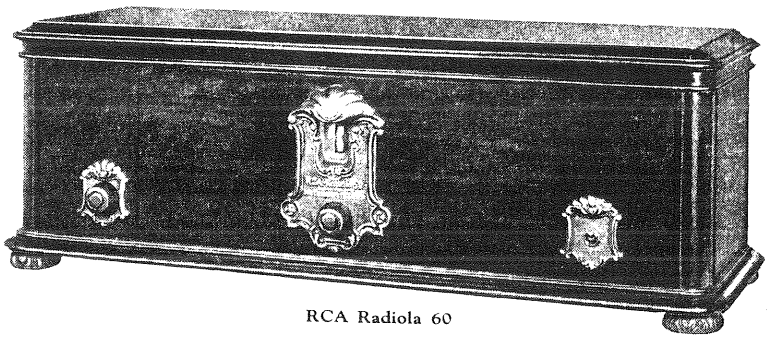
RCA
Radiola 60

SERVICE NOTES

PREPARED ESPECIALLY FOR
RCA AUTHORIZED DEALERS



RCA Radiola 60

Third Edition—2M—Jan. 1931

RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well-informed RCA Authorized Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that RCA Loudspeaker and Radiola owners may be entirely satisfied.

Obviously, this service can best be rendered by properly equipped service organizations having a thoroughly trained personnel with a knowledge of the design and operation of RCA Loudspeakers and Radiolas.

Such service organizations have been established by the RCA Distributors, and the RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributor.

Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer. To assist in promoting this phase of the Dealer's business the Service Division of the RCA has prepared a series of Service Notes —of which this booklet is a part—containing technical information and practical helps in servicing RCA Loudspeakers and Radiolas.

This information has been compiled from experience with RCA Dealers' service problems and presents the best practice in dealing with them. A careful reading of these Service Notes will establish their value, and it is suggested they be preserved for ready reference by the RCA Authorized Dealer.

In addition to supplying the Service Notes, the RCA Service Division maintains a corps of engineers who are qualified to render valuable help in solving service problems. These engineers call upon the trade at frequent intervals to advise and assist RCA Distributors in the performance of service work.

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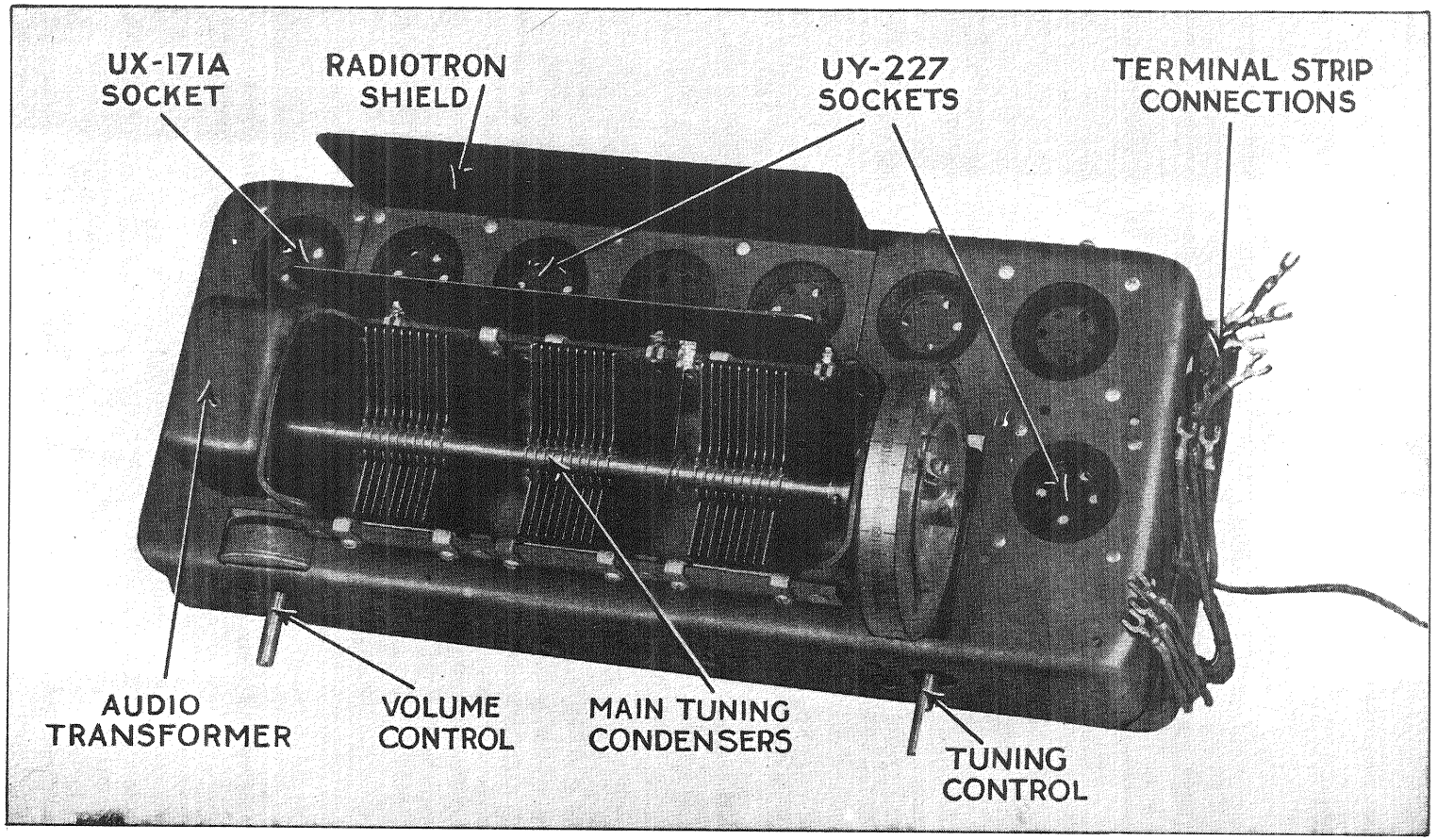


Figure 1—Top view of Receiver Assembly

RCA RADIOLA 60

(105-125 Volts. 50-60 Cycle A. C.)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 60 is a socket powered radio receiver employing an eight-tube fundamental super-heterodyne circuit and a full-wave rectifying circuit. Figure 1 is a top view of the receiver chassis. Seven Radiotrons UY-227, one Radiotron UX-171A, and one Radiotron UX-280 are used. Excellent sensitivity and tone quality are obtained. The socket power unit (Figure 2) provides all plate, grid and filament voltages used in the receiver assembly.

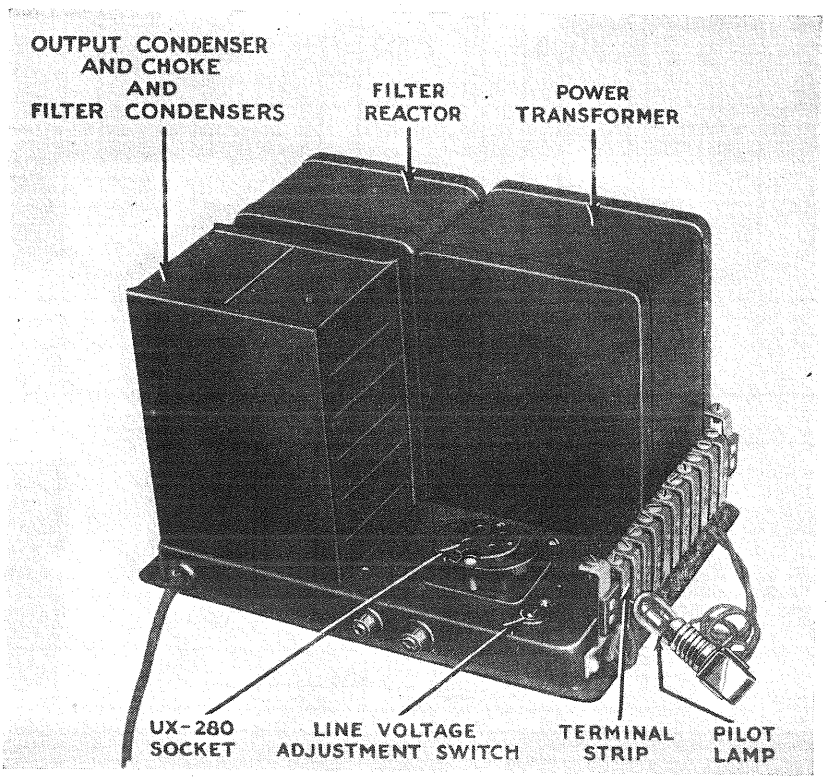


Figure 2—Top view of socket power unit

Radiola 60 is designed to operate on alternating current of 105 to 125 volts, 50 to 60 cycles, such as is used for house lighting. Connection to D.C. lines or to A.C. lines of different rating may damage the Radiola or the Radiotrons.

Radiola 60 is also made up in models designed for 105-125 volt, 25-40 cycle A.C. operation, The difference between this and the 50-60 cycle instrument is the power transformer. Should it be desirable to change a 50-60 cycle Radiola 60 for operation on 25-40 cycles, or vice versa, a change of the power transformer is all that is necessary. These transformers may be obtained through the regular RCA channels as a replacement part.

