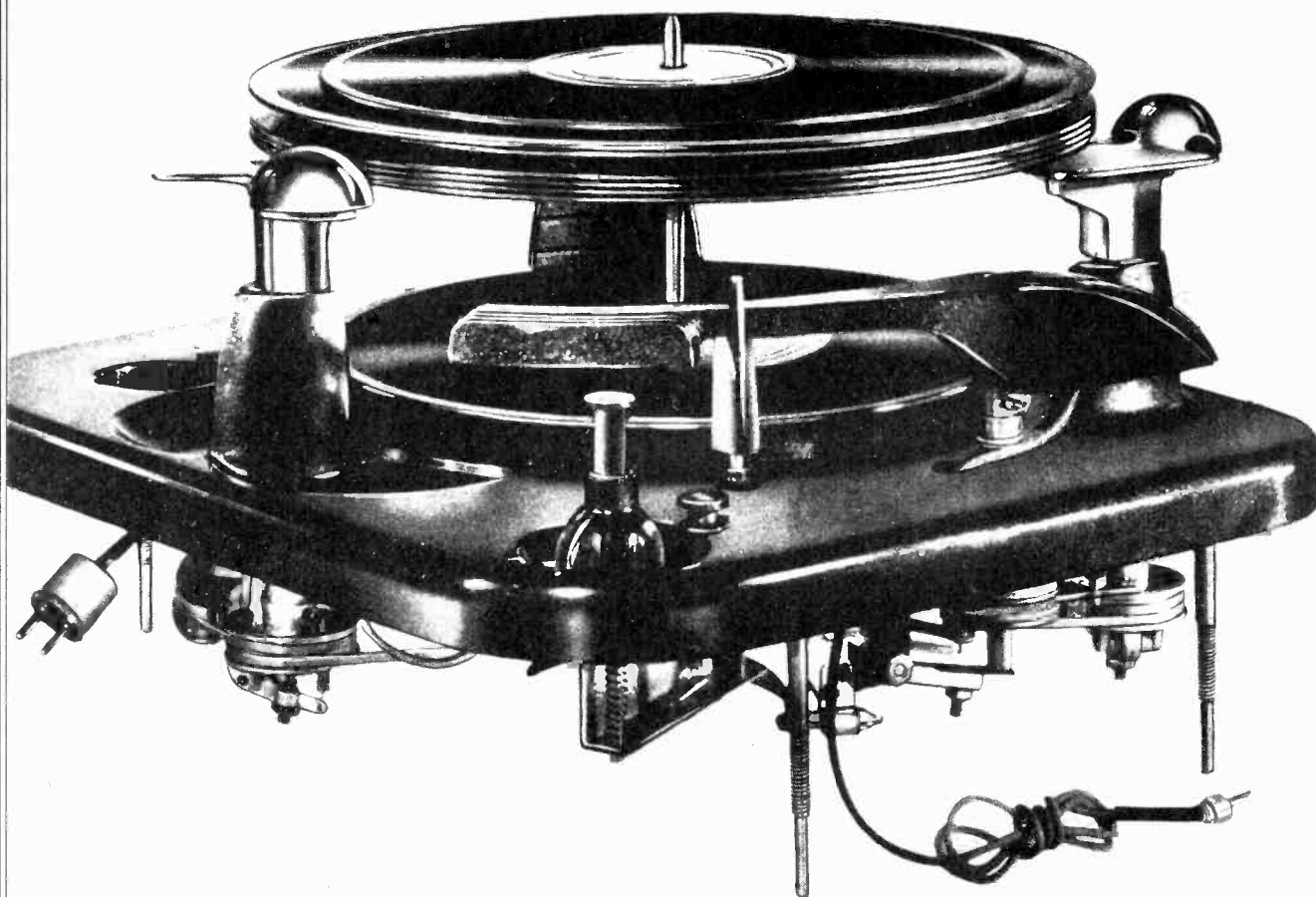
PRINCIPAL TROUBLE SYMPTOMS

CHECK
ADJUSTMENT

A.	Changer fails to trip after playing record while set on "A" automatic.	Nos. 2, 8.
B.	Changer fails to trip when push button is pressed. (See that pointer is set on "A").	No. 2.
C.	Trips too soon or before record has finished playing.	No. 2.
D.	Tone Arm lifts immediately without playing record or continues cycling.	No. 2.
E.	Tone arm lifts but does not swing out properly.	No. 12.
F.	Tone arm falls off record or misses record completely.	Nos. 1, 11.
G.	Tone arm slides in several lines on record.	No. 9.
H.	Tone arm fails to pull into first groove on record properly.	No. 9.
I.	Tone arm lands too far out or in on record.	No. 1.
J.	Tone arm lands in middle of record.	No. 9.
K.	Tone arm fails to clear stack of 16 10" records.	No. 10.
L.	Tone arm lands for 10" record even on a 12" record.	Nos. 5, 6.
M.	Changer cycles with pointer set on "M" for Manual operation.	No. 2.
N.	Changer jams and stops.	No. 7, 13.
O.	Records jam (check record edges). Also check.	No. 3.
P.	12" record is not dropped by one of shelves.	No. 5.
Q.	One or more shelves drop 2 records at a time.	No. 3.
R.	Changer fails to turn off automatically after playing last record.	Nos. 4, 9, 13.
S.	Records drop unevenly from shelf plates to turntable.	No. 7.

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TO THE SERVICE MAN

This service manual has been designed for the purpose of assisting the service man as far as possible, in his work of caring for the record changer mechanism, whether he is called to remedy some difficulty which has appeared in the field or to assure its continued satisfactory operation. For his convenience, the operating instructions supplied to the user may be summarized as follows:

The deluxe record changer automatically plays sixteen 10" records or twelve 12" records at one set-up, or fourteen 10" and 12" records inter-mixed. Each of the three posts has two plates; the lower one on which the records rest is the shelf plate, the upper one is the selector plate which takes from the bottom of the stack the next record to be played

and releases it to the turntable. To load for automatic operation, see that all three shelf plates are turned down toward the turntable, then place the stack of records to be played over the turntable spindle so that they rest on the three shelf plates.

Then see that pointer on control switch is set on "A" (automatic), and press "start" button to put changer in operation. (What are here called the selector plates of the changer are commonly known among service men as "blades" or "knives", names which are best avoided when talking to the user, as they may convey an exaggerated impression of sharpness or danger in the movement of these parts.)

To reject a record (or to start a change cycle as for testing purposes), simply press the "reject" button at any

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time while needle is upon a record. To play manually, turn shelf plates up, set pointer on "M" (for manual), then place a record on turntable and press "start" button to switch on motor, then place pick-up arm into position on record.

The changer can be turned off at any time by pressing down on stop button. If changer is left running, no damage will be done, as it will shut off automatically after the last record has been played.

REPLACEMENT PARTS

When ordering parts for this mechanism refer to the part number and model number of the entire mechanism, as shown on bottom view photo, in addition to the numbers and names of the parts shown in the illustrations.

ILLUSTRATIONS

The illustrations show all the vital parts of the changer. Code numbers are used to refer to parts shown in the numbered figures on the two photos, the numbered figures referred to are complete assemblies, the replacement parts list shows the complete assembly and below it are the component parts that can be supplied. Parts that are not listed cannot be separately supplied, therefore, order the assembly containing them.

OILING (reprinted from operating instructions)

The changer should be lubricated once a year with a few drops of good light machine oil at each of the following points:

Two oil wicks on motor bearings.
Turntable spindle bearings.
All other bearing points.
(CAUTION: Never oil the friction clutch at any time, as it will cause slippage.)

TO CHECK OILING

- (a) If squeaks are heard, compare the squeak with and without a load of records; any stack of records in motion is likely to squeak a little against a pin through their center. This can be corrected by rubbing a little wax on the turntable spindle.
- (b) "Caution": Do not oil felt washers on the two idler wheels as centrifugal force will throw the excessive oil out over the edge of idler wheel and cause loss of traction to turntable. (The purpose of the felt washer is to silence the idler

wheel operation and should not be used as an oil wick.

(c) Check the two oil wicks on the motor to see that they are thoroughly saturated.

(d) Check lubrication on turntable spindle bearings. The top bearings can be oiled by removing turntable (When replacing turntable, care should be taken not to injure rubber idler wheels.) Then oil lower bearings from below.

(e) Check lubrication at all other bearing points.

REPLACING MOTOR:

The service mechanic may be called upon to adapt the changer to a different power supply. For this purpose, or in case of any serious fault within motor, remove entire motor (Fig. 27) from the changer and replace it with a suitable new motor. See that motor frame is well grounded by wire. (In ordering a replacement motor, specify the power supply and give model number, also make and model number of phono-radio or other type of installation.)

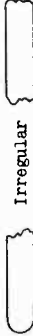

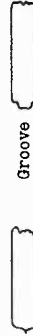

TROUBLE SHOOTING:

Cases of failure to operate satisfactorily will generally be found due to either neglect of proper lubrication, to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition, there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage), even though the utmost factory precautions are taken against it -- or that set screws may work loose due to external vibration. For tightening set screws, an Allen (hexagon) wrench is required. Be sure that set screws are properly seated on the holes or flats provided. Damage from tampering is likely to take the form of bent parts. Never bend any part during examination.

Among the principal trouble symptoms to which such causes may give rise, are the following:

- (1) MECHANISM IS SLOW IN STARTING, OR MOTOR GETS HOT
- (a) Check lubrication. Oil if necessary. See oiling instructions.
- (b) Check voltage. Line voltage may be abnormally low or high.
- (c) Motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement.

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- (2) MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS
- This indicates trouble in motor windings. Unless damage is easily seen and repaired, replace motor, as above described.
- (3) MOTOR IS SLOW IN STARTING
- (a) Changer may have been in a very cold place and may not yet have reached room temperature. Give it a fair chance to get warmed up, before concluding that motor is defective and proceed as in Paragraph 2 above.
- (b) The changer is equipped with a constant speed self-starting motor. Under all normal conditions it starts automatically and runs at correct speed.
- (4) SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS
- Check oiling as directed above. (If squeaks are heard, they will usually be found to come from the records - not from the mechanism.)
- See "To check oiling".
- (5) CHANGER IS NOISY WHEN IN CYCLE
- Check oiling. Also see if any part has become loose or bent and is rubbing against a moving part.
- (6) MOTION OF PICK-UP TOWARD TURNTABLE SPINDLE WILL NOT TRIP CHANGER MECHANISM
- See that control switch pointer is not set on "M" (MANUAL).
- (7) PRESSING PUSH BUTTON DOES NOT TRIP CHANGER MECHANISM
- (a) See that control switch pointer is not set on "M" (Manual).
- (b) Check control switch assembly (Fig. 17) to see whether there is an obstruction or a bent or loose part. Also check for loose set screws in switch knob.
- (c) Follow through on action from the push button to switch latch (90) and see that every part is operating properly.
- (8) SETTING POINTER ON "M" (MANUAL) FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION
- (a) Check for loose set screw in control switch knob.
- (b) Also check for loose or bent parts and be sure that manual latch (91) is holding the trip link rod to keep it from moving.
- (9) TONE ARM FALLS OFF RECORD
- Needle lands too close to edge of record. Not adjusted in far enough. (Check Adjustment #1.)
- (10) TONE ARM VARIES WHEN SET DOWN ON RECORD
- (a) Check for loose clamp screw in tone arm shaft head, may be loose on the tone arm shaft (73).
- (b) Be sure that stop lever engages the eccentric adjusting cams for both 10" and 12", holding them securely until needle has landed on record. (Check Adjustment #8.)
- (11) TONE ARM LANDS TOO FAR IN OR OUT ON RECORD
- (a) Due to not measuring properly. (See paragraph 10 above.)
- (b) If tone arm lands in middle of record and unit continues cycling. (Check Adjustment #8.)
- (12) NEEDLE LANDS PROPERLY ON RECORD, BUT FAILS TO MOVE OVER INTO RECORD STARTING GROOVE
- (a) Pick-up cord may be holding arm at back end, binding its action.
- (b) Check Adjustment #8.
- (13) NEEDLE LANDS PROPERLY ON RECORD BUT SLIDES IN ON RECORD
- (a) No needle in pick-up cartridge.
- (b) Broken permanent sapphire point in LP type cartridge.
- (14) TONE ARM RAISES BUT FAILS TO SWING PROPERLY
- Check Adjustment #9 & #10.
- (15) TONE ARM FAILS TO CLEAR STACK OF 16 - 10" RECORDS
- Check Adjustment #2.
- (16) TONE ARM LANDS FOR 10" RECORD EVEN ON A 12" RECORD
- Check Adjustments #5 and #6.
- (17) CHANGER CONTINUES CYCLING
- (a) Probably no clearance between hook end on trip lever and lug on intermediate gear (50) due to being bent. Straighten, if possible, or replace with new trip lever.
- (b) See paragraph #11 above.
- (18) MOTOR CONTINUES OPERATING
- Mercury switch (67) (See Fig. 14) may be out of level, probably caused by cabinet that changer is mounted in standing at an angle. Adjust mercury switch (67) by slightly loosening screws (66), adjust switch bracket (68), and tighten screws.
- (19) RECORD IS DRIVEN BUT NOT HEARD OR NOT HEARD WITH PROPER VOLUME
- (a) See that pick-up cord is properly plugged in.
- (b) Check amplifier and speaker and connections to them thoroughly.
- (c) Check pick-up cartridge, and replace with new one if found to be defective.
- (20) RECORD JAMS
- (a) Most slicing trouble (record jams) is due to off-size or defective records, and is no fault of the record changer or record changer adjustments. Properly manufactured recordings have a uniform semi-circular edge which can be successfully handled by a record changer even though the records vary considerably in thickness.
- Good  Irregular 
- Fin  Groove 
- Cross section of record edge showing a perfect record and three imperfect edges.
- (21) 12" RECORD IS NOT DROPPED BY ONE OF THE CHANGER PLATES
- Check Adjustment #5.
- (22) ONE OR MORE CHANGER PLATES RELEASE TWO RECORDS AT A TIME
- Check Adjustment #3.
- (23) RECORDS DROP UNEVENLY FROM CHANGER PLATES TO TURNTABLE
- Check Adjustment #7.
- (24) CHANGER FAILS TO SHUT OFF AUTOMATICALLY AFTER PLAYING LAST RECORD
- Check Adjustments #4 and #9.
- (25) TURNTABLE IS TIGHT
- This turntable is assembled to the turntable spindle cone with a taper lock fit in the center. To remove turntable, grasp with both hands, at the same time pulling upward while it is revolving.
- (26) MOTOR RUMBLE HEARD IN RECORD REPRODUCTION
- (a) Shipping screw not removed from motor as instructed.
- (b) Check motor leads. They may be pulled too tight, not allowing motor to float properly.
- CAUTION:
- If Pickup cartridge has a permanent point sapphire needle, utmost care must be taken to avoid breakage. Should the needle be broken it is necessary to replace the entire cartridge. Never attempt to remove permanent point sapphire needle from the cartridge since it is an integral part and cannot be removed without damaging the cartridge. Needles can only be replaced in cartridges having a needle screw.
- Convenient Reference
- Large service stations having more frequent occasion to service the Deluxe Changer, can obtain a second copy of this manual upon request to the manufacturer.

