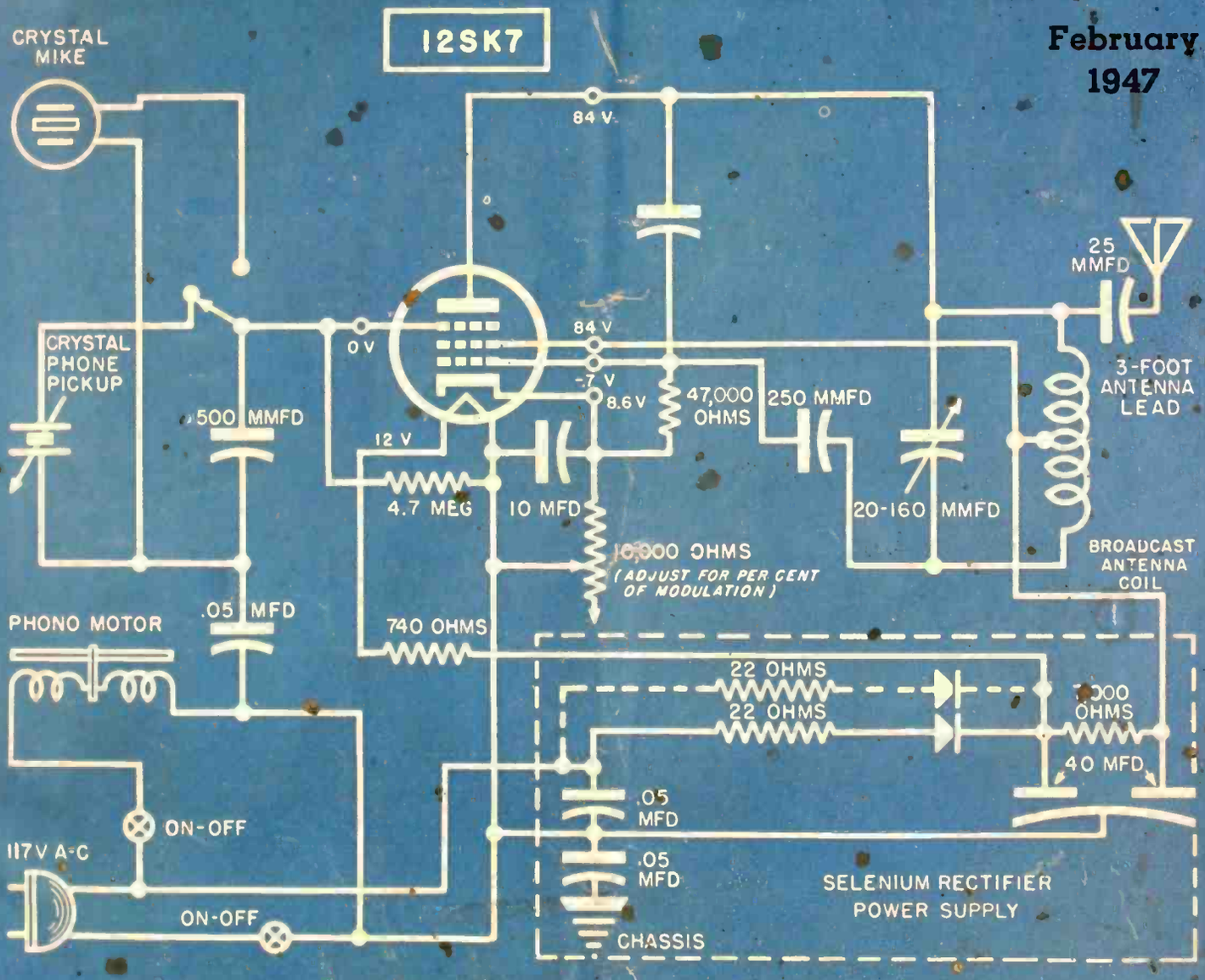
RADIO • TELEVISION • ELECTRONIC

SERVICE

February 1947



Phase oscillator using 12SK7 oscillator modulator powered by a selenium-rectifier system.

[See page 9]

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EDITORIAL

A COMMENDABLE PRACTICE to standardize many of the complex factors in the new type home and mobile receivers that feature automatic phono units, f-m and television has been adopted by quite a few manufacturers. Developed by the RMA Engineering Department, the standards provide for control of the dimensional characteristics of phonograph records to assure workability of record players and automatic record changers; drive-pulley simplification to reduce the number of drive pulleys used in connection with variable capacitors and other r-f tuning devices (this standard will simplify the drive-pulley stocks of Service Shops); and standard methods of measuring automobile receiver pickup so that a yardstick for checking receiver operation will be available. Other standards developed include a 10.7-mc i-f for v-h-f broadcast receivers, an i-f sound channel of between 21.25 and 21.9 mc for television receivers and the 300 ohm antenna-to-set transmission line for television receivers. Future sets will also feature use of a color-coded chassis wiring system so that it will be quite simple to trace wiring

A move was also made recently to standardize schematics and servicing data. The plan provides for standardization of band-switch layouts, tube envelope drawings, voltage data, methods of marking resistance values, etc.

We hope that the standards will be adopted by all manufacturers and very soon. Everyone will profit—manufacturer, Service Man and consumer.

The manufacturer will find his servicing department problems minimized.

The Service Man will find that he is able to locate problems more quickly, correct difficulties more accurately, return sets more promptly, service more receivers and increase his income.

The consumer receiving a better service will be quite grateful and be of immeasurable sales help to the Service Man.

HIGH-VOLTAGE POWER SUPPLY design has been altered considerably to supply the unusually high voltages required in television receivers. Up to 30,000 volts are now available from power supplies that are unusually compact and simple to operate. The trick is turned by using an oscillating tube circuit operating between 30 and 500 kc; a tuned tank circuit supplies the oscillating frequency. With these types of supplies, the high current danger is minimized because the supply cannot deliver a dangerous amount of current before the voltage drops to a very low level.

The procedure has proved so effective that it will probably be included in many types of equipment requiring high voltages. Watch for a series of articles on the subject in SERVICE.

RADIO · TELEVISION · ELECTRONIC
SERVICE
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LEWIS WINNER
Editorial Director

ALFRED A. GHIRARDI
Advisory Editor

F. WALEN
Managing Editor

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F. Walen, Secretary
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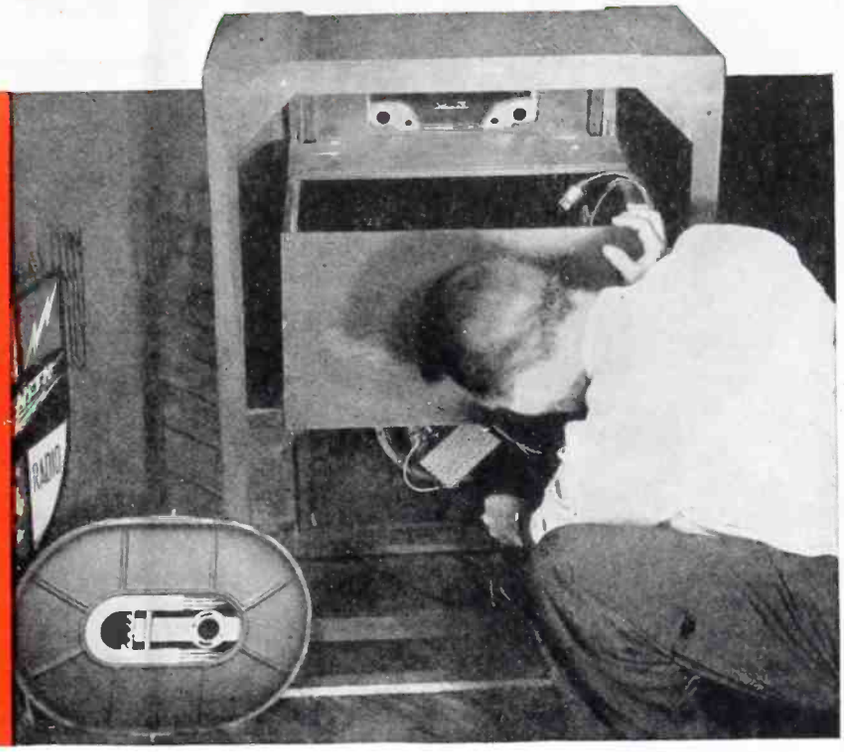

Do you lose valuable time discovering how to take out chassis, speakers and record changers from some of the new combinations? Are you familiar in all cases with *the proper sequence of removal?* Whenever the procedure is complicated, PHOTOFACT FOLDERS give you complete disassembly instructions—enable you to do an efficient job without damaging panels, dials, grilles or any other parts of the set. Better still, you're sure of getting them back together again in the quickest possible time.

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Set No. 13 . . . February 10
Set No. 14 . . . February 25

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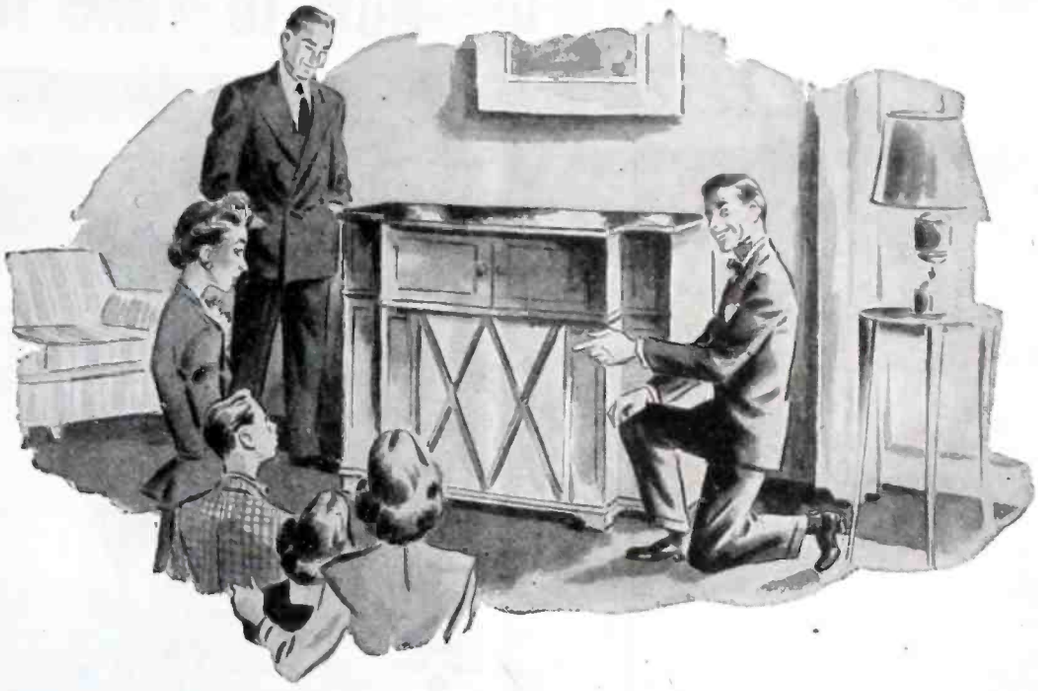

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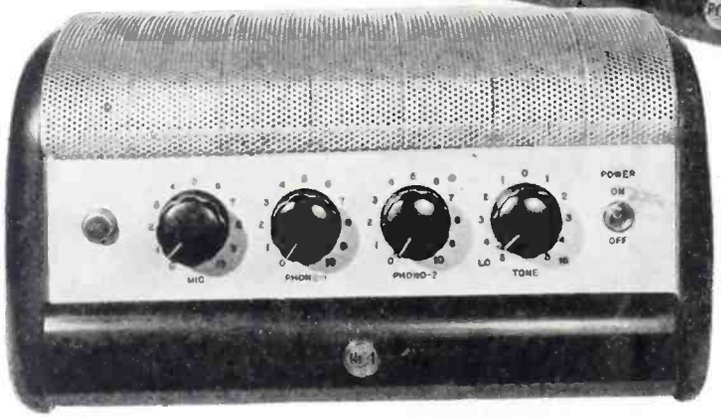

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Model MI-12295	77 db
Model MI-12296	100 db
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Low impedance microphone	250 ohms
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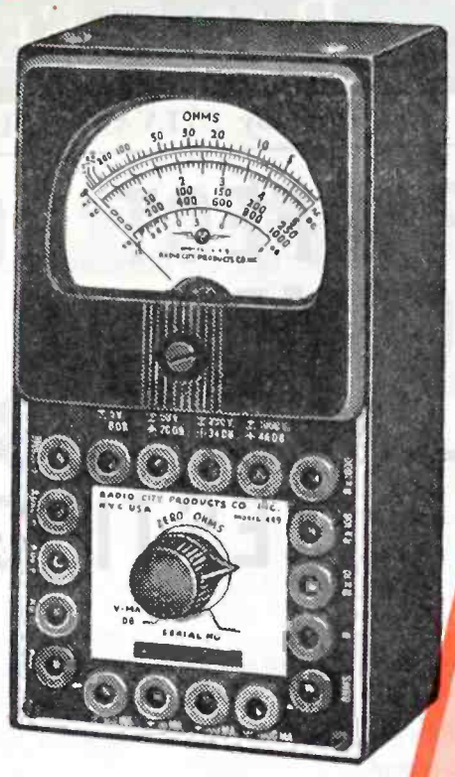

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D-C MILLIAMMETER: 0/.5/10/100/1000 ma. First scale division—.01 ma.

OHMMETER: 0/2000/20,000 ohms; 0/0.2/2 megohms.

DECIBEL METER: —6 to +10, +14 to +26, +28 to +40, +40 to +52. The db-scale calibration is based on a line impedance of 500 ohms, 6 milliwatts reference level. For other impedances correction charts are supplied.

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SYLVANIA NEWS
RADIO SERVICE EDITION

FEB. *Prepared by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1947

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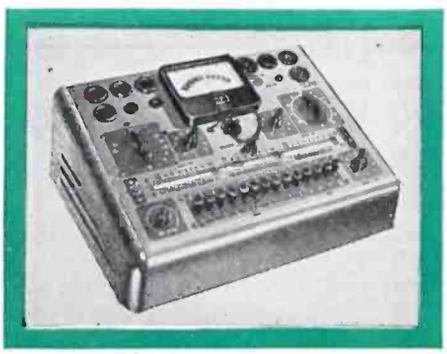
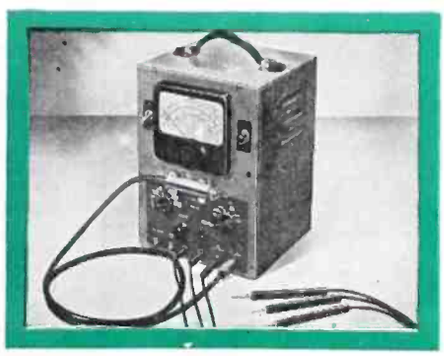
Instrument is compactly built, attractively styled, includes all essential accessories.

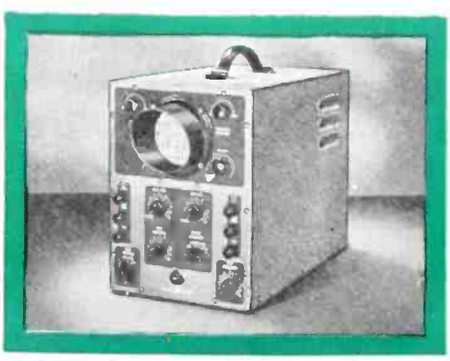
OSCILLOSCOPE, TYPE 131

This instrument is especially useful in rapid receiver alignment and trouble-shooting. Controls are easily accessible. Hood shades face of 3-inch cathode ray tube permitting use of instrument in well-lighted room. The cathode ray tube is shock-mounted and shielded against stray fields.

Cabinet is steel construction, ventilated with louvers, and finished in attractive pearl-gray baked enamel. Easily carried; weighs only 18 pounds. Eight-foot power cord provided for quick installation.







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PHONO OSCILLATORS

Using Miniature Selenium Rectifiers

(See Front Cover)

THE ADVENT OF THE miniature selenium rectifier permitting unusually compact construction has prompted the development of many effective portable units. An interesting example of this design appears in the circuit shown on the cover this month.

A phono oscillator or a wireless phonograph, the unit is actually a low-power broadcast transmitter using a 12SK7 oscillator-modulator stage powered by a selenium-rectifier source, which can be modulated by either a phonograph or a crystal microphone. Set at any desired frequency, it can then be picked up by any conventional receiver within a radius of 200', thus providing a low-cost phono service with a good percentage of modulation and low distortion output.

Circuit Features

Hum modulation, a common source of trouble, is reduced to a minimum by using d-c for the filament voltage. The source of this d-c potential is the high-voltage feed of the power supply, which is dropped to 12 volts through a 740-ohm resistor.

This means that the power supply must be capable of delivering a comparatively high current and consequently a 200-ma selenium rectifier is used. Where the 200-ma type is not available, two of the more common 100-ma types in parallel can be used with an additional resistor as indicated by the dotted line in the diagram.

The output of the power supply, after the filter, is 84 volts. However, this output is based on the fact that the filter capacitors are exactly 40 mfd. If they are not, the output may vary. This is corrected by varying the 22-ohm resistor until the proper value is obtained, or replacing the filter capacitors.

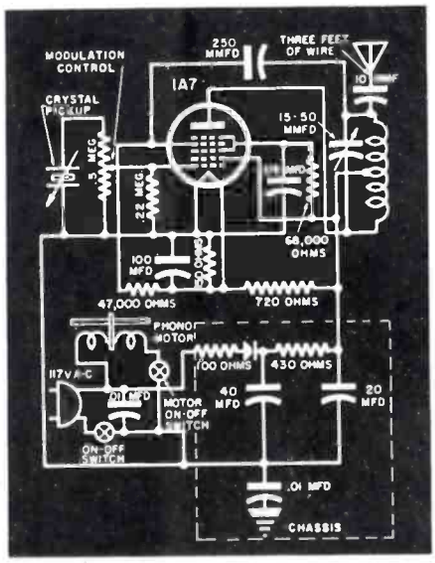


Fig. 1. An instantaneous-starting 1A7 phono oscillator using a selenium rectifier. Frequency of output is ordinarily adjusted to 1000-1700 kc range.

The 10,000-ohm control is for modulation and is normally set at 30% modulation. This can be done by applying the output of the oscillator to an oscilliscope and varying the resistor until the desired percentage of modulation is obtained. If a scope is not available 30% modulation can be obtained by the following empirical method. The control is set to zero (completely counter-clockwise). A receiver is then tuned to the frequency of the oscillator and the control is increased until a click is heard in the receiver. This point should be at approximately 30% modulation.

The 500-mmfd unit is a tone capacitor and can be adjusted for the most desirable tone quality. The value of this capacitor may vary for different phonograph pickups and should be carefully matched whenever a replacement of the pickup is made. The broadcast antenna coil and 20 to 160-mmfd capacitor determine the oscillator frequency. The coil can be any standard broadcast coil that is center-tapped. The values of the variable capacitor will depend mainly upon the coil and how much of the broadcast band is covered.

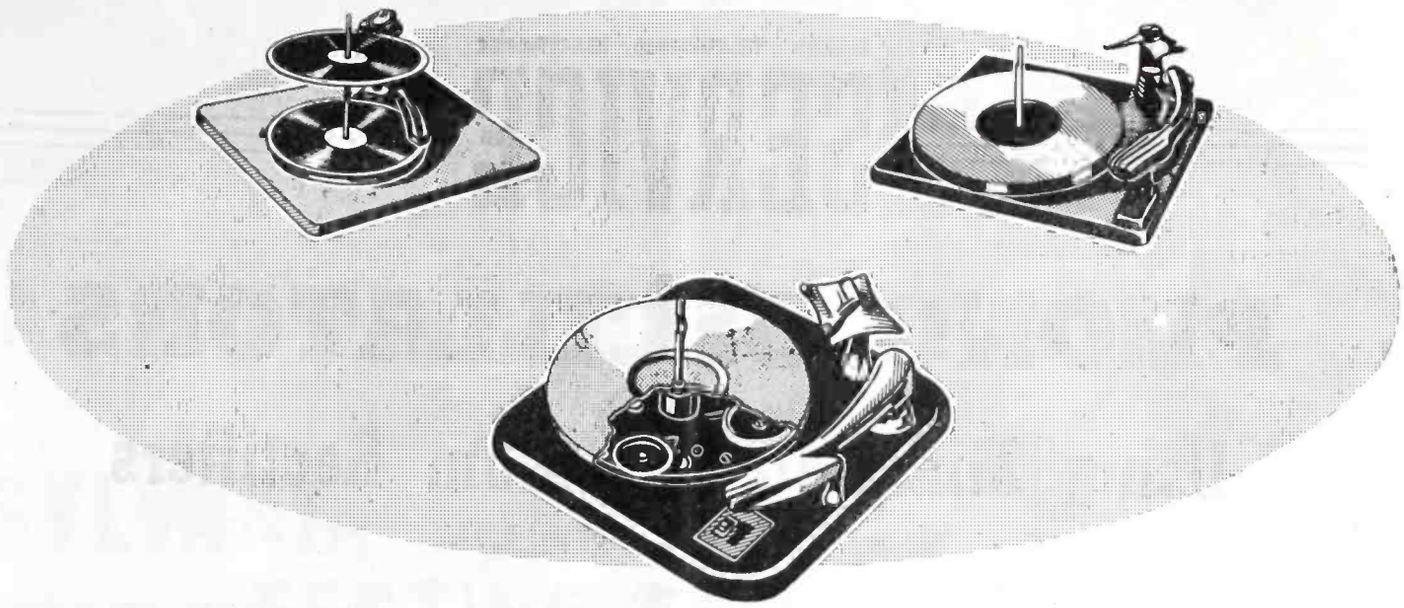
1A7-Type Phono Unit

For instantaneous starting a 1A7 phonograph oscillator, Fig. 1, can be used. This circuit takes advantage of the fact that the selenium rectifier rectifies immediately. Since the 1A7 has direct filament heating, the set will operate as soon as it is turned on. However, the 12SK7 is a sturdier tube and will take rougher handling and give better stability.

A crystal microphone can be inserted in either circuit by means of a double-pole switch. The microphone should be a high-gain type (output of over 2.5 volts at 40 cycles for normal speech input). If a low-gain microphone is used a preamplifier stage is necessary consisting of a 12SQ7 for the circuit shown on the cover and a 1H5 for the one in Fig. 1.

Credits

This information has been supplied through the courtesy of George Eannarino, sales engineer, Federal Telephone and Radio Corporation, Newark, New Jersey.