The following circuit characteristics are incorporated in the design of Radiola 60. See Figure 3.

(a) It has an eight-tube super-heterodyne circuit using seven Radiotrons UY-227 and one UX-171A in the receiver unit. Radiotron UX-280 is used as a full-wave rectifier in the socket power unit.

(b) The circuit consists of one untuned coupling stage; one tuned R.F. stage; a tuned heterodyne detector circuit; two intermediate R.F. stages; an oscillator; a second detector; and a power amplifier. (Figure 4.)

(c) The second detector, operated at 160 volts plate potential with grid bias, changes the radio frequency current of the intermediate stages into audio frequency current.

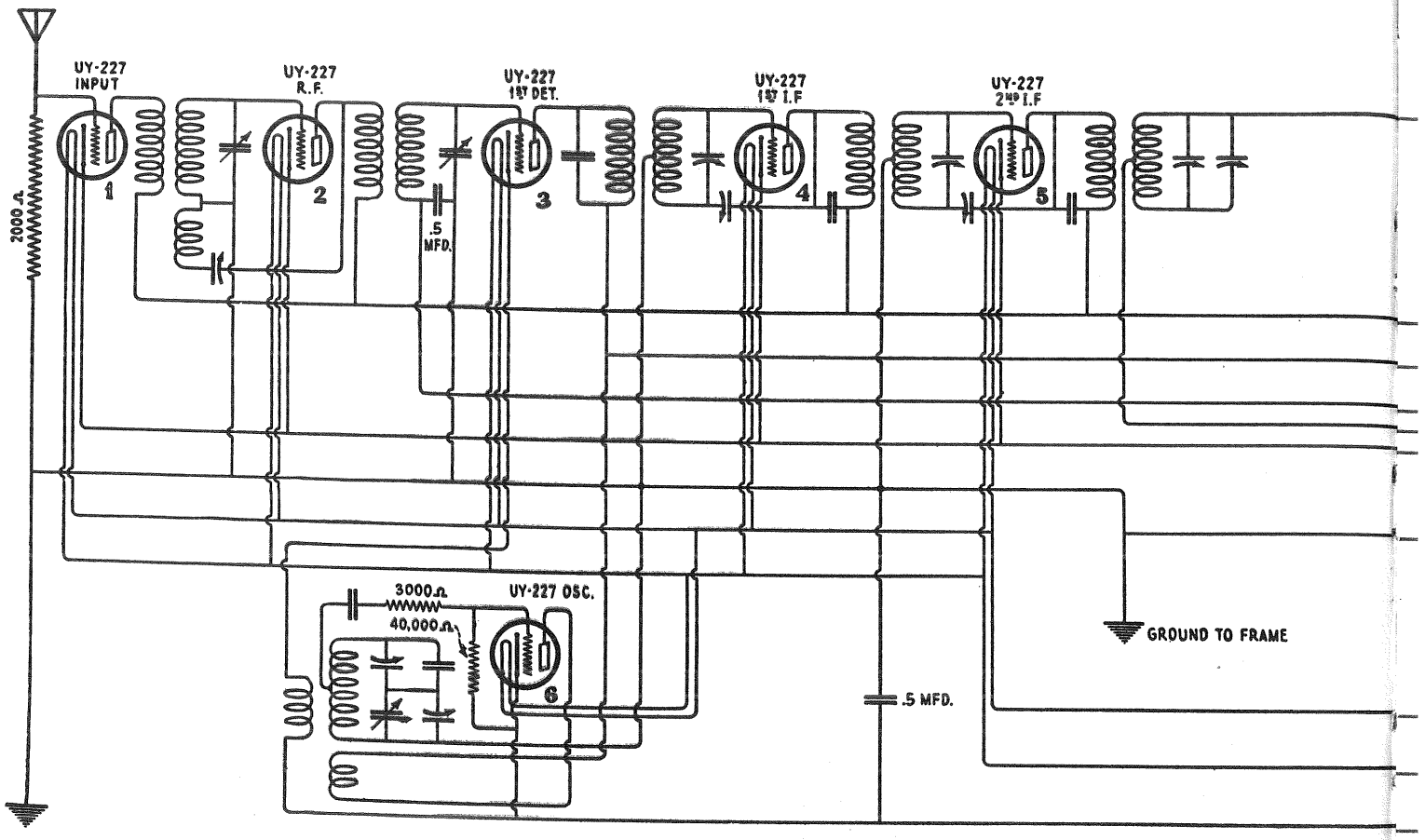


Figure 3—Schematic circuit diagram of

This gives improved quality and sufficient output to operate the power tube directly from the second detector, thus eliminating any distortion that might be present if an intermediate audio stage were used.

(d) The volume control regulates the grid bias on all radio and intermediate frequency amplifying stages, giving a positive control of volume, even on nearby local stations, without distortion.

(e) The use of the indirect heater type of Radiotron permits the connection of power amplifiers, such as Loudspeakers 104 and 105, to the detector without developing excessive hum.

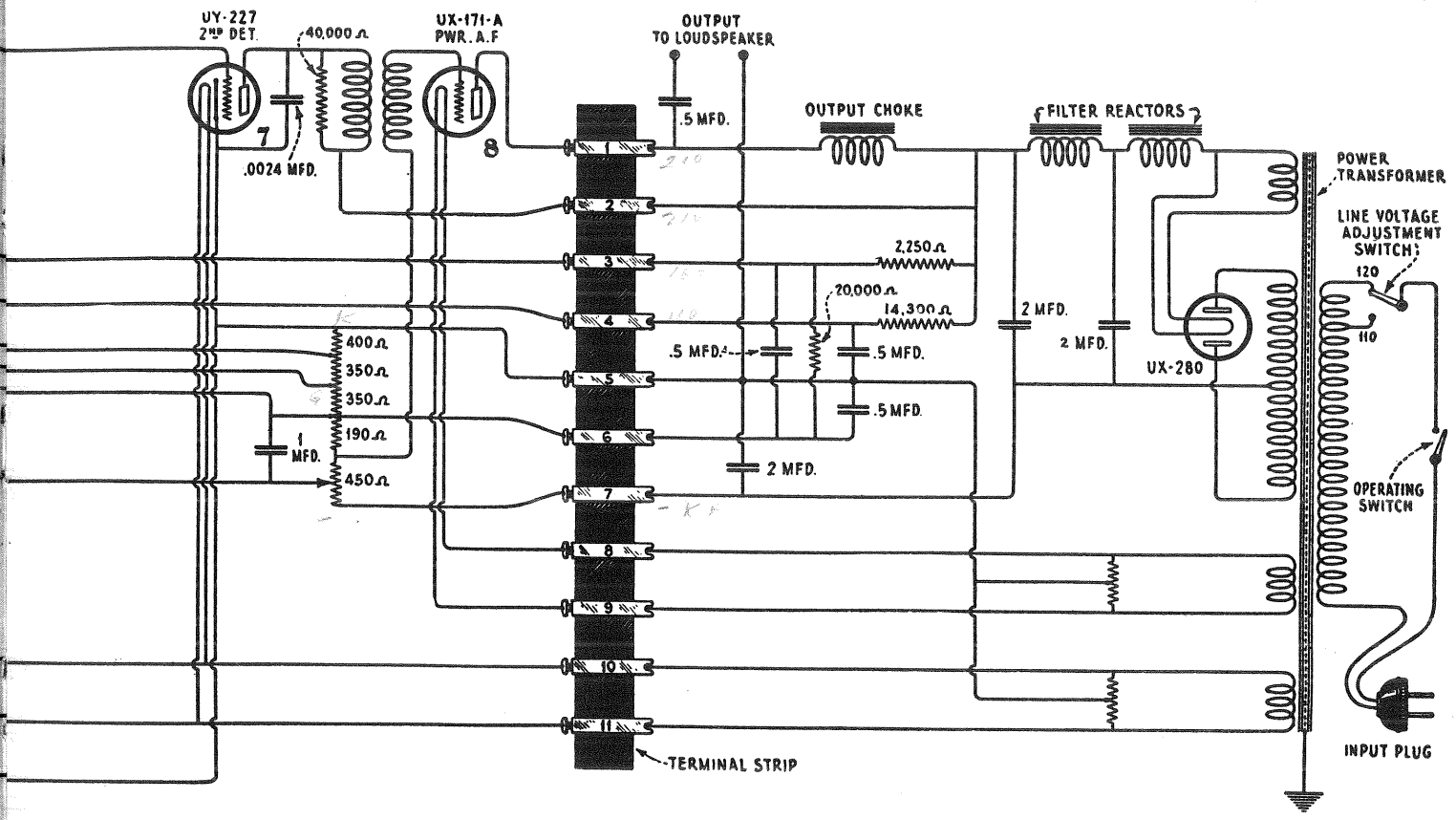
Figure 4 illustrates the sequence of the Radiotrons in the receiver, omitting Radiotron UX-280 in the socket power unit. From right to left, when facing the front of the Radiola, the Radiotron sequence is as follows:

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground across a resistance and functions as a coupling tube to the antenna system.

