



**LESSON
67 RA**

AUTOMATIC RECORD CHANGERS



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Radio phonograph combinations usually have automatic record changers which play 10" or 12" records in consecutive order as they are arranged by the operator. These automatic record changers have certain general characteristics in regard to their operation and maintenance requirements. We shall study these characteristics in this lesson, thereby enabling you to do a more complete and thorough job in the servicing of these phonograph combinations.

GENERAL SERVICE NOTES

Whenever you are called to service a phonograph combination which uses an automatic record changer that does not function properly, it is suggested that you check

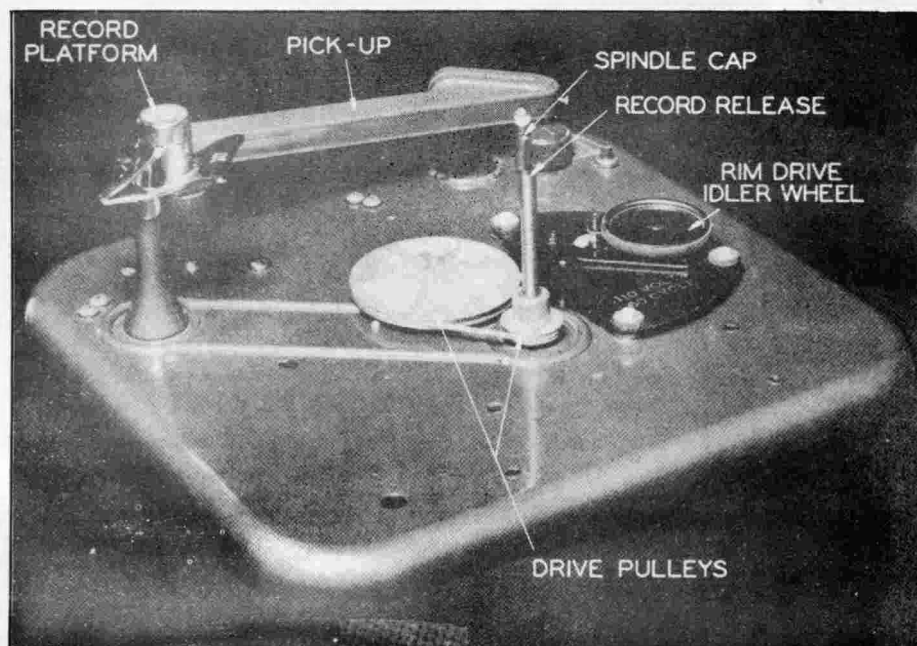


FIG. 1. Top view of the Motorola Models B-2-RC, B-3-RC, and B-4-RC Automatic Record Changers with the turntable removed.

the operation of the unit in order to observe its faulty characteristics. Confirm all the complaints made by the owner. You will be expected to not only correct these, but also others which are associated with these complaints. Make a complete visual inspection of the unit before removing it or making any adjustments.

If the unit will rotate, check the speed of rotation with the aid of a watch or clock that has a second hand. Place a small piece of white paper, about the size of a postage stamp, under and near the edge of a record. Place the pickup on the record

and count the revolutions made during a minute. The record should revolve at a speed of 78 revolutions per minute, however, this speed may vary from 77 to 79 R.P.M. Be sure this speed is checked at normal room temperature or at least at or near the operating temperature, as the oil or grease used may be hard enough to place an additional drag or load on the motor.

Try to determine whether or not the automatic record changer fails to operate due to a defective record or a record that does not have an eccentric groove at the finish. Then, too, you should observe any intermittent or irregular operation of the equipment. Also observe how the pickup comes down on the record at the start and how the pickup rises at the completion of a recording. Observe the condition of the record or records. The record must be in good mechanical condition and should not be chipped, particularly around the center hole.

You should also try not to play records automatically that are too thick, too thin, oversized, or undersized as in regards to their diameter or size of the center hole. Many of the automatic record changers will not play 10" or 12" records when they are mixed together. Records that were made before the days of automatic record changers may not change automatically due to the differences in the thickness or lack of a proper eccentric groove at the finish. These old records may be played individually; that is, one at a time.

After having observed a number of the apparent various difficulties with the automatic record changer, you should determine whether or not it will be necessary to remove it from the cabinet in order to correct the performance and adjust the unit. If adjustments are necessary; that is, there is no apparent broken parts and the unit has not been mishandled, then make the necessary adjustments. Oftentimes it is necessary to refer to factory service manuals for the proper adjustment and maintenance of a delicate mechanism. In some instances, it may be necessary to remove the automatic record changer from its cabinet and, when this is done, it should be supported in the horizontal plane, and at least twelve inches above the surface of the work bench. When supporting the instrument in this fashion, it is possible to get at all

the parts underneath the chassis of the unit. This permits the mechanism to operate in its normal position. Along with the regular servicing tools used by a serviceman, you will find that a mirror will be very helpful in making observations and adjustments without having to get into awkward positions.

50-60 CYCLE OPERATION

Whenever called to service an automatic record changer, always determine whether or not the unit has ever operated properly at this location. You may be called upon to service an automatic record changer which is not designed to operate from the power supplied in that particular locality. Call the local power company and find out the power line frequency for this area. In many parts of the country, there are areas using 50 and 60-cycle power. When an automatic record changer has been moved from one area to another, improper operation is observed due to this change. If this is the case, it may be necessary to replace the motor with one designed for the power frequency provided. Oftentimes the manufacturer of an automatic record changer can supply you with a drive wheel which may be attached to the shaft of the motor.

Since most of the motors used on automatic record changers are of the AC type, they will operate either from 50 to 60-cycle power. The motors are designed for 110 or 115-volt operation, however, improper operation of an automatic record changer is seldom due to too low or too high a line voltage. Most automatic record changer motors will operate properly over a considerable variation of the power line voltage; that is, generally plus or minus ten percent of the value stamped on the case of the motor. Over-heating of a motor may be due to the operation of a 60-cycle motor on a 50-cycle power line; that is, providing there is no excessive drag on the motor which is caused by a damaged part or bearing.

MOTOROLA AUTOMATIC RECORD CHANGERS

A number of important points in the servicing of automatic record changers have been discussed. Servicing information will be given on Models B-2-RC, B-3-RC, and B-4-RC made by the Galvin Manufacturing Corporation, located at 4545 Augusta Boulevard,

Chicago 51, Illinois. This organization manufacturers a fine line of automatic record changers and, when properly serviced and maintained, satisfactory operation and performance can be expected and obtained.

Models B-2-RC, B-3-RC, and B-4-RC are designed to handle 10" or 12" records; that is, either 10" or 12" records. They cannot be mixed, but, in either case, they must have the proper eccentric groove at the finish. As in most phonograph turntables, power is derived from an electric motor. This power is transmitted to the turntable through a geared down rim drive of the friction type. The turntable shaft is keyed to a small drive pulley, which, in turn, drives a large pulley about 3" in diameter through a spring belt, both of these units being located on top of the base plate. See Fig. 1. The 3" pulley transmits power by direct drive to another small pulley located under the top mounting plate. In turn, this second small pulley drives the large main drive wheel, which is about 4" in diameter and is located under the top mounting plate. When the turntable revolves, all of these pulleys and wheels revolve — regardless of whether or not the changer is going through a cycle of changing a record or playing a recording.