AUTOMATIC RECORD CHANGERS

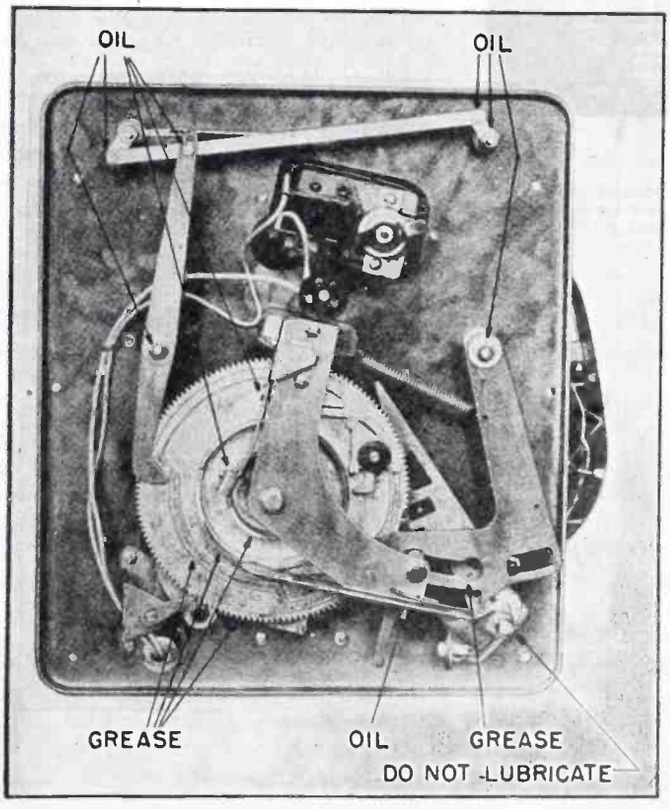
Farnsworth P-51 Automatic Record Changer

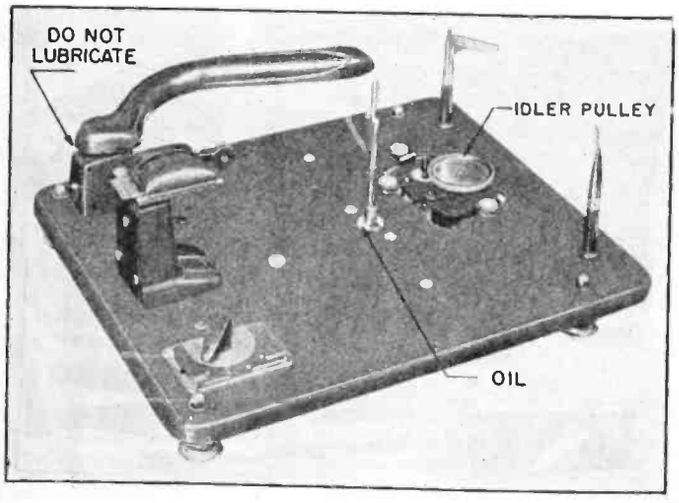
THE P-51 RECORD CHANGER is designed for twelve 10″ or ten 12″, but not mixed. Record shelf on this model should not be turned until the changer has stopped automatically and after all the records are dropped or removed from the record shelves.

Two makes of motors are used, Alliance and General Industries. The complete motors are interchangeable, but it is necessary to identify the make of motor when ordering an idler pulley. Either make may readily be distinguished by noting the location of the fan on the motor and the location of the hairpin cotter holding the idler pulley.

P-51 Service Suggestions

To remove turntable: The spindle gear may be wedged by a wooden block or a wrapped screwdriver between between it and the main cam, to prevent it from turning while the turntable is being unscrewed from the spindle (by rotating counter-clockwise). When replacing turntable, the *C* washer should remain fully inserted in the turntable shaft and the turntable should not bind on the idler pulley. The turntable may then be properly tightened. The record latch must be entirely in the recess in the spindle to permit the





Figs. 2 (below) and 3 (left). Fig. 2 shows oiling and lubrication points at top of Farnsworth changer, while Fig. 3 shows oiling and lubrication points for bottom of changer.

Servicing Notes on the Farnsworth P 51, RCA RP-176 and Bendix G-205 Automatic Record Changers

by GEORGE L. PETERS

turntable to be replaced. Gas pliers should never be used to hold the spindle.

To remove idler pulley: After the turntable has been removed, the idler pulley can be removed by slipping off the small hairpin cotter on the end of the idler pulley shaft.

When replacing the pulley a single drop of oil should be used on the pulley shaft. Oil should not be allowed to get on either the idler pulley or the turntable rim.

Friction trip assembly: The trip finger spacer is set on the tone arm support tube with an allowance of eight thousandths of an inch clearance between the cork washer and the baseplate. No attempt should be made to adjust the friction trip by changing this clearance. The friction trip is adjusted by raising or lowering the tone arm crank on the tone arm support tube, after loosening the tone arm crank setscrew.

Tone arm drop and needle landing: The needle should drop on the record at a position equi-distance from the outer edge and the first playing groove of a standard record. You should make sure that the changer is in playing position; that is, the tone arm has moved over so the needle is on the record. To make adjustment for 10" records the tone-arm crank setscrew should be loosened and the tone-arm crank moved clockwise to move the needle out. When making this adjustment, the friction-trip adjustment should not be disturbed. After the 10" setting has been properly made and the setscrew tightened, the 12" landing will usually be correct. If not it will be necessary to slightly bend the tone arm return lever near the point where it touches the 12" interceptor shaft. In both adjustments the record shelf must be in the corresponding 10" or 12" position.

Record latch chatter: Any chatter developing in the record latch may be corrected by applying a drop of light oil between the moving part of the turntable drive shaft and the stationary spindle.

When repairs are being made a careful check should be made of all moving parts to make sure that no binding occurs. All moving parts should be checked for binding before springs are connected.

All levers which operate on shoulder studs should be assembled with the burred side of the retaining washer away from the lever. This method is necessary to prevent the washer from binding on the lever.

Checking changer in cabinet: Before checking record changer in the cabinet, mounting bolts must be released and cardboard spacers removed; otherwise the changer will not properly feed records from the record support shelf and the tone arm will not position properly on the record. If any adjustments are made with the changer bolted down and the mounting bolts then released these adjustments will have to be remade.

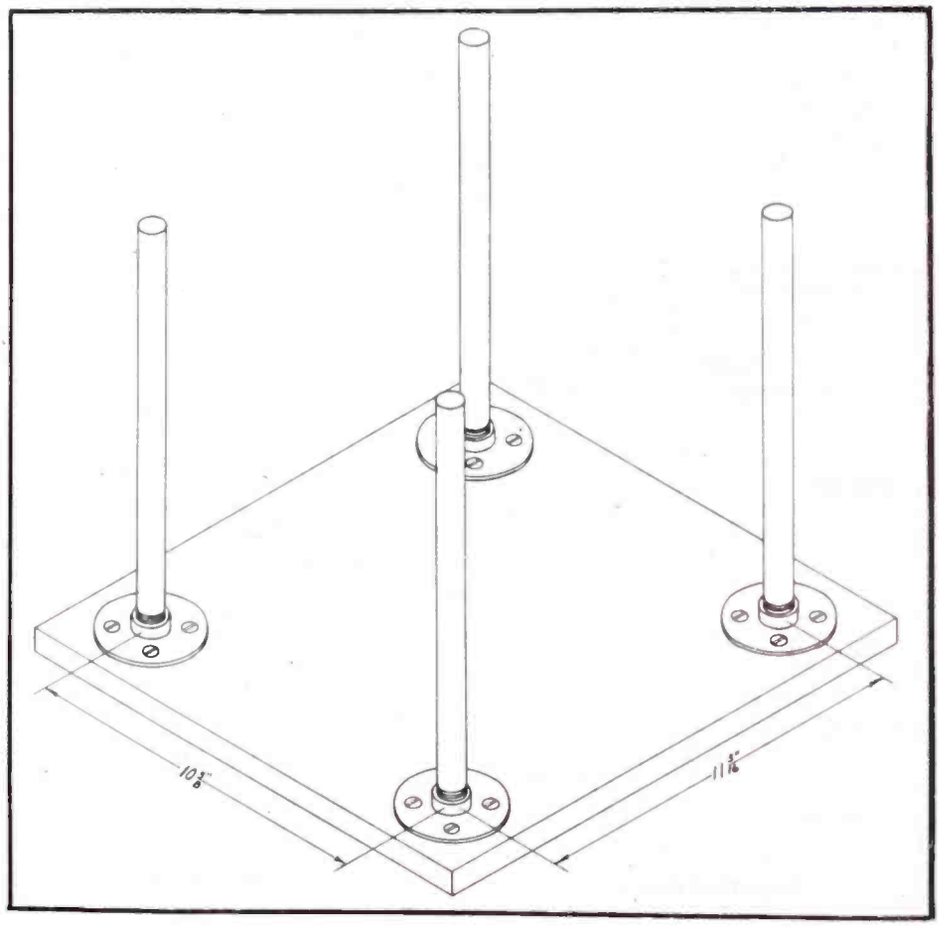
When setting up changer it should be checked for a needle landing with a full stack of records, both 10" and 12". This is done by loading the record support shelf with twelve 10" records and moving the control knob to reject, allowing the record to play through and trip, checking the landing on the second record, then tripping records up to and including eleven. The eleventh record should be allowed to play through and record twelve should be fed automatically, observing needle landing and automatic trip. This procedure should be repeated with ten 12" and instead of records eleven and twelve substitute records nine and ten in the preceding section. Avoid using force in an effort to raise the tone arm to a greater height than permitted by the tone arm support, force may result in breaking of the tone arm.

Lubrication: The record changer should be lubricated and cleaned periodically or when a major part or assembly is replaced. Dirt, old oil or grease may be removed with carbon tetrachloride or other similar cleaning fluid.

There are four sections of the record changer that should never be lubricated. There are the friction trip assembly, tone arm support tube, starting lever assembly, and tone arm hinge pin.

Light machine oil should be used on turntable drive shaft felts, tone arm lift

Fig. 1. Constructional details of a support for servicing changers. (Courtesy *Farnsworth.*)



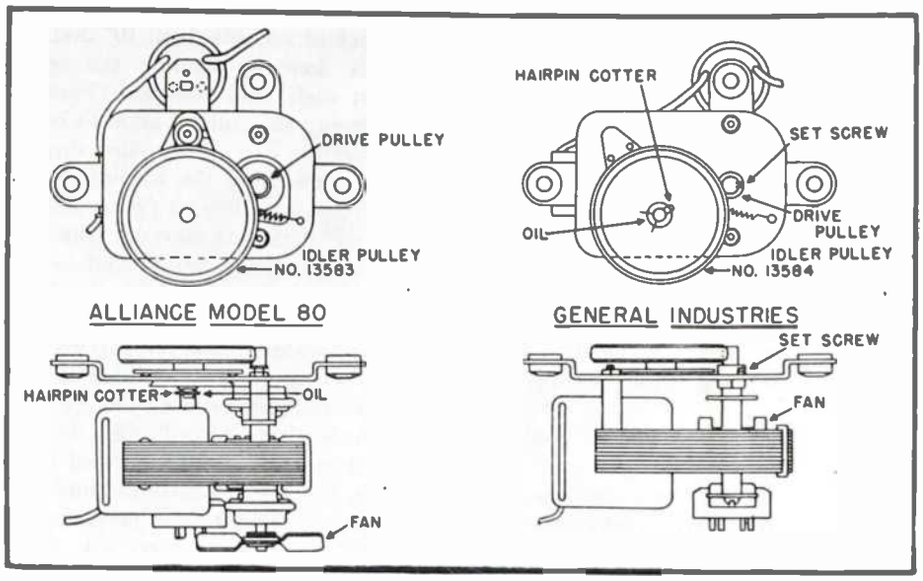


Fig. 4. Two types of motors used in Farnsworth changer; Alliance and General Industries.

lever rivet, record lift lever rivet and roller pin, tone arm return lever at the spacer, phono motor (one drop on felt at each end of shaft), idler pulley, crank link lever at pivot point and 12" interceptor shaft at bearing in baseplate.

Light grease of vaseline type should be applied on the main cam tube or stud, main cam at gear teeth and cam track, tone arm return lever at guide spacer and at record lift lever and spindle ball. A very light film can be applied at the spindle and tube-bearing surface.

Only a good grade of machine oil with a viscosity of SAE 10 should be used. Care should be exercised to prevent an excess of oil being used on any part and that no oil gets on the motor pulley, idler pulley or turntable rim.

Every six months or once a year a thin coat of light grease of the vaseline type may be applied to all surfaces of the main cam that contact lift levers and tone-arm lift lever.

Record changer holder: For holding a record changer after removal from the cabinet, a support, Fig. 1, can be used.

Materials required include one piece ¾" plywood 14½" x 15½", four ½" floor flanges, sixteen flat-head wood screws, ¾" long (diameter determined by size hole in floor flange), and four pieces of ½" pipe 12½" long threaded at one end.

Fig. 5

(*RCA RP* 176)

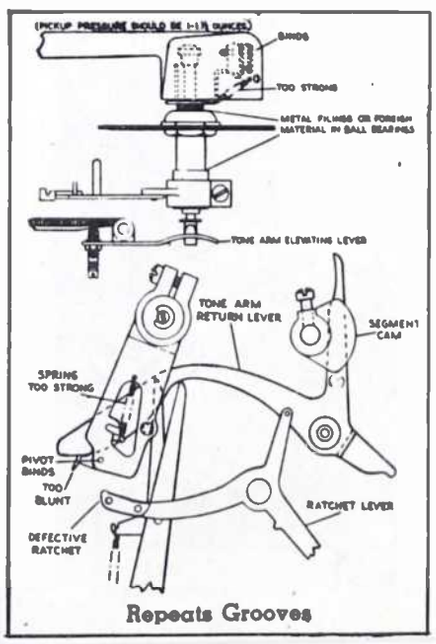
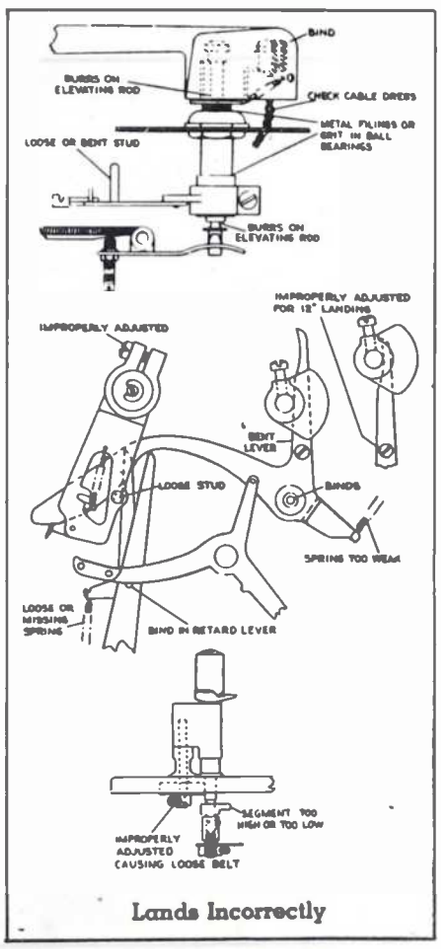


Fig. 6

(*RCA RP* 176)



pieces of ½" pipe 12½" long threaded at one end.

•

RCA RP-176 Automatic Record Changer

THIS IS A TWO-SUPPORT, drop type, non-intermixing mechanism designed to play automatically a series of twelve 10" or ten 12" records of the standard 78 rpm type.

Mechanism uses a crystal pickup cartridge, equipped with a sapphire point.

The tone arm is automatically returned to rest position and the power removed from the drive motor, after the mechanism has finished playing the last selection of the stack.

The changer is equipped with an eccentric tripping device to insure tripping on all standard records. The record support and separator are mechanically linked, requiring only one operation for changing of record size. Mechanism is provided with a safety clutch to prevent damage in case of a jam due to a defective record.

A pickup muting switch is also incorporated. This shorts out the pickup while the changer is in cycle, and prevents mechanical noises of moving parts from being amplified.

RCA RP-176 Servicing Suggestions

In Figs. 5, 6 and 7 appear drawings illustrating how to correct such problems as incorrect landing, groove repeats, slow speed, etc.

•

Bendix G-205 Record Changer

SEVERAL ADJUSTMENTS ON THE G-205 record changer are interlocking. Thus, in making one of these adjustments, it is quite possible that one or more of the others may need to be readjusted as a result.

These interacting adjustments are

Fig. 7

(*RCA RP* 176)

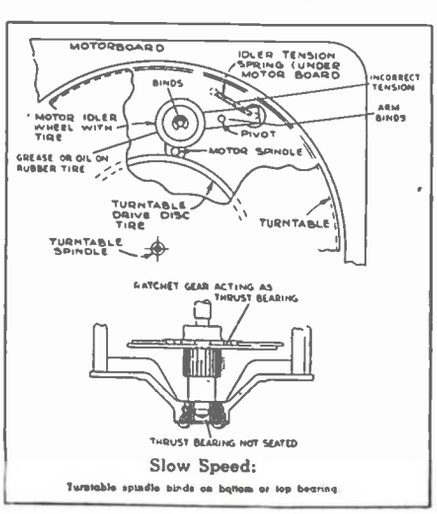


Fig. 8 (below). Obtaining correct spindle rotary position in Bendix changer by loosening spindle adjustment nut and rotating spindle bushing.

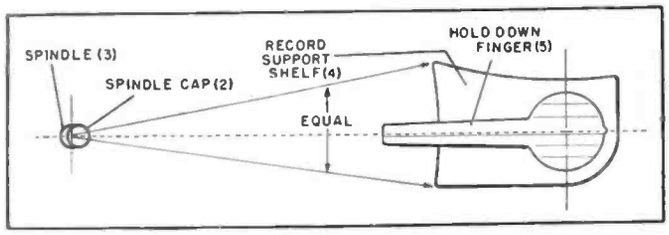
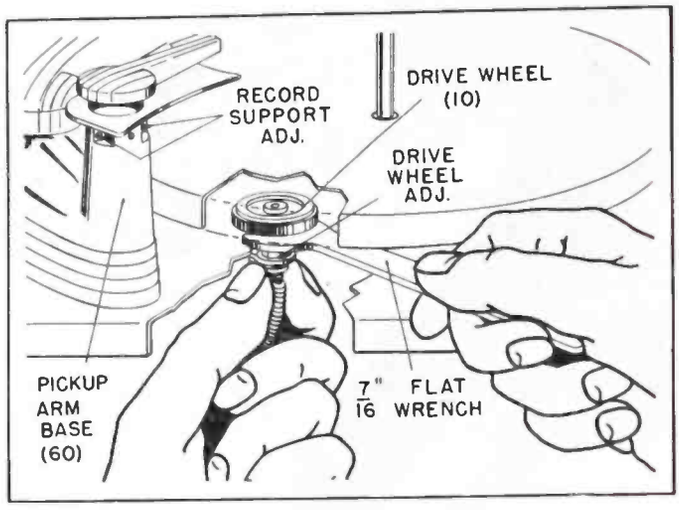


Fig. 9. Insuring firm engaging of drive wheel by turntable rim during cycle periods on Bendix changer.



as follows, and should be made or checked in the following order:

Spindle location: The spindle adjustment must be made *only* for the purpose of correcting clearance between the sector lever gear teeth (*18*) and record feed pinion gear teeth (*20*), or proper rotary position of the spindle. These two adjustments are made simultaneously, so that care must be taken that both are correct at finish of adjustment.

To adjust gear teeth clearance, the spindle adjusting nut should be loosened 1/16" (located at base of spindle, underneath motor board) and spindle assembly moved horizontally until correct gear clearance is obtained. The backlash between the sector lever (*18*) and the record feed pinion (*20*) should be approximately one-fourth the width of one gear tooth on the record feed pinion; Fig. 10.

Correct spindle rotary position is obtained by loosening spindle adjusting nut and rotating spindle bushing (*69*). Proper rotary position is obtained when a straight line is formed by the center of the spindle (*3*), the center of the spindle cap bearing (*2*), and the center of the hold down finger (*5*); Fig. 8.

It is quite possible, when making the foregoing spindle adjustment, that the spindle cap (*2*) and the eccentric may need correcting. It is suggested that both these adjustments be checked before proceeding.

Pickup arm base: After the spindle location has been adjusted, it is necessary that the distance from the edge of the record support (*4*) to the spindle be checked. The distance from the edge of the record support, in the 10" position, to the nearest edge of the center spindle is approximately 4 7/32". If this distance is incorrect, records may drop at an angle, or several records may drop at once.

To adjust the proper distance, the two pickup-arm base screws located under the motor board should be loosened and the pickup-arm base slid to or from the spindle until the correct distance (approx. 4 7/32") is obtained from the edge of the record support to the outer edge of the spindle.

Record support shelf: Correction of the pickup-arm base may necessitate a record support shelf (*4*) adjustment. Each end of the record support shelf must be equidistant from the center spindle. In the 10" position this distance should be approximately 4 7/32"; in the 12" position, approximately 5 7/32".

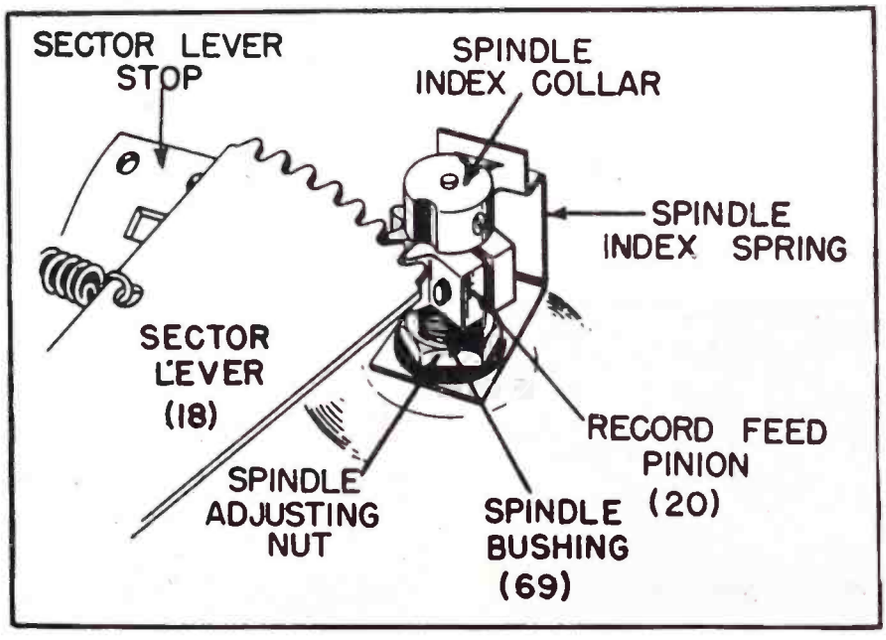
Two small screws located on top the pickup-arm base (*60*) are used to adjust the degree of rotation of record support shelf. The one nearest pickup arm adjusts the 12" position of record support shelf while the screw farthest from pickup arm adjusts the 10" position. Each must be adjusted to cause a selected record to drop squarely on turntable. Improper adjustment will cause records to bind on one corner of the record support shelf and not drop squarely on turntable: Figs. 8 and 9.

Drive wheel: The drive wheel (*10*) must firmly engage the turntable rim during cycling periods and completely disengage during playing cycles. Adjustment of the spindle location may move the turntable such that repositioning of the drive wheel may be necessary.

The drive wheel is mounted in a 1/8" hex head bushing (immediately under drive wheel) such that, as the bushing is rotated on an eccentric, the drive wheel is positioned with respect to the turntable rim.