Radiotron No. 2 is a stage of tuned radio frequency amplification. It is tuned by means of the first of the gang condensers.

Radiotron No. 3 is the tuned heterodyne detector. It is tuned by the center of the gang condensers.

Radiotrons No. 4 and No. 5 are the first and second intermediate frequency stages. These stages are tuned to a frequency of 180 K.C., giving ample distance between the two peaks of



receiver assembly and socket power unit

the oscillator to eliminate any possibility of stations coming in at more than one point on the tuning dial.

Radiotron No. 6 is the oscillator. It is tuned by the third of the gang condensers. Two trimming condensers are provided at the rear of the receiver assembly for adjusting the oscillator circuit to keep the resultant beat note at the correct frequency for the intermediate stages.

Radiotron No. 7 is the second detector. It operates at a plate potential of 160 volts with the proper grid bias and does not use a grid leak or condenser. Its output is sufficient to drive the power amplifier.

Radiotron No. 8 is the power amplifier stage. An output filter is provided for keeping the D.C. used with this tube out of the loudspeaker windings.

These various principles incorporated in Radiola 60 provides a radio receiver of advanced design, excellent performance and good tone quality

PART I—INSTALLATION

[1] ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiola 60 the antenna length need only be approximately 25 feet. It should be erected as high as possible and be removed from all obstructions. The lead-in should be a continuation of the antenna itself, thus avoiding all splices which might introduce additional resistance and, in time, corrode sufficiently to seriously affect reception. If it is abolutely necessary to splice the lead-in to the antenna the joint must be carefully soldered to insure a good electrical contact. Clean off all excess flux and tape the connection, to protect it from the oxidation effects of the atmosphere.

High-grade glass or porcelain insulator supports are required and at no point should the antenna or lead-in wire come in contact with any part of the building. Bring the lead-in wire from the outside through a porcelain tube insulator to the inside of the house for connection to the receiver.

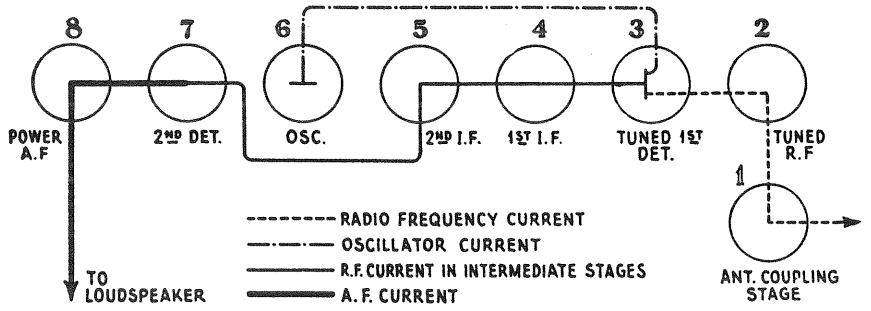


Figure 4—Radiotron sequence

The antenna should not cross either over or under any electric light, traction, or power line and should be at right angles to these lines and other antennas. An outdoor antenna should be protected by means of an approved lightning arrester, in accordance with the requirements of the National Fire Underwriters' Code.

[2] ANTENNA (Indoor Type)

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna of about 25 feet of insulated wire strung around the picture moulding or placed under a rug. In buildings where metal lathing is employed satisfactory results are not always possible with this type of antenna. However, due to its sensitivity Radiola 60 will generally give entirely satisfactory reception with an indoor antenna.

[3] GROUND

A good ground is quite as important as a good antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds and, as a rule, are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe. The service man should experiment with various grounds, and employ the one giving the best results.

[4] RADIOTRONS

A guide shield is provided on all the receiver Radiotron sockets to facilitate the insertion of the Radiotrons. The seven Radiotrons UY-227 are inserted in the five-contact sockets. The Radiotron UX-171A is placed in the four-contact socket in the receiver assembly, and the Radiotron UX-280 is placed in the socket power unit.

In placing Radiola 60 into operation, if no signals are heard when tuning to a station known to be broadcasting, examine the Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more of the same type known to be in operating condition will isolate the damaged one.

Socket No. 2 (Figure 4), the tuned R.F. stage, is the most critical for selection of the Radiotrons. Place in this socket the tube which gives the loudest signal and does not go into oscillation throughout the tuning range. If no tube is found that will not oscillate, a slight re-adjustment of the R.F. compensating condenser may be necessary, as described in Part II, Section 13.

Other stages somewhat critical are the oscillator and second detector, sockets No. 6 and No. 7, respectively. The remaining tubes should be interchanged until a tube is found for the oscillator that gives the loudest signal on a given station. The second detector Radiotron should be selected for its ability to handle large volume. Select the tube for this socket that will permit the volume control to be advanced and give the greatest output without overloading.

[5] LINE SWITCH

A two-way switch is provided in the S.P.U. for adjustment to line voltages. A shield over the terminal strip holds this switch in the 120-volt position. Unless it is definitely known that the line is always below 115 volts the switch should be left in its original position. It is a good plan to leave this switch at the 120-volt position on all lines unless unsatisfactory operation is experienced. If the switch is set at the 110-volt position on supply lines exceeding 115 volts the Radiotrons in the receiver will be damaged.

[6] KNOBS

Radiola 60 uses an improved type of push knob on the station selector and volume control. This knob is removed by simply pulling it off the shaft, and replaced by pushing it on. Very little trouble should be experienced, as no setscrews or other parts that might give trouble are used.

When placing this knob on its shaft care must be exercised not to push it tight against the washer between the knob and cabinet, as then it will bind. Sometimes in new sets the knob will have become pushed against the washer in handling, and bind. The remedy is merely to pull the knob out until it does not bind.

[7] RECEIVING LOUD LOCAL STATIONS

If excess volume control adjustment is used on local stations the signal will apparently have two peaks on the tuning dial. A further advance of the volume control will decrease the volume rather than increase it. This is entirely normal, and is caused by tube overloading. The correct method of tuning Radiola 60 on local stations is to reduce the volume control to the position where the station will be received at only one position on the station selector dial, and then adjust the volume control for the desired volume.

On some stations when tuned in with excessive volume a howl may be experienced. Should a condition of this kind occur the remedy is to reduce the volume control until the howl disappears.

This tuning procedure should be explained to the Radiola owner when an installation is made.

[8] DISTORTION DUE TO LOUD SIGNALS

In some localities extremely close to powerful broadcasting stations, reproduction may be distorted when reducing volume to a point satisfactory to the listener. When installing

a set determine by a listening test whether this condition exists or not and apply the following remedy if the reproduction is distorted.

Procure a single-pole single-throw switch (any type will do) and connect it in series with the antenna lead of the receiver. The switch may be located either inside or outside the cabinet in any convenient position. Opening the switch will disconnect the antenna and allow satisfactory reception on signals that would otherwise be distorted. The switch should be closed for reception from other stations.

[9] PICK-UP FROM LONG WAVE HIGH POWER CODE STATIONS

Should Radiola 60 be installed very close to long wave, powerful code stations, it is possible that a certain amount of pick-up and interference from them will be experienced. Trouble of this kind may be eliminated in the following manner:

(a) Procure the following equipment.
Two Radiola 16 antenna coils (RCA Stock No. 5658.)
One .0002 Mfd. fixed condenser.

(b) Connect as shown in Figure 5.

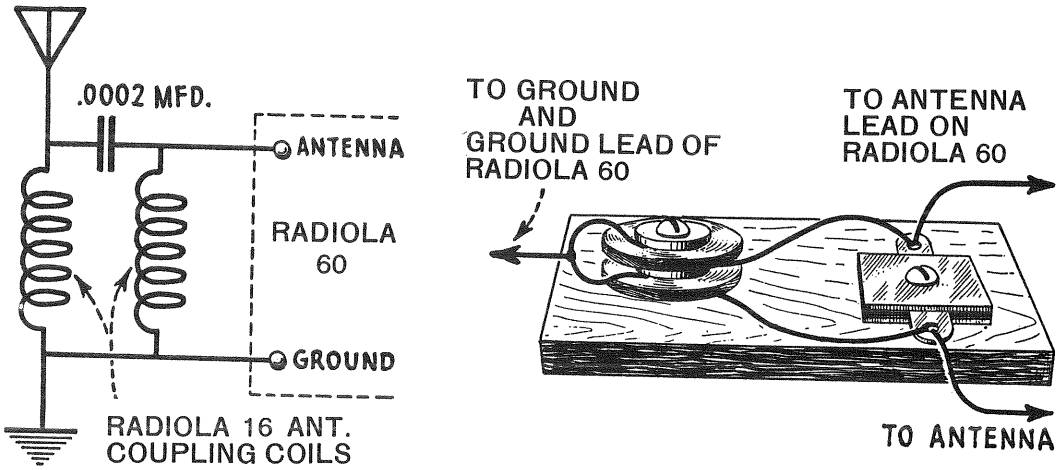


Figure 5—Long wave interference filter

(c) This apparatus may be placed inside of the cabinet of the receiver or made up in a separate unit and placed in any convenient location. It acts as a filter, allowing frequencies of the broadcast band only to reach the receiver.