By means of this series of pulleys, a high speed reduction ratio is obtained between the motor and the changing mechanism, which assures ample power and smooth operation. After the needle of the pickup has entered the eccentric groove, a phosphor bronze spring clip grips a fin on the automatic change switch. The pickup then oscillates slightly to and from the center of the record. This, in turn, causes the automatic change switch to make momentary contact, which is all that is necessary in order to start the changing cycle. When the switch closes, a small electromagnet is energized. This electromagnet pulls an armature back out of the way to permit 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 as shown in Fig. 2. Since the main drive wheel is already revolving, the engagement of the pawl now causes the cam wheel to revolve with it. Then, 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 as shown in Fig. 3,

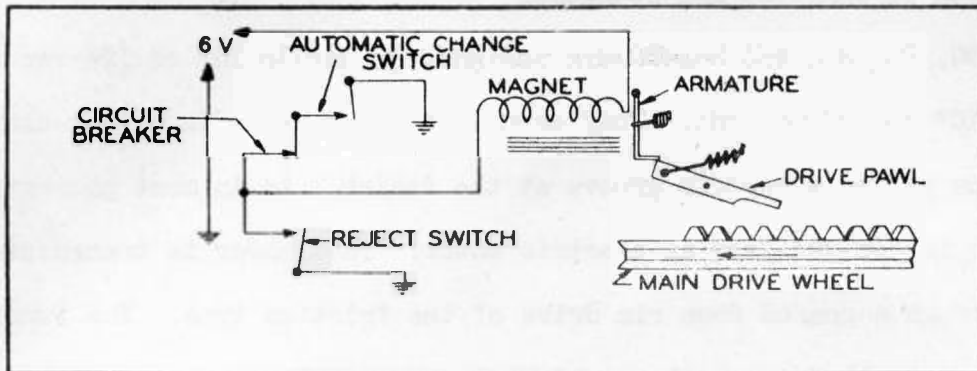


FIG. 2. The automatic change switch mechanism.

which automatically opens the magnet circuit, thereby de-energizing it in order to prevent "chattering"; that is, the opening and closing of the circuit breaker at a high rate.

During the next few degrees of rotation, the pickup elevating pin is caused to ride up on an inclined section of the cam as shown in Fig. 3, thereby elevating the pickup and lifting of the needle from the record

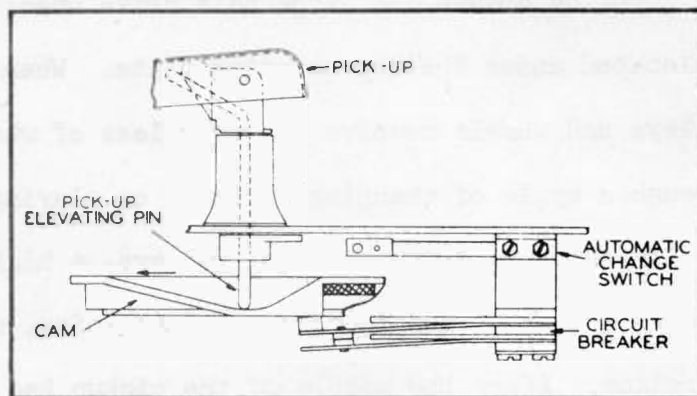


FIG. 3. This drawing shows the pickup elevating pin cam mechanism and the circuit breaker.

which has just been played. Then a few more degrees of revolution causes

the pickup guide groove on top of the cam wheel to swing the pickup out beyond the edge of the record so it will be out of the way when the next record falls on the turntable. This part of the mechanism is not visible since the cam wheel is mounted too close to the mounting plate, however, Fig. 4 shows a drawing of the upper surface of the cam wheel. As the cam wheel continues its rotation, there is another point on its circumference where 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 side of the trip-lever rolls up the incline on the cam, the other end of the trip-lever bears against the push rod that operates the record release, which is located near the top of the spindle, causing it to push the next record off its support, thereby dropping it on the turntable. This can be seen in Fig. 5. Then, as the cam continues to revolve, the groove in the top brings the pickup back over the edge of the record to the proper position where the needle will fall near the first groove as it comes down.

A few more degrees of revolution and the pickup elevating pin rides down another incline, permitting the needle to settle gently on the first groove of the record as illustrated in Fig. 3. 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.

During the last few degrees of rotation of the cam wheel, the circuit breaker switch is again closed as its fibre stud rides up an incline on the lower surface of the cam. This is illustrated in 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.

SETTING FOR 10" or 12" RECORDS

The record support platform is adjustable for either 10" or 12" records, depending upon which "lip" is turned towards the center of the turntable. The platform may be swung in an arc of 180 degrees so that either the 10" or 12" lip may point towards the spindle. Underneath the mounting plate, an eccentric mechanism is mounted rigidly to the record platform support shaft which moves the 10"-12" selector lever, which 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 point where the pickup comes down in order to play either 10" or 12" records automatically, 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 electromagnet exactly in the same fashion as does the automatic change switch, thereby making it possible to start the

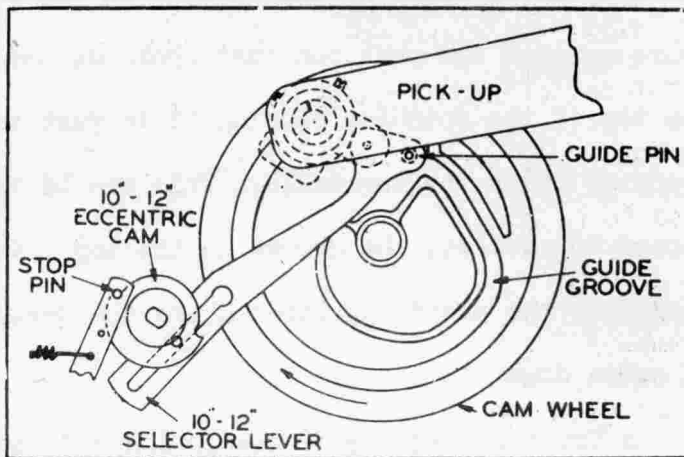


FIG. 4. The cam wheel mechanism is shown here.