When drive wheel does not engage properly, grasp the flexible shaft between the thumb and forefinger, and with mechanism operating in the record-playing position, rotate the eccentric drive shaft bushing with a 1/8" flat wrench until a slight drag between the drive wheel and the turntable rim can be felt in the flexible shaft. The hex bushing should then be rotated slightly in the opposite direction from before, until no further tendency to drag can be felt in the flexible shaft; Fig. 9.

Fig. 10. Bendix G 205 motor-board layout showing how to adjust sector lever and record feed pinion so that backlash is 1/4 width of gear tooth on record feed pinion.



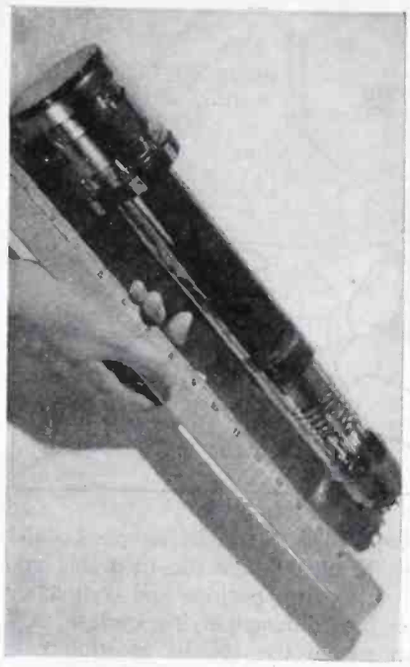


Image orthicon which does not require brilliant lighting for pickup. (*Courtesy RCA*)

TELEVISION Camera Tubes

by JACK CHENOWETH

Technical Dept., WLW

THE MODERN TYPES OF TELEVISION cameras using electronic scanning employ two types of tubes, the storage and instantaneous types.

An example of a storage type tube is the iconoscope (Fig. 1). This tube, developed by Dr. Zworykin, consists eventually of an electron gun and deflection system similar to that in many cathode-ray tubes, and a signal plate (Fig. 2) all combined in a glass envelope.

The signal plate consists of a sheet of mica, the front of which is coated with a photo-sensitive material. Caesium oxide over silver has been commonly used. These are formed in small globules in such a way as to be insulated from each other and appear as a mosaic surface. They are insulated from the back plate by the mica, generally used because of its efficient dielectric properties and its uniform thickness.

In use the picture or image to be televised is focused upon the mosaic by an external camera lens in a manner similar to that of an ordinary camera. When the image falls upon the mosaic each photoelectric globule will emit electrons in proportion to the amount of light falling upon it. Thus each photoelectric globule together with the mica dielectric and the plate directly behind form a small capacitor. This being the case, the photo-sensitive globule having emitted some electrons will have a positive charge, and due to the capacitive action will attract electrons to the plate directly behind it. The flow of electrons to charge the signal plate is up through R_1, Fig. 3. It is now apparent that if there were no other elements in the tube and an image were flashed upon the mosaic and the light source removed the image would be retained on the mosaic for an indefinite time, depending upon the efficiency of the dielectric and how well the globules are insulated from each other. Hence the term storage tube.

Scanning

Now let us see how the image is scanned and removed to the proper amplifiers. This is where the electron gun comes in. When used in a cathode-ray tube the electron gun together with a deflection system emits, focuses and deflects a beam of electrons upon a fluorescent screen or face of the tube. When used with the iconoscope the electron gun is used to focus a beam of electrons upon the mosaic and a deflection system is used to scan the mosaic with the beam at a predetermined rate.

As previously mentioned the photo-electric globules had emitted electrons in proportion to the amount of light that had fallen on each and had assumed a positive charge. Now if the mosaic is scanned by the electron beam from the electron gun all the missing electrons will be replaced by electrons from the beam. As a result each of the individual capacitors consisting of a photoelectric globule, the mica insulator and the signal plate will be discharged as the beam passes over that part of the mosaic. The discharge path for this will be down through R_1 with the varying voltage taken from the top of R_1 through capacitor to input of a video amplifier. At first glance it might be thought that since both the charge and discharge of the signal plate appear to take place through the same resistor this circuit would not be practical. It must be remembered though that the charge takes place during the entire scan period, 1/30 second, and is for the entire plate so that the charge current will average out into essentially d-c. The discharge current on the other hand is made up of the discharge of the individual capacitors formed by each globule. Therefore the signal current which may be thought of as passing down through R_1 is made up of varying or a-c pulses of extremely short duration.

The iconoscope requires a rather high intensity of light on the subject to be televised. This disadvantage has

Fig. 1. Iconoscope storage-type camera tube.

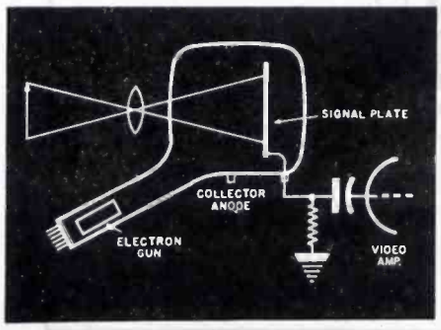
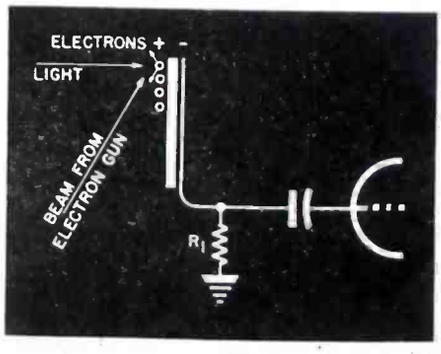


Fig. 2. Signal plate used in iconoscope, consisting of sheet of mica, the front of which is coated with a photo-sensitive material.

Fig. 3. How electrons flow to charge signal plate.



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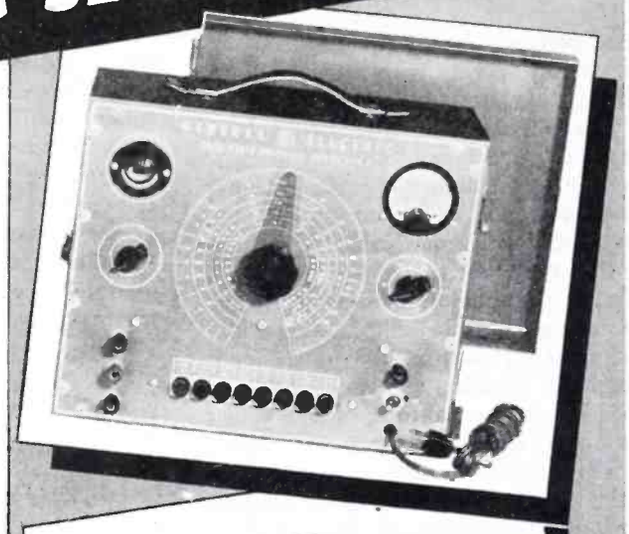

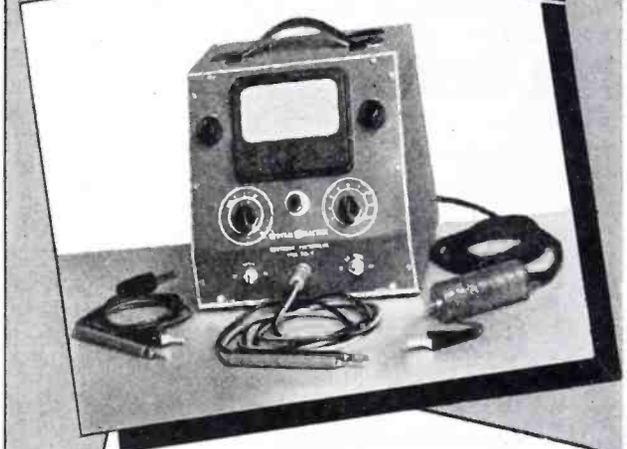

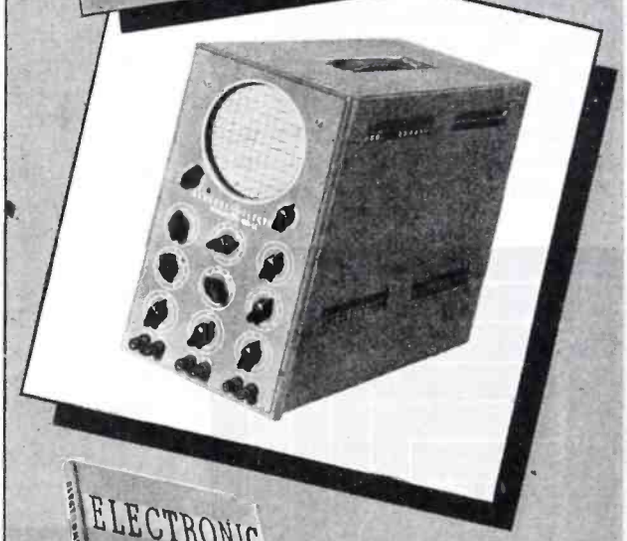

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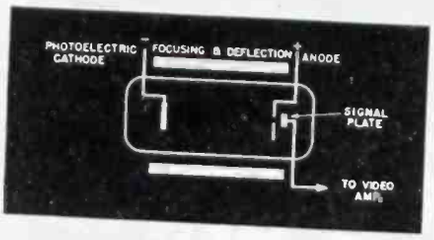


Fig. 4. Image-dissector instantaneous-type television tube.

been overcome by the image orthicon, which can operate with a candle light for lighting.

Thus far we have discussed a tube of the storage type. Now let us consider an example of the instantaneous-type tube, such as the image dissector developed by Farnsworth. A version of this type tube, as shown in Fig. 4, consists of a photo-sensitive cathode at one end of the tube, and an anode and pickup electrode at the other end. Magnetic focusing and defection coils are located external to the tube. When an image is focused upon the photo-sensitive cathode each point on the cathode will emit electrons in proportion to the amount of light striking that point. These electrons, whose concentration is proportional to the light that caused them to be emitted, will be attracted to the anode which is at a positive potential. As might be thought these electrons would tend to disperse as they move down the length of the tube if some means of keeping them together were not provided. This is accomplished by the focusing coil, which is provided externally to the tube, and is used to focus the field of electrons on the anode. Mounted near the anode is a small pickup electrode which is coupled to the input of a video amplifier. This electrode is struck by some of the electrons and receives a current proportional to the light from that part of the picture. Scanning is accomplished by deflecting the entire field of electrons or electron image, as it moves down the length of the tube, by vertical and horizontal deflection coils also mounted externally to the tube. The field of electrons is deflected in such a manner as to move it across the pickup electrode at the proper scanning rate. This tube is considered to be of the instantaneous type since only the electrons that actually strike the pickup electrode are used to develop the picture signal while all the electrons that strike the anode are lost. The output of this tube can be greatly increased by the use of the secondary emission method of electron multiplication.

Inasmuch as one of the major difficulties encountered with the basic type tubes discussed thus far is the very low signal output it is obvious that in order to develop a better tube some method must be used to increase the signal strength practically without increasing the illumination. One of the most practical ways of accomplishing this is the electron multiplier; 931 type phototube.

The 931, when connected as shown in Fig. 5, can give a current amplification of 200,000. When light strikes the photo-sensitive cathode of this tube the cathode will emit electrons which will be attracted to the positive potential at the dynode *1*. Upon striking this dynode each electron will dislocate several more electrons which will be attracted to the next dynode. This secondary emission will be repeated at each dynode which will be at a successively higher positive potential. It can be seen that by the time the electrons reach the anode or plate they will have multiplied many times. For instance if one electron released from the cathode displaced five secondary electrons from dynode *1*; and if this process were repeated at each succeeding dynode there would be 1,280 or more electrons striking the plate for every electron emitted from the cathode. This tube is not used for television but it does show very well a method by which a very high increase in signal current can be obtained in a television picture tube.

The image orthicon, Fig. 6, is an excellent example of how the electron multiplier may be used in a television

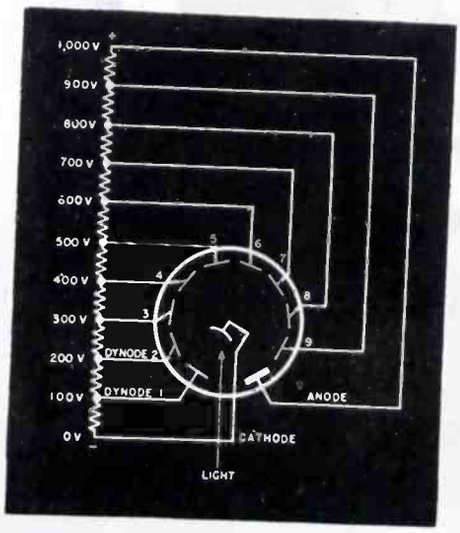
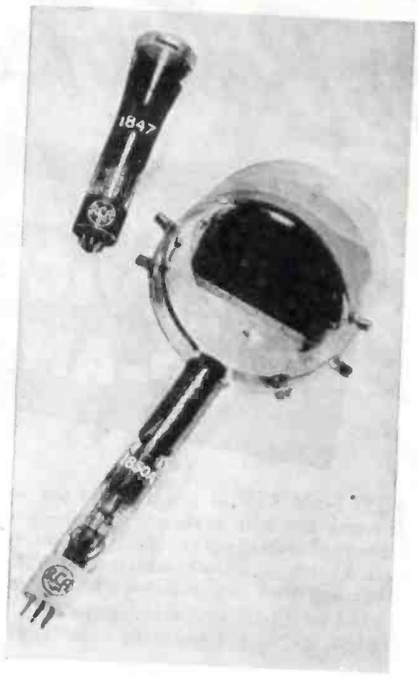


Fig. 5. Electron-multiplier phototube, type 931.

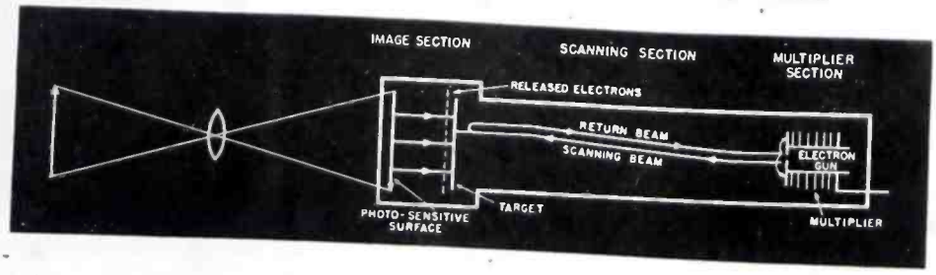


Bottom, professional or studio iconoscope; top, amateur type iconoscope. (*Courtesy RCA*)

camera pickup tube. This tube consists of three basic parts, an electron image section which actually increases the photoelectric current by secondary emission, an orthicon type scanning section and an electron multiplier section similar to that used in the 931. In the image orthicon the image to be televised is focused on the photo-sensitive surface by an optical lens as in the other types of camera tubes. This photo-sensitive face of the tube will release many electrons from its surface and the released electrons will be in proportion to the amount of light striking it. These electrons are attracted to and guided to the target plate. As these electrons in the form of an electron image strike the target each will dislodge several more electrons. This will leave on target an image of positive charges that will be proportional to the original image focused on the photo-sensitive surface of the tube. It can be seen at this point that this tube is a combination of instantaneous- and storage-type tubes. The beam from the electron gun is deflected so as to scan the back of the target, but in this orthicon-type

(*Continued on page 46*)

Fig. 6. Image orthicon.



Amphenol

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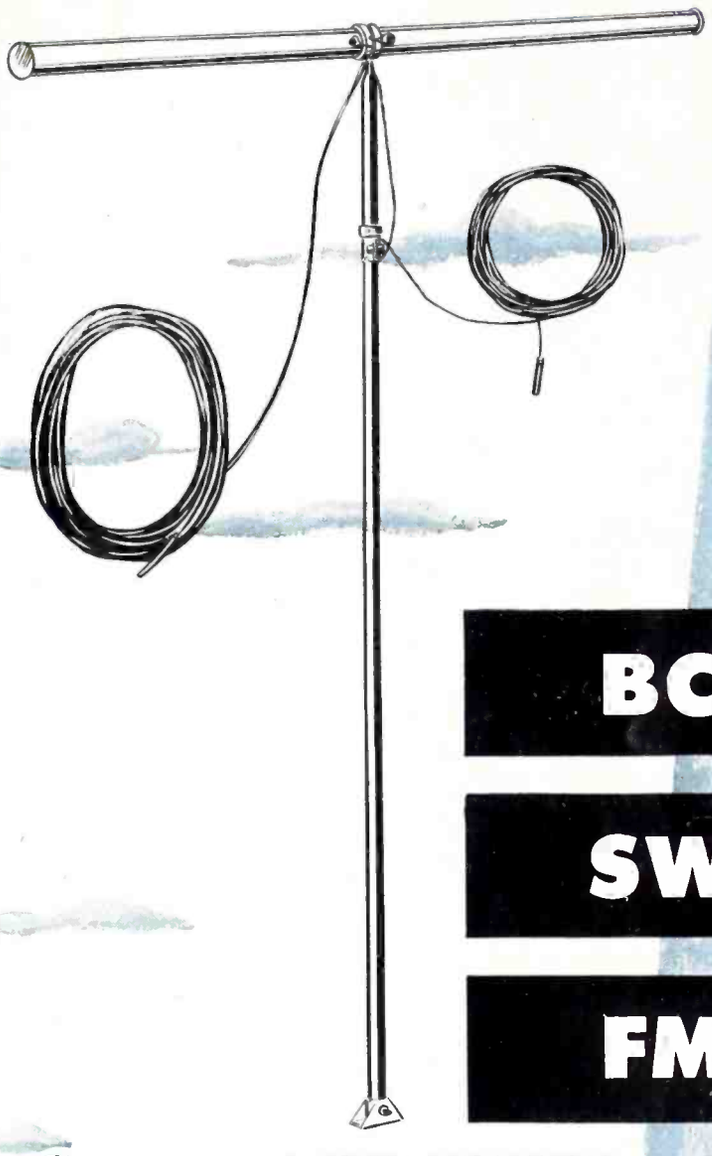

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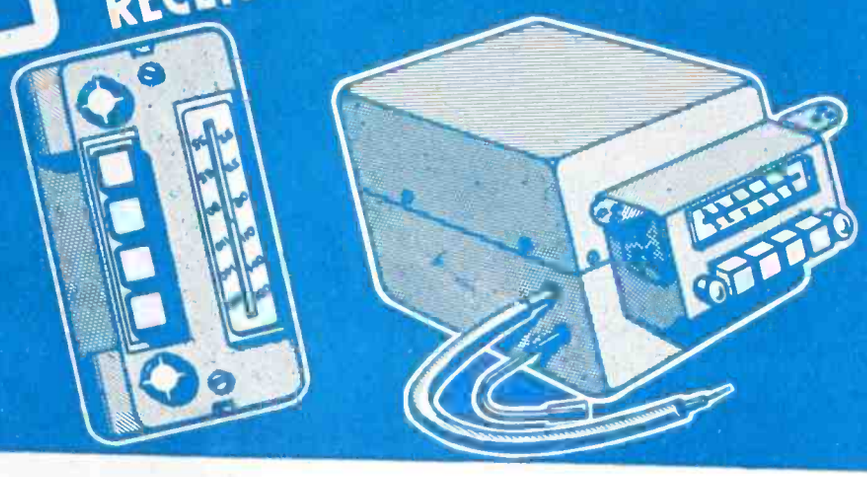

Solutions To Major Problems Met in Servicing Automobile Receivers Today. Noise Remedy Procedures. Correcting Troubles in Ignition and Vibrator Circuits.

by WILLARD MOODY

SERVICING AN AUTOMOBILE RECEIVER is in many respects no different than servicing an ordinary receiver, with capacitors broken down, resistors open, etc. But there are some factors that are peculiar to the auto set. It is usually quite compact and may be somewhat critical with respect to alignment, microphonic tubes, intermittent operation, noise, vibrator troubles.

Obviously, the automobile receiver must operate under difficult conditions. The antenna used with it cannot be very long or very high, hence sensitivity is important. Because of the high noise level of the auto ignition system, special installation precautions are necessary. The vibration of the car engine and mechanical shocks on the road make reliability and rugged construction essential requirements. The location of the auto set next to the firewall of the car makes protection from heat necessary. Because of the difference in the characteristics of the car interior, acoustically, and the acoustic properties of the average room in the home, a different type of audio response is necessary; usually tone controls are provided to secure the best results under varying conditions. Still another factor is ease of operation, leading to the development of push-button tuning and with it certain problems of installation and servicing.

A general understanding of basic radio theory is essential before one can service an auto set or solve installation problems that often crop up. Unskilled labor can be used to a certain extent under supervision in making installations, and often due to the design of the car and the relatively simple installation instructions that may come packed in the carton of the new radio, installations may be accomplished by the relatively untrained with fairly good results. It's the unusual and the difficult jobs that stop the man with a feeble knowledge of radio.

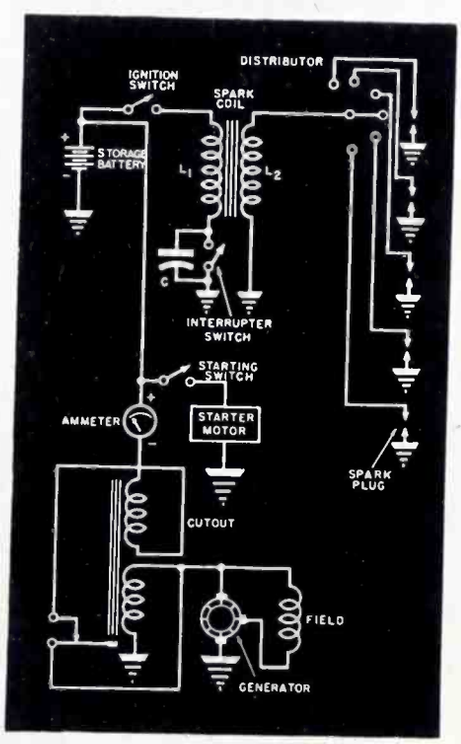

Fig. 1. Basic ignition circuit of car. Ammeter and generator connections appear at lower left. Bypass capacitor has been omitted.

Ignition Circuits

With used cars being sold and re sold, there may arise the necessity of moving one set to another car, which is not a new installation in a certain sense and may present new problems. For example, the set may have a synchronous vibrator. If the polarity is different in the new car, a change in the vibrator circuit will be required. This requires a knowledge of ignition

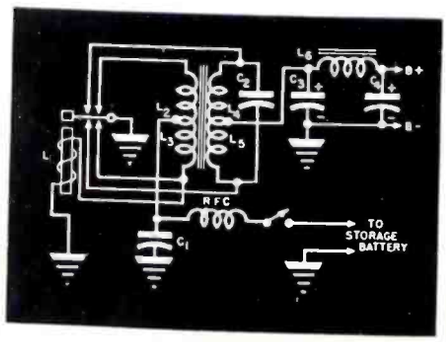

Fig. 2 (right). Synchronous vibrator circuit.

circuits; Fig. 1 illustrates a basic circuit.