MODEL 41

WEBSTER-CHICAGO CORP.

ADJUSTMENTS

Adjustments Nos. 1, 2, and 3 can be made from above. Changer need not be removed from cabinet. All adjustments are correctly made at the factory and ordinarily need never be altered. However, should it become necessary to readjust due to accident or tampering, proceed as follows:

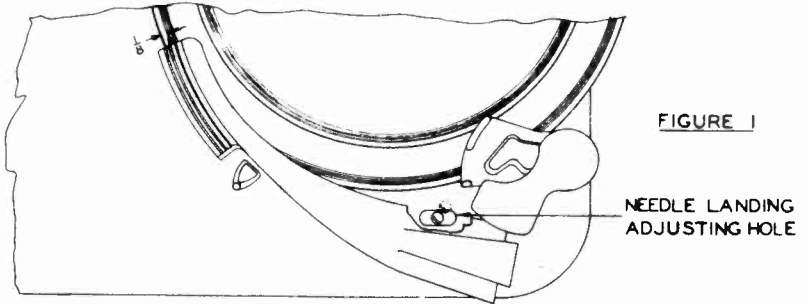


FIGURE 1

Adjustment #1: ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD

The position at which needle lands on record can be adjusted by inserting screw driver through needle landing adjusting hole just in back of tone arm (shown in Fig. 1). For adjusting the needle landing on a 10" record, insert screw driver into slot in 10" adjusting stud. For adjusting the needle landing on a 12" record, insert screw driver into the slot in 12" adjusting stud (See Fig. 2). Turn very slightly clockwise or counter-clockwise to move needle landing in or out. The factory adjustment of the needle landing is $1/8$ " in from the outer edge of the record. (See Fig. 1).

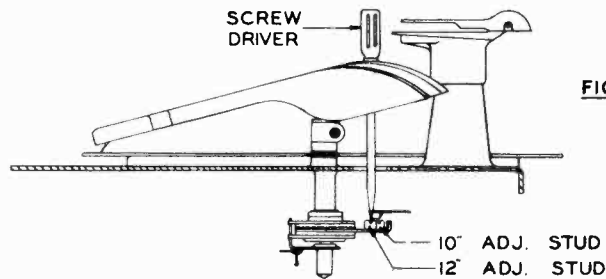


FIGURE 2

Adjustment #2: TONE ARM HEIGHT ADJUSTMENT

To adjust, insert screw driver into adjusting screw (6) through tone arm height adjusting hole in tone arm (1), shown above; to increase height to which tone arm rises, turn screw clockwise; to lower, turn counter-clockwise. The tone arm elevating pin (12) presses against this screw which should be adjusted so that the distance between the point of needle (in tone arm (1)) and the turntable is $1-3/8$ " to $1-1/2$ ", which is the equivalent of approximately sixteen 10" records.

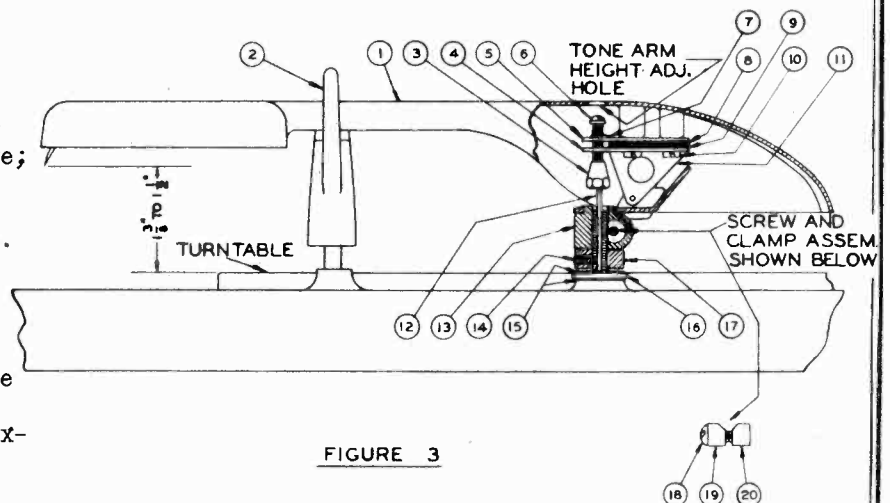


FIGURE 3

WEBSTER-CHICAGO CORP.

Adjustment #3: ADJUSTMENT FOR CHANGER PLATES

To adjust the distance between the selector plate (21) and the shelf plate (23) for 10" records, first select a 10" record that is approximately .070" thick. Then position it on changer and start a change cycle to revolve changer plates. Stop the turntable by hand just as the selector plate (21) is about to touch the record, and shut off the motor (See Fig. 4). Then slowly revolve the turntable by hand, allowing selector plate to contact edge of record so that it just slides over record, touching the surface lightly. Check all three selector plates, and if any adjustment is necessary, it can be done by inserting a #10 Allen wrench in the adjusting set screws (29). Turn set screw slightly clockwise to raise the selector plate and counter-clockwise to lower it. The set screws for adjusting the 10" record setting, and the 12" record setting are shown above in Fig. 5. To adjust for 12" records, select a 12" record that is approximately .090" thick, then follow same procedure as for adjusting 10" records. After correct adjustments have been made, tighten the locking collars (30) securely.

The following adjustments cannot be made from above, and therefore, it may be necessary, due to position of changer, to remove it from cabinet.

Adjustment #4: NO-RECORD SELECTING LEVER ADJUSTMENT

First be sure that spring tension on spring (33) is strong enough to lift the center blade raising pin (34) properly and fully, but not so strong that one 10" record will not fully depress pin and lever (See Fig. 7). Then, with set screw loose in no-record selecting lever (32) (See Fig. 6) and pin held down by weight of one 10" record, slide no-record selecting lever (32) into position so that it will just clear under lower edge (79) of the lower cam setting lever (79) by approximately 1/64" clearance (See Fig. 7). Then tighten set screw and check adjustment with and without a record, also be sure that without a record, the fin on no-record selecting lever (32) swings above cam setting lever (79) and portion of lever (32), indicated by arrow on Fig. 7, sweeps stop lever on cam setting lever into position shown in Fig. 15.

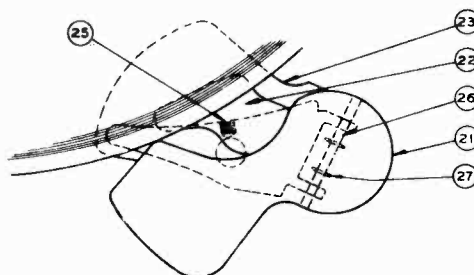


FIG. 4

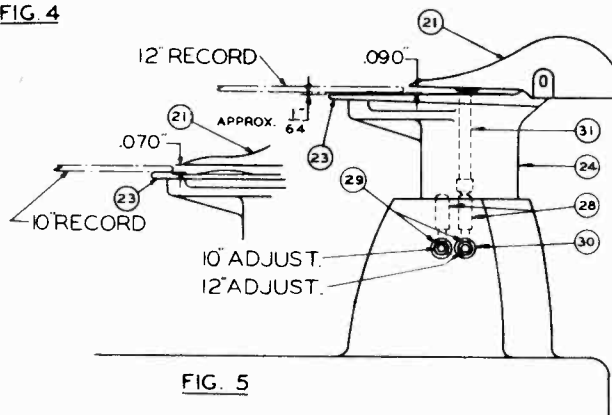


FIG. 5

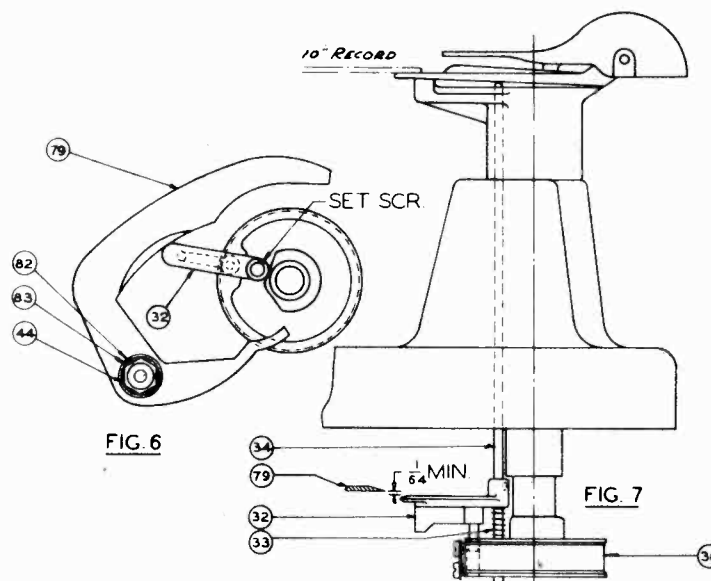


FIG. 6

FIG. 7

MODEL 41

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Adjustment #5: LIFTER LEVER
DIFFERENTIAL ADJUSTMENT

Place a 12" record over the turntable spindle so that the record rests on the center changer plate (22). Then check the center plate lifter lever (35) and see that point of this lever will just slide inside of center arm lifter cam (37). (See Fig. 8). Then place a 10" record under the 12" record so that the 10" record will rest on shelf plate (23) and the 12" record will then touch center plate (22) which presses down center pin (41) and moves lifter lever (35) closer to outside face of lifter cam (37) than it would be without the 12" record on top of the 10" record (See Fig. 10). The lifter lever (35) should then follow the outside of the center arm lifter cam (37) (See Fig. 9). If it is necessary to re-adjust, this can be done by means of adjusting screw (45) and lock nut (44) to balance out the contact of lifter lever (35) on both sides of cam (37) in relation to starting point of cam (See Fig. 10).

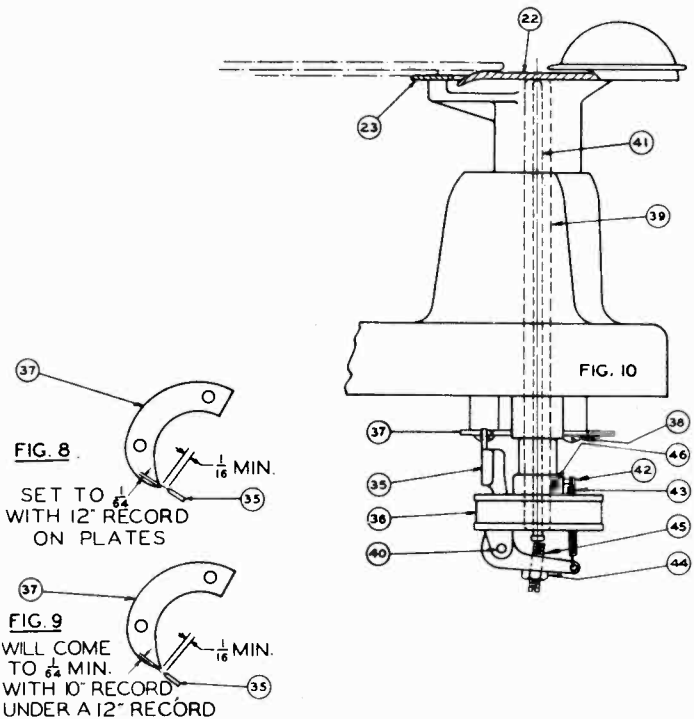
Adjustment #6: LIFTER LEVER
CLEARANCE ADJUSTMENT

Check the distance between the leading edges of the center plate lifter lever (35) and center arm lifter cam (37) with a 12" record resting on the shelf plates. It should be a minimum of $1/16"$. (See Fig. 8). It should not be necessary to check this adjustment unless the tape clamp screws (49) on the pulley (36) have been loosened. (See Fig. 11). To re-adjust after screws have been loosened, first set pulley so that when the slack in the tape line is taken up in the direction of forward motion of the tape segment (See Fig. 25 Bottom view photo), there will be the necessary $1/16"$ minimum dimension as shown in Figs. 8 and 9.