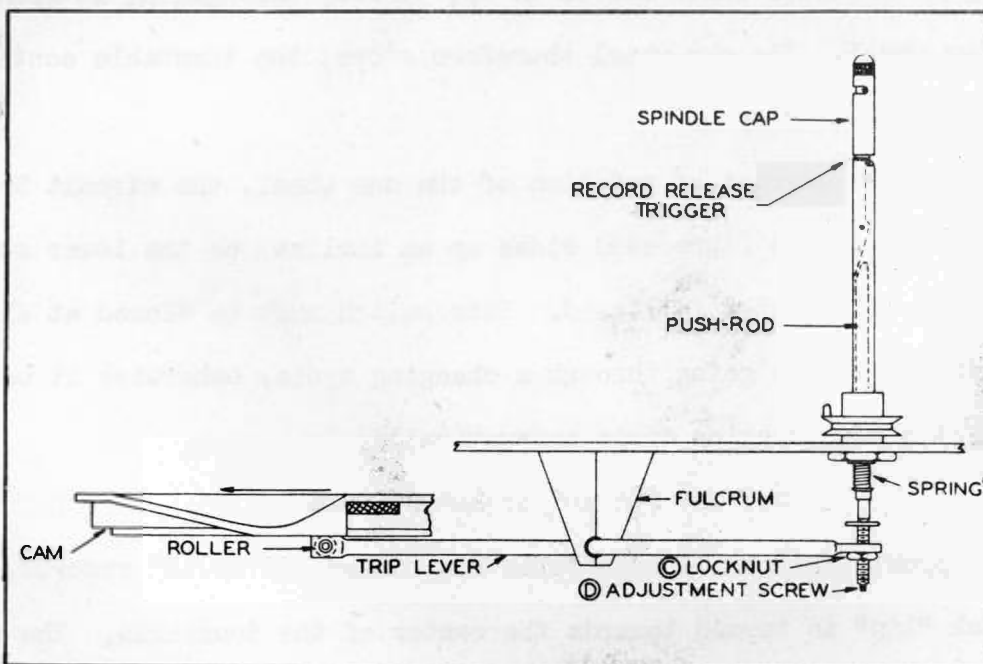


FIG. 5. The trip lever mechanism and the record release trigger.

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 electrical circuit showing the switches and the electromagnet can be seen in Fig. 2.

TO ADJUST RECORD RELEASE

Place a stack of 10" records on the changer. After turning the record support platform to the 10" position and starting the turntable revolving, press the "Start-Reject" button. If the first record does not drop to the turntable, 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. 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. Then, with an open end wrench, turn screw D a fraction of a turn clockwise and press the Start-Reject button again, checking to see if the record will now release. If the record fails to drop, tighten screw D a trifle at a time, testing after each adjustment until the setting is reached which releases the record. Tighten lock nut C, after which a few more records should be released to make sure the adjustment is correct. If the changer stops during the adjustment procedure, screw D may be too tight and it should be turned counter-clockwise a fraction of a turn.

PICKUP POSITION ADJUSTMENT

This adjustment is made to cause the needle of the pickup to drop in the first groove of the record as the changer completes a changing cycle. Turn the record support to the 10" position as shown in Fig. 1, place a standard 10" record on the turntable and start it revolving; then press the Start-Reject button. The changer should now start the changing cycle. Do not let the changer complete the cycle, but stop it at the point where the pickup starts to drop downward towards the outer rim of the record. If the cycle is stopped at the right point, the pickup 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 pickup. Loosen the two hex-head set screws in the bell crank casting B, which you see in Fig. 7. The pickup arm can now be moved back and forth when the set screws are loose. Move it to the point where the needle rests directly over the first groove in the record.

The correct dimension for proper adjustment is $4\text{-}25/32''$ from the needle point to the center of the spindle. To do this, tighten one set screw securely so that

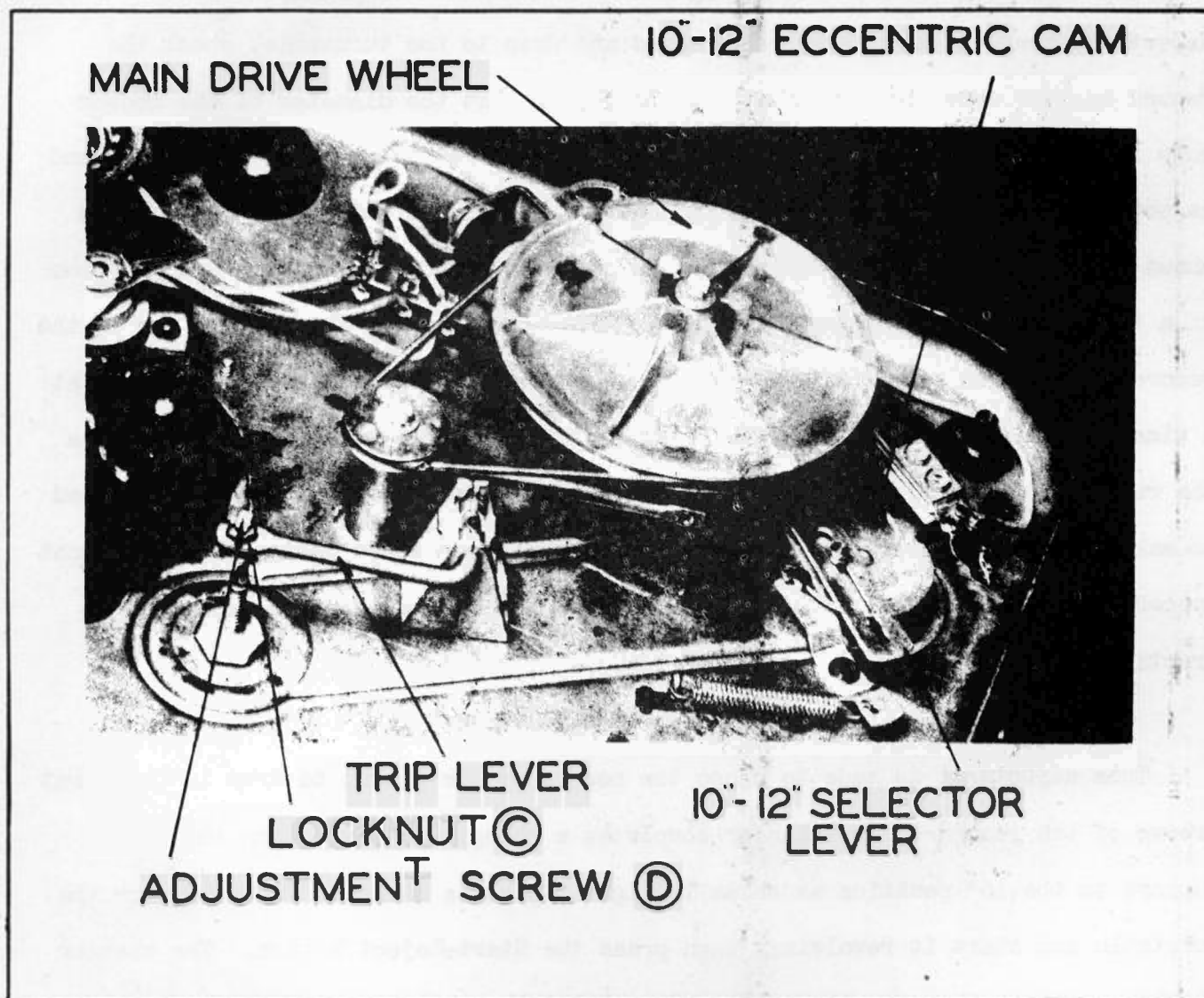


FIG. 6. This bottom view shows the trip lever and the adjustment screw.

the shaft does not move while checking the proper position of the pickup arm. After proper position has been located, tighten both screws securely. Then place a 12" record on the turntable and turn the record support to the 12" position. 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. It may be necessary to make a minor readjustment for proper operation.