When the ignition switch is closed and the interruptor switch is also closed, a current flows in L_1 and rises suddenly. The rise in magnetic flux through the core, because of linkage with L_2, induces a high voltage in L_2 due to the high step-up turns ratio on the transformer. The high voltage across L_2 is fed to the various spark plugs through a distributor switch, permitting firing of each plug in the proper order. The interruptor switch may be geared to the engine to provide a regular, periodic breaking of the primary circuit so that pulses of current flow in the primary to give the varying field required for transformer operation. The sparking at the interruptor is absorbed to a certain extent by the capacitor, *C*, but some interference inevitably results. Also, there is sparking at the plugs, with further noise generation. To limit the noise, it sometimes proves helpful to shunt a capacitor directly across the battery terminals. This capacitor should be of the shielded type, with the shielding grounded to the car frame. The noise may also be cut down by using a suitable suppressor in series with the distributor arm and individual suppressors on the various spark plugs. First a suppressor should be tried on the distributor and then if necessary suppressors can be tried on each plug. Spark plug suppressors should not be used unless required since they tend to cut down engine efficiency. In some cases it is practical to shield the wiring to the distributor arm and to the spark plugs, but usually this cannot be done or not very economically. In some airplane installations the wiring may actually be shielded and bonded to the frame of the plane for minimizing noise and interference.

The ammeter and generator connections are shown in the lower part of Fig. 1. Usually a capacitor is connected from an ammeter terminal on the dash or instrument panel to the panel metal for grounding. Another capacitor of the shielded type may be connected between the generator and ground, with the car frame serving as the ground, or the engine block. If the engine is floated on rubber it may be necessary to bond it to the frame of the car using flexible copper braid which has been tinned for protection from corrosion and easier soldering. The bypass capacitor connections are not shown in the drawing, as they are so simple to make. The cut-out operates so that the battery will not discharge into the generator when the generator voltage falls below that of the battery. If noise is heard due to make-and-break action at the contacts, they may be shunted with a capacitor, but this is not usually necessary.

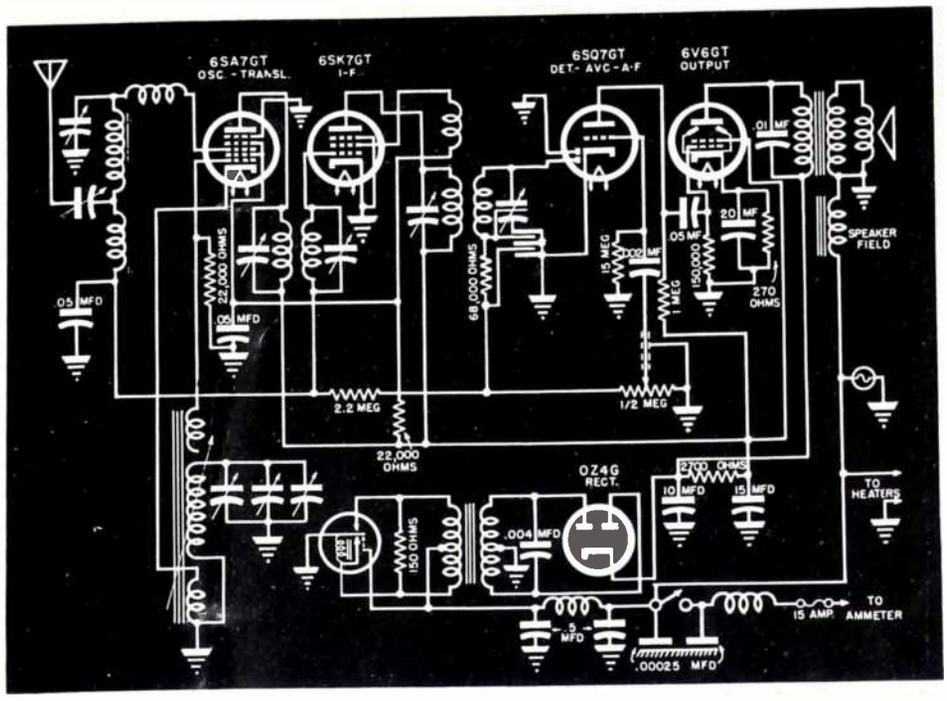

Fig. 3. Silvertone auto set, model 7091, using a non-synchronous vibrator.

In Fig. 1 the positive terminal of the battery is insulated from ground, the negative is grounded. In some cars reversed polarity for the ignition system is encountered. If the receiver uses a non-synchronous vibrator and tube rectifier, the polarity doesn't matter; for the synchronous vibrator circuit the polarity may be shifted by reversing the leads to the primary *or* secondary windings of the vibrator, but *not* to both windings.

A typical basic synchronous vibrator circuit is shown in Fig. 2. C_1 is an r-f bypass, C_2 the usual buffer and C_3 and C_4 filter capacitors. This type of vibrator functions as a mechanical rectifier as explained in standard texts.

The non-synchronous vibrators are more commonly encountered; a set using this type of circuit, is shown in Fig. 3 (Silvertone 7091). The OZ4, used sometimes, causes a great deal of noise and can be replaced, in the rectifier circuit, with a full-wave rectifier of the 6X5GT type having a high-vacuum design.

One of the most commonly encountered jobs in auto radio is getting rid of noise. Servicing the set itself for a noisy or intermittent condition is much like servicing an ordinary receiver for the same troubles, since the circuits are standard and basic servicing techniques apply. The essential differences occur in the type of installation of the car set. Recognition of the noise and identification are helpful in servicing.

Noise Remedy Procedures

(*1*) Try the set with car standing still and engine not running.

(*2*) Allow the engine to idle or run at a slow speed while the car stands still.

(*3*) Speed up the engine with car standing still.

(*4*) Drive the car and note the interference.

If the noise is heard with the engine not running, the fault lies in the set itself in all probability. A defective vibrator may cause excessive noise, as may a leaky or open buffer capacitor. A leaky filter that is increasing the drain on the power supply will cause the vibrator circuit current to go up, producing excessive sparking at the contacts and noise. A microphonic or intermittently shorting tube may cause noise. A poor contact in the voice coil circuit or an off-center cone may make noise evident. Distorted and off-center cones are very commonly encountered in auto radio work. The extremes of temperature and humidity make cones troublesome. A loose *rattle* type of sound may be due to a tube shield that is not seated firmly or to vibration by sound waves of some object on the dash, perhaps a cigarette ash tray or some other device.

If noise is heard while the car is not in motion and engine not running, the fault most likely is in the set. If the

(*Continued on page* 51)

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- Entire unit removable by taking out four screws. Just lift from receptacle to make new entries or install new chart.
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TUBE News

MINIATURE TUBES are now making their appearance in many receivers. According to a recent announcement by RCA, 40 types of miniatures have already been developed and are now being manufactured. These include voltage regulators, high-frequency diodes, r-f amplifier pentodes, pentagrid converters, power-amplifier pentodes, diode pentodes, super-control r-f amplifier pentodes, thyratron tetrodes, h-f

(*Continued on page 46*)

Miniature-tube reference chart.

0A2	Voltage Regulator (Cold-Cathode Glow-Discharge Type). Electrically similar to the larger type 0D3/VR150.
1A3	H-F Diode of the heater-cathode type. For use as a discriminator tube in FM receivers and in portable h-f measuring equipment. Resonant frequency, about 1000 Mc.
1L4	R-F Amplifier Pentode of the filamentary type. Features sharp-cutoff characteristic. For use in FM and AM receivers.
1R5	Pentagrid Converter. Useful as a mixer tube and oscillator in superheterodyne circuits. Has a conversion transconductance of 300 micromhos with 90 volts on the plate.
1S4	Power Amplifier Pentode of the filamentary type. Capable of handling an audio power output of 270 milliwatts. For use in broadcast receivers.
1S5	Diode-Pentode of the filamentary type. A combined diode and a-f pentode providing high voltage gain. For use in broadcast receivers.
1T4	Super-Control R-F Amplifier Pentode. Useful as an r-f or an i-f amplifier and as an automatic-volume-control tube.
1U4	R-F Amplifier Pentode with sharp-cutoff characteristic. For use in low-drain battery-operated receivers. Similar to type 1L4.
2D21	Thyratron (Tetrode Type). Useful as a relay tube and in grid-controlled rectifier apparatus. Will operate directly from a high vacuum phototube. Similar electrically to the larger type 2050.
3A4	Power Amplifier Pentode of the filamentary type. Can handle an a-f output of 700 milliwatts, or an r-f output of 1.2 watts at 10 Mc. Has filament arrangement for either series or parallel operation.
3A5	Twin-Triode of the filamentary type with filament arrangement for either series or parallel operation. For use in h-f applications. Has class C output of about 2 watts at 40 Mc.
3Q4	Power Amplifier Pentode of the filamentary type. Features high power sensitivity. Can handle a relatively high audio output of 270 milliwatts. For use in 3-way battery portable receivers.
3S4	Power Amplifier Pentode of the filamentary type. For use in 3-way battery portable equipment. Similar to type 1S4 but has filament arrangement for either series or parallel operation.
3V4	Power Amplifier Pentode of the filamentary type. Identical with type 3Q4 except for basing arrangement. For use in 3-way battery portable receivers.
6AG5	R-F Amplifier Pentode with sharp-cutoff characteristic. Features high transconductance and low input and output capacitance. Useful as an i-f video amplifier and as an r-f amplifier up to 400 Mc.
6AK5	R-F Amplifier Pentode with sharp-cutoff characteristic. Features high transconductance, low input and output capacitance, and low input conductance at high frequencies. Useful as an r-f amplifier up to 400 Mc.
6AK6	Power Amplifier Pentode. For use either singly or in push-pull in the output stage of compact receiver equipment. Can handle an a-f power output of 1.1 watts. Similar electrically to the larger glass type 6G6-G.
6AL5	Twin Diode of the heater-cathode type. Its high-perveance feature makes it particularly useful as an FM detector. Tube drop, 10 volts at 60 ma. per diode. Resonant frequency of each unit, 700 Mc approx.
6AQ5	Beam Power Amplifier of the heater-cathode type. Has characteristics similar to those of the larger type 6V6. For use in automobile and ac-operated receivers.
6AQ6	Duplex-Diode High-Mu Triode of the heater-cathode type. Similar to the metal type 6Q7. For use as a combined detector, a-f amplifier, and automatic-volume-control tube.
6AT6	Duplex-Diode High-Mu Triode of the heater-cathode type. Similar to the metal type 6SQ7. For use as a combined detector, amplifier, and automatic-volume-control tube in compact broadcast receivers.
6AU6	R-F Amplifier Pentode with sharp-cutoff characteristic. Similar to the metal type 6SH7. Features high transconductance and low grid-plate capacitance. Useful as a limiter tube in FM receivers.
6BA6	R-F Amplifier Pentode with remote-cutoff characteristic. Similar to the metal type 6SG7. Features high transconductance and low grid-plate capacitance. For use in the r-f stage of FM receivers in the 88-108 Mc band.
6BE6	Pentagrid Converter. Similar to the metal type 6SA7. Useful as a mixer (first detector) tube and as an oscillator in superheterodyne circuits. Has conversion transconductance of 475 micromhos with 250 volts on the plate. For use in FM receivers in the 88-108 Mc band.
6C4	H-F Power Triode of the heater-cathode type. Useful as a class C amplifier and oscillator. Has class C output of about 5.5 watts at moderate frequencies and 2.5 watts at 150 Mc.
6J4	U-H-F Amplifier Triode. For use primarily as a grounded-grid amplifier at frequencies up to 500 Mc. Features an extremely high transconductance of 12000 micromhos, a mu of 55, and relatively low cathode-grid capacitance and plate-grid capacitance.
6J6	Twin-Triode of the heater-cathode type. Particularly useful as a mixer tube at frequencies up to 600 Mc. May also be used as an oscillator.
6X4	Full-Wave High-Vacuum Rectifier of the heater-cathode type. Similar to the metal type 6X5 or the glass type 6X5-GT. For use in auto receivers.
12AT6	Duplex-Diode High-Mu Triode. Identical with type 6AT6 except for 12-volt heater. Equivalent in performance to the larger type 12SQ7. For use in compact ac/dc receivers.
12BA6	R-F Amplifier Pentode with remote-cutoff characteristic. Identical with type 6BA6 except for 12-volt heater. Equivalent in performance to the larger type 12SG7. For use in compact ac/dc receivers.
12BE6	Pentagrid Converter. Identical with type 6BE6 except for 12-volt heater. Equivalent in performance to the larger type 12SA7. For use in ac/dc receivers.
35W4	Half-Wave High-Vacuum Rectifier of the heater-cathode type. Equivalent in performance to the larger type 35Z5-GT. Heater is provided with a tap for operation of a panel lamp. For use in compact ac/dc receivers.
45Z3	Half-Wave High-Vacuum Rectifier of the heater-cathode type. Its small size, low dissipation, and heater rating of 0.075 ampere at 45 volts make it especially useful in 3-way battery portable receivers.
50B5	Beam Power Amplifier of the heater-cathode type. For output use in ac/dc receivers. Has a maximum signal power output of 1.9 watts. Equivalent in performance to the larger type 50L6-GT.
117Z3	Half-Wave High-Vacuum Rectifier of the heater-cathode type. Useful for supplying rectified power to 3-way battery portable equipment. Its heater may be operated directly across a 117-volt ac or dc supply line.
1654	Half-Wave High-Vacuum Rectifier of the filamentary type. Features a maximum peak inverse rating of 7000 volts, and a low filament current of 0.05 ampere.
9001	Detector Amplifier Pentode with sharp-cutoff characteristic. For use as an r-f amplifier or detector in u-h-f service. Its low current requirements provide a superior signal-to-noise ratio.
9002	U-H-F Triode. Useful as a u-h-f detector and amplifier. May be used as an oscillator in superheterodyne receivers at frequencies up to 500 Mc.
9003	U-H-F Pentode with remote-cutoff characteristic. Useful as a mixer or as an r-f or i-f amplifier in u-h-f service.
9006	U-H-F Diode of the heater-cathode type. For u-h-f service as a rectifier, detector, or measuring device. Resonant frequency, about 700 Mc.

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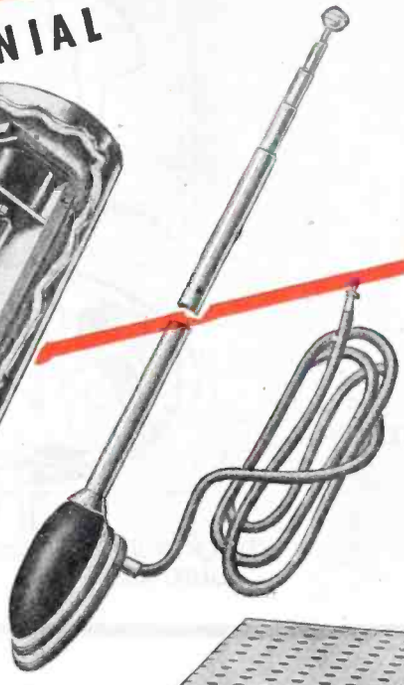

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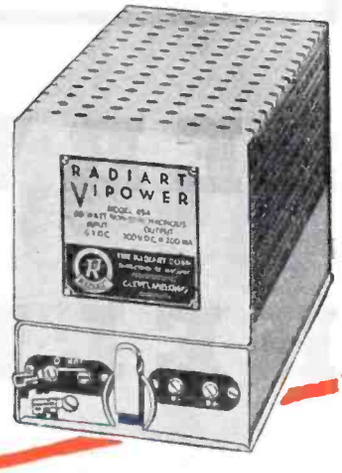

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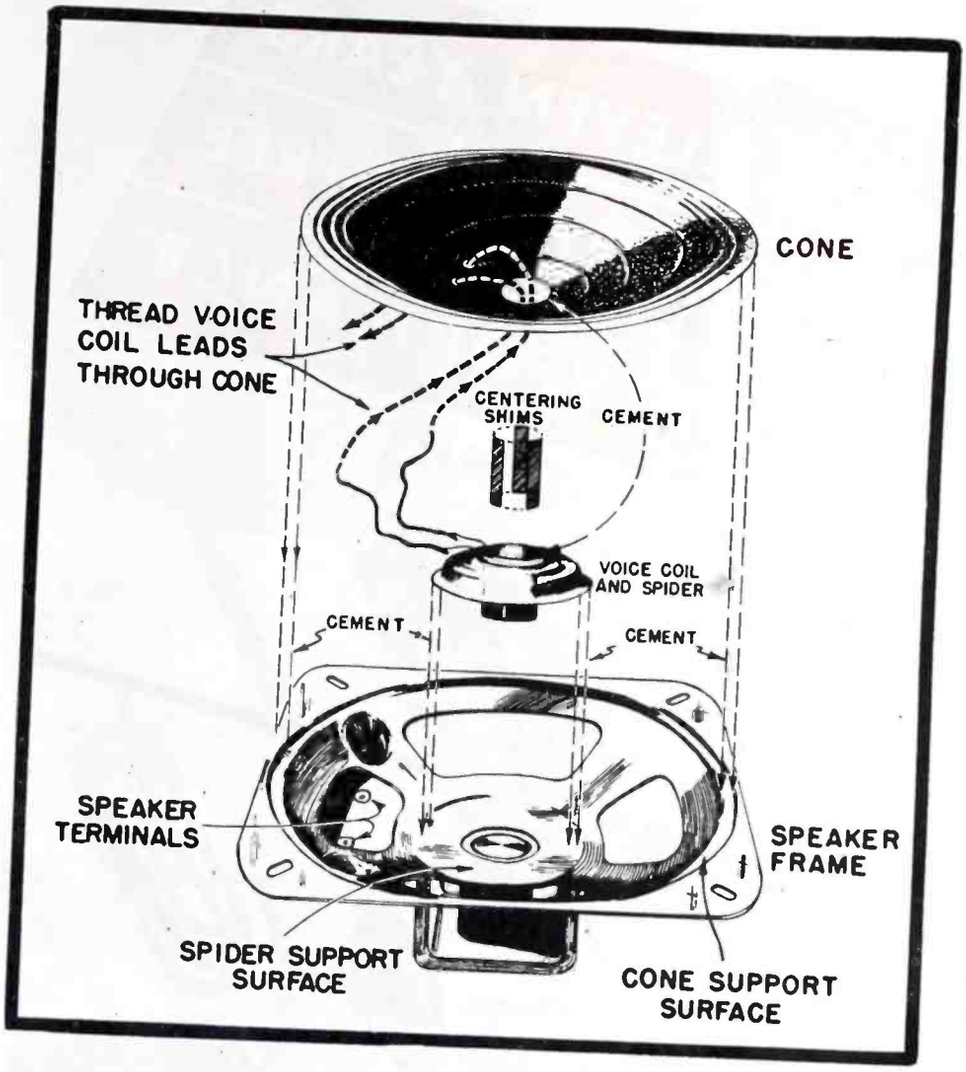

Fig. 1. Speaker cone replacement procedures

SERVICING HELPS

REPLACING SPEAKER CONES

IN REPLACING A CONE it is necessary to disassemble the cone with the voice coil leads being unsoldered first, the cone then being torn away and coil assembly parted from the frame of the speaker. Then the surfaces to which the spider and cone were cemented are cleaned by saturating with acetone until the material can be scraped away from the frame. The voice-coil gap in the speaker frame is then cleaned out with a dampened, lintless paper.

Assembly then follows, as shown in Fig. 1. First speaker cement[1] is spread over the spider support surface of the speaker frame so that when the spider is in place the complete surface of the spider mounting flange will be wetted by the cement. You must be careful not to get cement near the voice-coil gap.

After this cement operation, the spider must be placed immediately in its proper position in speaker frame, making sure that the voice coil is approximately centered in the gap. The voice-coil leads should be turned towards the same side as the speaker terminals as shown in the drawing.

Three centering shims are then placed down between the voice coil and the pole piece so that the shims are equally spaced around the gap. The arrangement of the shims before the insertion is shown in the illustration. Celluloid centering shims are usually available in kits of variable thickness, from 5 to 8 mils. A glossy-coated paper of proper thickness cut to ¼" wide strips may be used in place of the celluloid shims.

Cement is allowed to dry firmly. Then using a fine brush cement is applied to the outer surface of the voice coil. The cone is then placed down on the voice coil and spider, at the same time threading the voice-coil leads from the spider up through the center hole of the cone. The cone should be oriented so that the two small holes face the speaker terminals.

In the next step cement is applied to the center of the cone where it is to join the voice coil. This must be done very carefully so as not to destroy the spider, and be sure, too, that cement does not run into the gap. After the cement has set firmly the cone gasket is cemented to the rim of the cone.

Now the voice-coil leads are threaded through the holes in the cone and leads are soldered to the speaker terminals. Some slack should be left in the leads to permit normal movement of the cone in the air gap. Leads should be dressed so that they will not rattle against the cone. Then the voice-coil leads are cemented where they pass through the cone on both sides. Also the fine single strand voice-coil leads are cemented to the cone surface; otherwise they may cause rattle during operation. The centering shims are removed after the assembly is thoroughly dry. Dust cap is cemented in place, using cement at edge only.

This procedure can be used for large and small-size cones.

[*Data courtesy G.E.*]

[1]G.E. Cement UIC-001.

MULTI-RANGE WAVE TRAP USES

A MULTI-RANGE WAVETRAP has been produced by RCA; type 33,033; Fig.