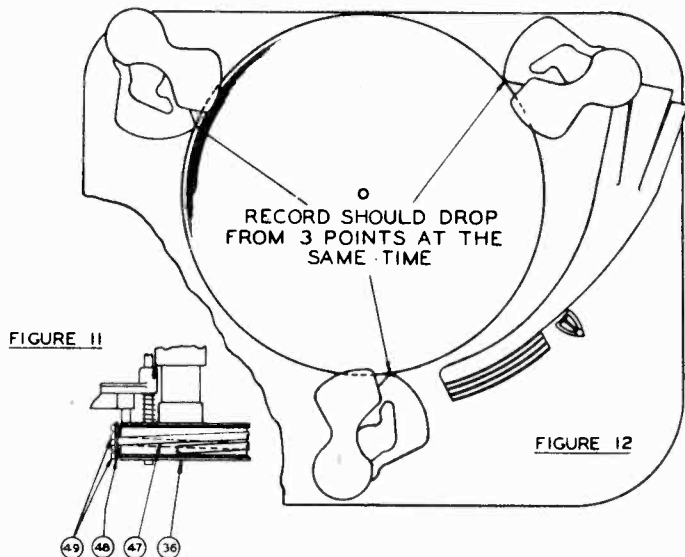
NOTE: If this adjustment is "off", most likely changer plate synchronization will also be off. Check adjustment #7.

Adjustment #7: CHANGER PLATE
SYNCHRONIZATION

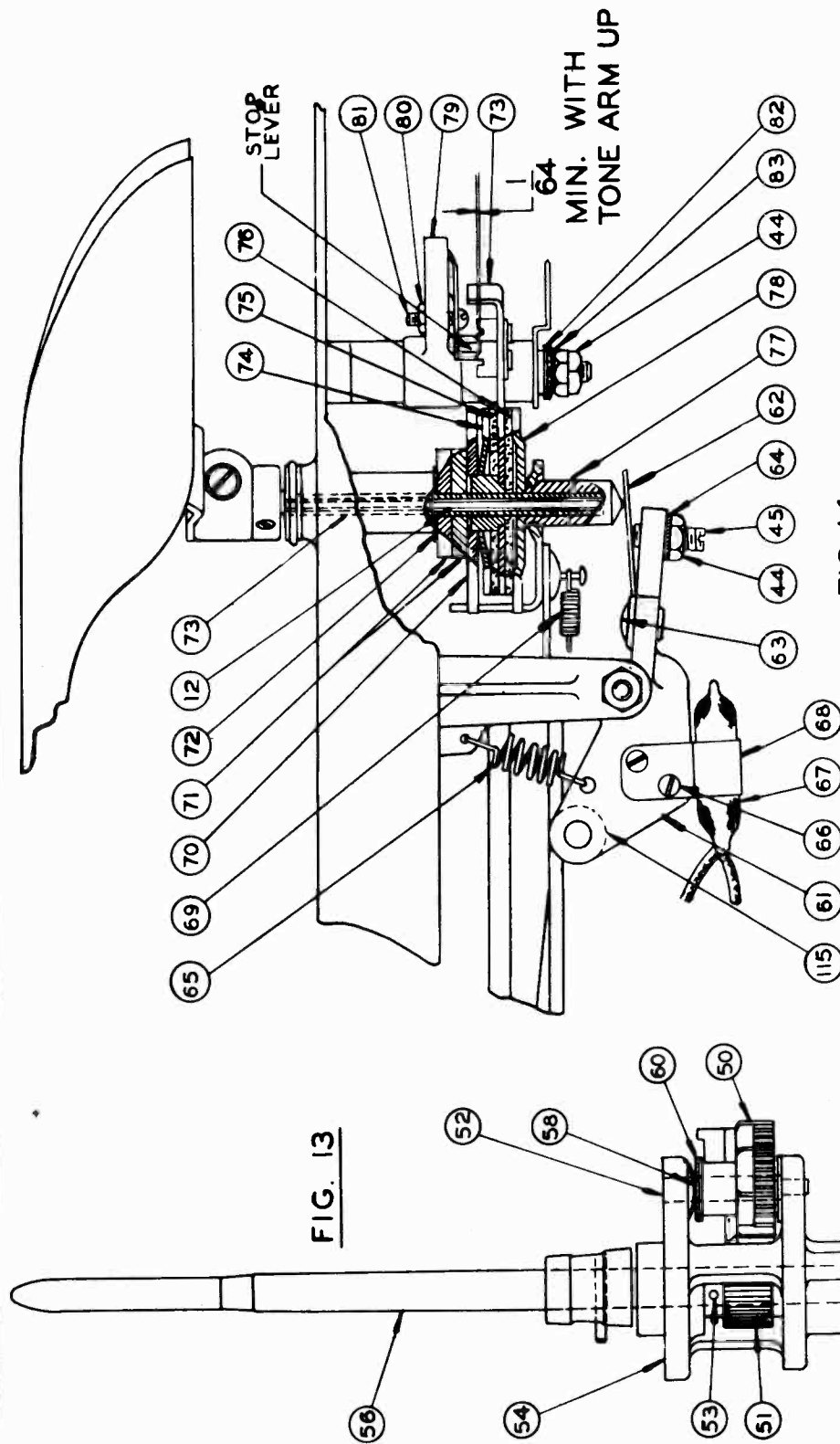
The synchronization of changer plates can be checked by placing one 10" record on the shelf plates. Then start a change cycle allowing it to continue until plates are just about ready to release the record. It can then be determined which plate is either slow or fast (See Fig. 12). This plate can then be adjusted by loosening the tap clamp screws (49) on the tape clamp plate (48) which hold the tape (47) from slipping on the pulley (36) (See Fig. 11). Then slightly move changer plate whatever is necessary to synchronize it with the other two plates so that record will drop evenly. Then tighten tape clamp screws (49) securely. (Also check adjustment #6).



NOTE: Tape line (47) should have a very slight amount of slack. Check by grasping tape line with thumb and index finger and moving it in and out approximately $5/8"$ with a moderate pressure.



WEBSTER-CHICAGO CORP.



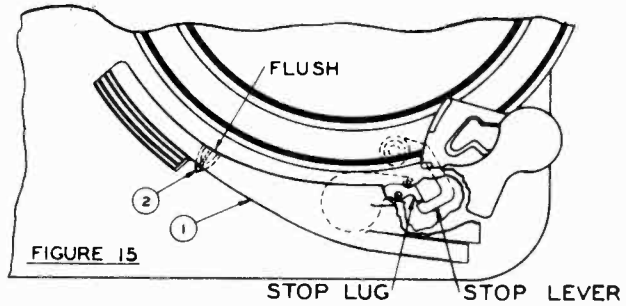
Adjustment #8: SETTING CAM ADJUSTMENT

First start a change cycle and release 10" record to turntable, then shut off power supply to motor when stop lever is contacting stud, on location plate (73).

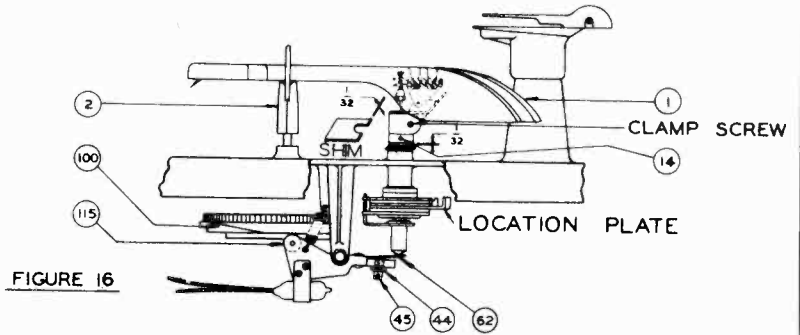
Then, by means of the adjusting screw (81) set stop lever so that there will be approximately 1/64" minimum overlap on eccentric studs. If there is not enough overlap, the stop lever will slide off instead of holding onto eccentric studs, while measuring tone arm (1) landing position. If there is too much overlap, then stop lever will not release tone arm and allow it to track in on record after change cycle is completed.

Adjustment #9: TONE ARM SWING ADJUSTMENT

First slightly loosen clamp screw on tone arm pivot assembly (See Fig. 16). Then start a change cycle and shut off power supply to motor when tone arm (1) is being held in stop position above the tone arm rest (2), and stop lever (on setting cam assembly) is contacting stop lug on locator plate (which is part of the tone arm shaft assembly (73)). (See Fig. 16). Align tone arm (1) flush with tone arm rest (2) as shown in Fig. 15, and tighten clamp screw. Then check action of tone arm and adjust needle landing as in adjustment #1, if necessary.



CAUTION: Never attempt to loosen set screw (14) except when it is necessary to disassemble clutch for replacement of parts. Be sure that vertical clearance of 1/32" (as shown above, between shaft collar and bearing washer) is allowed when reassembling. This is accomplished by inserting a 1/32" shim between the shaft collar and bearing washer. Then, with clutch assembly in high position as mentioned above, tighten set screw in collar to shaft, and remove shim.



Adjustment #10: RAISING LEVER PRESSURE ADJUSTMENT

To make this adjustment, first start a change cycle, then shut off power supply to motor when roller (115) is at the highest point on the cam gear (100), then loosen lock nut (44) and turn adjusting screw (45) under flat lifter spring (62) clockwise, until tone arm elevating pin (12) and tone arm shaft (73) (See Fig. 14) are completely raised, holding clutch assembly firmly in the high position and only slightly deflecting the flat spring (62) (See Fig. 16). Then tighten lock nut (44) securely and check operation.

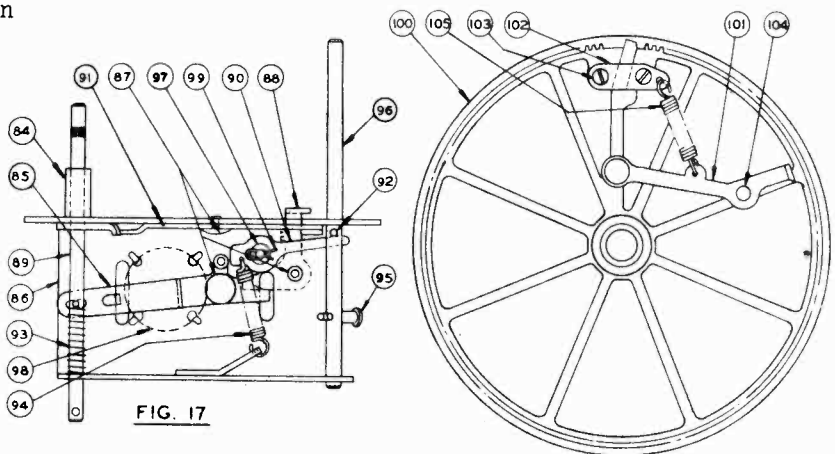


FIG. 17

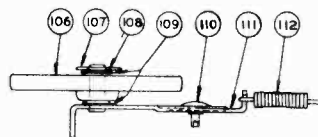


FIG. 19

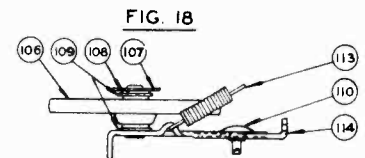
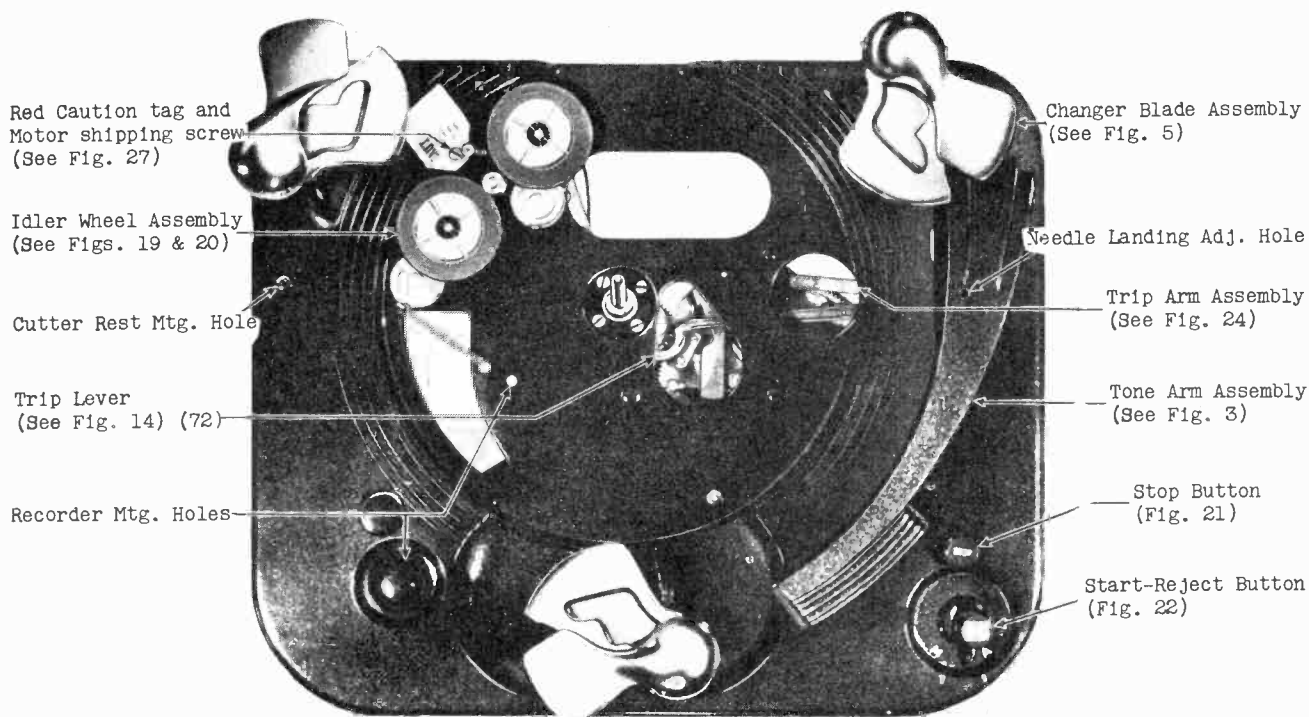