[10] CONNECTING RADIOLA 60 TO EXTERNAL POWER AMPLIFIERS AND POWER LOUDSPEAKERS

Due to using Radiotron UY-227 with the resulting low value of hum, Radiola 60 may be used in conjunction with power loudspeakers, such as RCA Loudspeakers 104 and 105, and external power amplifiers generally, when it is desirable.

For making such a connection it is necessary to disconnect the receiver audio transformer by removing the red lead from the voltage supply terminal (No. 2 on the S.P.U. terminal strip). Tape this lead and allow it to remain unused. Connect one lead of a Radiola 16 antenna coil (RCA Part No. 5658) to the plate connection of the second detector Radiotron UY-227. To the other lead of the Radiola 16 antenna coil connect one lead of the power amplifier input transformer and to the S.P.U. terminal No. 2 connect the other power speaker input lead. See Figure 6. This connection places a choke coil and the primary of the input transformer of the power amplifier in series with the detector plate supply without also being in series with the audio transformer in the receiver assembly.

Although the Radiotron UX-171A is not used when making such a connection, it must be left in the circuit to properly balance the load on the S.P.U. Without this tube in place an excessive rise in voltage will occur due to reduced load.

PART II—SERVICE DATA

[1] ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna; or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

[2] RADIOTRON SOCKETS

The sockets used in Radiola 60 are a six-gang UY socket assembly, a single UY socket, and two single UX sockets. One of the UX sockets is used in the socket power unit and is of a different design than those used in the receiver assembly.

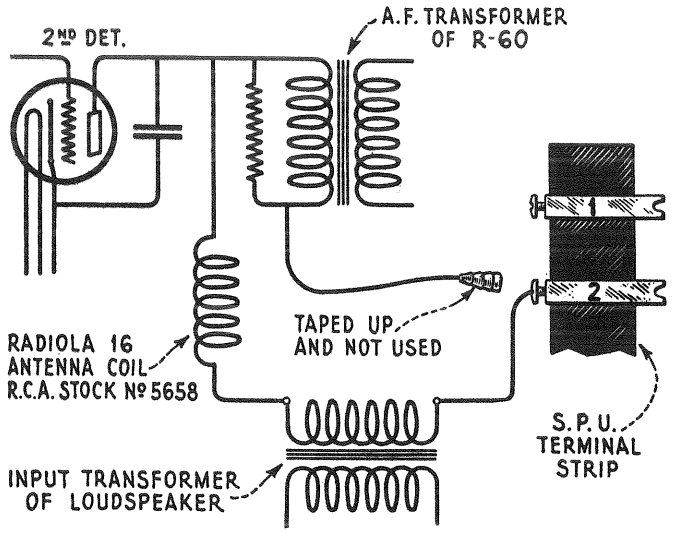


Figure 6—Hook-up of external power amplifiers and RCA Loudspeakers 104 *and* 105 *to Radiola* 60

The bakelite Radiotron guide shields used in the receiver assembly will prevent any possible shock from contact with high voltages in the socket when inserting the Radiotrons. The prongs of the tubes fit into this shield opening very snugly and require only a twist until the prongs find the correct holes into which they fit. This is especially helpful when inserting the five-prong tubes into their sockets.

[3] RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuits sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

If a Radiotron will not fit into a socket without considerable pressure, look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

[4] LOOSE VOLUME CONTROL

A loose volume control arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame.

[5] ADJUSTMENT FOR SLACK DRUM CONTROL

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash.

After considerable wear or extreme changes of temperature the cable may become slack. To take up this slack open lid of cabinet and turn the cable adjusting screw with clamp until the cable is taut. This screw may become seated after several adjustments are made, thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. Remove the cable adjusting screw and clamp. The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. It will be noted that the tapered pin in the new position cannot be inserted as far as originally. However, it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable

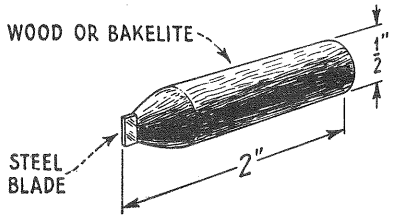


Figure 7—Non-metallic screw driver

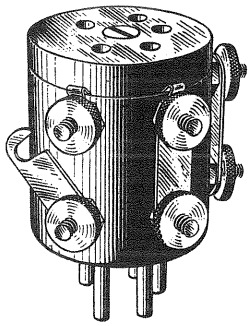


Figure 8—Radiotron socket adapter

again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and an additional half turn slipped on the drum which will provide for taking up all slack. Sufficient grooves are provided on the drum for this purpose.

[6] BROKEN CONDENSER DRIVE CABLE

A broken condenser drive cable can be replaced in the manner described in Part III, Section 7. However, if a new cable is not immediately available a temporary repair can be made in the following manner, provided the break in the cable is not in that section that passes over the small grooved drums.

Splice and solder the two ends together. Splicing consists of interweaving the strands, as with rope and not just twisting the cable ends together as in an electrical wiring splice. Splicing gives greater strength and forms a smaller body on the cable. When soldering use plenty of flux and a small amount of solder. Heat sufficiently so that the solder adheres to all the strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows excess solder to drip away. This is but a temporary repair to be used only until a new cable can be procured.

[7] HUM

If a pronounced hum develops during operation check the following:

(a) Low emission Radiotron UX-280. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(b) Defective center tapped resistance. A short or open of either of these resistances will cause a loud hum and imperfect operation of the Radiola.

(c) Any open of the several grounding connections in the Radiola or voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part II, Section 21.

(d) Use of Radiotron UX-171 instead of Radiotron UX-171A may cause an increase of hum. It is recommended that only Radiotron UX-171A be used as a power amplifier in Radiola 60.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part III, Section 13, and heating it in a slow oven. The open end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

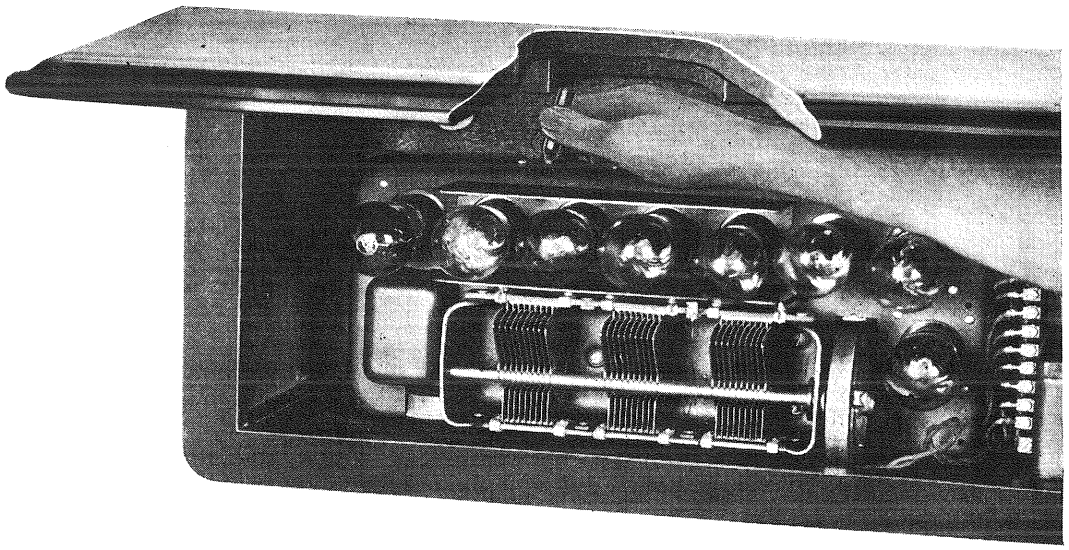


Figure 9—Adjusting oscillator trimming condensers

[8] LOUDSPEAKER POLARITY

The use of an output filter in Radiola 60 makes unnecessary any adjustment for polarity of the output current. Any type of loudspeaker (either horn or cone) can be connected in the manner that gives the most pleasing reproduction.

[9] LOW VOLUME AND WEAK SIGNALS

Low volume or weak signals may be caused by:

(a) Defective antenna system. A poor antenna and ground or one in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2 and 3, should be followed if trouble of this kind is experienced.

(b) Defective Radiotrons. A defective Radiotron in any stage may cause weak signals. Before checking other causes it is a good plan to check all Radiotrons by interchanging them with ones of a similar type known to be in good operating condition.

(c) R.F. compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 13.

(d) Oscillator trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the Radiola may be sensitive at certain portions of the tuning scale and very insensitive at other sections. Should these condensers be badly out of adjustment, only very loud local stations will be heard. The correct method for adjustment of these condensers is given in Part II, Section 12.

(e) Intermediate transformers not correctly tuned or matched. Should the tuning condensers connected across the secondaries of the intermediate transformers be out of adjustment, weak signals and poor tuning or, in some cases no signals will result. Refer to Part II, Section 14, for the correct method of adjusting the I.F. transformers.