(*Continued on page* 43)

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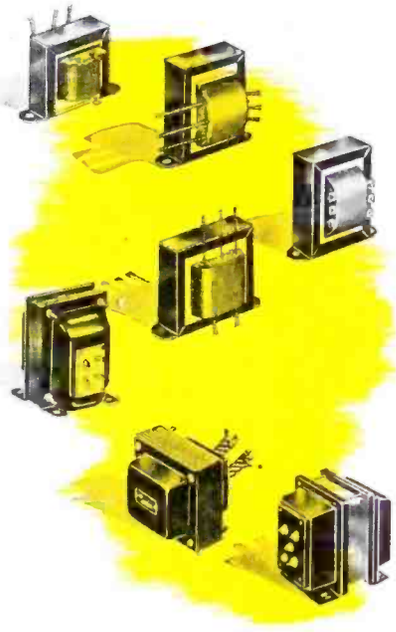

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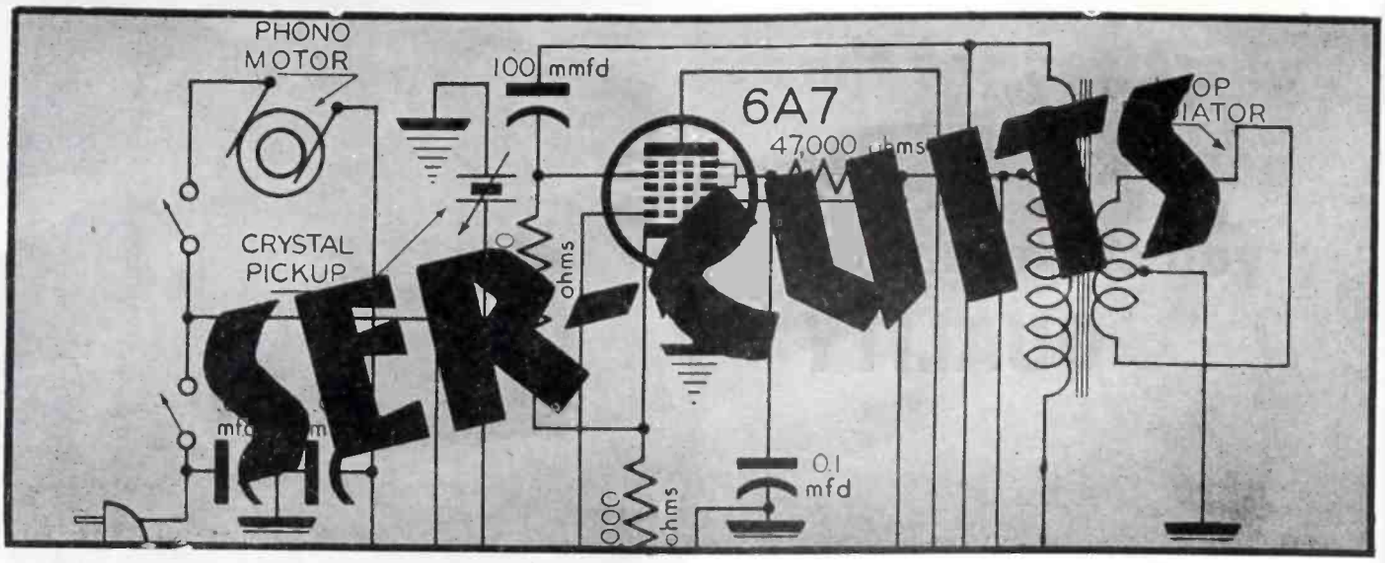


MANY UNUSUAL TUBE lineups are appearing in receivers today. In the ECA 108 push-pull a-c/d-c receiver, (Fig. 1, see page 28 for circuit), for instance, a 6SA7 converter feeds a 6SF7 combined i-f amplifier and diode detector with a standard avc system, and a 6SL7G dual-high-gain triode serves as first audio amplifier and inverter which, in turn drives a pair of 25L6 beam output tubes.

Inverse Feedback

An inversed feedback voltage is fed from the grounded voice coil to the low side of a ½-megohm volume control across 33 ohms and through a 100-ohm series resistor to control the degree of feedback. The tone control, which consists of a .002-mfd capacitor in series with a ½ megohm variable resistor, is directly across the volume control.

Triode Bias

Bias for the pair of triodes is obtained by a 2200-ohm cathode resistor without audio bypass. Bias for the push-pull stage is similarly obtained through 82 ohms. The inverter is excited from a potentiometer of 470,000 ohms and 18,000 ohms across the input to the first 25L6, the voltage being obtained from the 18,000 ohms. Because of the high plate currents demanded by the 25L6s, a pair of 25Z6G rectifiers must be used. One rectifier supplies the power tubes; the other, the rest of the set. Resistance filters serve both cases.

It should be noted that, in a receiver with inversed feedback from the output transformer secondary, the polarity of the windings of the output transformer must be rigidly observed or the set will break into severe audio oscillation.

G.E. YRB 82-1, 67-1, 67-2

(See page 31 for circuit)

Compact table models representing simplified 5-tube design appear in Fig. 2; G.E. YRB 82-1; 67-1 and 67-2. The loop primary and external antenna circuit contains a .01-mfd blocking capacitor and 470-ohm damping resistor to attenuate any resonant peaks in the antenna circuit. A 12SA7 oscillator grid leak of 22,000 ohms runs directly from oscillator grid to cathode instead of the usual *B*. A capacity winding is used instead of a grid capacitor. A 12SK7 i-f, 12SQ7 detector-first audio and 50L6 beam output stages are conventional with the power tube plate being supplied directly from the 35Z5 rectifier, the screen grid and balance of the receiver from a resistance filter of 30 mfd, 2700 ohms and 30 mfd.

Motorola 65X11, 12 and 13

(See page 32 for circuit)

Motorola models 65X11, 65X12 and 65X13 (chassis HS-2) shown in Fig. 3, use a 12SJ7 as an r-f amplifier in a 2-gang arrangement with resistance coupling between r-f and 12SA7 converter. An i-f wave-trap is placed across the converter input. The 12SA7 is conventional except for a 4.7-megohm resistor between oscillator grid and the avc bus to supply an initial bias. A separate avc filter isolates the i-f stage from the r-f and converter; values used are 2.2 megohms and .05-mfd. The detector and audio circuits are standard with a 12SQ7 and 35L6 feeding a 5" electro speaker. A 35Z5 rectifier uses the speaker field as a series filter element, no resistors then being necessary. A 25-mfd capacitor is used between *B*– and chassis.

Garod 45APA

(See page 32 for circuit)

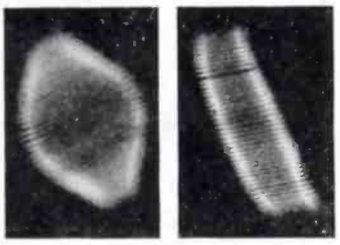
Garod's 4-tube portable automatic phonograph, model 45APA, appears in Fig. 4. This is an a-c job drawing 40 watts and using a 3-stage amplifier with degeneration through the second stage. Two equalizers are used between the crystal pickup and the 12SQ7 input grid; one, a parallel network of 250 mmfd and 100,000 ohms being connected in series with the output lead, the other operating as a bass compensation network (.01-mfd and 100,000 ohms) from the volume control arm to ground. A tone control of 100,000 ohms and .01 mfd shunts the output of the first audio. The second a-f stage uses a 12SK7 in a triode connection with 6800 ohms

(Continued on page 28)

It's the shape of the shimmy that counts!

Radio Dial Lights

CERTAIN radio frequencies cause considerable vibration in the filament and lead-in wires of a dial lamp. Testing old style lamps, General Electric research engineers found that the difference in natural frequency between the coil and the lead-in wires produced a destructive whipping action which eventually tore the filament apart. By "matching" these frequencies in the new lamps, they permitted the filament to vibrate without bending—and eliminated a common cause of lamp failure.



Old Filament New Filament

This example is typical of the constant research which makes G-E miniature lamps the leaders in quality and service. Features like these assure satisfied customers and satisfying profits when you sell G-E lamps for radio dial lights and similar uses:

1. Dependable, trouble-free performance.
2. High level of maintained light output.
3. Low current consumption.
4. Long life.
5. Profitable to handle.
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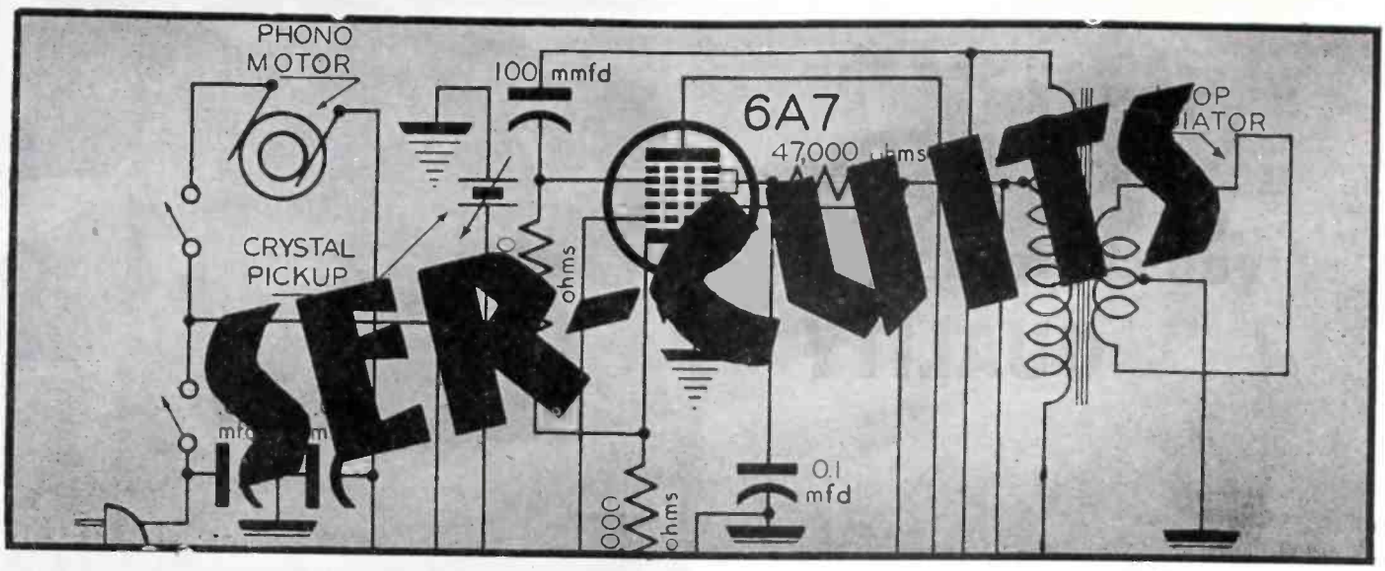
G-E LAMPS

GENERAL ELECTRIC



MANY UNUSUAL TUBE lineups are appearing in receivers today. In the ECA 108 push-pull a-c/d-c receiver, (Fig. 1, see page 28 for circuit), for instance, a 6SA7 converter feeds a 6SF7 combined i-f amplifier and diode detector with a standard avc system, and a 6SL7G dual-high-gain triode serves as first audio amplifier and inverter which, in turn drives a pair of 25L6 beam output tubes.

Inverse Feedback

An inversed feedback voltage is fed from the grounded voice coil to the low side of a ½-megohm volume control across 33 ohms and through a 100-ohm series resistor to control the degree of feedback. The tone control, which consists of a .002-mfd capacitor in series with a ½ megohm variable resistor, is directly across the volume control.

Triode Bias

Bias for the pair of triodes is obtained by a 2200-ohm cathode resistor without audio bypass. Bias for the push-pull stage is similarly obtained through 82 ohms. The inverter is excited from a potentiometer of 470,000 ohms and 18,000 ohms across the input to the first 25L6, the voltage being obtained from the 18,000 ohms. Because of the high plate currents demanded by the 25L6s, a pair of 25Z6G rectifiers must be used. One rectifier supplies the power tubes; the other, the rest of the set. Resistance filters serve both cases.

It should be noted that, in a receiver with inversed feedback from the output transformer secondary, the polarity of the windings of the output transformer must be rigidly observed or the set will break into severe audio oscillation.

G.E. YRB 82-1, 67-1, 67-2

(See page 31 for circuit)

Compact table models representing simplified 5-tube design appear in Fig. 2; G.E. YRB 82-1; 67-1 and 67-2. The loop primary and external antenna circuit contains a .01-mfd blocking capacitor and 470-ohm damping resistor to attenuate any resonant peaks in the antenna circuit. A 12SA7 oscillator grid leak of 22,000 ohms runs directly from oscillator grid to cathode instead of the usual *B*. A capacity winding is used instead of a grid capacitor. A 12SK7 i-f, 12SQ7 detector-first audio and 50L6 beam output stages are conventional with the power tube plate being supplied directly from the 35Z5 rectifier, the screen grid and balance of the receiver from a resistance filter of 30 mfd, 2700 ohms and 30 mfd.

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(See page 32 for circuit)

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Garod 45APA

(See page 32 for circuit)

Garod's 4-tube portable automatic phonograph, model 45APA, appears in Fig. 4. This is an a-c job drawing 40 watts and using a 3-stage amplifier with degeneration through the second stage. Two equalizers are used between the crystal pickup and the 12SQ7 input grid; one, a parallel network of 250 mmfd and 100,000 ohms being connected in series with the output lead, the other operating as a bass compensation network (.01-mfd and 100,000 ohms) from the volume control arm to ground. A tone control of 100,000 ohms and .01 mfd shunts the output of the first audio. The second a-f stage uses a 12SK7 in a triode connection with 6800 ohms

(*Continued on page* 28)

It's the shape of the shimmy that counts!

Radio Dial Lights

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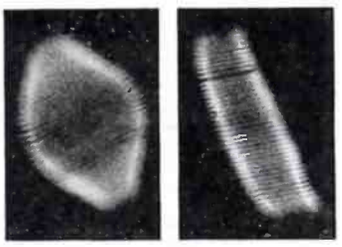

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1. Dependable, trouble-free performance.
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G-E LAMPS

GENERAL ELECTRIC

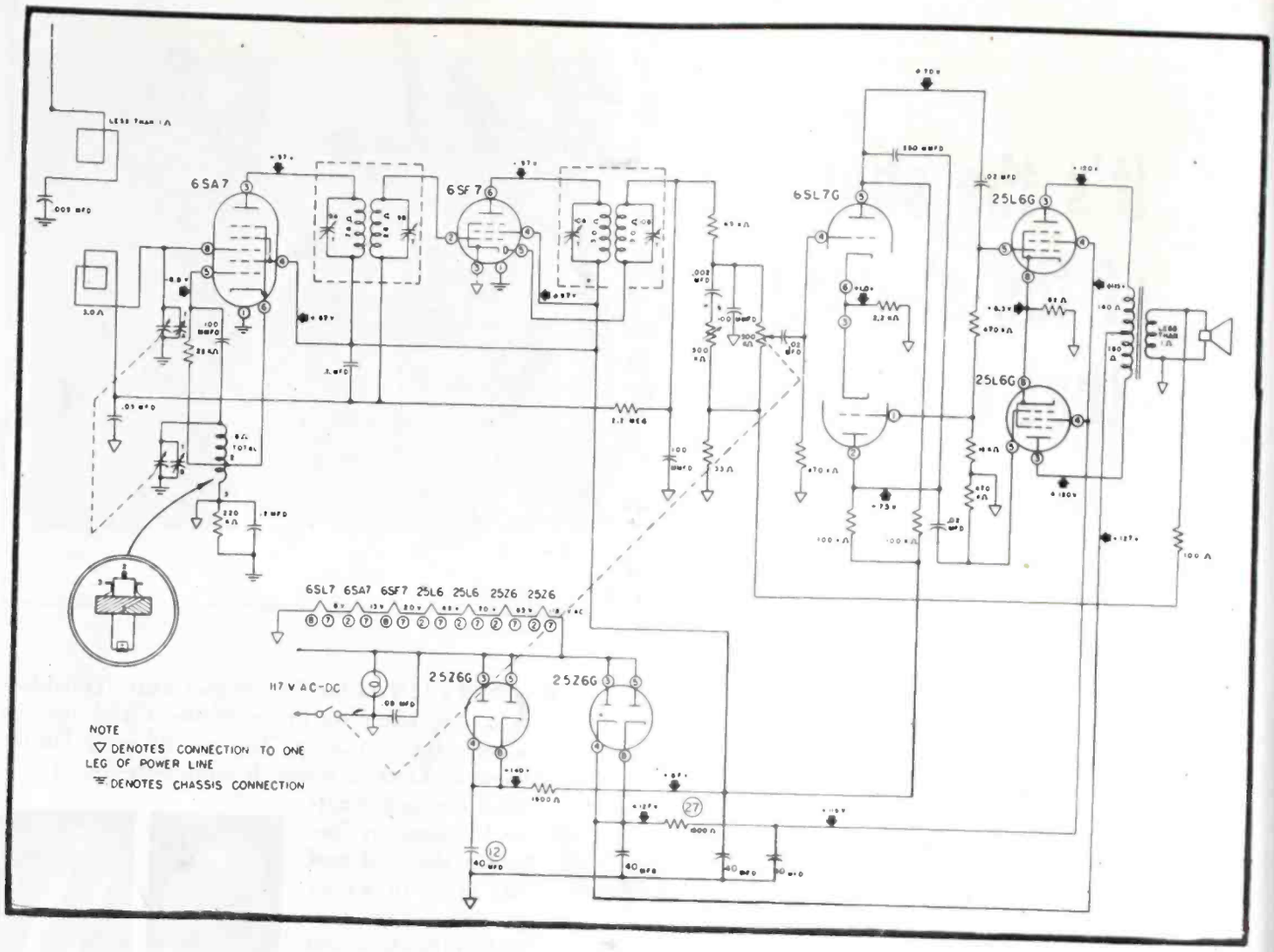

Fig. 1 (above). **ECA 108** push-pull a-c/d-c set using 6SA7 converter, 6SF7 combined i-f amplifier and diode detector with a standard ave system. Fig. 2 (left). Alignment procedure data for the ECA 108.

Alignment Procedure

In order to make a proper alignment, the following equipment is required:

1. A signal generator capable of providing a modulated radio frequency output over the frequencies required.
2. A suitable output meter or sensitive AC voltmeter with a .1 mfd series blocking condenser.
3. A coupling loop, made of three turns of stiff hookup wire, 4 inches in diameter, mounted on a suitable block of wood or stand.
4. A non-metallic screwdriver.

With the receiver on and the volume control at maximum, connect the signal generator to the coupling loop and bring the loop close to the receiver chassis. Adjust the signal generator output to minimum necessary to give a suitable indication on the output meter, which should be connected from B minus to the plate of one output tube. CAUTION: Make sure the output meter is isolated from DC by a series blocking condenser.

With the gang condenser fully meshed, adjust the pointer so that the left hand edge of the pointer saddle is one inch from the end of the dial frame.

SET SIGNAL GENERATOR AT	SET GANG	LOOP DISTANCE	ADJUST TRIMMER	TUNE FOR	OPERATION
455 KC	Meshed	Close	9a 9b 10a 10b	Max.	Align - I.F.
1720 KC	Fully Open	Close	20a	Max.	Align Oscillator
1400 KC	1400 KC	Close	20b	Max.	Align - R.F.

(Continued from page 26)

cathode bias, no bypass. This feeds a 50L6 with 150 ohms bias and again no bypass. The third a-f grid sends back a degenerative signal to the second a-f grid through .05 mfd and 470,000 ohms. *B* power is derived from a 35Z5 and a 2-section resistance filter, the 50L6 plate being supplied from the first section. The phono frame is grounded through a .005-mfd capacitor.

[Circuits, alignment procedures and voltage data on the G.E., Motorola and Garod models appear on pages 31 and 32.]

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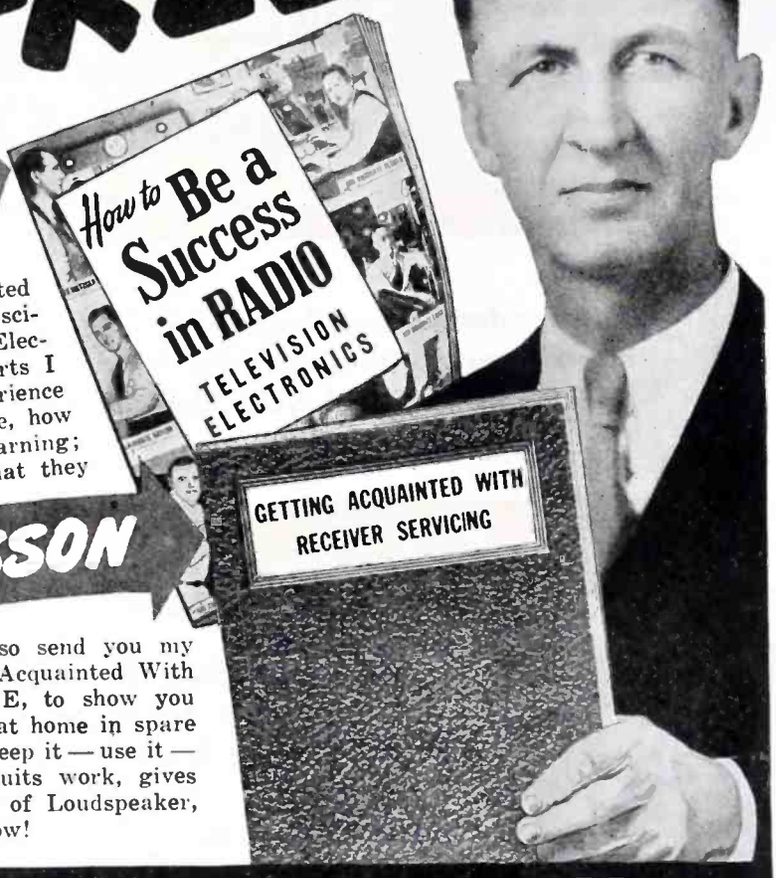

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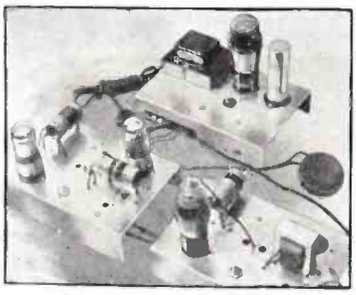

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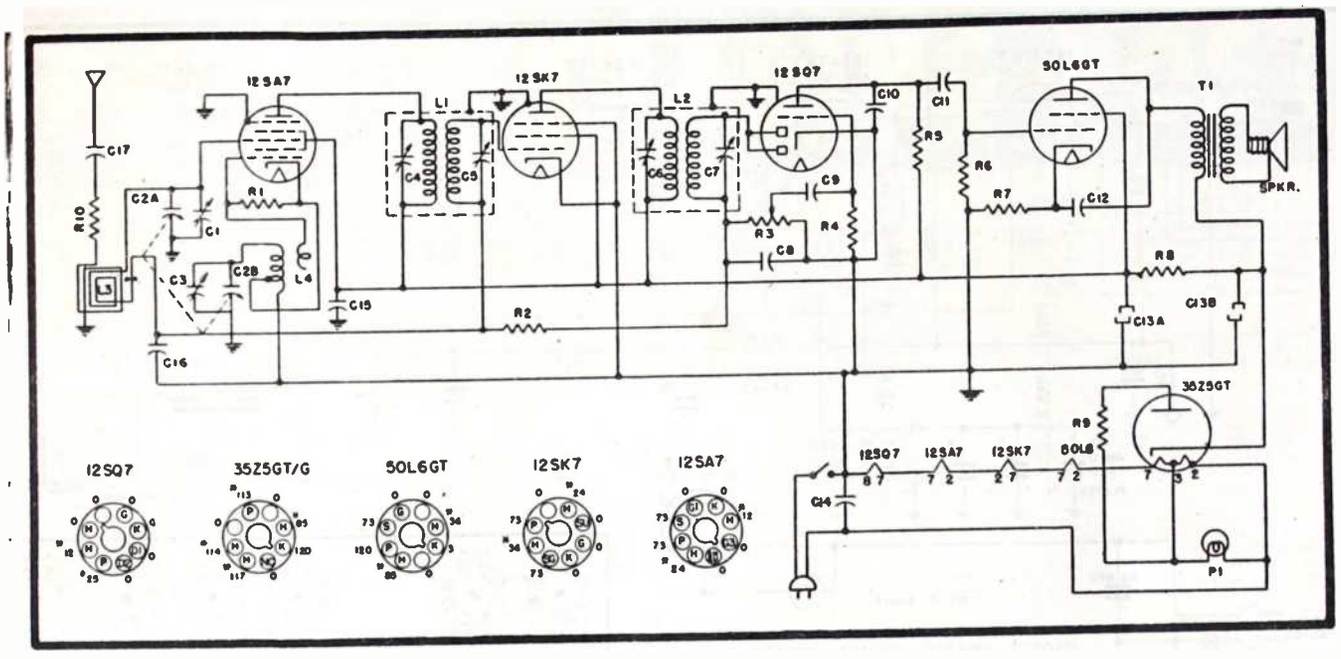


Fig. 2. G.E. YRB 82-1, 67-1 and 67-2 a-c/d-c five-tube receiver with loop primary and external antenna containing a .01-mfd blocking capacitor and 470-ohm damping resistor to attenuate any resonant peaks in antenna.