TO LINE UP RECORD PLATFORM

It is important that all points on the "lip" of the record support platform be equi-distant from the center point of the spindle. This will assure all points of the record leaving the platform at the same time. If the record support is too far out of alignment, the record will actually hang on the point nearest the spindle and fail to drop properly. 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. Turn the record support platform to the 10" record position, making sure it is turned all the way to the stop. Slip a standard 10" record over the spindle and check to make sure it clears the lip of the platform at all points. See Fig. 9.

If one point on the lip extends farther than the other, the position of the record support may be adjusted after loosening the two Bristol set screws E, located directly under numeral 12 on the record support. See Fig. 9. Be sure the eccentric selector cam, which is located under the base, is turned all the way to its stop. See Fig. 4. A test should then be made after tightening the set screws. Test the adjustment by running a 10" 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.

The Motorola Automatic Record Changers, Models B-14-RC, B-15-RC, and B-16-RC, are rather unique and are typical of the type of equipment found in radio-phonograph combinations. Before attempting to service any of these models, check the records first to make sure they are not causing the trouble. The instrument will handle most of the 10" or 12" records now available on the market, but it is not guaranteed to handle all of them. Do not mix 10" and 12" 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 fin-

ish. Most of the old records, however, may be played one at a time. The top view

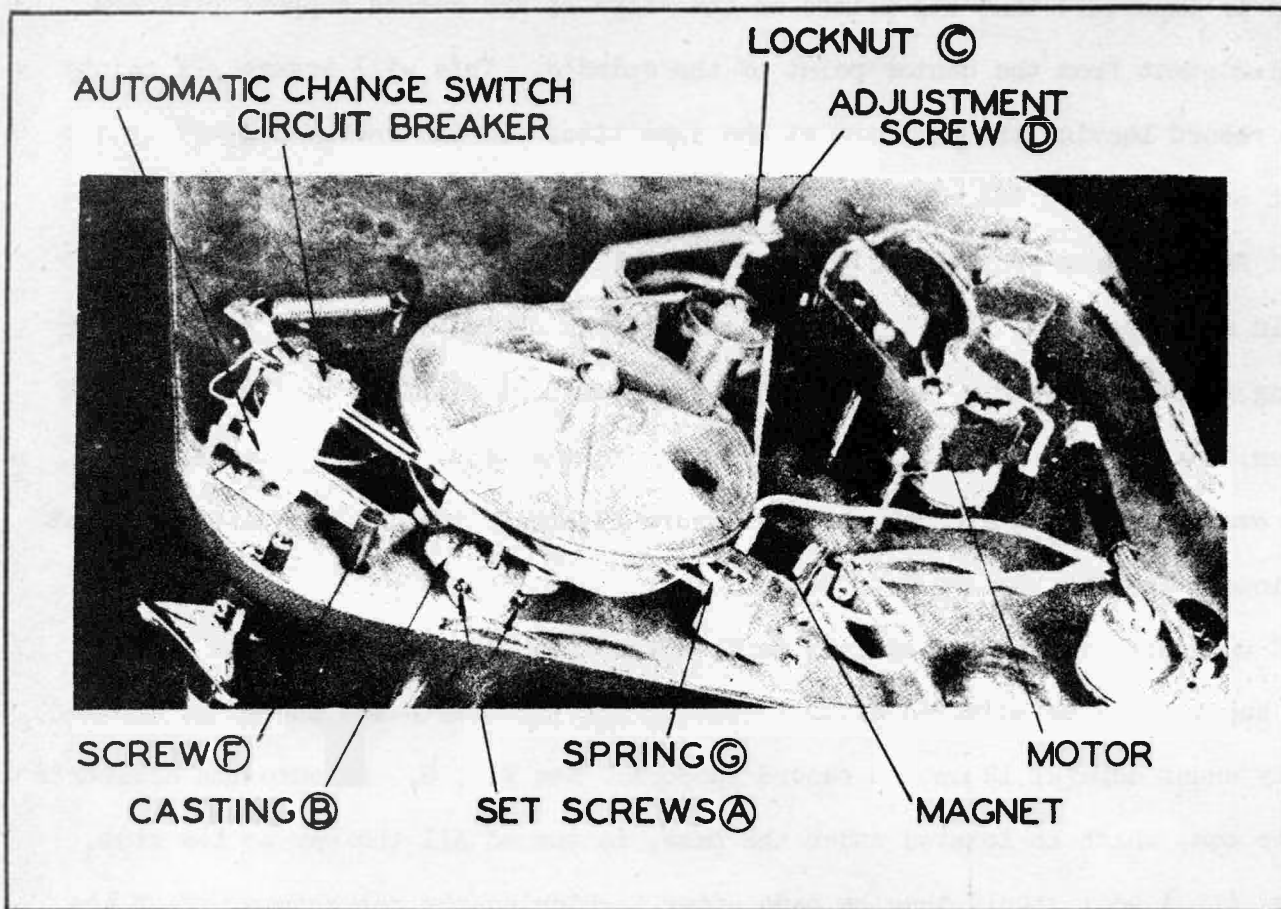


FIG. 7. This photograph shows the motor and the drive wheels.

of these automatic record changers is shown in Fig. 10. Note that the stop-start switch as well as the reject; that

is, the automatic and manual

switches, can be seen. As in

most phonograph turntables, power

is derived from an electric mo-

tor. This power is transmitted

to the turntable through a geared down rim drive of the friction type, as can be seen

in Fig. 11. The only mechanisms that operate during the playing of a record is the

motor and the turntable. The changing mechanism is entirely disengaged until the

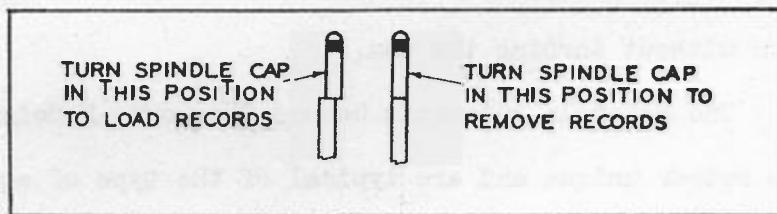


FIG. 8. The details on the spindle cap are shown here.

change cycle starts. There is no drag or excessive load on the motor during the playing of the records. The turntable is equipped with an oilite bearing and a ball thrust bearing, thereby reducing the possibility of "wows". That is, there is less tendency for a variation in speed as the turntable rotates.