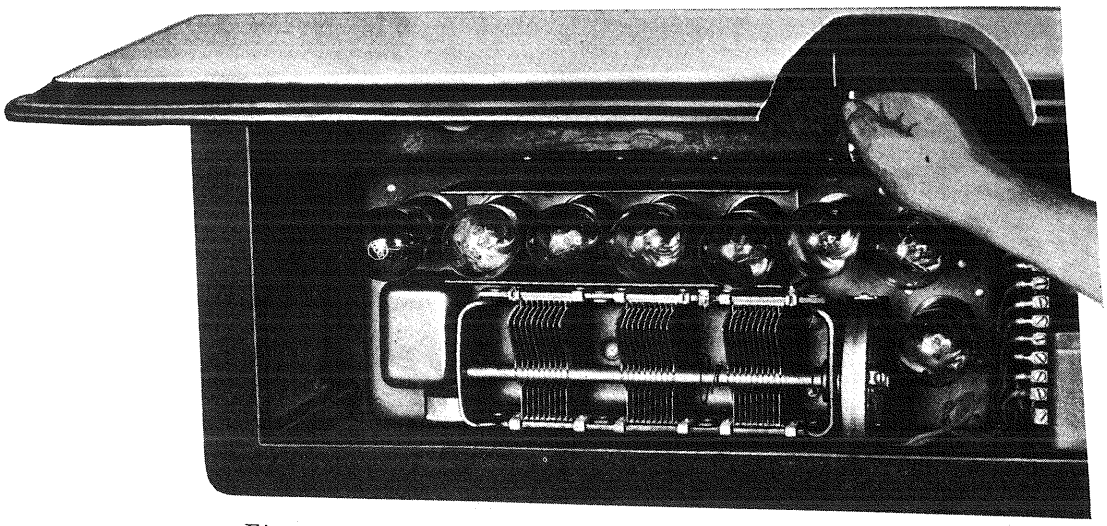


Figure 10—*Adjusting the R.F. compensating condenser*

(f) Defective A.F. transformer or output condenser and choke. A defect in any of these parts will cause weak signals and abnormal operation. Check by means of the continuity test and make any replacement that is necessary.

(g) Low voltage from S.P.U. Check S.P.U. voltages at terminal strip with readings given in Part II, Section 17. Low voltages may be caused by a low emission rectifying tube or defective resistances in the S.P.U. or receiver. Check by means of continuity test.

(h) Open or short of various connections in receiver. Check by means of continuity tests and make any repair or replacement that is necessary.

[10] AUDIO HOWL

Audio howl may be caused by:

(a) Incorrect adjustment of R.F. compensating condenser. A compensating condenser adjusted to the verge of oscillation may cause a howl on nearby stations. Adjust as suggested in Part II, Section 13.

(b) Open A.F. condenser connections. An open of the A.F. by-pass condenser may cause a howl.

(c) Open large by-pass condenser connections. An open of the connections to the large by-pass condensers may cause a howl.

(d) Defective volume control resistance. Should there be an open or short in the volume control or in its adjacent resistances an audio howl may develop.

(e) Vibrating elements in receiver Radiotrons. A gradually developed howl may be due to the loudspeaker causing the receiver Radiotron elements to vibrate. To overcome this condition, interchange the Radiotrons in the receiver, especially the detector, or change the relative angle of the loudspeaker to the receiver.

(f) Poor ground. Install ground system as suggested in Part I, Section 3.

(g) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause a howl.

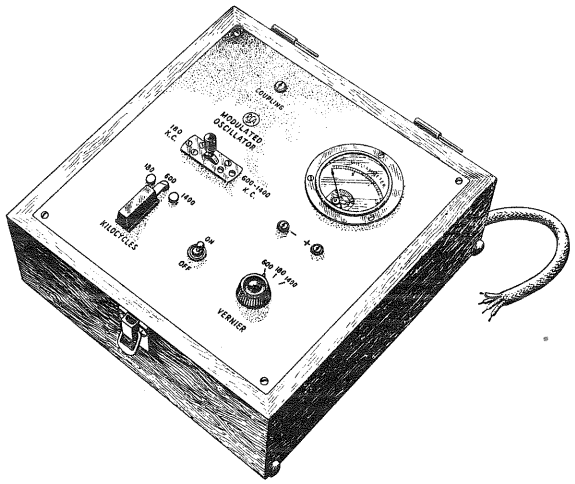


Figure 11—*Test Oscillator* (*Driver*)

(h) Defective resistance in S.P.U. or the receiver assembly. An open resistance unit may cause howl. Under such conditions it is advisable to turn the set "off" until the trouble is found, otherwise excessive voltage rise may cause further damage.

(i) Neutralizing condensers in intermediate transformers out of adjustment. These condensers being out of adjustment might cause an I.F. stage to oscillate which will result in a howl when a station is tuned in, especially at loud volume. Adjust the neutralizing condensers as described in Part II, Section 14.

(j) Open of any of the several ground leads in the Radiola. This may cause some of the circuits to go into oscillation and result in a howl when a station is tuned "in." Generally a loud hum will also be present. The several grounding leads in the Receiver Assembly and in the Socket Power Unit should be checked and any open or poorly soldered joint should be repaired.

[11] DISTORTED REPRODUCTION

Under normal conditions Radiola 60 will deliver a strong signal of excellent quality to the loudspeaker. The high sensitivity of Radiola 60 makes it undesirable to operate the set at full volume when receiving from nearby broadcasting stations. If the loudspeaker production is poor test the output from the receiver. A pair of phones may be used for this purpose. Poor quality or distortion may be due to any of the following causes:

(a) Defective Radiotrons. Though the Radiola may be in operating condition a defective Radiotron in any stage will cause distortion. This is especially true of the detector, audio stage and the rectifier tube.

(b) High or low plate and grid voltages from the Socket Power Unit or a defective resistor in the Receiver Assembly. In the Socket Power Unit distortion may be caused by a defective Radiotron UX-280 or resistance unit.

(c) Defective A.F. transformer. Check by means of continuity test and replace if necessary.

(d) Trimming condensers out of adjustment. Should the oscillator trimming condensers be out of adjustment the beat signal may not be exactly the frequency to which the intermediates are tuned. This will cause weak signals and distortion of those received. This condition may or may not be present throughout the tuning range of the receiver. Adjust as described in Part II, Section 12.

(e) Receiver oscillating. Should some circuit other than the oscillator be oscillating, distortion will be experienced when tuning in a station. This will be accompanied

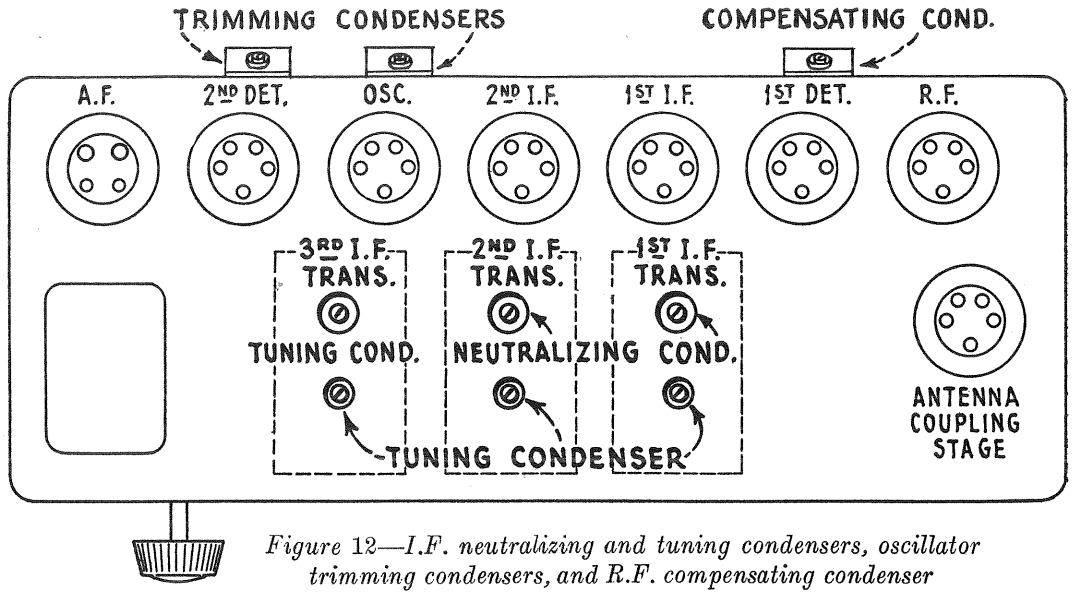


Figure 12—I.F. neutralizing and tuning condensers, oscillator trimming condensers, and R.F. compensating condenser

by a whistle or squeal when the carrier wave of the station is tuned in. To remedy trouble of this kind consult Part II, Section 10.

(f) Intermediate transformers out of line or not properly matched. This will have the effect of giving distorted reproduction and reduce the sensitivity of the receiver to a marked degree. Line up the entire I.F. transformer assembly as described in Part II, Section 14.

[12] ADJUSTMENT OF OSCILLATOR TRIMMING CONDENSERS

Two trimming condensers are provided for adjusting the oscillator circuit so that the beat note will always be 180 K.C. throughout the tuning range of the receiver.