Circuit, Voltage Data, Parts List And Alignment Procedure for G.E. YRB 82-1, 67-1 and 67-2

Fig. 2 *a* (below). List of parts for G.E. receivers.

Symbol	Description
C1	Ant. trimmer condenser
C2A	Tuning condenser, ant. section
C2B	Tuning condenser, osc. section
C3	Osc. trimmer condenser
C8	220 mmfd mica capacitor
C9	.005 mfd paper capacitor
C10	220 mmfd mica capacitor
C11	.01 mfd paper capacitor
C12	.02 mfd paper capacitor
C13A	30 mfd electrolytic capacitor
C13B	30 mfd electrolytic capacitor
C14	.05 mfd paper capacitor
C15	.05 mfd paper capacitor
C16	.05 mfd paper capacitor
C17	.01 mfd paper capacitor
R1	22,000 ohm carbon resistor
R2	2.2 megohm carbon resistor
R3	Volume control .5 megohm
R4	4.7 megohm carbon resistor
R5	470,000 ohm carbon resistor
R6	470,000 ohm carbon resistor
R7	150 ohm carbon resistor
R8	2700 ohm carbon resistor
R9	18 ohm carbon resistor
R10	470 ohm carbon resistor

Fig. 2 *b* (right). Alignment data for G.E. models.

ALIGNMENT PROCEDURE

ALIGNMENT FREQUENCIES

I.F. ..... 455 KC
R.F. ..... 1720 and 1500 KC

I. F. ALIGNMENT

Connect an output meter across the voice coil. Turn the volume control to maximum. Set test oscillator to 455 KC and keep the oscillator output as low as a readable meter reading will permit. Apply signal to the converter grid through a .05 mfd capacitor and align progressively the trimmers in the 2nd and 1st I.F. transformer cans.

R. F. ALIGNMENT

Apply the R.F. alignment signals through a standard I.R.E. dummy antenna to the receiver antenna post. With the gang condenser wide open, align the oscillator trimmer (C17B) to 1720 KC. Change the generator signal to 1500 KC, tune the receiver to the signal and peak the antenna trimmer (C17A) for maximum output.

PRECAUTION

If the signal generator is A-C operated, use an isolating transformer between the power supply and the radio receiver power input. The use of an isolating capacitor is not recommended, as A-C through the capacitor will introduce hum modulation and/or create the possibility of a burned-out signal generator attenuator.

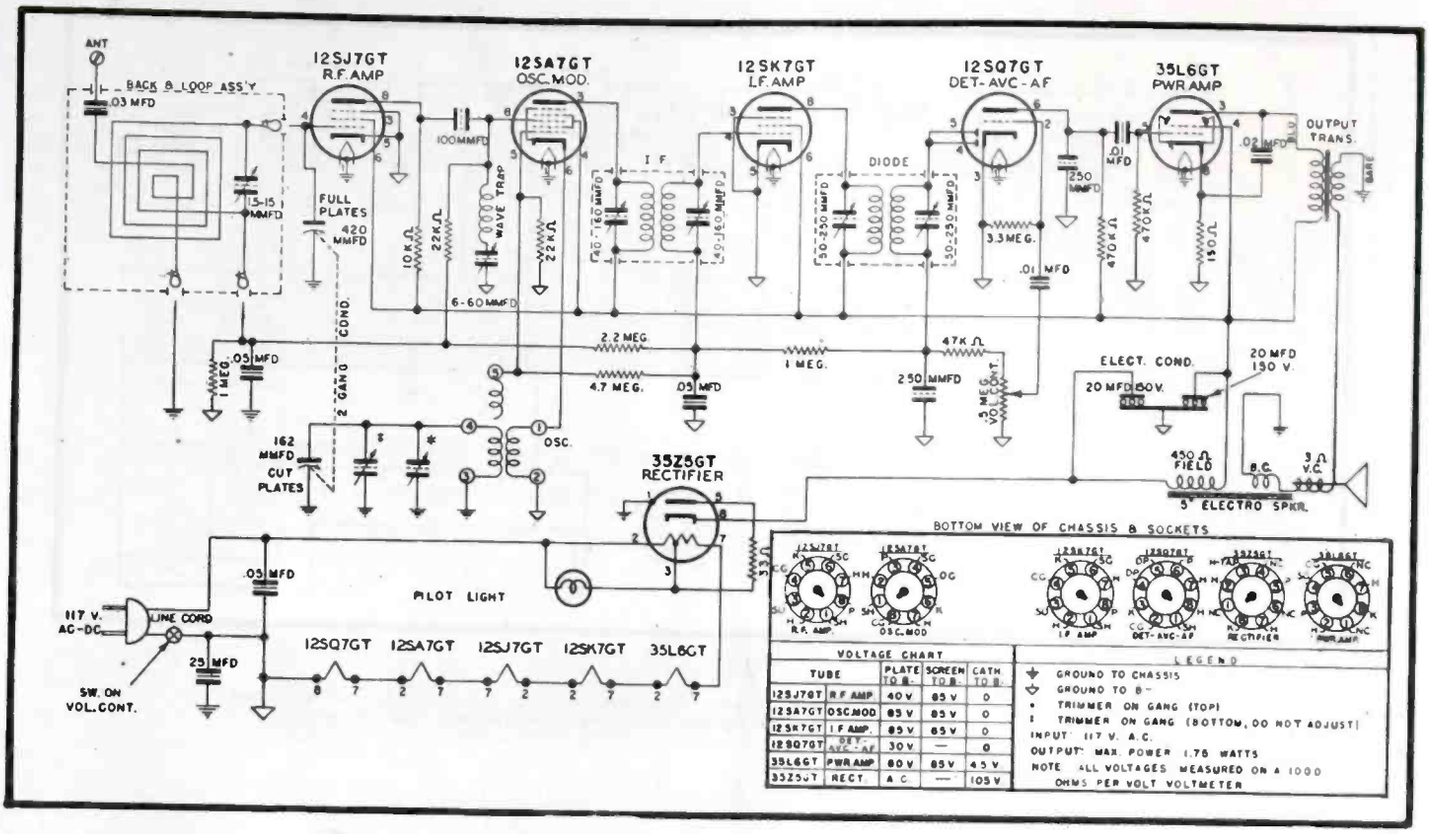
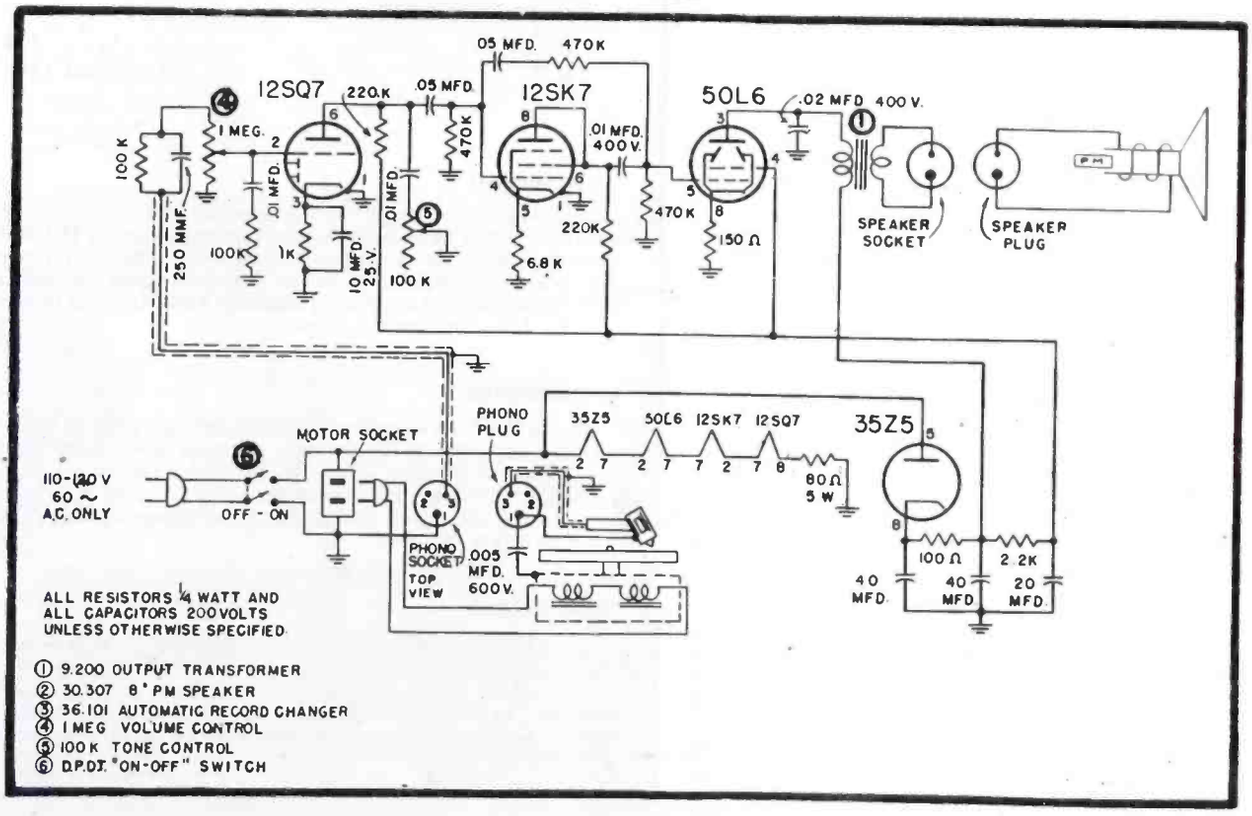


Fig. 3. Motorola 65X11, 12 and 13 with a 12SJ7 as an r-f amplifier in a 2-gang arrangement with resistance coupling between r-f and 12SA7.

Circuits of Motorola 65X11, 12 and 13, and Garod 45APA

Fig. 4. Garod 4-tube portable with automatic phono, model 45APA.



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FOR SALE OR TRADE — Weston tube checker #777, new, $50 or will trade for Rider manuals, any numbers. J. Simrin, 1555 Odell St., Bronx 62, New York.

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FOR SALE — New test equipment: Solar CE Exameter, $35; Simpson 260 VOM, $29.50; RCP #664 VT voltmeter, $39.50; Dumont 164D oscilloscope, $95; Triplett 2413 tube tester, $39.50 and used RCA record changer, $10. Write for list. Lifetone Sound Labs, 2013 Peoria Ave., Peoria 4, Ill.

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FOR SALE OR TRADE—100-watt American Beauty soldering irons; Taylor transmitting tubes, MB midget meters. Want good 16mm. Bell & Howell or Ampro sound movie projector. G. D. Griffin, 222 Eddy St., Ithaca, N. Y.

FOR SALE—2 pr. new Klein longnose 6" pliers, $2.25 ea.; new 200-watt American Beauty soldering iron, $7.25. M. A. Porter, 1709 N. Larrabee St., Chicago 14, Ill.

FOR SALE—"Fundamentals of Radio" by Everitt; "Mathematics for Electricians and Radiomen" by Cooke. $2 each. Majestic 91-92 chassis or speaker cheap. O. H. Williamson, Cooper, Texas.

WANTED—SX-25 in good condition. Will give my S-19R plus cash, or will pay all cash. V. E. Neilly, 1108 S. Atherton St., State College, Pa.

WANTED—A transcription player for 16" records at 33⅓ revs. Give price and details in first letter. H. W. Smith, 407 Arlington St., Austin 21, Texas.

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FOR SALE—C-D BN capacitor bridge; Sprague interference analyzer; C-B #126 'scope; C-B OMA oscillator; Simpson #230 V.O.M.; Trindell light weld and braze outfit. Malcolm O. Grow, 329 Iron St., Lehighton, Pa.

FOR SALE—New G.E. 24v input 1000v 350 ma. output dynamotor. Power supply; Meissner midget 3-tube midget with bc. coil less tubes. John C. Wirth, R.D. #1, Mifflinburg, Pa.

FOR SALE—Superior XRayometer; Superior model 1130S signal generator; Superior channel analyzer; Hay 0-10 ammeter; new Superior tube tester. $125 takes it all. Perfect condition. J. L. Roberts, Howard, Kansas.

WANTED—Complete set of Rider's service manuals. Ben's Radio Service, 1726 So. Purdum St., Kokomo, Ind.

FOR SALE—O.D. finish cabinet for SCR-211 frequency meter. Also 100th and 3000v 150 ma. transformer, not center tapped. E. Harris, 3319 Catalpa Ave., Chicago 25, Ill.

WANTED — Thordarson plate transformer T-19P63, 6000v CT 4840 CT 300 ma.; or T-19P68, 6000v CT 4680v CT 500 ma. Robert E. Foltz, 49GBT, 1214 4th Ave., Sterling, Ill.

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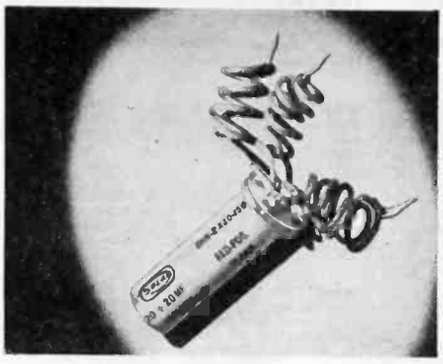
Harry Kalber Sales Manager

NEW PRODUCTS



SOLAR ELECTROLYTICS WITH STUD-DISK AND PLATE MOUNTINGS

A stud-disk and plate mounting device is now being used on all Solar type DH *universal* replacement dry electrolytic capacitors.

The design permits clamping of the capacitor to set chassis in a vertical position when type DH units are used to replace old screw-base or twist-prong electrolytics. No additional chassis holes are required.

For flat under-chassis mounting, the stud-disk is removable by bending two tabs. Capacitors may then be fastened by a universal mounting strap which is packaged with each capacitor.

* * *

STANDARD PRESSED STEEL TOOL KITS

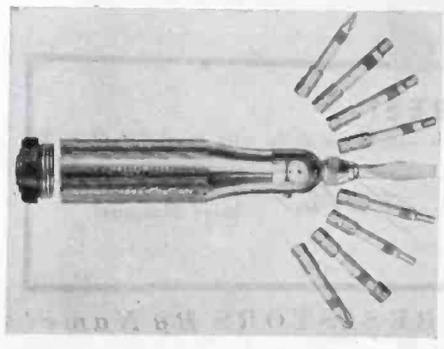
Seven tool kits containing 50 interchangeable tools have been developed by the Standard Pressed Steel Company, Jenkintown, Pa.

The *socket screw* kits, are available in two handle sizes, with a swivel bit-chuck; contain keys for driving socket set, cap, Phillips and slotted head screws.

Socket wrench kits, in two handle sizes and with a swivel bit-chuck, contain 6 and 12 point hex sockets from No. 4 up to and including ½".

Auto kits, in two handle sizes and with a swivel bit-chuck, contain those small tools necessary to auto maintenance.

The *home* kit is a midget tool (4" long) with gimlet, tack lifter, square awl, Phillips screw driver, ¼" and $\frac{1}{16}$" flat screw drivers and bottle cap opener.



RCA V-T AUDIO VOLTMETER

A vacuum-tube audio voltmeter, WV-73A, has been announced by the RCA engineering products department.

Instrument, featuring a 20 cycle to 20-kc meter range, can be used to measure gain and noise level in power amplifiers and ripple voltages in power supplies. Meter can be used to locate sources of frequency distortion and faulty amplifier components in receivers, phonographs, and public address systems.

The main components consist of a precision attenuator, three-stage high-gain stabilized amplifier, balanced diode rectifier, d-c microammeter, and a regulated power supply.

The voltage to be measured is fed to the attenuator through a shielded cable attached to a jack on the front panel. The attenuator consists of an eleven position switch connected to non-inductive resistors, arranged in such an order that consecutive switching ranges overlap by 10 decibels.

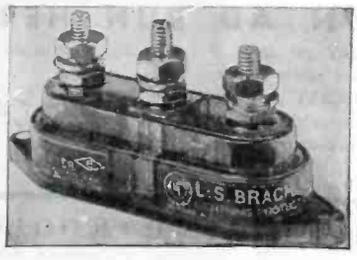
From the attenuator, the voltage is fed to the high-gain amplifier, which employs a conventional feedback circuit to obtain stabilization and sharply reduces the input capacity of the first tube. Output voltages from this amplifier are fed to a balanced diode rectifier in order to produce d-c for energizing the meter.

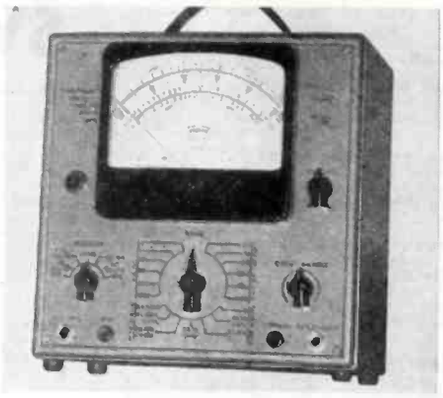
Rectifier is designed to produce an output voltage that is proportional to the average value of the full wave, providing a meter reading that is said to agree very closely with an rms meter for all usual distorted wave-forms.

* * *

BRACH LIGHTNING ARRESTER

A revised model of the Vis-O-Glow lightning arrester has been announced by the L. S. Brach Mfg. Corp., Newark, N. J. Arrester uses a sensitive rare gas tube in multiple with heavy conductive plates, forming an auxiliary air gap. The air gap plates do not function except when the current enters the antenna in excess of the capacity of the tube.





TRIPLETT VOLT-OHM-MILLIAMMETER

A volt-ohm-milliammeter, model 2450, that can be used for f-m and television or any sensitive circuit requiring high-impedance measuring, has been announced by the Triplett Electric Instrument Company, Bluffton, Ohio. Has long-scale 6" meter with three-color markings.

Uses two voltage-regulator tubes.

Ranges: D-c volts, 0-2.5-10-50-250-500-1000; a-c volts, 0-2.5-10-50-250-500-1000; d-c ma, 0-0.1-1.0-10-50-250-1000; ohms, 0-1000 (midscale 10)-10,000-100,000; megohms, 0-1-10-100-1000; capacity in mfd, 0-.05-.5-5-50-500.

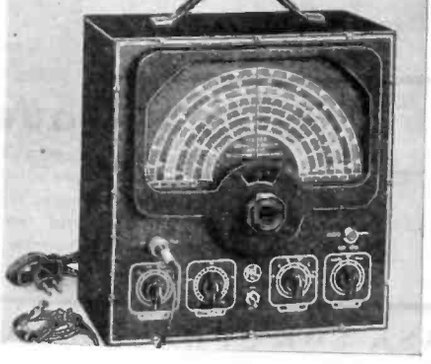
* * *

MICROMASTER TUNING SIGNAL GENERATOR

A signal generator, model 570, has been announced by the Premier Electronic Laboratories, 382 Lafayette St., N. Y. 3, N. Y.

Featured is the *Micromaster Precision Dial*, which contains spring-loaded split gears to eliminate backlash and provide split-cycle tuning. Frequency range, 75 kc to 50 mc on fundamentals and up to 150 mc on third harmonic.

Buffer stage is modulated by an internal 400-cycle generator providing pure sine wave modulation (less than 5% distortion) as well as an audio signal for external testing purposes. Instrument can also be modulated by an external variable audio oscillator.



BRUSH MAIL-A-VOICE RECORDER

A magnetic recording device, the Mail-A-Voice, that records and reproduces on magnetic-type *folding* paper blanks has been announced by the Brush Development Company, Cleveland, Ohio. Unit draws 27 watts in *play* position and 31 watts in *record* position. Recording time is 3 minutes; turntable speed 20 rpm; recording 40 lines to inch. Recordings can be folded into any letter envelope, and can be *erased* and used over or filed for permanent record.

* * *

LENNAN POCKET LIGHT

A pocket light that clicks the light *on* when the bulb is pressed, has been produced by Lennan Lights, Inc., 231 West Olive Avenue, Burbank, California. Touching a release-ring (through which the bulb protrudes) clicks the light *off*.

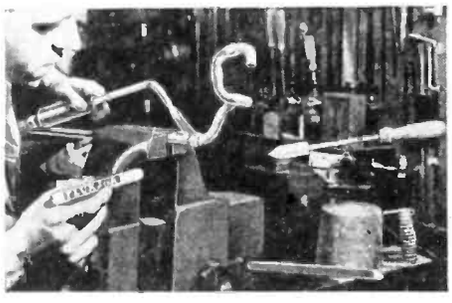
Supplied in two sizes: pen two cell and finger length one cell.

* * *

LAKE CHEMICAL STICK FORM SOLDERING FLUX

Soldering flux molded into a stick form, *Flux-Stick*, has been developed by the Lake Chemical Co., 607 N. Western Ave., Chicago 12, Ill.

Form is said to be non-acid and non-running. Can be applied to hot or cold metals.



* * *

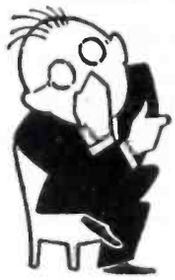
C-D MIDGET CAPACITORS

A line of flat midget capacitors, type ZN, is now available from Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

Capacitors are non-inductively wound with Kraft paper and impregnated with halowax. The leads are anchored to the capacitor body.

Types include units from ¾" length, ¼" width and 3/32" thickness to that of

(*Continued on page* 38)



OLD TIMER'S CORNER

by SERVICER

A FEW WEEKS ago the boys decided to hold a round-robin talk-fest at the club house. After tossing a few problems around, one of the boys asked if we had heard about the comparative new-comer in our midst, Richard Ronsten. Dick had returned from a stint in the Signal Corps with a Purple Heart and a lot of know-how. He had set up a small store back on Juneway Terrace and was even now, less than a year after opening, pushing the old timers of the town all around the place in the matter of sales.

Not that he had a lot of customers, but he did manage to sell a lot of industrial equipment installations and round up a lot of business from the local school and even from some of the county offices.

"I've heard of him, and I think he's crooked", said John, who was always blaming everything that went wrong on the other fellow's alleged crookedness, though heaven knows there was not ever any truth to his remarks. "Nobody could get all that business without doing something out of the way," he concluded.

"I've heard of him, too, and I think that you are wrong, Johnny," I said. "You're just jealous because Dick is a better salesman than you, than perhaps everyone of us. And he's got energy to burn and gets around, too".

"I suppose that energy got him the Gates School installation. I suppose that it was only energy that got him the County Court House p-a installation. Or the County Sewerage Disposal Plant intercom job. . . ."

"Don't be so hasty, John," I remonstrated." There are a lot of ways for any of us to get those jobs if—and I say again, *IF* we wanted them as bad as Dick!"

"You mean he cut prices? You mean that perhaps he played politics?" Johnny guessed hopefully, for he was loath to agree that Dick had really outsold and out maneuvered him.