CHANGING CYCLE

As the needle in the pickup finishes a record and enters the eccentric groove, the tension spring A pulls the drive arm assembly B forward as shown in Fig. 12, starting the change cycle. Once the cycle has started, roller D holds drive wheel C against the turntable by riding out of the detent notch E in the rim of the main cam wheel assembly as shown in Fig. 13. The next few degrees of rotation causes the pickup elevation pin G to ride up on an inclined section H of the main cam wheel, thereby elevating the pickup and lifting the needle from the record which has just been played, as shown in Fig. 14.

A few more degrees of revolution causes the pickup arm through guide groove I in the main cam wheel to swing out over the edge of the record to get out of the way of the next record. The turntable continues to drive the main cam wheel and, through guide groove J in the underneath section of the main cam wheel, guides the gear segment assembly K through its arc which, in turn, drives the brass pinion gear L which swings the record release cam M through a 180-degree arc, aligning it with the top cap N, thereby picking up the next record; and then back 180 degrees into alignment with spindle O, permitting the record to fall on the turntable as shown in Fig. 15.

As the main cam wheel continues to revolve, the pickup elevating pin G rides down another incline, permitting the needle to settle gently on the first groove of the record. When the main cam wheel approaches the full 360-degree point of its revolution, trigger rest extrusion P pushes against trigger reset stud Q, causing the trigger to be "cocked" ready for the next cycle. In the same motion, it pushes drive wheel C away from contact with the rim of the turntable. Since roller D falls

into detent E at this point, there is no contact between drive wheel C and the turntable; therefore, the cycle is ended.

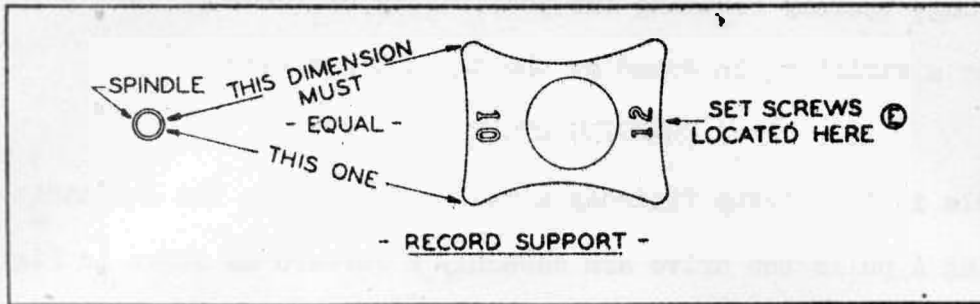


FIG. 9. Record support adjustment is important.

The setting for 10" or 12" records and the line-up record platform procedure for these models is the same as that used in setting up and aligning the Motorola Models B-2-RC, B-3-RC, and B-4-RC as covered on pages 3, 4, 5, and 6.

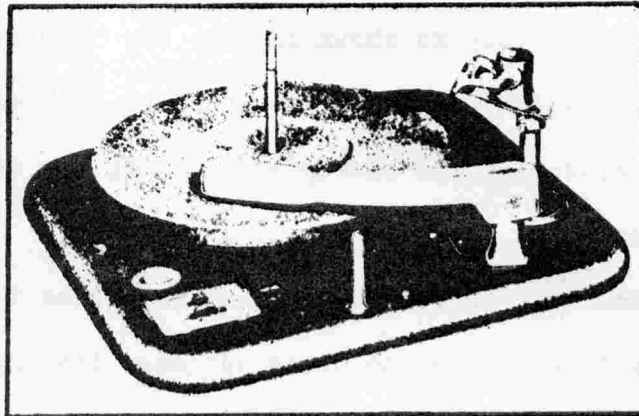


FIG. 10. Top view of the Motorola Models B-14-RC, B-15-RC, and B-16-RC Automatic Record Changers.

MANUAL START-REJECT SWITCH

This switch is mounted near one corner of the mount plate and has three positions as indicated on the medallion. The switch is mechanical and it is 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. This lever can also be pushed into the manual position at any time without damaging the mechanism.

TO ADJUST RECORD RELEASE

With the changer in normal playing position, the record release cam should line up perfectly with the spindle as shown in Fig. 15. If it does not, loosen the two slab head screws of the small brass pinion gear, as shown in Fig. 12 and turn the record release cam with the fingers so that it is in perfect alignment with the spindle. Tighten the two slab head screws securely. The tubes should be removed to get at the set screws in the wireless player models.

TO ADJUST PICKUP 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. This is done in the following manner.

- A. Turn the record support to the 10" position.
- B. Place a standard 10" record on the turntable and start it revolving.
- C. Allow the pickup to come down on the record and stop the machine.
- D. Using a 3/16" offset box wrench or socket wrench, loosen the two hex head set screws T in the bell crank casting as shown in Fig. 13.
- E. Start the turntable and allow the mechanism to start the change cycle. Stop the machine at the point where the arm is just going to drop on the record.
- F. Revolve the turntable by hand until the tone arm falls on the record or drops to its free position.
- G. With the set screws loose, the pickup 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. The correct dimension for proper adjustment is 4-25/32" from the needle point to the center of the spindle.
- H. Tighten one set screw securely so that the shaft does not move while checking the proper position of the pickup arm. After proper position has been located, tighten both set screws securely.
- I. Now place a 12" record on the turntable and turn the record support to the 12" position.
- J. 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 readjustments to obtain the proper results.

SPECIAL SERVICE NOTES

The following special service notes apply not only in general to these Motorola Automatic Record Changers, but also to many other types.

1. MECHANISM IS SLOW IN STARTING, OR MOTOR HEATS

This may be caused by:

- (a) Improper lubrication.
- (b) Abnormally high or low line voltage. Check voltage.
- (c) Damaged motor. If found damaged, remove motor and return it to factory for repair or replacement.