FIG. 18

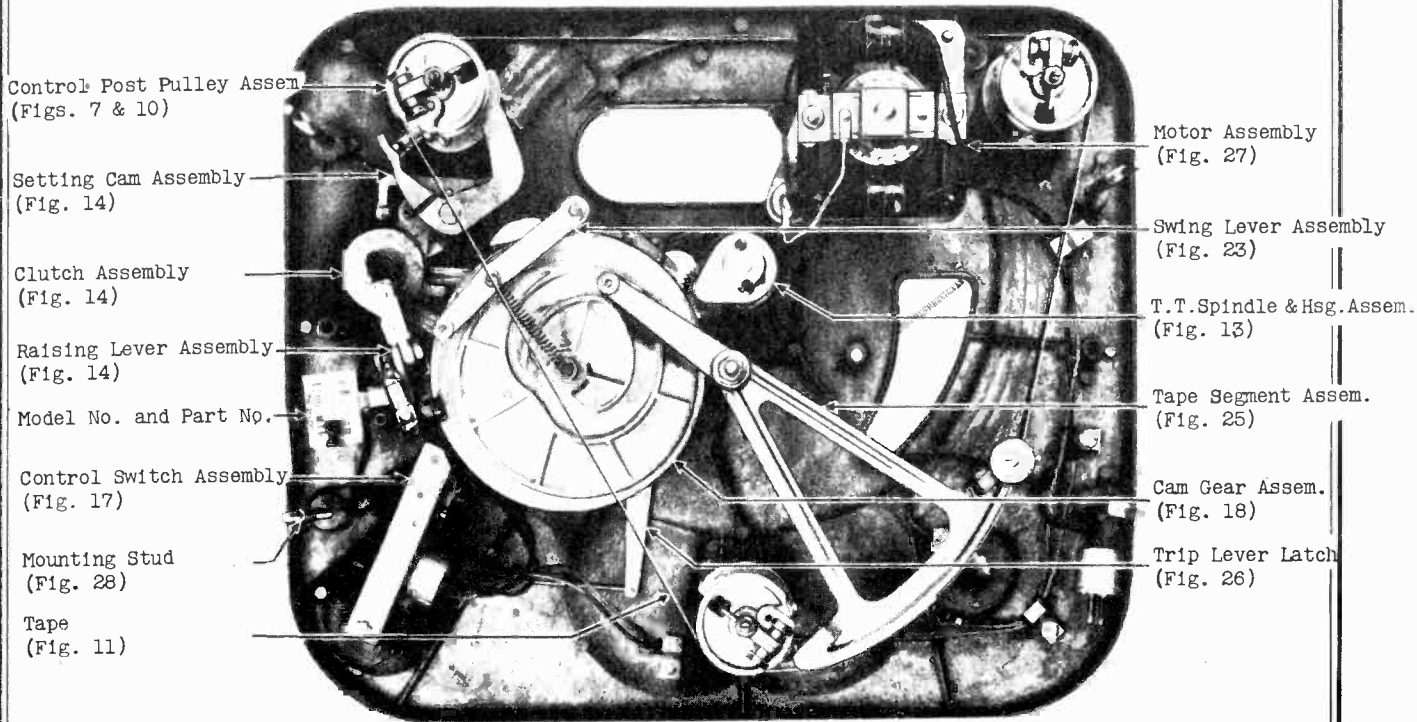
FIG. 20

WEBSTER-CHICAGO CORP.

MODEL 41



Top View



Bottom View

WEBSTER-CHICAGO CORP.

Loc. No.	Part No.	Part Name	Loc. No.	Part No.	Part Name	Loc. No.	Part No.	Part Name	Loc. No.	Part No.	Part Name
1		Tone arm assembly (give Model No.)	46	26A087	8-32x1/4 Cone point - Allen socket, headless set screw	76	12A636	Cork friction disc (small)	12A908	Stop button	Fig. 21
2	12A907	Pickup cord (give model No.)	77	11A904	Swing lever assembly	77	11A904	Swing lever assembly	11A917	Stop spring & pin assembly	
3	12A966	Tone arm rest	78	12A813	Tone arm bottom friction cup	79	11A909	Setting cam assembly	12A837	Swing lever	
4	12A920	Tone arm adj. screw nut	80	12A078	Tape clamp	80	12A078	6-32 hex nut	12A852	Cam pin	
5	12A919	Tone arm blank	81	26A079	Tape clamp screws	81	26A079	6-32x1/2" R.H.M.S.	12A856	Tone arm swing link	
6	26A229	Tone arm spring	82	25A057	#5 Internal tooth lockwasher	82	25A057	Washer	12A857	Shoulder rivet	
7	12A984	Adjusting screw	83	25A048		83	25A048	Spring washer	12A860	Shoulder rivet	
8	12A922	Tone arm spacer	84	26A077		84	26A077	Hex nut	12A861	Lifter roller	
9	12A921	Tone arm spacer	85	11B996	Control switch assembly	85	11B996	Control switch assembly	12A862	Swing lever spring	
10	26A021	Screw	86	11A746	Manual arm assembly	86	11A746	Manual arm assembly	12A863	Trip arm assembly	
11	12A923	Tone arm bracket	87	12A066	Shoulder rivet	87	12A066	Shoulder rivet	12A864	Trip link	
12	12A909	Tone arm elevating pin	88	12A618	Trip kick lever	88	12A618	Trip kick lever	12A865	Trip arm spring	
13	12A918	Tone arm pivot assembly	89	12A620	Push button stem	89	12A620	Push button stem	12A866	Washer - brass	
14	26A008	8-32x 216 Headless set screw	90	12A623	Manual latch	90	12A623	Manual latch	12A867	Spring clip	
15	12A692	Bearing race washer	91	12A621	Swing lever spring	91	12A621	Swing lever spring	11B753	Tape segment assembly	
16	11A781	Tone arm shaft collar	92	12A681	Cam pin	92	12A681	Cam pin	11B755	Tape segment & bushing assembly	
17	11A919	assembly	93	12A720	Push button stem spring	93	12A720	Push button stem spring	12A060	Cam roller	
18	26A079	8-32x1/2" R.H.M.S.	94	12A635	Switch cam roller	94	12A635	Switch cam roller	12A056	Cam roller stud	
19	12A625	Swivel head clamp sleeve	95	12A836	Switch cam roller pin	95	12A836	Switch cam roller pin	12A020	6-32x1/4 screw	
20	12A631	Swivel head clamp	96	12A866	Tone arm rest snarf	96	12A866	Tone arm rest snarf	12A547	Retainer washer	
21	26A054	4-40x5/16" R.H.S.T. screw	97	25A028	Trigger spacer	97	25A028	Trigger spacer	12A108	Tape segment screw	
22	M93	Plug (cinch)	98	32A002	AC Switch	98	32A002	AC Switch	12A024	Washer	
23	21A128	Cartridge support	99	50A034	Spring clip	99	50A034	Spring clip	12A027	1/4-20 hex nut	
24	11A894	Changer plate assembly	100	11A906	Cam gear assembly	100	11A906	Cam gear assembly	12A814	Trip lever latch	
25	12B646	Upper changer plate	101	11A921	Cam latch & trigger assembly	101	11A921	Cam latch & trigger assembly	12A1028	Trip link	
26	12B647	Center changer plate	102	12A656	Latch plate	102	12A656	Latch plate	12A209	Shoulder screw	
27	12B603	Lower changer plate	103	26A029	Latch plate screw	103	26A029	Latch plate screw			
28	26A087	8-32x1/4 Headless set screw	104	12A660	Swivel pin	104	12A660	Swivel pin			
29	50A030	Spring clip	105	12A700	Spring	105	12A700	Spring			
30	12A663	Adjusting pin	106	26A027	1/4-20 Hex nut	106	26A027	1/4-20 Hex nut			
31	26A090	Adj. set screw	107	11A906	Cam gear assembly	107	11A906	Cam gear assembly			
32	26A382	Adj. set screw lock nut	108	11A905	Cam latch & trigger assembly	108	11A905	Cam latch & trigger assembly			
33	12A906	Lifter pin	109	12A656	Latch plate	109	12A656	Latch plate			
34			110	26A029	Latch plate screw	110	26A029	Latch plate screw			
35	11B916	Control post pulley assembly	111	11A853	Idler wheel link & stud assembly	111	11A853	Idler wheel link & stud assembly			
36	12A674	No-record selecting lever	112	12A750	Spring	112	12A750	Spring			
37	12A668	Selecting lever spring	113	12A720	Spring	113	12A720	Spring			
38	26A011	8-32x3/16" headless set screw	114	11A657	Idler wheel link & stud assembly	114	11A657	Idler wheel link & stud assembly			
39	11B916	Control post pulley assembly	115	12A695	Cork friction disc (large)	115	12A695	Cork friction disc (large)			
40	12A667	Blade post stem									
41	12A672	Center blade raising pin									
42	12A673	Lifter spring pin									
43	12A700	Center blade lifter spring									
44	26A077	10-32 hex nut									
45	26A085	10-32x5/8" headless set screw									

WEBSTER-CHICAGO CORP.

- BA Changer Post Washer P-12093
- BB Changer Shaft--Front P-12041
- BB Changer Shaft--Rear (Not shown) P-12073
- BC Changer Shaft Pin P-12065
- BD On-Off Switch (Give Model No.; see at EN)
- BE Pickup (Give Model No.; see at EN)
- BF Grommet (3 required) P-2518
- BF Washer (3 required) P-2519
- BG Record Pin (with Motor)
- BH Changer Plate Washer P-12061
- BI Changer Plate Spring P-12081
- BJ Pointer
- BK Shelf Plate } Changer Plate P-12403
- BL Selector Plate } Assembly (2 reqd.)
- BM Changer Cup or Knob (2 reqd.) . P-12044
- BN Cam Gear Screw

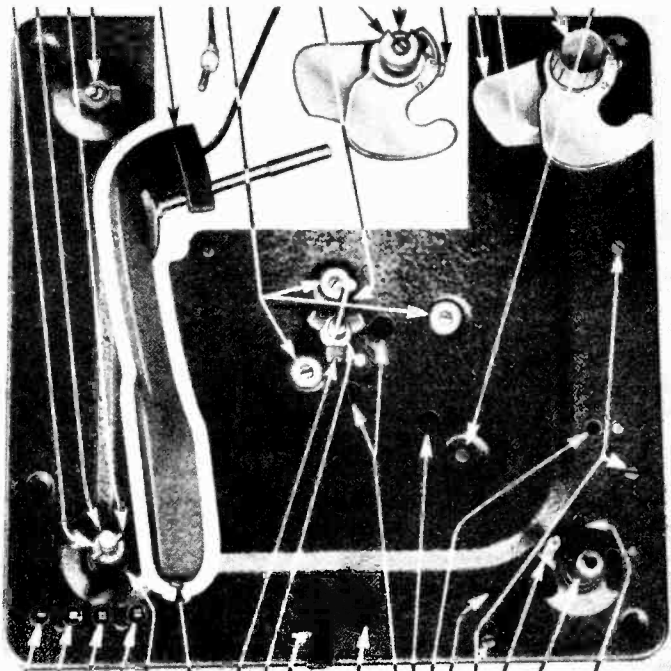


PHOTO A-B. Top View.

- P-12100A Push Button Assembly "R" AA
- P-12100B Push Button Assembly "M" AB
- P-12100C Push Button Assembly "12" AC
- P-12100D Push Button Assembly "10" AD
- P-12043 Changer Post AE
- (Give Model No. as at EN) Needle Setscrew AF
- P-12008 Neoprene Tubing AG
- P-12127 Drive Pinion Assembly AH
- P-12126 Pickup Support Bracket Assembly AI
- Needle Landing Adjustment Hole AJ
- Motor Oiling Holes AK
- Oiling Hole AL
- Oiling Hole AM
- Oiling Hole AN
- (3) Sub-Plate Attachment Screws AO
- P-12005 Lifter Rod Nut (OE) AP
- P-12046 Swivel Post AQ
- Trip Adjustment Hole AR

Illustrations

The three photos illustrate all vital parts of the Changer. Letters are used alphabetically to refer to points on photos; thus, Motor Oiling Holes "AK" are found by simply glancing down Column A (left side of Photo A-B) to letters AK. Reference letters must NOT be used for ordering parts: order only by factory numbers. Where no number is given, part cannot be separately supplied; order the Assembly containing it.