"I mean nothing of the kind!" I said heatedly. "Dick is as square a shooter as anyone of us . . . perhaps even a bit squarer. I happen to know what he's been doing because he consulted with me before he ever started out in the radio business. If you fellows will quiet down, I'll give you the whole story."

"If you know the whole story, why didn't you sell those jobs yourself," Johnny demanded. "You're not so rich that you can afford to pass that type of work up. Especially the County Court House installation which ran into four figures. That's nice money, fellow!" Johnny concluded.

"I could have gone after those jobs, too," I told the gang. "But in a way I am not fitted out to do that sort of thing any more. I lack the man power and

the instruments. Also I would rather sell sets and repair them than to make installations, regardless whether they be in the local Gates School or the local dance hall."

"Now do you boys want to hear how Dick did it, or not?" I finished.

"We do, and it had better be good," they chimed in.

"Well, Dick came into my shop during that first week that he was back from the wars. He asked me a lot of questions about starting a radio store and I told him what I could. After all I would give all of you fellows a lift, why not Dick? He was quick to see that with his know-how acquired from Uncle Sam in the Signal Corps that he would be a whiz at installations. Also Uncle Sam had been a trifle forgetful in teaching Dick how to *sell* anything except the business end of a gun. Dick had installed all sorts of p-a systems and radio sets for the Army. He had had charge of the Red Cross hut installations. He had saved enough for the tools and he knew so many short cuts in work that he could actually do the work of two men himself.

"You all remember when he opened. His store was small and he didn't have many sets on display. For that matter none of us had any either. But he had one thing that few if any of us had. He had a little book filled with information on auditorium coverage, how many watts were needed to cover an office, and a wealth of catalog sheets which he had accumulated.

"He didn't wait for the manufacturers to send him these sheets like you fellows. No he did not. He wrote again and again and so got first hand information of what was available. Now many of us signed up with one or another house to handle their merchandise. Dick didn't do that. He went over to see the local distributors. He told them that he was just starting and would they be interested in having him try to sell their *available* material for any installation he could get. Mind you, he told them it would not be exclusive with any one of them, only that he would sell what he could and would not stock any manufacturer's models. This sounded fair to the distributors, since they didn't have the contacts that Dick said he had. And since the territory was open anyhow, they were agreeable.

"Then Dick went around to the Gates School, for instance. He made measurements, he looked over the construction of the school building, and he went there while there were students in the rooms too. Then he went back to the store and figured exactly what it would take to cover that building itemizing the cost of the wire, the units, the loudspeakers and the fees he wanted for the installation.

"Then armed with these facts, neatly typed, he approached the principal of the school. Naturally, the principal was only too glad to have the figures and he readily agreed that a p-a system coupled to a good phono-radio combination was just what was needed. Only there was the matter of the School Board to hurdle.

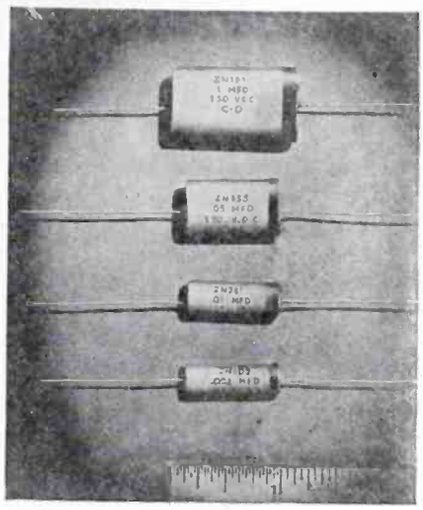
"Dick told the principal that he would undertake to talk to the School Board for the principal. And he did so. He showed the head of the Board what the installation would cost, how long it would take for the installation and how long there was a guarantee. In fact he showed the chairman of the Board how

(*Continued on page 47*)

NEW PRODUCTS

(*Continued from page 35*)

1" length, 5/8" width and 3/16" thickness. The values range from .0001 mfd to 0.1 mfd; d-c rated voltages from 150 to 600.



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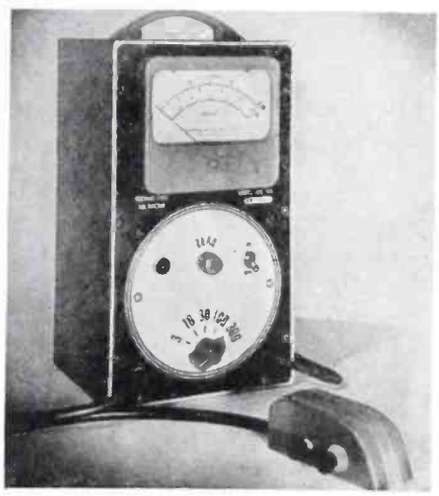
SCHOTTLAND V-T-V-M KIT

A vacuum-tube voltmeter kit, LKV-300, has been announced by Frederic D. Schottland, 104-18 Metropolitan Avenue, Forest Hills, N. Y. Voltage range is .2 to 300 a-c in five ranges. Frequency response, 50 cps to 50 mc. Uses one 6AL5; two 6J5 and one 6ZY5G.

Circuit features a twin-diode probe working into a bridge-type feedback stabilized amplifier.



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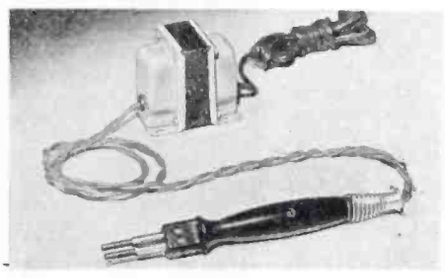
THERMADOR SOLDERING TOOL

A soldering tool that is said to require no preheating has been developed by the Thermador Electrical Manufacturing Company, 5119 District Boulevard, Los Angeles 22, California. Operating current is in use only through actual contact with metal and cools immediately.



Standard equipment includes 3/16" carbon tips, Thermatite transformer, 6" of rubber-covered primary cord and 4' flexible cotton covered secondary heater cord. The voltage across the carbon rods is 6.

Specifications: 96 watts, 50/60 cycles, 110-120 volts a-c; length including carbon 7", weight of tool 3 ounces, total weight including transformer approx. 3½ pounds.

* * *

G. E. GERMANIUM CRYSTAL

Germanium crystal diodes, with a safe forward current of .05 ampere and a safe back voltage of 60 volts, have been announced by the specialty division of the G. E. electronics department.

Diode can be used as a rectifier, modulator, detector or voltage regulator.

Body length 23/64", diameter 7/32". Interelectrode capacitance approximately .2 mmfd. Life performance about 3000 hours.

Diode is reported to be extremely sturdy, units having been dropped 10 successive times to a hardwood block from a distance of 30" without impairment of performance.

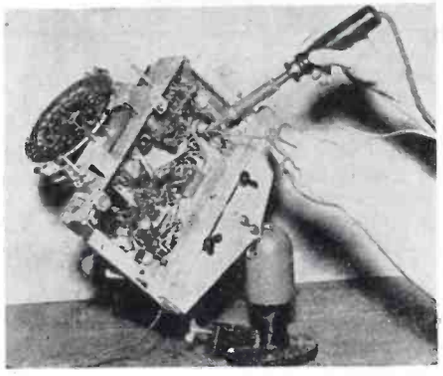
* * *

POWRARM UNIVERSAL POSITIONER

A universal work positioner to hold and position all kinds of benchwork, the Powrarm Automatic Positioner, has been produced by the Garfield Engineering Corporation, Kansas City, Missouri.

Positioner is said to hold light or heavy work and permit turning 360° at any

angle or horizontal or axial planes and 180° on vertical planes. Produced in both hydraulic and mechanical models.



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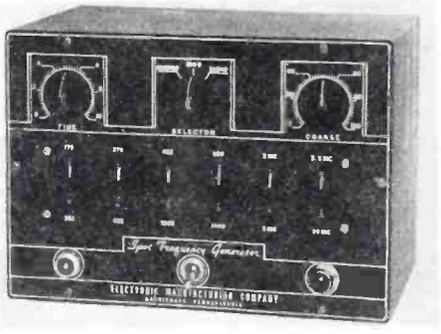
ELECTRONIC MANUFACTURING SPOT-FREQUENCY GENERATOR

A spot-frequency generator, model 200, containing 12 pre-set frequencies, has been developed by the Electronic Manufacturing Company, 714 Race Street, Harrisburg, Pennsylvania.

Stability is said to be assured by an electron coupled circuit. Attenuates to less than one microvolt.



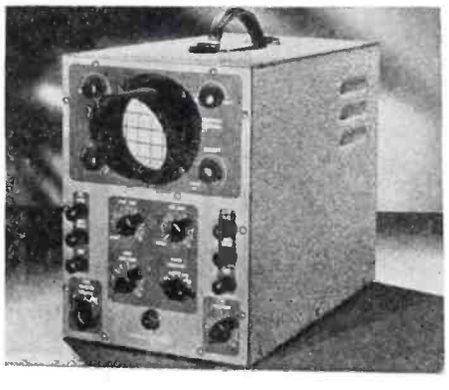
* * *

SYLVANIA CATHODE-RAY OSCILLOSCOPE

A portable-type c-r oscilloscope, model 131, has been announced by the radio tube division, Sylvania Electric Products Inc., 500 Fifth Avenue, New York 18, N. Y.

Signal frequency range from 15 to 40,000 cycles is provided with a five-range selection control. Visual study of wave form is provided by a 3" cathode-ray tube designed for 650-volt deflection plate operation.

Sweep circuit of oscilloscope is built around an 884 gas-triode oscillator. Tube complement includes 3AP1 c-r tube; 5Y3GT/G rectifier; 7Y4 rectifier; two 707 amplifiers; and the 884 gas triode oscillator.



NEWS

HOWARD W. SAMS ANNOUNCES RADIO SERVICE CLINIC

A radio service clinic section offering a consulting service for service shops, dealers and jobbers has been announced by Howard W. Sams & Co., Inc. The section will be conducted at 2805 E. 10th Street, Indianapolis, Indiana, where some 3,000 square feet of floor space are being laid out and equipped with all the facilities of a modern service shop. The regular Photofact activities will be conducted at 2924 E. Washington Street, Indianapolis, Indiana.

The new section will function as a clinic for service routines. Time charts, parts costs, suggested parts inventories, consumer charges and printed forms will be among the many subjects that will be analyzed by the clinic.

The service will be offered to subscribers of Photofact Folders who are members of the Howard W. Sams Institute. The Institute has been very active in solving a variety of Service Men's problems, having offered thus far thousands of replies to technical questions, schematic diagrams and information, recommendations and advice covering replacement parts, receiver troubles, etc. The Institute has also prepared four monographs: "How Much Is Your Labor Worth?" (4 parts); "Accounting Procedures for Radio Service Engineers" (5

parts); "How To Make Radio Cabinet Repairs" and "How To Increase Your Business."

The clinic will not only concern itself with a-m equipment but frequency modulation and television.

* * *

LEON ALPERT NOW HEADS EASTERN AMPLIFIER

Leon Alpert has purchased a 50% interest in Eastern Amplifier Corporation, 794 East 140th Street, New York 54, N. Y. and has assumed complete supervision and control of general management.

Leonard A. Meyerson has retired from Eastern Amplifier and resigned as president.

Walter E. MacDonald has been appointed general sales manager.

Leon Alpert

* * *

GENERAL TRANSFORMER SERVICE MANUAL

A service manual and parts list covering models of Porta Power has been prepared by General Transformer Corp., 1264 W. Van Buren St., Chicago, Ill.

* * *

MALLORY VITREOUS ENAMEL RESISTOR FOLDER

An 8-page engineering data folder, VER-1146, describing vitreous enamel resistors, has been released by P. R. Mallory & Co., Inc., 3029 E. Washington St., Indianapolis 6, Ind.

The data folder contains detailed descriptive text regarding Mallory vitreous enamel fixed and adjustable power resistors; fixed tab, adjustable and ferrule construction in commercial types, and Mallory type RN fixed resistors in tab construction.

Detailed specifications for each type include resistance values, ratings and dimensions and all other essential technical information on construction and performance.

* * *

SOLAR EXPANDS CAPACITOR REPLACEMENT LINE

Some 63 new ratings have been added to the line of Solar DY twist-prong electrolytics. The expanded line includes high capacitance and multiple voltage capacitors of values hitherto generally unavailable.

Capacitors are described in Solar leaflet ES-102, available from Solar Capacitor Sales Corp., 285 Madison Avenue, New York, N. Y.

* * *

G.E. TELEVISION COURSES

First of a series of two-week television courses to acquaint distributors with the technical aspects of television installation and service were recently presented by the receiver division of G. E.

Some 25 service managers and personnel representing distributors in present

(*Continued on page* 48)

SIMPLIFIED FOLDED DIPOLE F-M AND TV RECEIVER ANTENNA

AN F-M OR TELEVISION receiving antenna can be constructed with FTR 300-ohm leadin wire K-1046.

Requiring between 5′ and 10′ depending on the frequency, this antenna, a *T* match type, consists of a 300-ohm cable which is a half wavelength long. It is shorted at both ends and has a one conductor cut in the center as the input or leadin point.

To make up the antenna, the cable is shorted first at both ends by stripping the insulation for a short distance and twisting the two conductors together. Then they are soldered and an insulating lacquer spread over them to weatherproof the connection. These shorted ends also provide a means of supporting the antenna without effecting the characteristics of the transmission line.

Then the leadin is connected to the midpoint of one conductor. This operation requires a little more caution since the width of the cut must exactly equal the conductor spacing of the leadin. The cut is made just clear of the inside of one conductor exactly at the midpoint. Sufficient insulation is removed from the two ends of the conductors thus provided so as to enable the leadin to be connected to them. The connections are soldered and lacquered and the assembly is now ready for mounting.

The antenna is mounted by simply suspending it on to an insulating material, such as wood, using the two exposed short circuited ends as means of support. For maximum signal pickup the antenna should be as high off the ground as possible. However when an outdoor antenna is either impractical, (due to climatic conditions), or unnecessary, the antenna can conveniently be placed under the rug or behind a piece of furniture.

The antenna shown in Fig. 1 was designed for f-m reception and is therefore 58″ long.

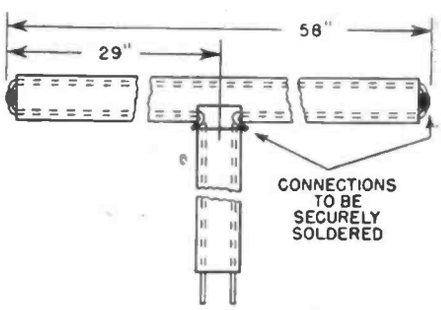


Fig. 1. Structural drawing of the f-m antenna using a 300-ohm leadin cable.

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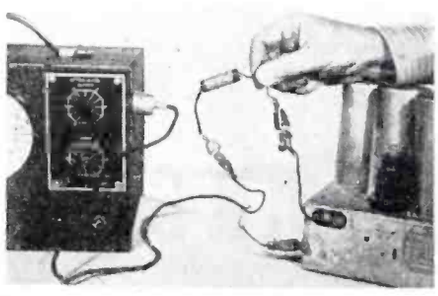
SIGNAL-GENERATOR AID



A small size capacitor arranged with clips on the terminals saves time when aligning receivers.

SERVICING HELPS

(*Continued from page 24*)

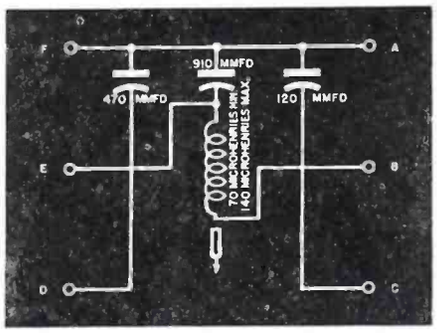
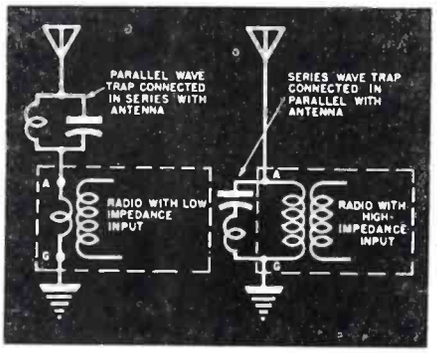


Fig. 1*a* (above). Schematic of multi-range wave trap with a range of 450 to 2100 kc.

1(*a*). The unit has an approximate range of 450 to 1,200 kc.

On sets with a low-impedance input (few turns on primary of antenna coil, with a d-c resistance usually less than 10 ohms) the trap (parallel type) is connected in series with the antenna; Fig. 1 (*b*).

Where the input impedance is high (large number of turns on primary of antenna coil, with a d-c resistance of



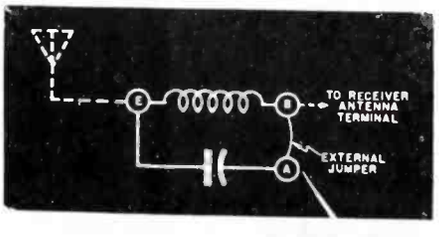
Figs. 1*b* (above left) and *c* (right). In *b* appears the connection for a parallel wave trap connected in series with the antenna, and in *c* appears a series wave trap connected in parallel with antenna; the *b* connection is for a receiver with a low-impedance input, while the *c* connection is for a receiver with a high-impedance input.

10 ohms or more) the trap (series type) is connected in parallel with the antenna; (Fig. 1(*c*).

There are many ways in which the trap can be connected. For 450 to 760 kc (Fig. 2), for instance, the antenna lead is removed from the receiver and

(*Continued on page 44*)

Fig. 2. Wave trap connection for 450 to 760-kc range.



SERVICING HELPS

(*Continued from page 43*)

connected to terminal, *E*, on the wave-trap. A short connector is connected between trap terminal, *B*, and receiver antenna terminal, *A*. Then terminals, *A* and *B*, are interconnected with a jumper lead.

For the 450 to 760-kc range trap terminal *B* can also be connected to receiver antenna terminal, *A*, and trap terminal *A* connected to receiver ground terminal, *G*; Fig. 3. Normal antenna and ground connections on receiver should not be disturbed.

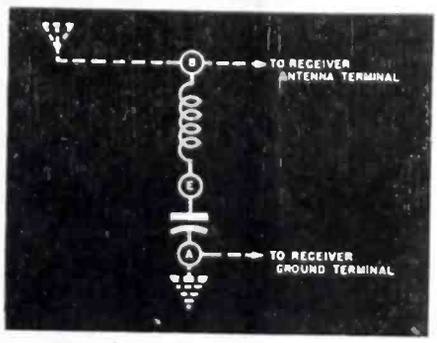


Fig. 3. Wave trap connection for 450 to 760-kc range.

Dual Range Connections

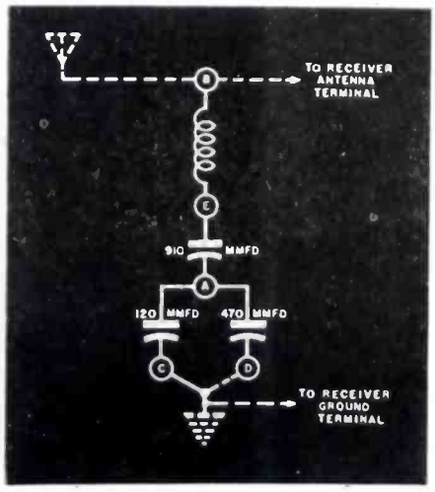
Figs. 4 and 5 show other methods that can be used to cover the 760 to 1,275-kc and 1,275 to 2,100-kc ranges. In Fig. 4, *C* goes to ground for the 1,275 to 2,100-kc range and *D* goes to ground for the 760 to 1,275-kc range.

Trap terminal *B* goes to receiver antenna terminal, *A*, and trap terminal, *C* or *D*, to receiver ground terminal, *G*, as required to give the correct range. Do not disturb normal antenna and ground connections on receiver.

In Fig 5, for the 1,275 to 2,100-kc range *C* goes to *B*; for the 760 to 1,275-kc range, *D* goes to *B*.

Antenna lead is removed from receiver and connected to terminal, *E*.

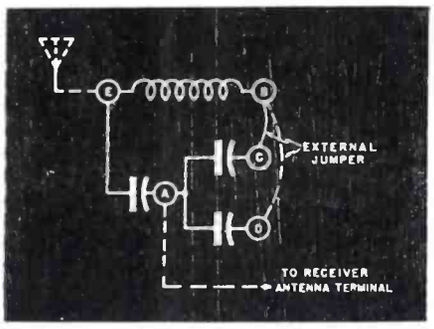
Fig. 4. Method of connection of trap for the 760 to 1275-kc and 1275 to 2100-kc ranges.



on trap. A short connector is installed between trap terminal, *A*, and receiver antenna terminal, *A*. Then trap terminals, *C* and *B* or *D* and *B*, are interconnected with a jumper lead to give the required range.

[All wave trap schematics courtesy RCA]

Fig. 5. Trap connections for two ranges: 760 to 1275 kc and 1275 to 2100 kc.



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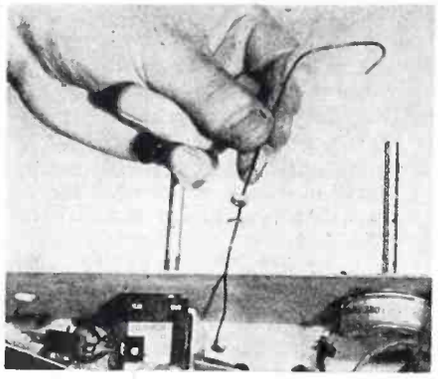
WIRE TO POSITION NUTS AND WASHERS



Difficulty is often experienced in placing nuts and washers on the threads of a bolt which is located under radio wires and parts.

The use of a piece of soft bare wire will speed up such work.

One end of the wire is placed on the end of the bolt and the other end of the wire is slipped through the holes in the nut and the washer.

The nut and washer are then guided along the wire to the bolt.

•

NEWCOMB AUDIO DISPLAY

Newcomb Audio Products standard model (H series) and deluxe model (K series) amplifiers displayed at the recent Los Angeles West Coast Electronics Manufacturers Association Show. Newcomb is located at 6824 Lexington Avenue, Hollywood 38, Calif.

JOHN RIDER SAYS...

The First Impression

"Have you ever visited the pretentious offices of a professional man—or, for that matter, any establishment which was clean, orderly, obviously well conducted and bespoke affluence—a business which catered to the higher income earners? There is hardly a human being who does not develop certain favorable mental reactions under such conditions.

"As the client or customer—you feel that you'll pay for what you're getting—maybe a bit more than you would have to pay elsewhere—but it's probably worth it. You're inclined to think: the individual *must* be good to afford such a layout! Even when you feel that you're paying more than you might elsewhere—you take pride in doing business with such a man or such a store . . . the air of the place—the courtesy tendered makes you sell yourself. It accomplishes effects never possible through advertising alone. That first impression is extremely important. *Are you cultivating such an approach in your shop?*"

TUBE NEWS

(*Continued from page 22*)

twin triodes, beam-power amplifiers, duplex-diode high-mu triodes, h-f power triodes, u-h-f amplifier triodes, twin triodes, sharp cut-off u-h-f pentodes, remote cut-off u-h-f pentodes, u-h-f diodes and triodes, and full-wave and half-wave rectifiers.