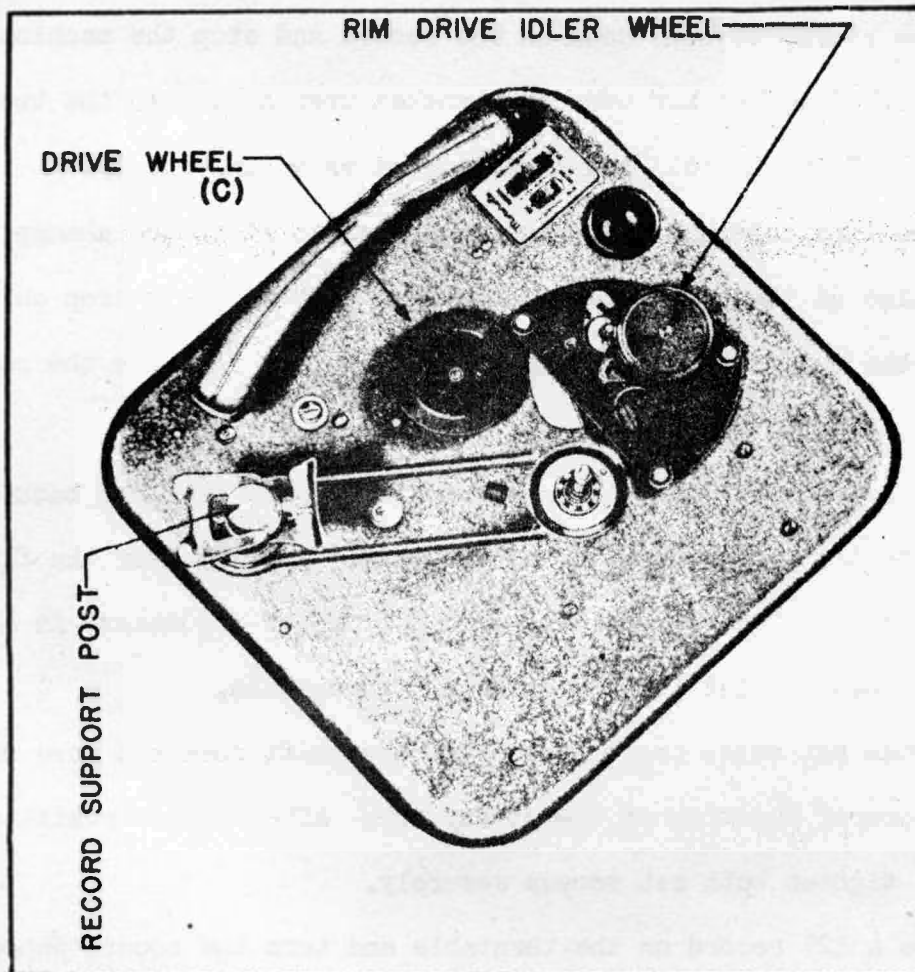


FIG. 11. Top view of Models B-14-RC, B-15-RC, and B-16-RC unit without the turntable.

2. MOTOR FAILS TO RUN

- (a) This indicates trouble in motor windings. Unless the damage is easily seen, replace motor.

3. MOTOR SLOW IN STARTING

- (a) Check oiling. 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 have reached room temperature. Give it a fair chance to get warmed up before concluding that the motor is defective.
4. SQUEAKS OR OTHER NOISES HEARD DURING THE PLAYING OF RECORDS
- (a) Check oiling. If squeaks are heard, they will usually be found to come from the records -- not from the mechanism.
- (b) Compare the squeak with and without a load of records. If squeak disappears when records are removed, this can be corrected by rubbing a little wax on the turntable spindle.
5. CHANGER IS NOISY WHEN IN CYCLE
- (a) Check lubrication. See if any part has become loose or bent and is rubbing against a moving part.
6. "WOW" IN RECORD REPRODUCTION
- (a) Record is warped or otherwise defective, or the instrument is not being operated at normal room temperature about plus 72 degrees Fahrenheit.
- (b) May be caused by oil or idler wheels, or inside rim of turntable.
7. CHANGER CONTINUES TO CYCLE
- (a) Burrs on the trigger release. This trigger is case-hardened. Use a hone to remove burrs. Make sure the trigger is flat and that the notch is at an absolute 90° angle.
- (b) Bell crank is not flat along the edge that the trigger holds. File carefully.
- (c) Tension spring A is too tight. Loosen nut T to release tension.
- (d) Eccentric screw not properly adjusted - not allowing drive wheel C to be released from the turntable.

WIRELESS PHONOGRAPH OSCILLATORS

Wireless phonograph oscillators are used in conjunction with some automatic record changers. These units consist of one or two tubes. One tube serving as the

rectifier, while the other serves as an oscillator and modulator combination. The

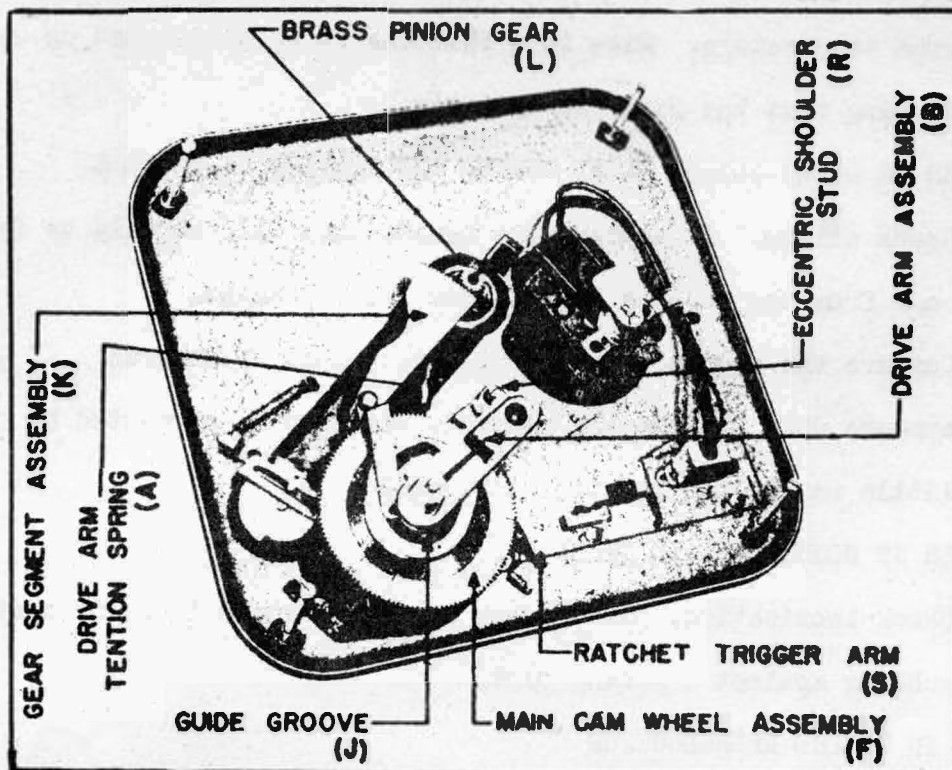


FIG. 12. Bottom view of Models B-14-RC, B-15-RC, and B-16-RC unit without the turntable.