Oiling

The Changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 6 points. All points can be reached from above, through holes in the mounting plate, as follows:

- No. 1) Three oil holes on motor
- No. 2) gear housing. Reach all 3
- No. 3) holes through 2 holes AK.

No. 4 Through hole marked AL, drop the oil upon flat surface of cam. It will dis-tribute itself to proper points.

No. 5 Through hole marked AM, see felt wick, and drop the oil directly upon it.

No. 6 Through hole marked AN, see felt wick, and drop the oil directly upon it.

MODEL 210

WEBSTER-CHICAGO CORP.

To Check Oiling

If squeaks are heard compare the squeak with and without a load of records; any stack of wax records in motion is likely to squeak a little against a pin through their center. See that all five wicks are in position, including three 1/4" round wicks in frame of Motor, one washer-shaped wick ("No. 5") on Lift CV, and one ("No. 6") on Cam Lever CS. See that each wick is thoroughly saturated (as it may not be if insufficient oil or too heavy oil has been used). Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil or low-viscosity oil). If necessary, clean gummed-up wicks with kerosene. See that each is saturated with good oil; then, before replacing them, drop a little good oil into the holes. The gearbox of the Motor is packed with a semi-fluid grease at the factory, and it should never be necessary to take it apart for lubrication purposes.

General Description of the Change Cycle

An automatic record player for records of two sizes has three principal duties to perform. These duties are here performed by three mechanisms, interconnected and built together but largely separate in their operation.

(1) The record-changing mechanism--brought into operation originally by the contact of Lifter Cam DG with Pawl DH--is the simplest of the three. It is driven by the cam groove (not visible) on under side (in Photo C-D) of Cam Gear DF. As Cam Lever CS is forced, by the Pawl, out underneath Lift CV (which is shown revolved to the right for visibility) the Lift rises and forces roller DJ into the under groove in Cam Gear. The motion is transferred to Rear Changer Shaft (at ED) through Cam Connecting Rod DE (EC), thence through Changer Connecting Rod FD to Front Changer Shaft BB.

(2) The pickup-operating mechanism--likewise brought into operation originally by the cam-and-pawl action upon Cam Lever CS--is driven in part by the groove in upper (visible) side of Cam Gear DF. As Cam Lever is forced out, at the beginning of the change cycle, against Link CG, it causes the Link to push upward upon Pickup Plunger DA, thus lifting needle from record. The same pressure upon Link CG works, through Guide Arm CD, to force Stud DD down into the groove on the Cam Gear. This rotates the pickup

arm, while Pickup Plunger DA holds it up off of record. It is rotated first out beyond the turntable until Selector Plates BL have dropped the next record, then rotated back to proper position to start playing.

(3) The mechanism for bringing needle into correct starting position must operate accurately for both 10" and 12" records. Partly due to this requirement the starting position is not determined by the cam action. The upper groove on Cam Gear is designed so that it, acting alone, would carry the needle farther back toward record pin than would ever be desirable as a starting adjustment. Travel of pickup arm toward Record Pin is then stopped, at proper point for lowering onto the record, by action of Lever Hub CL. The stopping takes place as lug EW (upon the Lever Hub) strikes the shoulder on Rod EX. This enables entire mechanism rotated by cam action on Guide Arm CD to travel on past the proper point of rotation for record-starting, while the pickup arm itself, which is held rigid to Lever Hub CL, is accurately stopped at proper record-starting point.

Correct adjustment for starting position of needle requires therefore only correct adjustment of Rods EX and FK; the radial difference of 1 inch between correct starting position for 10" and 12" records is taken care of by exact dimensioning, at the factory, of surfaces at right end of Rod FK which stop against the "10" and "12" key stems. Due to this, when Adjusting Cam at FP is turned (as directed below under Adjustment A) the starting position of needle is simultaneously altered for both 10" and 12" records.

Adjustments

There are three adjustments that can be made. Except on certain early Changers (See B, below), ALL THREE CAN BE MADE FROM ABOVE: CHANGER NEED NOT BE REMOVED FROM CABINET. All adjustments are correctly made at the factory, and ordinarily need never be altered. Should it become necessary to readjust, due to accident or tampering, proceed as follows:

A. ADJUSTING LANDING POSITION OF NEEDLE ON THE RECORD. If needle comes down on the sound track, playing of records will not start at their beginning. Insert screw-driver through hold AJ. Turn screw head on Needle Landing Adjusting Cam FP very slightly counter-clockwise. If needle comes down too close to outer edge of record, or out beyond

WEBSTER-CHICAGO CORP.

MODEL 210

edge of record, turn Adjusting Cam clockwise.

The factory adjustment of needle landing is $1/8$ " in from outer edge of record.

Compare also Paragraph 12 below.

B. ADJUSTING DISTANCE FROM RECORD PIN AT WHICH TRIGGER WILL TRIP AND CHANGE CYCLE WILL BEGIN. Insert screwdriver through hole AR. Turn screw head on Trip Adjusting Cam CJ clockwise for earlier tripping, or counter-clockwise for later tripping. (Effect is to alter position of the Cam which strikes Trigger CP. It may be found that Cam has been revolved through a half-turn; in this case, above directions would apply only after Cam has been returned to correct position by revolving screw head one-half turn).

On some models of this Changer no hole will be found in Main Plate at AR. To make the adjustment on these Changers, access must be had to the under-side of the mechanism. Instead of Cam CJ, there will be found a Trip Adjustment Screw, so placed that its end strikes the trigger directly. For earlier tripping, turn this Screw clockwise; for later tripping turn it counter-clockwise.

This changer does not depend, for automatic tripping, on the records being provided with any special grooves at end; it trips whenever needle comes within a certain distance of Record Pin. The factory adjustment is for $1-3/4$ " to $1-7/8$ " from center of Record Pin. This is the most generally satisfactory distance; no modern record will then be cut off before playing is finished, and none will fail to trip at end. For certain records of early manufacture, it may be impossible to find an adjustment that will always trip and never cut off, but these may always be played manually.

C. ADJUSTING HEIGHT TO WHICH PICKUP ARM RISES. The arm should rise, during the change cycle, high enough so that it clears by only $1/4$ " the record above it, next to be played. (Be careful, before deciding that readjustment is necessary, to see that the record at bottom of stack is not a warped one.) To make this adjustment, loosen Lock-Nut AP (CE) and turn Pickup Sleeve DB to lengthen or shorten Pickup Plunger DA. However, if Pickup is made to rise too close to bottom record, Stud DD may never clear the groove in Cam Gear. In making this adjustment, therefore, care must be taken to see that Pickup arm does not keep moving back and forth continuously (due to Stud DD remaining in engagement with groove). When correct adjustment is found, tighten Lock Nut securely.

Replacing Motor

The service mechanic may be called upon to adapt the Changer to a different power supply. For this purpose, or in case of any serious fault within Motor, remove entire Motor EA (with Record Pin and connecting gear drive) from the Changer, and replace it with a suitable new Motor. (In ordering a replacement Motor, specify the power supply and give Model Number at EN; also make and model number of phono-radio or other type of installation.)

When mounting replacement Motor, it is most important to see that Record Pin is centered between the two Posts of the Changer, that it stands perpendicular to Main Plate EB, and that it has not become bent. When the new Motor has been attached, with three screws through Grommet Sleeves FF into its frame, and Record Pin is seen to revolve without appreciable wobble (a wobble would indicate that it has been bent in transit from factory) the correct position of Pin midway between the Posts can be accurately checked in this way: Place a single 12" record on the Shelf Plates BK, press "R" button, and turn Turntable forward by hand. Immediately after the Shelf Plates open and let it fall, turn Turntable slightly backward, and with other hand support the record between the Shelf Plates; it can then be readily seen whether Record Pin is off center. If it is, remove the record and Turntable, and loosen slightly the screw or screws BF nearest the Shelf Plate to which record appeared closest. This should improve evenness of operation. However, unless the unevenness was slight, it will be necessary for a permanent repair to insert a shim or two on one or more of the three screws (or change shims from one screw to another). The shims used are shaped like an ordinary washer, cut out at one side (see cut-away view at FE, showing a shim in place upon one of the Grommet Sleeves). Shims can readily be cut out with shears and punch from thin metal or cardboard--or an assortment of shims of different thicknesses can be had from factory (order "Assortment of P-1397 Shims"). They should be inserted, around proper screws (when screws have been sufficiently loosened) between Motor Frame and the metal Grommet Sleeve. Do not insert shims next to rubber grommet.

Before tightening screws, drop Drive Pinion Assembly AH into mesh with Idler Gear (but not down far enough to seat upon drive pin). Then make sure that when the three screws are tightened, Drive Pinion and Idler still

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WEBSTER-CHICAGO CORP.

work freely together and do not bind. If necessary, loosen screws again, and shift them until proper tooth clearance is obtained. Then tighten screws, and test, as above directed, the centering of Record Pin between Changer Posts.

In wiring up, consult wiring diagram for particular installation. Use only Underwriters' approved wire. See that Motor Frame is well grounded by wire soldered to lugs, as shown on Bottom View photo.

Trouble Shooting

Cases of failure to operate satisfactorily will generally be found due either to neglect of proper lubrication, or to tampering with the mechanism after it leaves the factory, or to injuries accidentally sustained as by external vibration or by impact of some heavy object. In addition there is always the possibility that any kind of spring may "go dead" (cease to operate without any visible breakage) even though the utmost factory precautions are taken against it--or that setscrews may work loose due to some external vibration. For tightening setscrews, a No. 8 size Allen (hexagon) wrench is required; be sure that setscrews are properly seated on the holes or flats provided. Damage from tampering is likely to take the form of bent parts; never bend any part during examination. Be careful, especially, never to push upward from below on Cam Connecting Rod Lift CV while mechanism is operating; bending may result, and even slight bending here might interfere with correct timing of the cycle operations.

Among the principal trouble symptoms to which such causes may give rise, are the following:

1. MECHANISM IS SLOW IN STARTING, OR STALLS DURING A CHANGE CYCLE, BUT A SLIGHT FORWARD PUSH WITH THE HAND STARTS IT AGAIN.

May be caused by

- a. Failure to lubricate properly. Oil thoroughly, per instructions above.
- b. Loose setscrews.
- c. Weakness of drive: line voltage may be abnormally low, or motor windings damaged. If windings are found damaged, remove motor and return it to factory for repair or replacement. See above: "Replacing Motor."

2. MOTOR FAILS TO RUN, EVEN WHEN IT IS ENTIRELY DISCONNECTED FROM OTHER WIRING AND PROPER VOLTAGE IS APPLIED DIRECTLY TO THE TWO ENDS OF ITS WINDINGS. This indicates trouble in Motor windings. Unless the dam-

age is easily seen and repaired, replace Motor, as above described.

3. MOTOR IS SLOW IN STARTING.

- a. Check oiling, as directed above. It may not have been properly done; old oil may have become gummy.
- b. Changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that Motor is defective, and proceeding as in Paragraph 2 above.

4. SQUEAKS OR OTHER NOISES, DURING PLAYING OF RECORDS.

- a. Check oiling, as directed above. (If squeaks are heard, they will usually be found to come from the records--not from the mechanism).
- b. See that all setscrews are tight.

5. CHANGER IS NOISY WHEN IN CYCLE. Check oiling.

6. MOTION OF PICKUP TOWARD RECORD PIN WILL NOT TRIP CHANGER MECHANISM.

a. (Only on models not having Trip Adjustment Hole AR) It may be found that, instead of trigger being actuated, there is stretching of Swivel Spring CK, allowing the spreaders to open. Increase tension of the Spring, by bending slightly the lug on either Spreader. If this increased tension causes needle to jump across the record, needle may be a little out of vertical, radially--it may "lean" toward center of record. To remedy this, grasp Pickup arm and twist it, very slightly, in a clockwise direction (looking from needle end) so that it stands vertical, or even leans a little in outward direction.

b. If trigger is being properly actuated, probably Cam Lever CS is binding against Sub-Plate CU. Look for dirt or obstructions; see that Pawl DH and Trigger CP are working freely on their rivets. If the Lever engages the Pawl so that Lift CV forces roller DJ up into the under groove on Cam Gear, and if set screws are tight, the change cycle must operate, as Cam Gear turns.

7. PRESSING "R" BUTTON DOESN'T TRIP CHANGER MECHANISM.

a. Check Key Control Unit FM: see whether there is an obstruction or a bent part which

WEBSTER-CHICAGO CORP.

prevents "R" button from going clear down to the end of its travel.

b. Examine Reject Rod FI. If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be restored in same way. Grasp the two ends and twist it slightly.

c. If Trigger CP is being properly actuated but without starting a change cycle, see directions above, Paragraph 6-b.

8. PRESSING "M" BUTTON FAILS TO PUT CHANGER MECHANISM OUT OF ACTION SO AS TO ENABLE MANUAL OPERATION. First see that button goes clear down; then follow its action through Manual Rod FH.