These tubes have been made for filament and heater ratings of 1.4 to 117. The majority of the tubes are for 1.4 and 6.3 volts. Plate supply for these tubes vary from 45 to 250. The 1L4, 1R5, 1S4, 1S5, 1T4, 1U4, 3A4, 3A5, 3Q4, 3S4, and 3V4 all are filament type tubes.

The *1*-type tubes are for 1.4 v; *3*-type tubes for 1.4 and 2.8 v; *6*-type tubes for 6.3 v; *12*-type tubes for 12.6 v; and the 9000-series are for 6.3 v. The prefix numbers of the rectifiers also indicate the cathode voltage; 35W4, 35 volts, 45Z3, 45 volts, etc. The exception to this rule is the 1654 half-wave rectifier which operates with only 1.4 volts.

The screen-supply voltages that can be used with these tubes vary from 45 to 180. For instance, the 1L4 r-f amplifier pentode will operate with either 67½ or 90 volts on the screen, while the 6AK6 power-amplifier pentode and the 6AQ5 beam-power amplifier operate with a screen supply of 180 or 250 volts, respectively.

On page 22 appears a quick reference chart identifying the various miniatures. A chart of socket connections for these tubes will appear in the March issue of SERVICE.

(All data supplied through the courtesy of the Tube Department, RCA)

•

TIRE TUBE TO PROTECT METER AND PREVENT CASE SLIPPING

Smooth-surface slipping of pocket-size indicating meters can be prevented by use of a strip of tire tube.

With test leads attached it is very easy to pull the meter from a smooth bench top since the case is also smooth. The rubber strip arranged as illustrated gives traction to the case and prevents this possibility.

Section of tire tube can be so placed to protect the meter glass face when not in service.

TELEVISION

(*Continued from page 16*)

tube the beam is checked, so that with no charge on the target, it does not quite reach the target and returns to the base of the tube. However when the target contains positive charges in the form of an image enough electrons will be attracted to the back of the target to neutralize the positive charges while any remaining electrons will turn and go to the electron multiplier in the base of the tube. This return beam will now be of a varying intensity due to the loss of some electrons on the target, and this variation will be in proportion to the original image focused on the tube. The return beam will be attracted to the multiplier section where it will strike the first dynode. From this point the action is very similar to that of the 931. The output of the multiplier section of the tube can be fed into the input circuit of a video amplifier and used to modulate a television transmitter.

OLD TIMER'S CORNER

(*Continued from page 37*)

easy it would be to take advantage of certain short-wave lessons being broadcast from Boston and some other places. All this had a bearing on the sale. In the final analysis, Dick did a bangup job.

Dick Got the Job

"But he was not through. The head men demanded more information on the short-wave teaching that was going on, according to Dick. So Dick got on the long distance phone and had a complete curriculum back here in 24 hours. And to clinch the argument, he invited the whole Board to a demonstration of what was being taught by setting up a short-wave receiver in the school office and bringing in the program for all to hear. That did it.

"Dick got the job. He told me he made about $600 for a two weeks' work period, which is not bad. So when you say that Dick got the jobs through pull or by being crooked, you fellows are just pulling the wool over your own eyes. Dick's just a natural-born salesman. And above all, he's very thorough, and not a bit afraid of work.

"When he goes after any job he really does a lot of preliminary work and surveying. He knows every corner that can be cut, and he knows every expense that normally one would run into in the installation. That sort of salesmanship is too rare to be turned down.

"So if you fellows want to keep up with Dick—who I predict will be a member of the local Chamber of Commerce before we're a year older—you had all better get on your respective horses and ride like the wind. . . . That's the only way that you can catch Dick. let alone pass him!"

•

ALUMINUM VOICE COILS

Aluminum-foil based voice coil recently developed for loudspeakers.
(Courtesy G.E.)

•

Correction

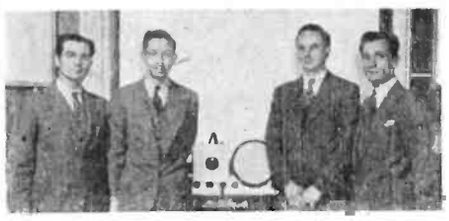
In the cover diagram of January, SERVICE, the plate and the grid return of the first i-f transformer should have been connected to B+ and ground, respectively.

NEWS

(*Continued from page 41*)

television areas attended the sessions.

Among the topics covered were a thorough analysis of the salient features of a television receiver, factors which influence the design of receivers, tubes, television signals, components, future engineering trends, power supplies, antenna and transmission lines, installation adjustments and trouble shooting.



Instructors who directed the television training course, left to right: K. Fowler, W. L. Parkinson, H. B. Lippert and B. Anthony.

* * *

WALCO CATALOG

A 4-page folder describing sapphire, ruby and precious metal needles, and illustrating needle displays and other merchandise helps, has been prepared by Electrovox Company, Inc., 31 Fulton St., Newark 2, N. J.

* * *

SCHELLSCHMIDT MECK AD HEAD

Richard H. Schellschmidt has been appointed advertising manager of John Meck Industries, Plymouth, Indiana.

* * *

OHMITE OHM'S LAW CALCULATOR

A pocket-size Ohm's Law calculator has been produced by Ohmite Manufacturing Co., 4877 Flournoy Street, Chicago.

The calculator provides direct readings in ohms, volts, amperes and watts. It also supplies answers to parallel resistance and series capacitance problems and will multiply, divide and find squares and square roots.

All computing scales are printed on one side. On the opposite side are a composition resistor color code and catalog number of stock resistors and rheostats.

Cost of calculator is 25 cents.

* * *

ALUMINUM SOLDER CORP. TO MAKE SWISS DEVELOPED ALUMINUM SOLDER

Exclusive manufacturing and distribution rights in North and South America for an aluminum solder, Prolyt, which uses no flux or flux substitute, developed by Walter Schaffner and Herman Grunauer, Swiss engineers, has been acquired by the Aluminum Solder Corporation, 10 East 52nd Street, New York City.

The solder was processed for Handex AG, Zurich, Switzerland, during the war.

* * *

HARKAVY JOINS INSULINE

Victor M. Harkavy has joined the Insuline Corp. of America and will be in

charge of new product development and design.

Mr. Harkavy was formerly assistant division chief of the Crystal Research Laboratories, Hartford, Conn.

* * *

SCENIC RADIO CATALOG

A 16-page catalog describing signal generators, tube testers, signal tracers, meters, capacitors, record changers, pick-ups, etc., has been released by Scenic Radio and Electronics Co., 53 Park Pl., N. Y. 7.

* * *

DERBY CO. NAMED HALLICRAFTERS SERVICE CENTER IN CHICAGO

John M. Derby Company, 151 East Erie Street, Chicago, Illinois, have been appointed Hallicrafters service center in Chicago.

* * *

JOHN H. MILLER APPOINTED WESTON ENGINEERING VICE PRESIDENT

John H. Miller has been named vice president and chief engineer of Weston Electrical Instrument Corporation, Newark, N. J. He succeeds W. N. Goodwin, Jr., who, although retired, has been retained as an engineering consultant.

* * *

PEERLESS TO HANDLE TUNG-SOL NEW YORK WHOLESALE SALES

Peerless Radio Distributors, Jamaica, Long Island, have assumed ownership of the New York warehouse and distribution plant of Tung-Sol Lamp Works, Inc., at 71 Murray Street, New York. M. D. Fine and Charles Shankman are co-owners of Peerless.

The Peerless warehouse at 92-32 Merrick Road, Jamaica will be used as the main office and major distributing point of Tung-Sol lamps.

Mac Natovitz will be in charge of the New York office.

* * *

RCA RECEIVING TUBE BOOKLET

A 16-page booklet "Receiving Tubes for Television, F-M and Standard Broadcast" has been issued by the Tube Department of RCA.

Booklet contains characteristics and socket connections of all tubes including television projection and direct-view kinescopes. A chart classifying tubes according to their functions and cathode voltages also appears in the booklet.

Booklet is available at 10 cents a copy from RCA tube distributors or Commercial Engineering, Tube Department, RCA, Harrison, N. J.

* * *

RCP INSTRUMENT CATALOG

A 24-page catalog, No. 129, describing a variety of test instruments has been published by Radio City Products Company, Inc., 127 West 26th Street, New York City.

Instruments described include portable and counter type tube testers, multitesters, v-t-v-m, signal generators and tube and set testers.

Reiner instruments are also described; a-c and d-c volt-milli-ammeter, square-wave generator, multipliers and shunts, etc.

* * *

RADIONIC EQUIPMENT COMPANY CATALOG

A catalog, No. 47, listing parts, record changers, p-a systems, test instruments and meters, tubes, etc. has been released by Radionic Equipment Co., 170 Nassau Street, New York 7, N. Y.

* * *

WELLS RELAY MANUAL

A 9-page manual describing a variety of relays has been released by Wells Sales, Inc., 4717 W. Madison St., Chicago 44, Illinois.

Engineering information includes coil resistance and voltage, contact data, sensitivity and insulation. Dimension and price data are also supplied.

* * *

OLSON CATALOG

A 48-page pocket size catalog has been published by Olson Radio Warehouse, Inc., 73 East Mill Street, Akron, Ohio.

Filament-Dropping Resistor Chart

by E. B. MENZIES

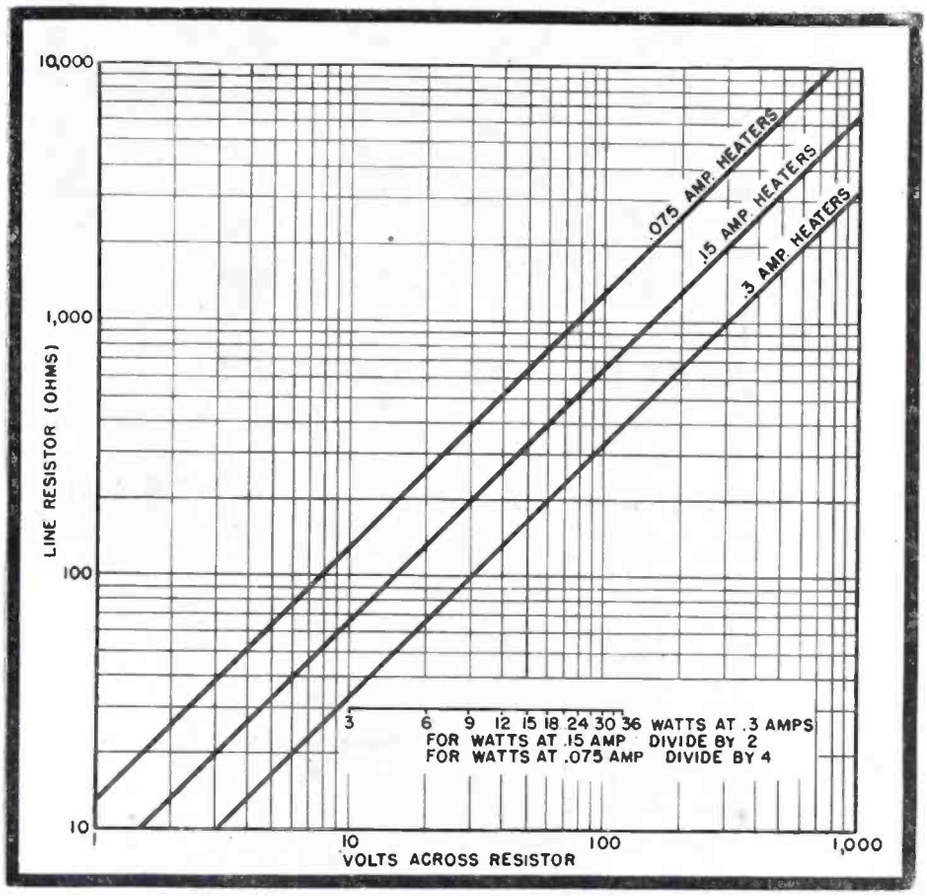


Chart that provides values of filament-dropping resistors for a-c/d-c receivers. The "volts across resistor" is equal to the line supply minus the total of the heaters and dial lamps. This chart is correct for the stated value of heater current. Resistance values will be too high if the supply to the rectifier plate is also drawn through the filament-dropping resistor.

AUTO SETS

(Continued from page 19)

noise is heard with the engine running, the vibration of the motor through the car may be causing an intermittent contact of some part in the receiver, or it may be a case of engine noise.

With practice, the various types of noise can be recognized. Disconnecting the antenna and finding that the noise remains usually indicates a faulty set or an ignition-suppression job. For example, an open capacitor from ammeter to dash, or poorly made connection, or a similar fault in the generator capacitor bypass circuit could be responsible. Sometimes it's merely a matter of getting a good clean contact. There may be considerable grease and dirt in the vicinity of the generator.

A poor antenna or no proper grounding of the shielding may cause the set to be excessively noisy. The fitting of the antenna cable plug into the radio must be made properly. Noise at high engine speeds may show a faulty generator which needs a commutator cleaning job or new brushes. Noise heard with the car in motion may be due to tire static. Noise suppressors in the hub caps, or metallic painting on the tires, may help in getting rid of the noise.

Finally, with regard to replacement of vibrators the circuit should be checked carefully with an ohmmeter before installing a new vibrator. Otherwise, the replacement may be damaged. If buffer capacitors are replaced, use the same capacitance rating that was used originally and a voltage rating equal to or greater than the original.

Servicing auto sets is a dirty, back-breaking and often quite laborious job. If possible, enlist the aid of a worker, who may be relatively unskilled, to do the heavy work while you supervise operations and bench repairs. Functioning efficiently in this type of work is important if costs to customers are to be kept reasonably low and profits reasonably high. The work is often more difficult than servicing home models, but can be more profitable. For one thing, car owners are usually in a better position to pay any necessarily higher repair costs.

Service manuals covering the various auto sets are necessary, as much a part of the job as a screwdriver—they save time. Every step of the servicing operation should be studied to find ways of getting the set out of and back into the car with a minimum of effort.

And, of course, a good working knowledge of electrical and radio principles is mandatory for success. This means more than mere book study which is not enough for the average individual but may be adequate for the occasional exception; it means technical training either through correspondence with a suitable school, or resident study. Usually, for the working man, the correspondence school is more practical and less costly. Books help and should be available for reference.[1]

[1] Mallory-Yaxley Technical Manual.
Ghirardi, *Modern Radio Servicing.*
Pender, *Electrical Engineer's Handbook* (Power).

•

MECK RECORD PLAYER

Table model record player, model 3A6-P8, recently developed by Meck Industries. Unit using an electronic amplifier, crystal pickup and 4" electrodynamic speaker, is 11" wide, 4" high and 15" deep.

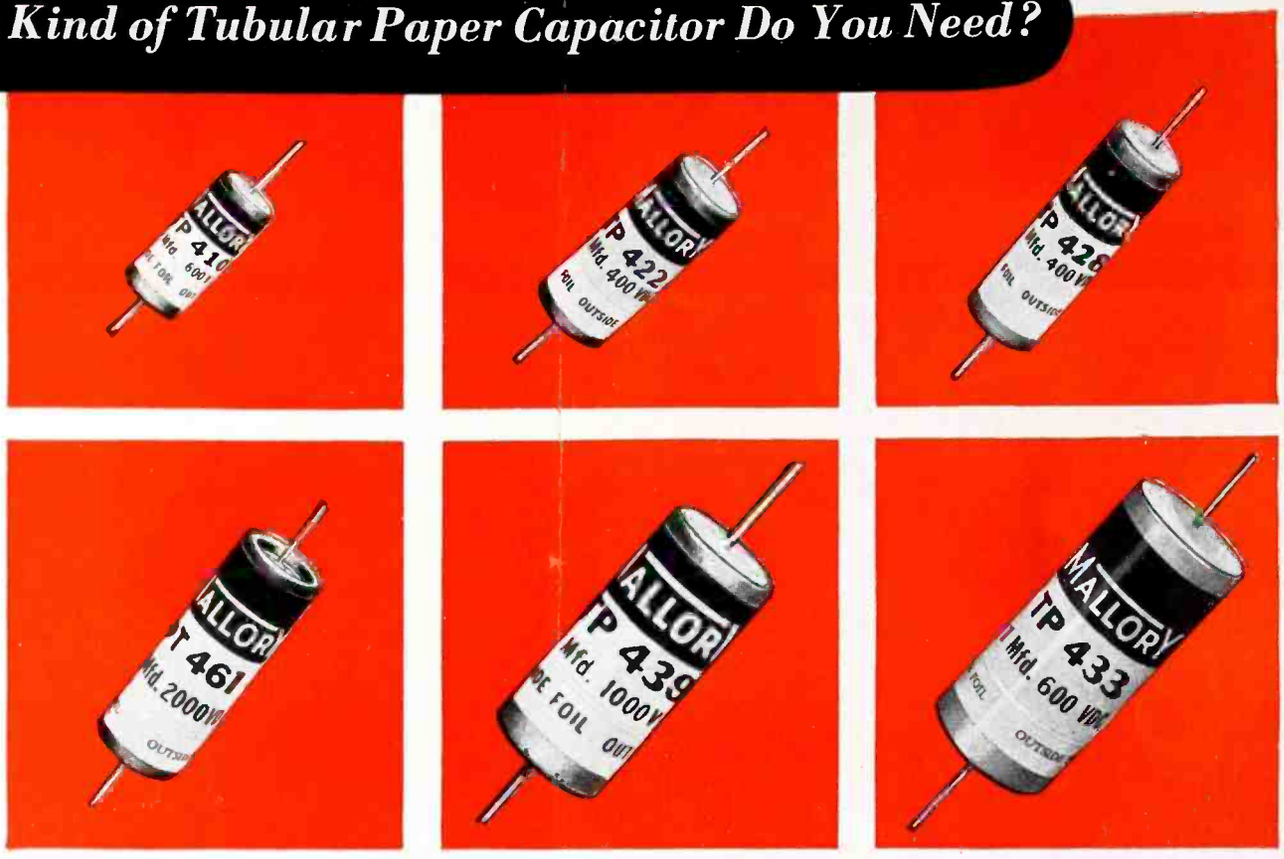
JOTS AND FLASHES

QUITE A DISPLAY OF TELEVISION SETS appeared during the recent Furniture Show in Chicago. Most of the models featured 6"x8" direct-viewing screens and provided for a-m and f-m reception. G.E., Stewart-Warner, Crosley, Stromberg-Carlson, Bendix, Motorola, Emerson, Howard Radio, Farnsworth and RCA all had representative models at the show. The G.E., Crosley, Motorola and Farnsworth sets are expected to make their appearance in the early Spring. The RCA sets, of course, are already on the production line. The other models are expected to appear during the late Fall. . . . A. R. Hough has succeeded Arthur L. Pollard as the Weston representative in Tennessee. . . . Hutchins Industries, Inc., Chicago, are now the national sales representatives for the Vocal-Aire sound system which is being manufactured by Dilks, Inc., Norwalk, Conn. . . . Dorman D. Israel, vice president in charge of engineering and production of Emerson Radio has received the War Department Certificate of Appreciation. . . . The Ward Products Co. has become a division of the Gabriel Co., automobile snubber manufacturer. Ralph Wiesenberger and Harry Wiesenberger, Ward president and vice president, respectively, will remain with Ward which will keep its identity and be operated as a division of Gabriel. . . . Harry DeSimone has been named division manager of the metropolitan New York and New England territory of Telex, Inc. . . . L. D. Allen, 201 East Water Street, Syracuse, N. Y. and Marshall T. Ball, 75 Niagara Street, Buffalo, N. Y., representing Electronic Associates, will cover all of New York State except New York City for Radio City Products Co., Inc. . . . National Carbon Co., Inc. has opened a plant at St. Albans, Vermont for the production of flashlight cases. . . . Hutchins Industries, Inc., 325 W. Huron Street, Chicago, have been named to represent the Hoffman Radio Corp., Los Angeles. . . . Nate Hast, for the past several years merchandising manager of the Lear Home Radio Division, has opened his own sales office in Chicago as a national radio and appliance sales and merchandising specialist. . . . J. P. Kay, Kansas City, Mo., recently received a Hamilton gold watch for his Aeropoint needle sales record during 1946 from Burton Browne, president of Aeropoint. . . . Ray Hutmacher, former with Maguire Industries, Inc., has formed a sales unit, The Salescrafters, Inc. at 510 N. Dearborn Street, Chicago. . . . The first in the new series of leaflets devoted exclusively to amateur components has been issued by Sun Radio and Electronics Co. Inc., 122-124 Duane Street, N. Y. 7, N. Y. . . . Harry E. LeRoy is now director of manufacturing for the RCA Victor Division. Mr. LeRoy was formerly general plant manager of the RCA Products Department. . . . Charles O'Neil Weisser has become sales manager of Emerson Radio. He was formerly sales promotion manager. . . . Another phonograph record manufacturing plant has been built by RCA at Canonsburg, Pa. . . . The Sampson Co., 3201 S. Michigan Avenue, has been named exclusive distributor in the Chicago area for Aeropoint needles.

ADVERTISERS IN THIS ISSUE

SERVICE INDEX—FEBRUARY, 1947

What Kind of Tubular Paper Capacitor Do You Need?



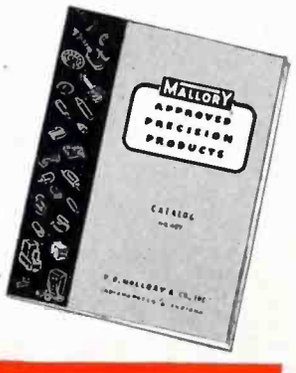
The MALLORY Line of capacitors is really complete

MALLORY makes 75 different paper tubular capacitors to supply your "every need" and for your convenience. They range in rating from 400 volts to 1600 volts—and in size from ⅜" x 1" to 1¼" x 2½".

These paper tubulars are divided into two broad categories—wax impregnated and oil impregnated. Both are hermetically sealed to provide against atmospheric penetration. Both are carefully factory-tested so you get *all* the quality that Mallory puts into them.

Get the complete story from your Mallory Distributor or from the Mallory Catalog.

You save a lot of time if you check the Mallory Catalog for replacement parts as you need them. Do you have a copy? If not, see your Mallory Distributor.



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*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

OVERWHELMING ACCEPTANCE...

because they're Radio-Engineered for Extra listening hours

THE VERY FACT that RCA Batteries are designed *for* radio *by* radio engineers, is the reason why dealers and servicemen everywhere are turning to RCA *Preferred Type* Radio Batteries for greater profit and customer satisfaction.

Each radio-engineered battery type has the right capacity for the current drain of the sets it is designed for. And all "A-B" types are engineered so that *both* sections deliver effective voltage for the *full* life of the battery pack.

Add this to the fact that RCA is the greatest name in radio, and you'll understand why the smartly packaged and competitively priced RCA Radio Batteries lead the way today. You can get your stock conveniently and quickly from the same RCA Distributor who supplies you with RCA tubes, parts, and test equipment.

RCA

TUBE DEPARTMENT

RADIO CORPORATION of AMERICA

HARRISON, N. J.