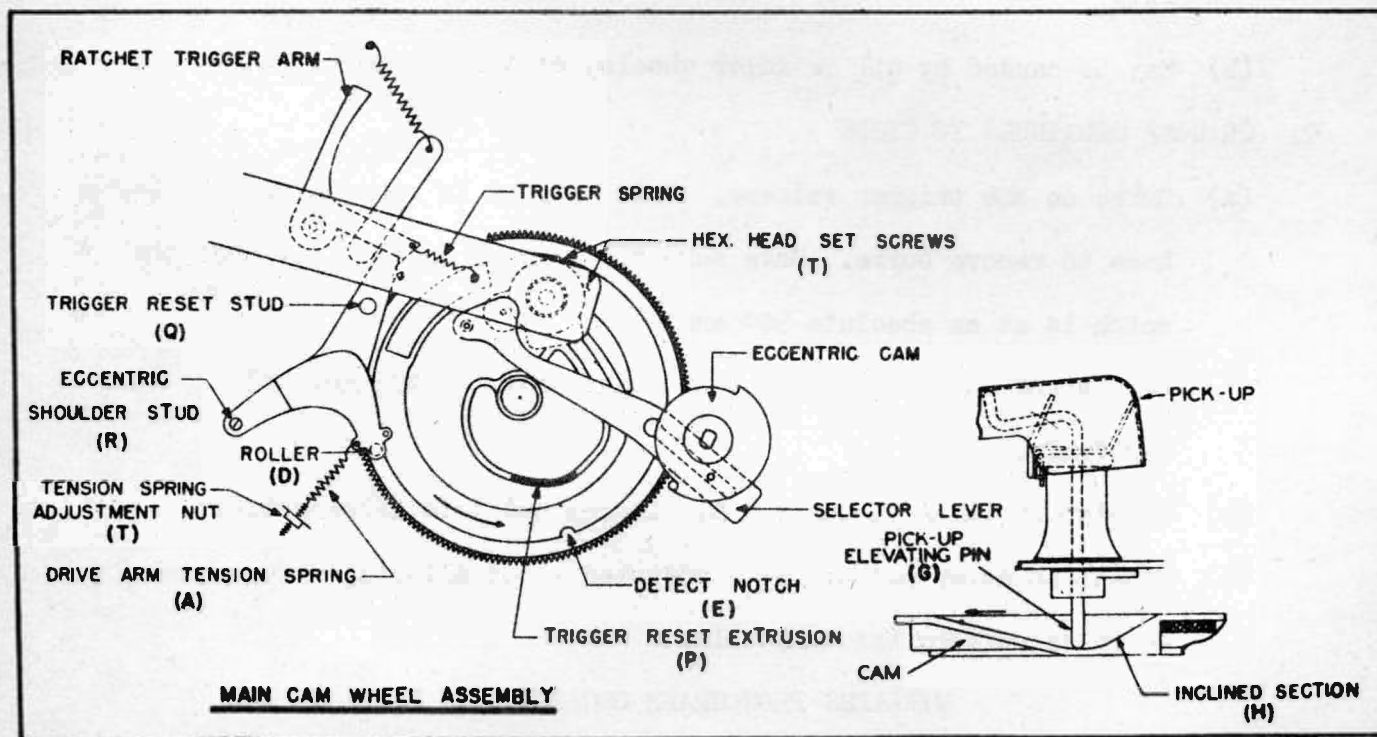


FIG. 13. The main cam wheel assembly used in Models B-14-RC, B-15-RC, and B-16-RC is shown here.

oscillator is able to develop sufficient R.F. power to enable satisfactory reception

and reproduction of the recording within a few feet of the unit. The frequency range of most wireless phonograph oscillators is between 1,200 and 1,700 kilocycles. A schematic diagram of the Motorola Model 22B is shown in Fig. 16. This unit is designed for 60-cycle operation. Power is supplied to the power transformer primary winding, through the line cord and plug, and the "on-off" switch. Note that the power cord leads are hexagonal (hex.) and round so they may be identified when replacing the power cord plug. The .05 mmfd. capacitors 5 and 6 are used to place the power line at a R.F. ground potential, thereby preventing the radiation of the R.F. output of the oscillator from going out over the power line. Note also that the phonograph motor 15 is connected directly across the power line.

Power transformer 2 has two secondary windings. One supplies voltage to the heaters of the two tubes, 6SK7GT and 6J5GT. The other winding supplies the high AC voltage required for the half wave rectifier type 6J5GT tube. The grid and plate elements of the type 6J5GT tube are connected together and serve as the anode of the rectifier. The AC voltage is applied to the elements 3 and 5. On the positive peak of the AC voltage, electrons flow from cathode 8 to the elements 3 and 5. This will cause a potential to exist across the 10 mmfd. filter capacitor with the red lead. Current will then flow through resistor 12, having a resistance of 4,700 ohms. This resistance serves as the filter in combination with the capacitor having a capacity of 10 mmfd. with the yellow lead.

The voltage present across the filter capacitor is applied to screen grid element 6 and plate 8 through the plate winding of oscillator coil 1. The plate of the oscillator tube is coupled with capacitor 8 having a capacity of 25 mmfd. to grid element 4 for additional feedback. Resistors 11, having a resistance of 47,000 ohms, serve as the grid resistors; that is, the resistor that completes the grid to cathode circuit.

Capacitor 7, having a capacity of 100 mmfd., serves as the grid coupling capacitor. The cathode elements 5 of the type 6SK7GT tube is connected to the 10,000-

ohm rheostat shown as bias control 13. The 10 mmfd. capacitor, which is connected to element 5 of the type 6SK7GT tube having the green leads, keeps the cathode of

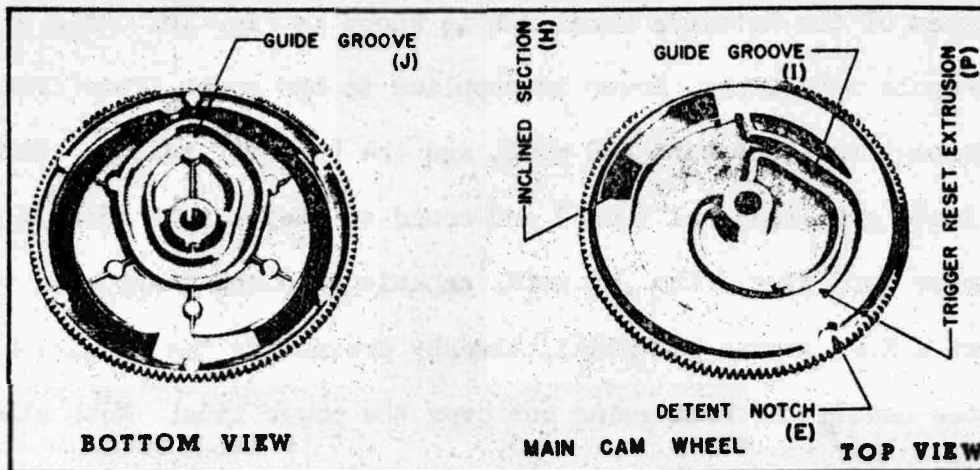


FIG. 14. Bottom and top views of the main cam wheel for Models B-14-RC, B-15-RC, and B-16-RC series.

this tube at the ground potential insofar as R.F. and A.F. currents are concerned. The DC voltage between the cathode and ground or chassis is used for the purpose of regulating the negative voltage on the suppressor grid of the type 6SK7GT tube. This