The most noticeable symptom of the oscillator trimming condensers being out of adjustment is insensitivity of the Radiola in some sections or throughout the tuning range. To check the adjustment of the trimming condensers as a possible cause of any noticeable insensitivity in the receiver proceed in the following manner:

(a) Procure the following equipment:

A modulated oscillator giving signals at 1,400 and 600 Kilocycles. Figure 6 shows the constants and circuit diagram of an oscillator satisfactory for this purpose which may be operated entirely from the house lighting circuit.

A short non-metallic screwdriver. Such a screwdriver is shown in Figure 7 with its maximum dimensions.

An adapter (See Figure 8) suitable for connecting to the plate of the second detector Radiotron (No. 7.) This adapter will be found very useful around a repair shop for breaking into various circuits without unsoldering any wire. If no adapter is available connect the milliammeter in series with the connection at terminal No. 2 in the Socket Power Unit. This will necessitate the removal of the terminal strip shield.

A 0-10 milliammeter.

(b) Place the adapter in Radiotron socket No. 7 and connect the milliammeter in series with the plate by opening the link on the adapter and connecting the meter to each plate connection.

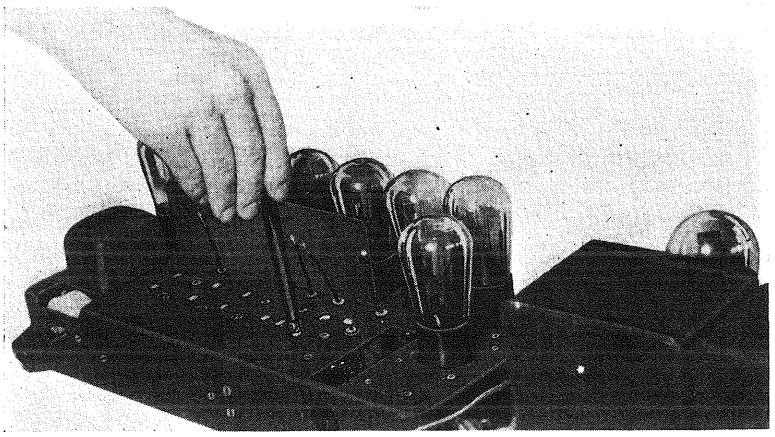


Figure 13—Adjusting the I.F. transformers

(c) With the Radiola in operation, place the oscillator in operation at 1,400 K.C. and tune the Radiola by adjusting the station selector until a deflection caused by the external oscillator is obtained in the milliammeter. Adjust volume control so that deflection is not beyond scale of meter.

(d) Now adjust the oscillator trimming condenser on the left (Figure 9) with the small non-metallic screw-driver until a maximum deflection is obtained in the milliammeter.

(e) Adjust oscillator for 600 K.C. Tune in the Radiola with station selector and then adjust the trimming condenser to the right for maximum deflection of the milliammeter.

(f) Now readjust at 1,400 K.C. as indicated in (c) and (d).

With this adjustment the trimmming condensers are correctly adjusted for maximum efficiency, that is, so adjusted that the beat signal will be 180 K.C. throughout the tuning range.

[13] ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The radio frequency compensating condenser should not be touched unless it is definitely ascertained that no other failure exists as a possible cause of receiver insensitivity, which is the most noticeable indication of the need for adjusting the compensating condenser.

An oscillating condition of the receiver may be caused by improper adjustment of this condenser.

A step by step procedure for making proper adjustment follows:

(a) Procure a small non-metallic screwdriver (See Figure 7.)

(b) Place Radiola in operation in usual manner and tune in a station, preferably at the lower wavelengths.

(c) Locate the position of the compensating condenser (See Figures 10 and 12.)

(d) With the volume control at the position of maximum intensity—not maximum setting—adjust the screw of the condenser until the Radiola goes into oscillation. This will cause a whistle whenever a station is tuned "in." Then turn the screw in the opposite direction until the set just goes out of oscillation and no howl is experienced when receiving loud local stations. This is the correct adjustment for the radio frequency compensating condenser.

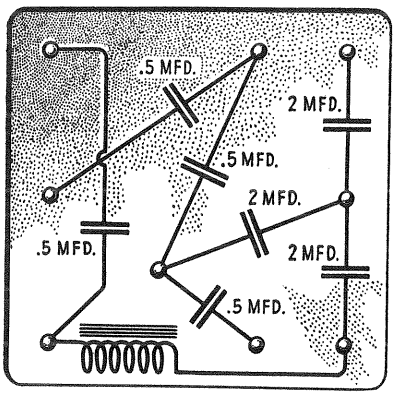


Figure 14—Internal connections of filtering and by-pass condensers, and output condenser and choke

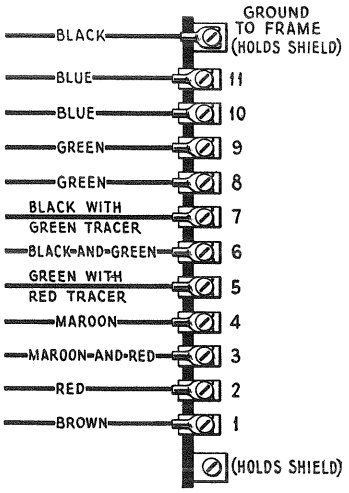


Figure 15—S.P.U. terminal strip with color scheme of connections

[14] ADJUSTMENT OF I. F. TRANSFORMERS

The three I.F. transformers used in Radiola 60 are of the air core, tuned primary and tuned secondary type. The primary condenser is of the fixed type, while the secondary is adjustable. Also in each assembly an adjustable condenser is provided for neutralizing the I.F. stage.

Should a transformer burn out or its primary fixed condenser change in capacity it will be necessary to replace that particular transformer. The correct procedure for making such a replacement is contained in Part III, Section 10.

A simple method of locating a shorted transformer is to use a resistance bridge or the resistance measuring method described in "Radiola 32 Service Notes." The approximate transformer primary D.C. resistance is 20 ohms; secondary 100 ohms. Due to the circuit arrangement it will only be possible to get a reading of 50 ohms on the secondary as the end connection goes to the neutralizing condenser and the reading must be made at the center tap connection. This test can be made from the underside of the chassis. (See circuit diagram Figure 17.)

After replacing a defective I.F. transformer or to make adjustments the following tuning and neutralizing procedure must be followed for correctly lining up the various circuits. This is

of utmost importance, as the entire performance of Radiola 60 is based on the correct functioning of its intermediate stages.

The following equipment is needed:

1. A Test Oscillator (Driver). See Figure 11.
2. A coupling lead for coupling the output of the Driver to the grid coil of the first detector.
3. A non-metallic screw-driver.
4. A "dummy" Radiotron UY-227—a normal tube with one heater prong removed.

This Driver, together with all the above items, will be furnished to RCA Distributors by the RCA Service Division.

Preliminary steps to be taken before adjusting the tuning, neutralizing and trimming condensers:—

(a) Remove receiver assembly and S.P.U. from cabinet as described in Part III, Section 1 and Section 10.
(b) Remove main tuning condenser assembly as described in Part III, Section 4.
(c) Replace screw holding ground lead on under side of receiver assembly and make certain that ground lead makes good contact with the chassis frame.
(d) Connect all leads to the S.P.U. terminal strip except No. 2 (red), which should be connected to the clip from the Driver. The other lead with the spade terminal from the Driver should be connected to terminal No. 2 on the S.P.U. terminal strip. These connections merely place the milliammeter in the Driver test set, in series with the plate supply to the second detector.
(e) Now place the coupling coil from the Driver under the center coil of the R.F. and Oscillator assembly. This is the transformer between the tuned R.F. stage and the first detector. Replace all Radiotrons except the Oscillator and turn operating switch "ON." Also connect a loudspeaker to the output pin jacks of the S.P.U.
(f) Place Driver in operation by switching "ON," and set switches and vernier condenser at 180 K.C. The note from the Driver will then be heard in the loudspeaker.

The I.F. transformer tuning condensers may now be adjusted as follows:

(a) Adjust the tuning condensers successively on the third, second and first I.F. transformers (Figure 12) for maximum signal in the loudspeaker and maximum reading on the milliammeter. If pointer should go off milliammeter scale reduce the volume control. After making one adjustment on the transformers it is a good plan to repeat, as slight changes may have occurred in tuning the other circuits. No signal, or a loud howl indicates neutralizing condensers are at either extreme, and should be readjusted.

A maximum reading by adjusting all three tuning condensers indicates correct tuning of the intermediate stages.

It is now necessary to check the neutralization of the I.F. stages as follows:

(a) Leave all adjustments and apparatus in position on completion of tuning, but substitute a pair of phones for the loudspeaker. Place dummy Radiotron in first I.F. socket. Now adjust the neutralizing condenser on the first I.F. transformer. (See Figure 12) for the position of minimum or no signal. This is easily identified and the adjustment is not critical.
(b) Replace the first I.F. tube and place "dummy" tube in second I.F. stage. Repeat the same adjustment as in (a) only adjusting with the neutralizing condenser on the second I.F. transformer. It will be noted that the two condensers on the third transformer are connected in parallel for tuning. This stage does not require neutralizing.