9. MOTOR STOPS IMMEDIATELY WHEN CHANGER SWITCH IS TURNED OFF DURING A CHANGE CYCLE (instead of continuing to run, as it should, until needle is again upon a record, and then stopping). Or--

10. TURNING ON-OFF SWITCH FAILS TO STOP CHANGER AT ALL. Either of these two conditions would indicate failure of Cycling Switch EH. Cycling Switch operates normally to short-circuit the manual On-Off Switch (which may be located in position shown at FA or elsewhere) during change cycle only. Such damage to Cycling Switch (not likely to occur) would necessitate returning either the Sub-Plate Assembly or the entire Changer to factory.

11. CHANGER FAILS TO REPEAT LAST RECORD. See Paragraph 6, above.

12. NEEDLE LANDS PROPERLY ON RECORD BUT FAILS TO MOVE OVER INTO RECORD GROOVE. Pickup arm is normally impelled toward center of records by Lead Spring ER. Should a slight increase in its tension be found necessary, this can be easily obtained by bending the lug, to which it is attached, down against Main Plate. If tendency then appears for needle to jump across record, check angle of needle (see Paragraph 6-a above).

13. RECORDS FALL UNEVENLY UPON TURNTABLE. Seldom objectionable (some unevenness may even be advantageous) this is due to Record Pin not being correctly centered between Changer Posts. If necessary, it can be corrected as described above; see "Replacing Motor."

14. LAST RECORD DROPS ON ONE SIDE ONLY. This suggests a Changer Post bent out of perpendicular to Main Plate. Test as directed above under "Replacing Motor." If Post must be straightened, be careful not to bend other parts.

15. CHANGER CONTINUES CYCLING. Probably due to failure of Lift CV to be drawn back out of engagement with Cam Gear. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.

16. RECORD IS DRIVEN, BUT NOT HEARD, or NOT HEARD WITH PROPER VOLUME. See that Pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type, or 0.5 volt if of magnetic type. If pickup cartridge is found not to deliver proper output, remove it and install another.

17. SELECTOR PLATE FAILS TO SEPARATE BOTTOM RECORD FROM STACK. This is due either to a badly warped condition of the record, or to its being of a thickness very considerably different from those now in standard use. The design of both Selector and Shelf Plates is such as to accommodate a maximum variation in thickness and flatness of records, but certain records may be found which are so far out as to be impracticable for use in automatic changers.

If Necessary to Disassemble the Changer

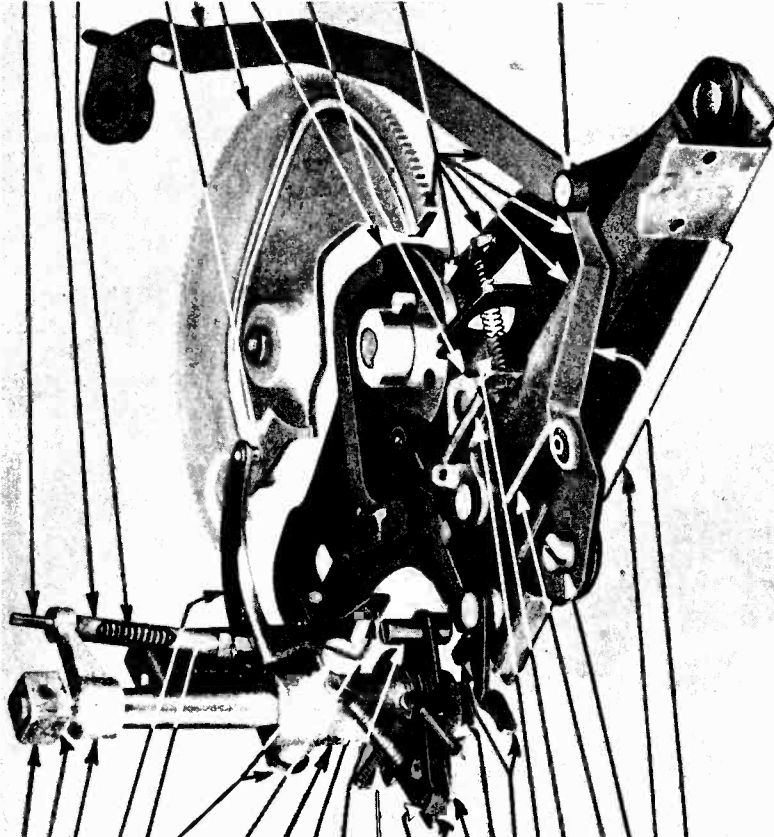
First detach the entire changer mechanism (except Changer Connecting Rod Assembly FD and Cam Connecting Rod Assembly DE, also seen at EC) from Main Plate EB. To do this, first take out Shoulder Screw CT, to free the rest of the mechanism from Assembly DE. Then remove the three screws AO, which hold Sub-plate Assembly DI to Main Plate EB. Also remove Screw BN, which holds Cam Gear DF. Pull off the four Key Control Buttons. Remove, then, the two screws that hold Key Control Unit FM to Main Plate. Now remove Control Unit Truss Bar FO, Rejection Rod Support EP, and Extension Rod Bracket FQ-- this means taking out five screws. Remove Flat Spring FJ, by taking out one screw. Rods FH and FI can then, with due care, be extracted without bending. Free the Cam

- DA Pickup Plunger . . . P-12095
- DB Pickup Plunger Sleeve P-12096
- DC Pickup Plunger Spring P-12097

- DD Stud
- DE Cam Connecting Rod
- DF Cam Gear
- DG Lifter Cam
- DH Pawl

- DI Sub-Plate and Gear Assembly . . . P-12709

- DJ Roller



- P-12123 Swivel Shaft and Head Assem. . . CA
- P-2522 Fibre Washer (2 required) . . . CB
- P-12048 Lifter Guide . . . CC
- P-12111 Swivel Guide Arm Assembly . . . CD
- P-12003 Lifter Rod Nut (AP) . . . CE
- P-12072 Trunnion Shoulder Screw (2 reqd) CF
- Link . . . CG
- P-12701 Swivel Tube and Trunnion Assem. CH
- P-12087 Swivel Guide Arm Spring . . . CI
- Trip Adjusting Cam . . . CJ
- P-12089 Swivel Spreader Spring . . . CK
- P-12703 Stop Lever and Trigger Adj. Assem. CL
- P-12026 Upper Swivel Spreader . . . CM
- P-12027 Lower Swivel Spreader . . . CN
- P-12099 Pickup Leader Spring (ER) . . . CO
- Trigger . . . CP
- P-12084 Pawl Spring . . . CQ
- P-12085 Cam Lever Spring . . . CR
- Cam Lever . . . CS
- P-12007 Shoulder Screw . . . CT
- Sub-Plate . . . CU
- Cam Connecting Rod Lift . . . CV

Photo C-D. View of Sub-Plate Assembly, Together with Certain Other Assemblies

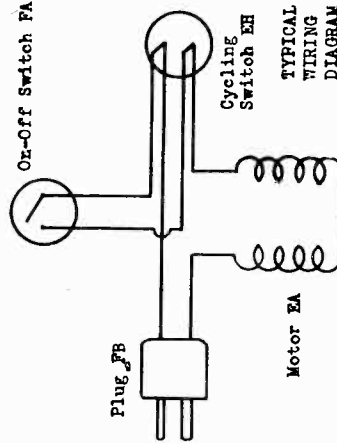
Connecting Rod Assembly DE, by loosening setscrew holding Spreader Hub EE to Rear Changer Shaft. In reassembling, reverse the procedure, taking care to get all springs properly connected as shown in the photos, without stretching any of them.

The Changer plays twelve 10" or ten 12" records. . . . To reload, revolve the two posts slightly, grasping them underneath the Shelf Plates. Turn them back after the played records are re-

moved; they will fall and lock when in proper position. Then place the new records on the Shelf Plates, and push "R" button to put Changer in operation. . . . To play the other size records, turn the knob at top of each post until proper figure is opposite pointer, and press the "10" or "12" button, to agree with pointer setting. . . . To reject a record (or to start a change cycle as for testing purposes) simply press the "R" (Release or Reject) button, at any time while needle is upon a record. . . . To play manually, turn plates out of

the way as for reloading, and press "M" button.

(What are here called the "plates" of the Changer are frequently known among mechanics as "blades"--a name best avoided when talking with users because it may convey to some an exaggerated impression of danger in the movement of these parts.)



WEBSTER-CHICAGO CORP.

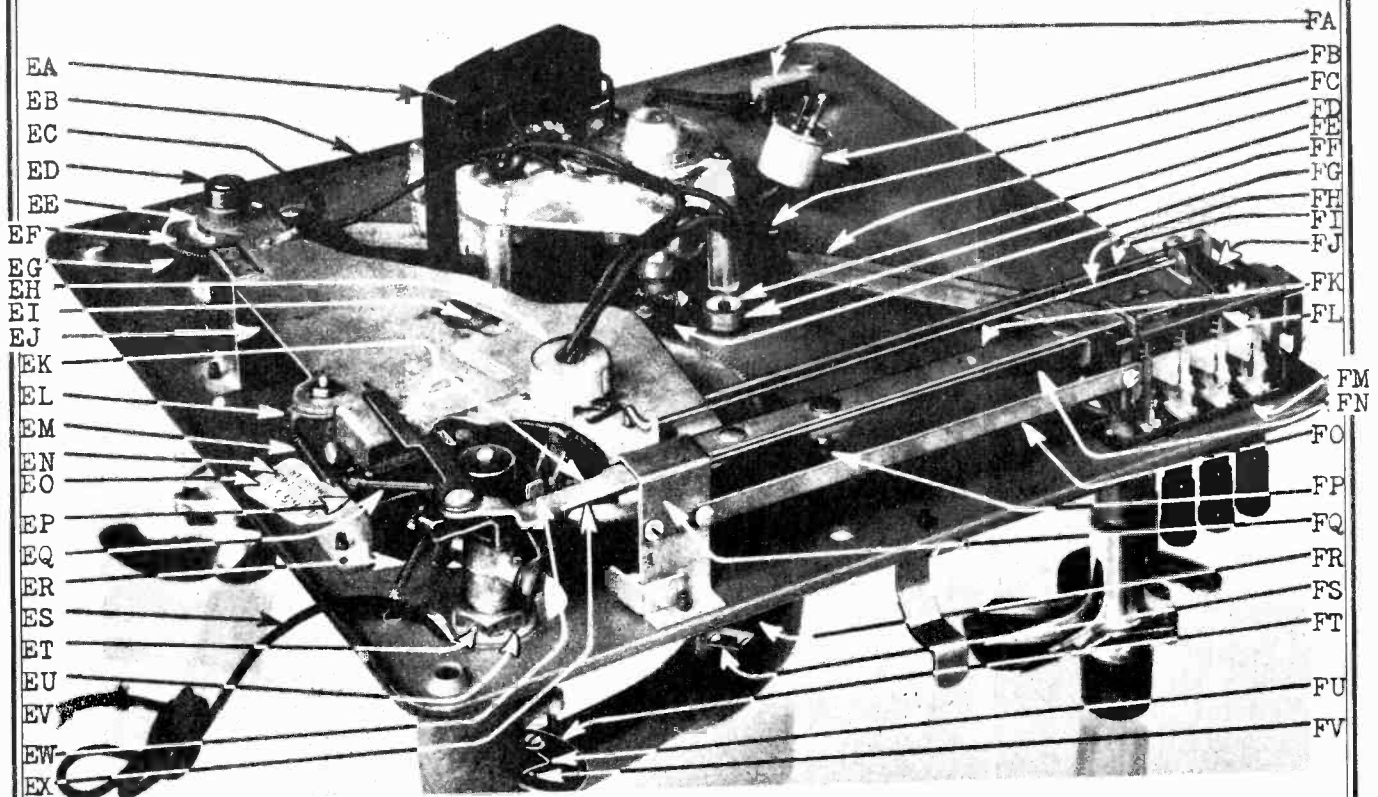


Photo E-F. Bottom View

(Give Model No. as at EN) . Changer Motor	EA	FA	On-Off Switch (Give Model No.; see at EN)
(Give Model No.) . Main Mounting Plate Assm.	EB	FB	Male Plug with #7002 Shell M-21
Cam Connecting Rod	EC	FC	Cord Clamp 292-8
P-12400 Changer Shaft Collar	ED	FD	Changer Connecting Rod Assem. P-12122
Spreader Hub Assembly	EE	FE	Shim (Assortment) P-1397
P-12045 Spring Roller	EF	FF	Grommet Sleeve (3 reqd.) P-12059
P-12088 Changer Spreader Spring	EG	FG	Idler Gear
Cycling Switch	EH	FH	Manual Key Rod P-12077
P-12085 Cam Lever Spring	EI	FI	Rejection Rod P-12510
P-12709 Sub-Plate and Gear Assem. (DI)	EJ	FJ	Manual and Rejection Rod Spring P-12090
P-12116 Adjusting Rod Assembly	EK	FK	Extension Rod
Cam Connecting Rod Lift (CV)	EL	FL	Key Control Bracket P-12038
P-12083 Cam Connecting Rod Lift Spring	EM	FM	Key Control Unit P-12079
Changer Model Number	EN	FN	Adjusting Rod Spring P-12087
Changer Serial Number	EO	FO	Control Unit Truss Bar P-12094
P-12505 Rejection Rod Support	EP	FP	Needle Landing Adjusting Cam
P-12084 Adjusting Rod Lever Spring	EQ	FQ	Adjusting Rod Bracket P-12036
P-12099 Pickup Leader Spring (CO)	ER	FR	Pickup Cartridge (Give Model No. as at EN)
(Give Model No. as at EN) Pickup Cord	ES	FS	Cartridge Clamp P-2218
P-12053 Post Nut	ET	FT	Tone Arm Lift Plate P-2223
#1228 Shakeproof Washer	EU	FU	Hinge Pin Spring P-2235
M-93 Male Plug (on end of cord)	EV	FV	Tone Arm Hinge Pin P-2234
Lug on Lever-Hub Assem.	EW		
Adjusting Rod	EX		

MODEL 210

WEBSTER-CHICAGO CORP.