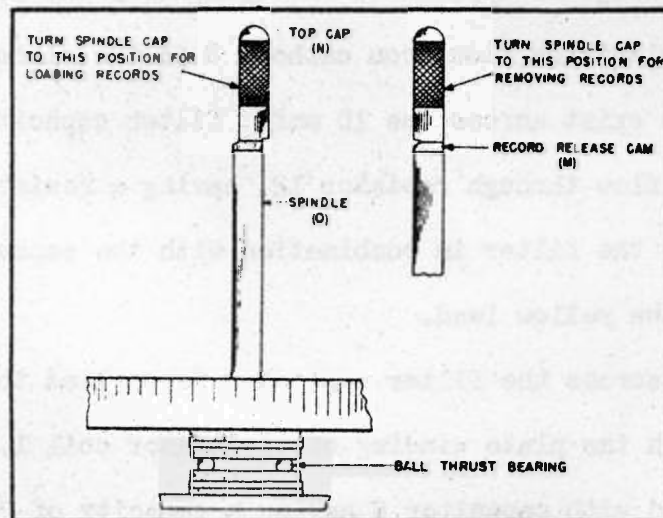


FIG. 15. Spindle cap details for Models B-14-RC, B-15-RC, and B-16-RC series.

control, therefore, places a negative bias voltage on the suppressor grid and affects the degree of amplitude modulation.

The crystal pickup 14 has a black ground lead and a brown lead which is connected to suppressor grid 3 of the type 6SK7GT tube. The 470,000-ohm resistor 10

is connected to the brown lead of the pickup and the chassis serves as a load on the pickup, as well as providing a complete path between suppressor grid 3 and the chassis or ground circuit.

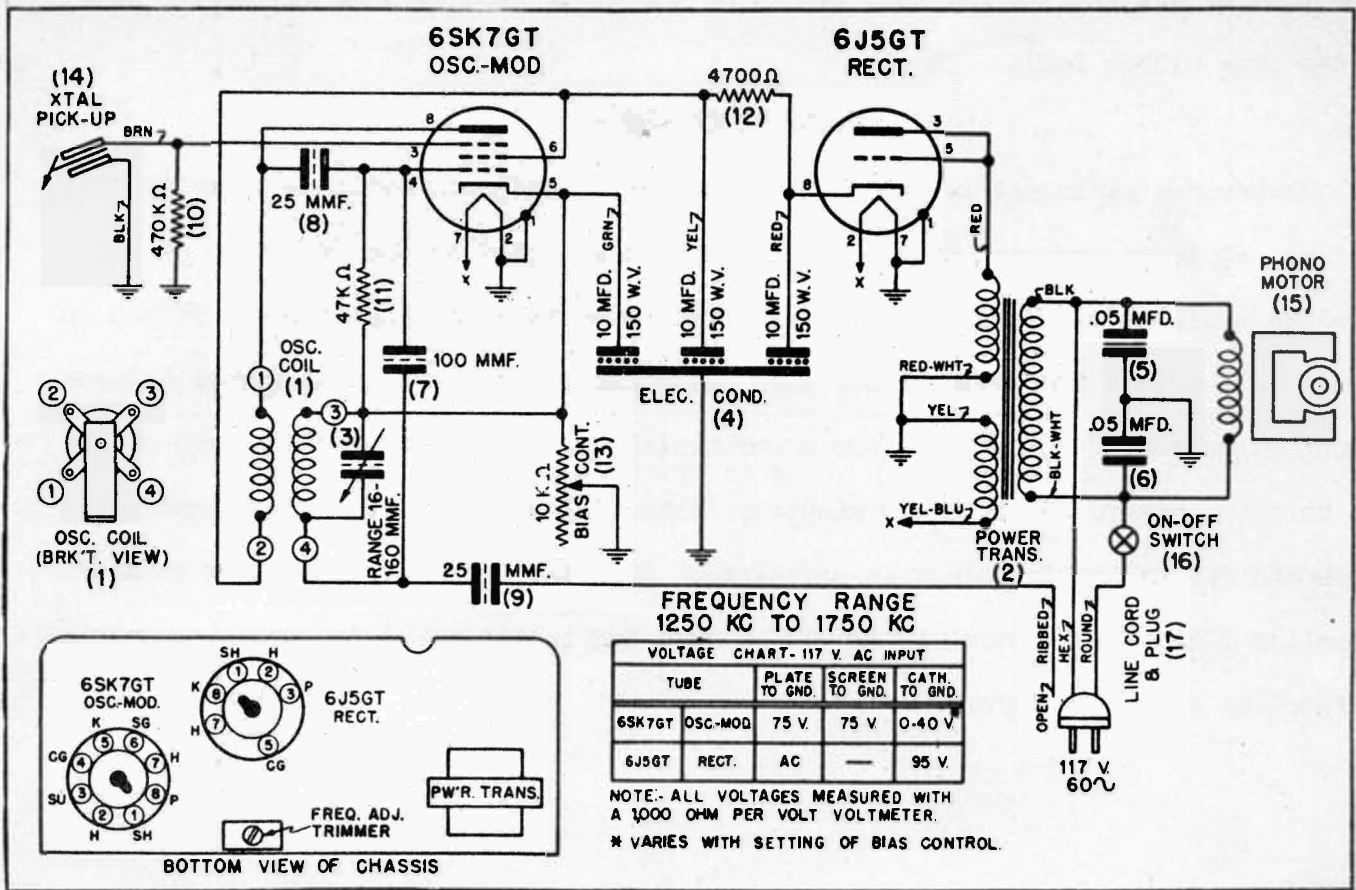


FIG. 16. Schematic diagram and service data on the Motorola Model 22B Wireless Phonograph Oscillator.

The service data given, along with the schematic diagrams, indicates the numbers assigned to the lugs on oscillator coil 1. Note also that the bottom view of the chassis is given in the lower left hand corner of the drawing. Note that the socket connections for the two tubes are indicated. The voltage chart shows the plate, screen, and cathode-to-chassis voltages for an AC line voltage of 117 volts.

There are only two adjustments to be made in the proper operation of the wireless phonograph oscillator. The bias control, which is adjusted for the greatest percentage of modulation and the best degree of fidelity of reproduction, and the frequency adjusting trimmer 3, which is adjusted for the purpose of placing the os-

cillator on a frequency which is free from interference. Capacitor 3 has a range between 16 and 160 mmfd. and is connected across the grid circuit winding of oscillator coil 1. Capacitor 9, having a capacity of 25 mmfd., is connected to a wire running parallel to the full length of the power line cord to the unit. This is the open ribbed lead.

SETUP PROCEDURE

Whenever a radio set is used with a wireless phonograph oscillator having push buttons, it is recommended that a push-button be assigned to the frequency of the wireless oscillator. Then, with the wireless phonograph oscillator power switch 16 turned off, adjust the settings for this push-button for the weakest signal between strong signals from stations. Turn power switch 16 to the "on" position and allow the unit to operate for about 15 minutes. This will enable it to warm up and stabilize insofar as its frequency is concerned. Then the frequency adjusting trimmer capacitor 3 and bias control 13 should be adjusted individually for the best degree of fidelity of reproduction.