After the I.F. transformers are properly tuned and neutralized they should perform at their maximum efficiency. It is a good plan to check the adjustments of the two oscillator trimming condensers (See Figure 20) at this point. The correct method

for doing this is indicated in Part II, Section 12. The Driver illustrated in Figure 11 may be used for this adjustment. The procedure for adjusting the trimming condensers follows:

(a) Replace main tuning condensers and solder all connections in place. Place coupling lead of the oscillator near the Radiola antenna lead.
(b) Set Driver switches and vernier condenser for 1,400 K.C.
(c) With all Radiotrons in place in the receiver tune for Driver signal with main tuning condensers. If reading goes off milliammeter scale reduce volume control.
(d) Adjust trimming condenser on left (facing front of Radiola, Figure 12) for a maximum reading.
(e) Shift frequency of Driver to 600 K.C. and tune in with main tuning condensers. Adjust trimming condenser on right for maximum milliammeter reading. This is the condenser on the right of the other trimming condenser (See Figure 20).
(f) After adjusting at 600 K.C., check again at 1,400 K.C., and make any readjustment necessary.

This check of the trimming condensers completes the adjustments to be made on Radiola 60 with the Driver. The receiver assembly and S.P.U. should now be returned to the cabinet and the Radiola returned to normal operation.

Due to the increased sensitivity of the receiver it may be necessary to reduce the setting of the R.F. compensating condenser to prevent the tuned R.F. stage from oscillating. This can be ascertained by tuning in stations of different wavelengths and noting if the receiver oscillates at any point throughout its tuning range. (See Part II, Section 13.)

[15] FILTER CONDENSERS AND OUTPUT CONDENSER AND CHOKE

The output choke and condenser, and the filtering and by-pass condensers are located in one container in the S.P.U. Figure 14 shows the internal connections. The procedure for testing this unit is to "click test" the choke for an open, and charge and discharge the condensers individually by shorting their terminals with a screw-driver. A condenser that will not retain its charge is defective. Approximately 200 volts D.C. should be used when making this test.

An open output condenser or an open or shorted choke will cause weak and distorted reproduction. A defective filter condenser is indicated by excessively hot plates, possibly showing color, in Radiotron UX-280. Shorted by-pass condensers will cause abnormal operation or inoperation.

[16] VOLTAGE SUPPLY SYSTEM

Figure 16 illustrates a schematic diagram of the cathode, grid and plate voltage supply system of the various tubes used in the receiver assembly.

This receiver uses the series supply arrangement for securing different drops through various sections of a resistor placed in the plate return lead to secure proper bias for the grid circuits and proper potential for applying to the cathodes and heaters. Electrically the volume control is a section of this resistance and it functions by varying the grid bias on the R.F. and I.F. stages sufficiently to give a positive control of signal strength delivered to the second detector.

A bleeder resistor of 20,000 ohms is provided across the supply circuit at the 135-volt position. The use of this resistor prevents any excessive rise in voltage that would otherwise occur upon removal of all Radiotrons or if some failure resulting in reduced load occurred in the receiver.

[17] VOLTAGE READINGS

When checking Radiola 60 for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man will need both an A.C. and D.C. Voltmeter, the D.C. meter being 600 ohms per volt or higher in resistance. The following voltages at the terminal strip of the S.P.U. are correct with all tubes in place and the line adjustment switch in the correct position for that particular location. The tubes must be in good condition otherwise the D.C. voltages may be excessively high.

The shield over the terminal strip must be removed before any readings can be made. The terminal numbers are counted from front to rear of the Radiola, No. 1 being near the front and No. 11 near the rear.

Terminals	*Correct Voltage*
1 to 7	200 D.C.
2 to 7	210 D.C.
3 to 7	160 D.C.
4 to 7	110 D.C.
8 to 9	5 A.C.
10 to 11	2.25 A.C.

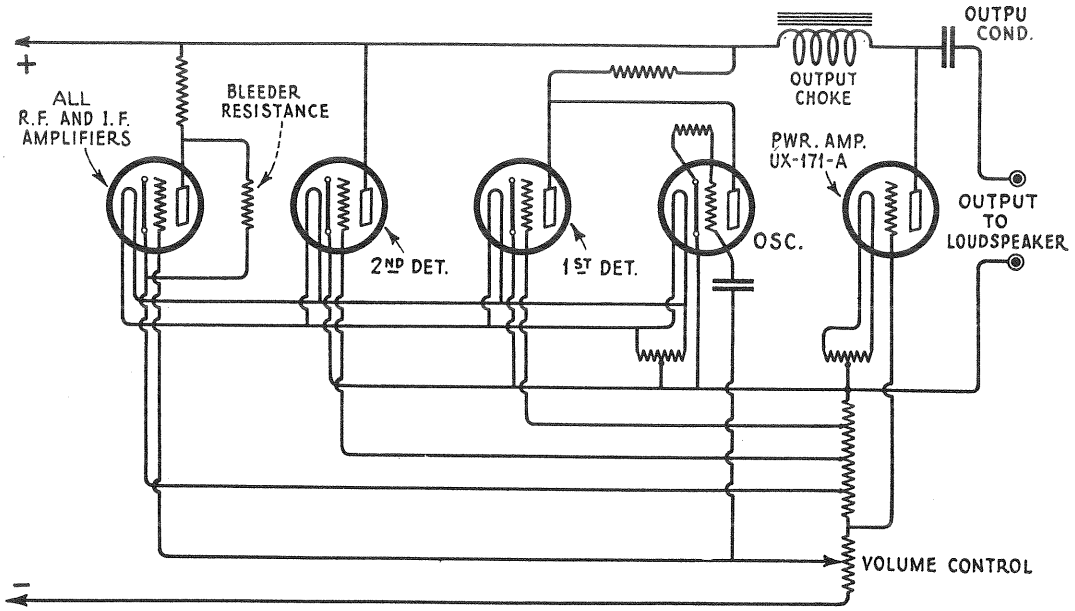


Figure 16—*Schematic circuit diagram of the voltage supply system*

[18] CHECKING RESISTANCE VALUES

When checking a Radiola 60 for possible trouble it is always a good plan to check the various resistance values of different strips used both in the receiver assembly or in the socket power unit. These values are shown in the schematic circuit diagram, Figure 3. A resistance bridge should be used for checking these values, or if this is not available, the method suggested in "RCA Radiola 32 Service Notes" (page 16) will give good results for the lower values of resistance. The high values, such as 14,300 and 20,000 ohms may be checked by measuring the voltage drop across them, after ascertaining that all other circuits are in correct operating condition.

[19] RADIOLA 60 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly (Figure 17) and S.P.U. (Figure 18). Disconnect the antenna and ground leads; the cable connecting the S.P.U. to the receiver assembly; and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient voltage to give a full scale deflection when connected directly across the battery terminals should be used in making these tests. The receiver sockets, numbers and lugs used in these tests are shown in Figures 17 and 19. The S.P.U. terminal numbers are shown in Figures 15 and 18.