IF LANDING POSITION OF NEEDLE IS NOT CONSTANT
OR PICKUP ARM CANNOT BE ADJUSTED TO SET
NEEDLE DOWN IN STARTING GROOVE OF RECORD

In the first production of the automatic record changer, the pickup arm may display the following symptoms:

1. After the pickup arm has been set for the correct landing position, the needle does not lower consistently to the starting groove of a record during the playing of any one size of records.
2. The needle lowers so far away from the starting groove of the record that turning the needle landing adjusting screw does not bring the needle to the starting groove.

In early production, the pickup lead was permitted to hang down directly below the foot of the pickup. In such instances, the lead may become entangled with the rotating mechanism for the pick-up arm. This will produce either one of the above actions.

To remedy the condition, clamp the pickup lead to the bracket - See Fig. 1, leaving enough slack in the lead to permit free action of the pickup arm. That portion of the lead under the clamp should be covered with tape.

The clamping arrangement consists of a small clamp, a No. 6 shakeproof lockwasher, and a 6-32 shakeproof self-tapping machine screw. On request, these items will be supplied free of charge by the factory.

IF PICKUP ARM DOES NOT SET NEEDLE DOWN IN
STARTING GROOVE OF BOTH 10" and 12" RECORDS

It may be found that any one setting of the needle landing adjusting screw will not cause the phono pickup arm to set the needle down in the starting groove for both 10" and 12" records.

This condition may be remedied as follows: Set the automatic record changer for 10" record operation. Turn the needle landing adjusting screw so that the pickup arm sets the needle down in the starting groove of a 10" record.

Replace the 10" record with a 12" record and set the automatic record changer for 12" record operation. Start the mechanism. Note the landing position of the needle.

November 20, 1939

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If the needle does not set down on the record or sets down too near to the edge of the record, bend the shaft of the 12" button (See Fig. 2) a VERY SLIGHT AMOUNT away from the extension rod. If the needle sets down on the record past the starting groove (toward the center of the record), bend the shaft of the 12" button a VERY SLIGHT AMOUNT toward the extension rod.

PICKUP ARM
(REST POSITION)

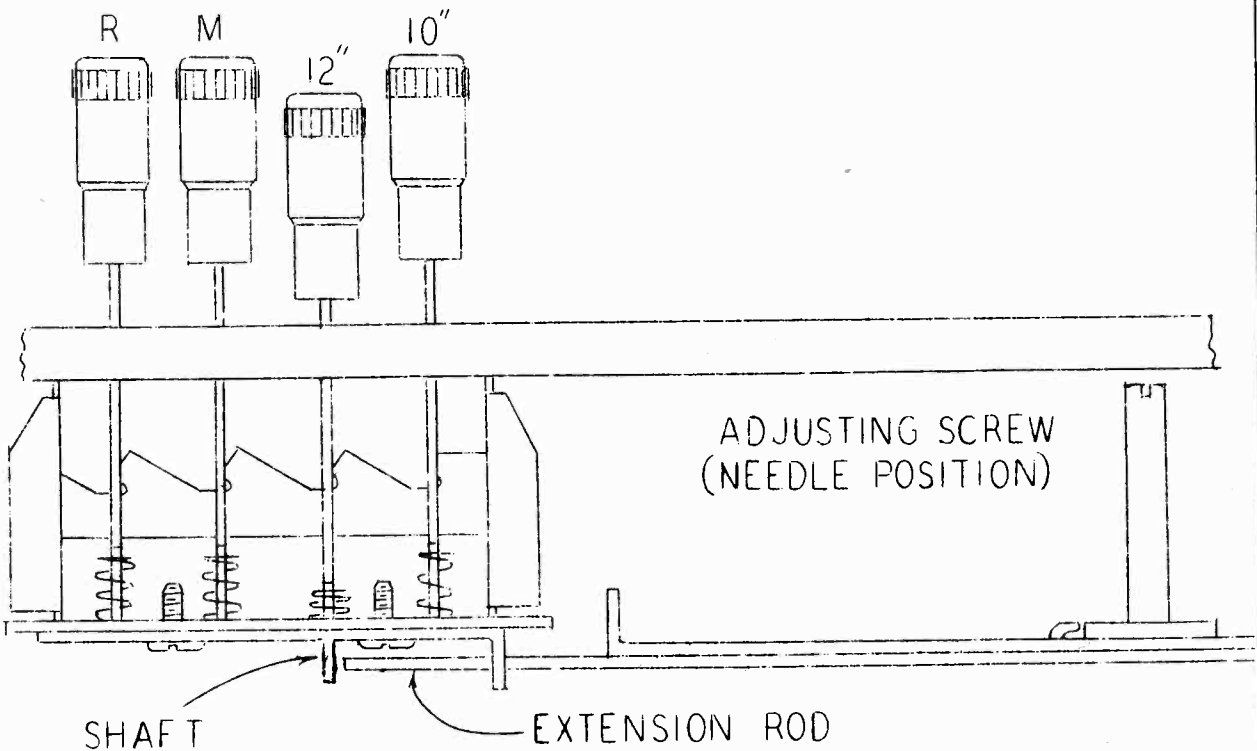
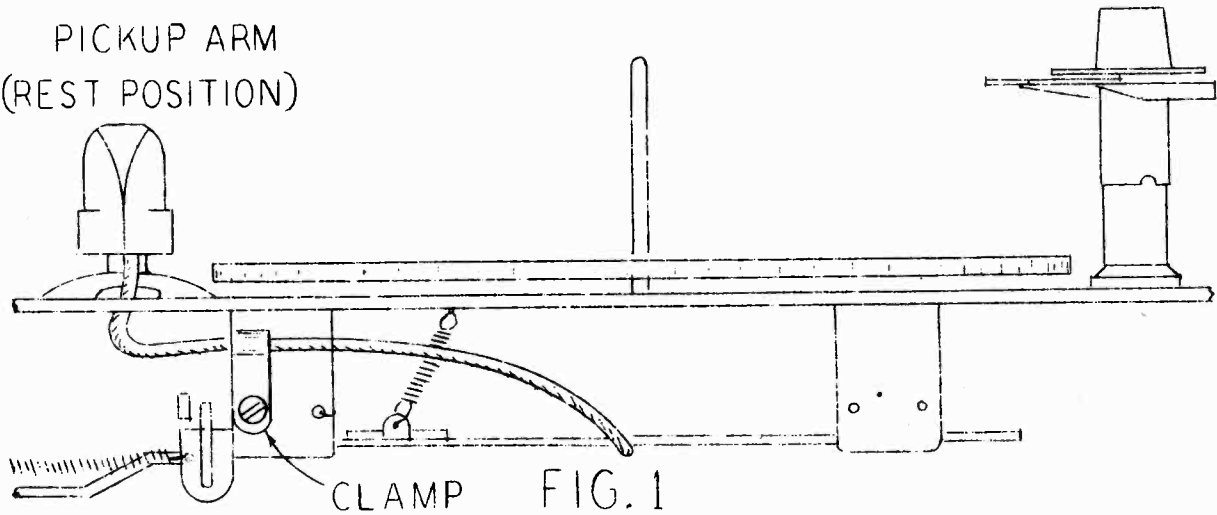


FIG. 2

#529-2

WILCOX-GAY CORP.

MODEL A-101, A-102

Table with columns: Part No., Description, Last Price. Includes items like Pickup Arm Assembly, Arm Channel only, Carriage Washer, Cartridge Clamp Plate, etc.

NOTE: Turntable spindles are individually fitted to the spindle bearings within the gear housing of the lateral feed screw assembly. Therefore, turntable spindles are not obtainable separately.

CHASSIS PARTS

Table with columns: Part No., Description, Last Price. Includes items like Rubber Foot (large), Rubber Foot (small), Shavings Receptacle, etc.

MICROPHONE PARTS

Table with columns: Part No., Description, Last Price. Includes items like Microphone with Handle, Cord and Plug, Microphone Handle only, etc.

These prices are subject to change without notice.

CHASSIS PARTS

Table with columns: Part No., Description, Last Price. Includes items like Antenna and Ground Terminal Strip, Chassis Mounting Screw, etc.

A-101 MASTER UNIT PANEL ASSEMBLY PARTS

Table with columns: Part No., Description, Last Price. Includes items like Antenna and Ground Terminal Strip, Cable Clamp -- Single, etc.

A-102 TURNTABLE UNIT -- RECORDER PARTS

Table with columns: Part No., Description, Last Price. Includes items like Recording Arm Assembly, Arm Channel only, etc.

HOW TO USE THE INDEX

The Index to "Automatic Record Changers and Recorders" is divided into two parts: one pertaining to the text portion, pages 1 to 60, and the second covering the manufacturers' service data, pages 61 to 733. The latter portion requires a word of explanation so that the user can find the needed data as quickly and as easily as possible.

The left-hand column (see example below) lists the model numbers of radio-phonograph combinations in which a record changer is employed; such a combination may or may not have a recorder also. The next column lists the radio manufacturer's model number of the record changer and/or recorder used. The third column lists the manufacturer of the record changer or recorder and that company's model number of the unit. The last column lists the pages on which the data pertaining to the unit appear.

BELMONT RADIO CORP.

Radio Combination	Record Changer or Recorder Model No.	Manufacturer	Pages
8AE1	104263	General Instrument 102	257 to 260
796	—	RCA RP-139-A	463 to 467

The Belmont model number of the radio combination is 8AE1 and the Belmont number for the record changer used in the model 8AE1 is 104263. This record changer is manufactured by General Instrument Corp. and that company's model number is 102. The service data covering the model 102 will be found in the General Instrument section on pages 257 to 260 inclusive. The record changer used in Belmont model 796 is made by RCA Mfg. Co., the RCA number being RP-139-A and the data appearing in the RCA section on

pages 463 to 467 inclusive. In other words, if you want to know the make and model number of a record changer or recorder that is used in a radio-phonograph combination, look up the name of the manufacturer of the combination, as Belmont, Galvin, Zenith, etc., and opposite the combination model number in the first column you will find the desired information together with the page numbers on which the data appear.

In several instances the same manufacturer makes both radio combinations and record changers, as RCA Mfg. Co. In the first column will be found model numbers of any combinations in which record changers or recorders are used and in the second column will be found the model or specification numbers of the record changer. In such cases, the third column will be blank, as the number already appears in the second.

In some cases a receiver manufacturer has furnished specifications to a record-changer manufacturer for a changer that is similar to a model of the latter's regular line. In order to avoid repetition, such changers are listed as being similar to a certain model of the record-changer manufacturer. An instance will be found in the listing of model H-79 of the General Electric Co., in which is used a record changer that is similar to the Webster model 11.

In those instances where you know the name of the manufacturer of the record changer or recorder, look up the model number of the unit under the manufacturer's name. The first column is blank, as this is only for radio-combination model numbers, the model number of the unit being found in the second column. The page numbers on which the data will be found are in the last column.

TEXT INDEX

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Torque	5	Playing time		

MANUFACTURERS' INDEX

ADMIRAL

See CONTINENTAL RADIO & TELEV. CORP.

AIR CHIEF

See FIRESTONE TIRE & RUBBER CO.

AIRLINE

See MONTGOMERY-WARD

RADIO COMBINATION MODEL NO. RECORD CHANGER OR RECORDER MODEL NO. MANUFACTURER PAGES

ALLIED RADIO CORP. (KNIGHT)

D174	Gen. Ind. R-70L	242-247
D175	New Prod. 301	312-313
D176	Gen. Ind. R-70L	242-247
D185	New Prod. 301	312-313
D186	Gen. Ind. RC-130	255-256
D187, D188, D189	Seeburg B	551-566
D190	Gen. Ind. RC-130	255-256
D191, D195, D197, D198, D199	Seeburg B	551-566
B10572, B10573	RCA 9865 or Seeburg J-4A	463-471, 584-588, 595-606, 614-618
B10575	Seeburg JR-4B	608-613, 621, 622
B10579, B10580	RCA 9865 or RCA 9880	463-471
B10585, B10586	Seeburg J-4A	584-588, 595-606, 614-618
	or RCA 9865	463-471
B10587, B10588	Seeburg JR-4B	584-588, 595-606, 614-618
B10591	Gen. Inst. 101	257-260
B10592, B10593, B10594	Gen. Ind. RC-130	255-256
B10604	RCA 9865	463-471
B10605	Gen. Inst.	
B17183	Seeburg B	551-566
B17184	Gen. Ind. RC-130	255-256
B17185	New Prod. 301	312-313
B17186	Gen. Ind. RC-130	255-256
B17187	Seeburg B	551-566
B17188	Gen. Ind. RC-130	255-256
B17190	Seeburg B	551-566
B17191	Gen. Ind. RC-130	255-256

ANSLEY RADIO CORP.

R1	Gen. Ind. "L" AC	239-241
	Gen. Ind. "M" AC-DC	
R2 (Before Dec. 1939)	Garrard RC6 AC	173-186
	Also refer to	268-272
	Garrard RC5 AC-DC	173-186
	Also refer to	268-272
R2 (After Dec. 1939)	Garrard RC10 AC	187-200
	Also refer to	274-280
	Garrard RC11 AC-DC	187-200
	Also refer to	274-280
R3 (Before Dec. 1939)	Farns. Capehart S30	136-142
R3 (After Dec. 1939)	Webster 21 AC	670-676
	Webster 21-J Mechanism AC-DC	670-676
R4	Gen. Ind. RC-130	255-256
R5 (Before Sept. 1941)	Gen. Ind. C-120	248-253
R5 (After Sept. 1941)	Gen. Ind. C-125	248-253

AUTOMATIC RADIO MFG. CO., INC.

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175	Seeburg J-19B	"

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SEARS, ROEBUCK**

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	* The basic mechanism of the 10-inch and 12-inch drop-type automatic record changers, with some variations, was used in these models. The variations involved external finish; pick-up arm styling; drive (direct drive—direct with a coupling—rim drive on inner edge of turntable—rim drive to a rubber tire on disc under motorboard); motor (governor—constant speed—synchronous, etc.); presence or absence of a pick-up shorting switch, and automatic motor-power switch. Also there were a few minor changes in the mechanism itself, principally the shape of the cam on the large gear (to smooth out the change-cycle action), and the omission of a lever.		
RADIO PRODUCTS CORP.			
RC-50, RC-51, RC-52, RC-53			541-545
REK-O-KUT			
R12, R16			546
SEARS, ROEBUCK & CO. (SILVERTONE)			
R5501 (101.618-1A), 5509 (101.618-2), 5511 (101.619)	101.220 Series		
5511A (101.619A), 5561 (101.617)	101.320 " (Erwood) New Prod. 220, 320 Series		310-314
5571 (101.631), 5571A (101.631A)	101.220 Series, 101.320 " (Erwood) New Prod. 220, 320 Series		310-314
5581 (101.634), 5601 (101.628), 5601A (101.628-1A)	101.340 Series, 101.341 " (Erwood) New Prod. 220, 320 Series		549, 310-314
			549

SEARS, ROEBUCK WEBSTER-CHICAGO

SEARS, ROEBUCK & CO.—(Cont.)			
RADIO COMBINATION MODEL NO.	RADIO CHANGER OR RECORDER MODEL NO.	MANUFACTURER	PAGES
5621 (101.632), 5661 (101.633,-1), 5721 (110.418), 5834 (110.420)	101.220 Series, 101.320	(Erwood) New Prod. 220, 320 Series	310-314
6346, 6346A, 6446, 6446A	101.584,-1, 2,-3	Webster 11	550 665-669
	101.584-4,-5	Webster 210	550 713-721
6447	101.590,-1, 2,-3	Webster 11	665-669
	101.590-4,-5	Webster 210	713-721
6449 (101.628)	101.220 Series, 101.320 Series	(Erwood) New Prod. 220, 320 Series	310-314
7069 (101.658)	101.205,-6, 7,-10	(Erwood) New Prod. 205, 206	547, 548
7071 (100.384)	101.201	Gen. Inst. 201	260-263
7228	126.206	RCA RP-139 B or E	468-471
7245	107.375	RCA RP-139 B or E	468-471
8929, 8930, 8950 (138.190-2)		Webster 210	713-721
8929, 8930, 8950 (138.190-3)		(Erwood) New Prod. 320	310-314
	101.220,- 221,-223, 101.320,-321,- 323	(Erwood) New Prod. 220 etc.	310-314
	101.340, 101.341		549
		Also see (Erwood) New Prod. 220 and 320 Series	310-314
	101.205,-206, 101.207,-208, 101.210		547-548
J. P. SEEBURG CORP.			
B			551-566
BR (Record-o-matic)			567-570
C			571-583
J Series (Early)			584-588
J Series (Late)			595-606, 614-618
JM Series			607, 619, 620
JR Series (Early)			589-594
JR Series (Late)			608-613, 621, 622
SENTINEL RADIO CORP.			
216FY		RCA	
216JY		Seeburg JR-10A150	608-613, 621, 622
216MY		RCA	
220-F, 220-J, 220-M, 221-F, 221-J, 221-M		RCA RP-145A	463-467, 472, 474
248K		RCA RP-152M	430, 463, 465-467, 491-494
SONORA RADIO & TELEV. CORP.			
TXF, TXF67		RCA RP-139A (9865)	463-467
KXF, KXFU, KXF95		Gen. Inst. 101	257-260
KSA, KSAU, KSA96		Gen. Ind. RC-130	255-256
KL-185		Gen. Ind. RC-130L	255-256
LV-186		Oak 4200-39	315-323
SPARKS-WITHINGTON CO. (SPARTON)			
85		General Industries K7 (Similar to Model K)	239-241
105X, 105XS		"	"
766XP, 766XS		"	"
1166XP, 1166XS		"	"
1176XP, 1176XS		"	"
SPEAK-O-PHONE RECORDING & EQUIPMENT CO.			
1-50			623-624
100			624
100A			625

SPIEGEL, INC.			
RADIO COMBINATION MODEL NO.	RADIO CHANGER OR RECORDER MODEL NO.	MANUFACTURER	PAGES
A-2080 (7C-PH)		RCA RP-139B	468-471
CP-5020		Gen. Inst. 101	257-260
CP-5026, CP-5027		Erwood 402 or RCA drop type	468-471
CP-5060		Gen. Inst. 101	257-260
B5P6570 (832P)		Erwood 402	
DP-7016, DP-7062		(Erwood) New Prod. 300	312-313
DP-7064		Gen. Ind. RC-130L	255-256
Z-7080 (7C-PH)		RCA RP-139B	468-471
STEWART-WARNER CORP.			
01-6C9		RCA RP-139B	468-471
01-6F9		RCA RP-145A	463-467, 473-474
11-6V9, 11-7A8, 11-7A9, 11-8D6, 11-8D7, 11-8D8, 11-8D9		Seeburg J	584-588, 595-606, 614-618
11-8R8		Gen. Ind. R-70	242-247
11-8R9		Seeburg JR-5B	589-594, 608-613, 621, 622
11-10A6, 11-10A8, 11-10A9, 11-10A10		Seeburg J	584-588, 595-606, 614-618
17-7B8, 17-8E6		Gen. Ind. C-120	248-253
1269-P		Gen. Ind. "L"	239-241
STROMBERG-CARLSON TEL. MFG. CO.			
2 (Multi-Record)			626-635
5, 6, 7, 9			636-664
14, 24, 27		2 (Multi-Record)	626-635
54		5	636-664
72, 74		6 and 7	636-664
145-P, 160-P		Gen. Ind. (7380) "L" and 17	239-241
240P, 245P		Gen. Ind. (7465) "M"	
260-P		Stromberg Carlson No. 7	636-664
341-P, 350-P		RCA RP-132 (9844)	
420-PL, 430-PF, 430-PLW		Webster 210	713-721
430-PL		Farns. Capehart S-30	136-142
455-PL		Webster 210	713-721
460-PF		Garrard RC-50	198-211
		Also refer to	268, 274, 285-288
470-PF		Webster 210	713-721
509-PF, 520-PF, 520-PG, 520-PL		Farns. Capehart P-2	113-122
520-PN, 520-PS		Webster 21 or 22	670-682
530-PL		Gen. Ind. C-120	248-253
535-PG, 535-PL		Webster 40	692-702
535-PS		Webster 21 or 22	670-682
555-PL		Webster 210	713-721
920-PF, 920-PFB, 920-PG, 920-PGB, 925-PF		Webster 24 or 22	675-682
925-PS		Farns. Capehart P44	143-153
935-PL			
935-PF, 935-PR, 955		Webster 41	703-712
7380		Gen. Ind. "L" and 17	239-241
7465		Gen. Ind. "M"	
TROY RADIO & TELEV. CO.			
TR-170		RCA 9800	
TR-729, TR-1186			
Portable		Gen. Ind. C-120	248-253
TR-1186A		RCA RP-139C	463-471
TRUETONE See WESTERN AUTO SUPPLY CO.			
UNITED MOTORS SERVICE, INC.			
R-1186-88		RCA RP-152C	430, 463, 465-467, 491-494
R-1186X		RCA RP-139A	463-467
WARWICK MFG. CO. (TROUBADOR)			
2-553		New Prod. 301	312-313
2-554		Oak 4200-4	315-323
		New Prod. 220	310-311
2-714		New Prod. 320	310-314
WEBSTER-CHICAGO CORP.			
11			665-669
21, AC-21, AC-DC 21J			670-676
22			675-682
23			683-690
24			677-682
25			691
40			692-702
41			703-712
210			713-721

**WELLS-GARDNER
ZENITH**

WELLS-GARDNER & CO.

RADIO COMBINATION MODEL NO.	RECORD CHANGER OR RECORDER MODEL NO.	MANUFACTURER	PAGES
7A41-3A		Webster 11 (M-11)	665-669
7A41-R-3A			
7A41-R-3B			
7A41-R-3C		RCA 9865A	463-467, 473, 474
7A41-S-3A		Seeburg J-3A, J-3B	584-588, 595-606, 614-618
7A41-S-3B			
7A41-S-3D		Seeburg J-3B, J-3A	584-588, 595-606, 614-618
7A41-S-3C		Seeburg J-3B	584-588, 595-606, 614-618
7A41-SC-3C			
7A41-SC-3D		Seeburg JR-3D	589-594, 608-613, 621, 622
8A30-3A		Webster 11 (M-11)	665-669
8A51-3A		Webster 23	683-690
8A51-O-3A			
8A51-O-3B		Oak RC-1	315-323
9A46-SP-3B		Seeburg J-3B	584-588, 595-606, 614-618
9A46-SCP-3B		Seeburg JR-3D	589-594, 608-613, 621, 622
9A46-S9-3B			
9A46-S-3A		Seeburg J-3B	584-588, 595-606, 614-618

**WESTERN AUTO SUPPLY CO.
(TRUETONE)**

D901		Gen. Ind. K	239-241
D906, D906C			
D1075		RCA RP-139B	468-471
D1076, D1077M			
D1077W		Seeburg J	584-588, 595-606, 614-618
D1171		Radio Prod. RC-50	541-545
D1172		Webster 23	683-690
D1175		Gen. Inst. 101	257-260
D1176		Webster 23	683-690
		Oak RC-1	315-323

WESTERN ROYAL

W671		Seeburg J	584-588, 595-606, 614-618
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WESTINGHOUSE ELECTRIC SUPPLY CO.

WR-473, WR-474			
WR-474L		RCA RP-139B	468-471
WR-476		RCA RP-139A	463-467
WR-482, WR-484		RCA RP-152C	430, 463, 465-467, 491-494
WR-486		RCA RP-155	430, 495-501
WR-42X2			
WR-42Z2		RCA RP-162	507-510, 515-517
WR-42X3			
WR-42X7			
WR-42X4			
WR-42X5			
WR-42X14			
WR-42X15		RCA RP-158	502-510

WILCOX-GAY CORP.

RADIO COMBINATION MODEL NO.	RECORD CHANGER OR RECORDER MODEL NO.	MANUFACTURER	PAGES
Recordio Pro		Service Requirements similar to 55-2015	
A-70, A-72		Similar to Gen. Ind. R-70	242-247
A-81, A-82		55-2015	Similar to Gen. Ind. R-70
A-89, A-91			
A-92		Service Requirements similar to 55-2015	Similar to Gen. Ind. R-70
A-93 and A-94			
Recordio		55-2020	Similar to Gen. Ind. RC-130
A-96 Transomatic		55-2018	Similar to Gen. Ind. C-120
A-98 Recordio		55-2032	Similar to Gen. Ind. RC-130

ZENITH RADIO CORP.

5R686			
6R684		169-70	New Prod. 320
		169-74	Oak 2400
6R687			
6R688		169-78	Oak 2400
6S305, 6S306			
6S307		169-31	RCA RP-139B
6S596		169-48	New Prod. 220
6S596J			
6S597J (Late)		169-55	Webster 23
6S597 (Early)		169-48	New Prod. 220
7S487, 7S488		169-36, 37	Webster 11
7S581, 7S582		169-42	Webster 21
7S585		169-36, 37	Webster 11
7S584		169-42	Webster 21
7S591		169-48	New Prod. 220
7S591J		169-55	Webster 23
7S598		169-48	New Prod. 220
7S598J		169-55	Webster 23
7S681, 7S682			
7S685		169-68	New Prod. 320
8S586		169-36, 37	Webster 11
8S587, 8S588		169-42	Webster 21
8S593		169-51	Gen. Ind. R70
8S594 (Early)		169-50	Gen. Ind. RC-130
8S594J (Late)		169-60	Seeburg JR (Early)
10S491			
10S492		169-36, 37	Webster 11
10S599		169-63	Webster 22
10S690		169-80	Seeburg B
10S589			
10S590		169-42	Webster 21
12S494		169-36, 37	Webster 11
12S595			
12S595Z		169-42	Webster 21
12H678			
12H679		169-83	Seeburg B
12H689		169-89	"
12H695			"
12H696		169-83	"
14H697		169-94	Seeburg BR
15S308		169-31	RCA RP-139B
15S495		169-36, 37	Webster 11
22H698		169-92	Webster 41
22H699			"
S-9000		169-53	New Prod. 220