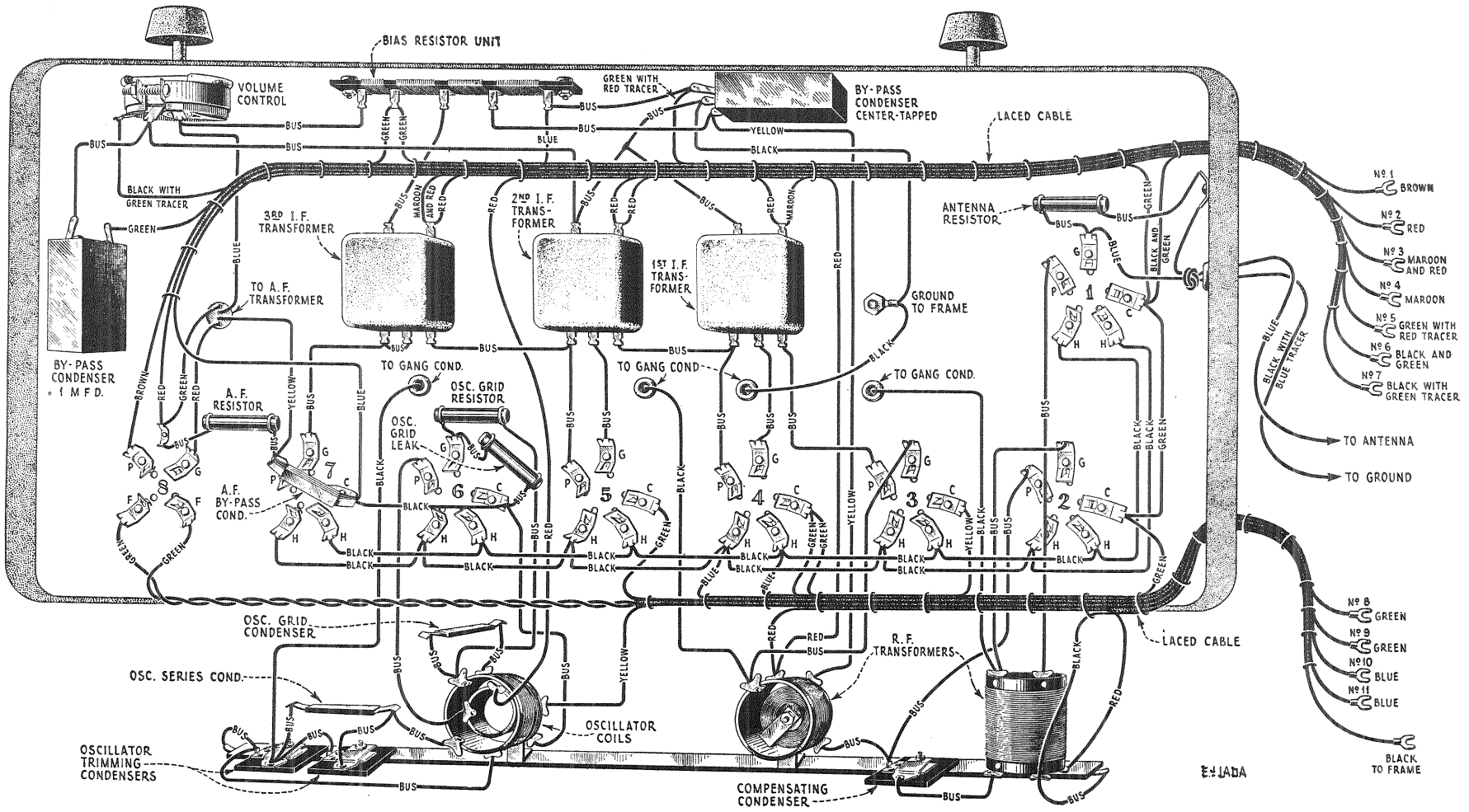


Figure 17—Wiring continuity and location of parts in receiver assembly

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove all Radiotrons and Disconnect Cable at Terminal Strip

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna lead to ground lead	Closed	Open antenna resistor
	Antenna lead to G1	Closed	Open connection
	G2 to ground	Closed	Open secondary of 1st R.F. transformer
	G3 to Lug No. 5	Closed	Open secondary of 2nd R.F. transformer or resistance unit.
	G4 to ground	Closed	Open secondary of 1st I.F. transformer
	G5 to ground	Closed	Open secondary of 2nd I.F. transformer
	G7 to ground	Closed	Open secondary of 3rd I.F. transformer or resistance unit
	G8 to Lug No. 6	Closed	Open secondary of audio transformer or resistance unit
	Lug No. 5 to Lug No. 7	Closed	Open resistance unit or volume control
	Ground to Lug No. 7	Closed	Open volume control contact arm or poor connection
Plate	P1 to Lug No. 3	Closed	Open primary 1st R.F. transformer
	P2 to Lug No. 3	Closed	Open primary 2nd R.F. transformer
	P3 to Lug No. 4	Closed	Open primary 1st I.F. transformer
	P4 to Lug No. 3	Closed	Open primary 2nd I.F. transformer
	P5 to Lug No. 3	Closed	Open primary 3rd I.F. transformer
	P6 to Lug No. 4	Closed	Open plate coil of oscillator coils
	P7 to Lug No. 2	Closed	Open primary of audio transformer
	P8 to Lug No. 1	Closed	Open connection
Filament	Cathodes No. 1, No. 2, No. 4 and No. 5 to Lug No. 6	Closed	Open connection
	Cathodes No. 3, No. 6 and No. 7 to Lug No. 5	Closed	Open pick-up winding of oscillator or connection
	Lug No. 8 to one filament contact Socket No. 8	Closed	Open connection
	Lug No.9 to other closed filament contact Socket No. 8	Closed	Open connection
	Lug No. 10 to one heater contact of Sockets Nos. 1, 2, 3, 4, 5, 6 and 7	Closed	Open connections
	Lug No. 11 to other heater contact of Sockets Nos. 1, 2, 3, 4, 5, 6 and 7	Closed	Open connections
Miscellaneous	G2 to P2	Open	Shorted compensating condenser
	G4 to P4	Open	Shorted neutralizing condenser
	G5 to P5	Open	Shorted neutralizing condenser
	G6 to Cathode 6	Closed (Weak)	Open oscillator grid leak
	G8 to Lug No. 5	Closed	Open resistance unit or secondary of A.F. transformer
	G8 to Lug No. 7	Closed	Open secondary of A.F. transformer or open volume control

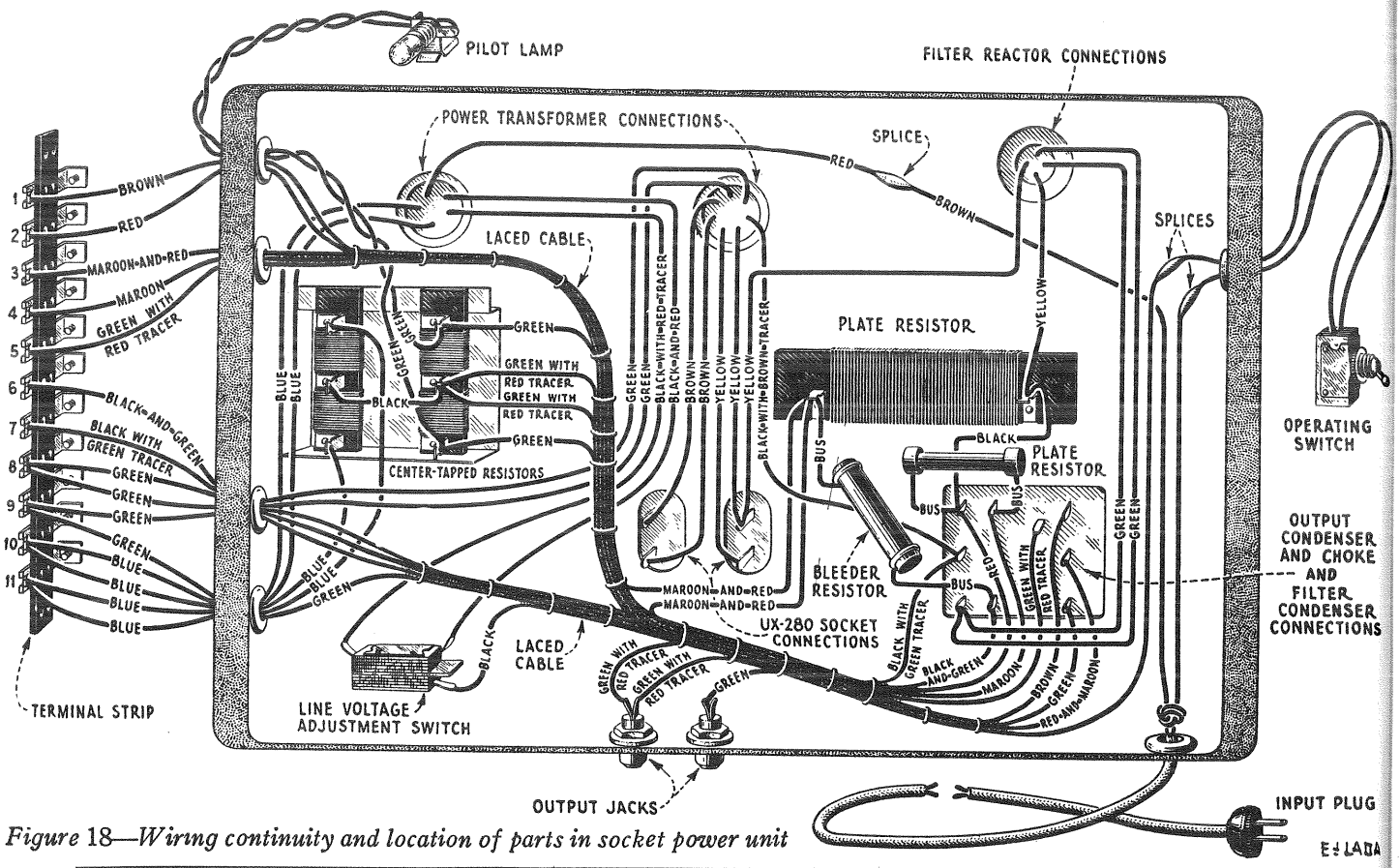


Figure 18—Wiring continuity and location of parts in socket power unit

SOCKET POWER UNIT CONTINUITY TESTS

Remove Radiotron UX-280 and Disconnect Cable at Terminal Strip

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
S.P.U.	G to P of UX-280 socket	Closed	Open high voltage winding of power transformer
	Across filament contacts of UX-280 socket	Closed	Open UX-280 filament winding of power transformer
	One filament contact of UX-280 socket to No. 1	Closed	Open output choke or filter reactors
	Terminal No. 1 to No. 3	Closed	Open resistance unit or output choke
	Terminal No. 1 to No. 4	Closed	Open resistance unit or output choke
	Terminal No. 3 to No. 6	Closed	Open resistance unit
	Terminal No. 4 to No. 5	Open	Shorted .5 mfd. condenser
	Terminal No. 5 to No. 6	Open	Shorted .5 mfd. condenser
	Terminal No. 5 to No. 7	Open	Shorted 2 mfd. condenser
	Terminal No. 8 to No. 9	Closed	Open UX-171A filament winding and resistance unit
	Terminal No. 10 to No. 11	Closed	Open UY-227 filament winding and resistance unit
	One loudspeaker jack to No. 1	Open	Shorted output condenser
	Other jack to No. 5	Closed	Open connection

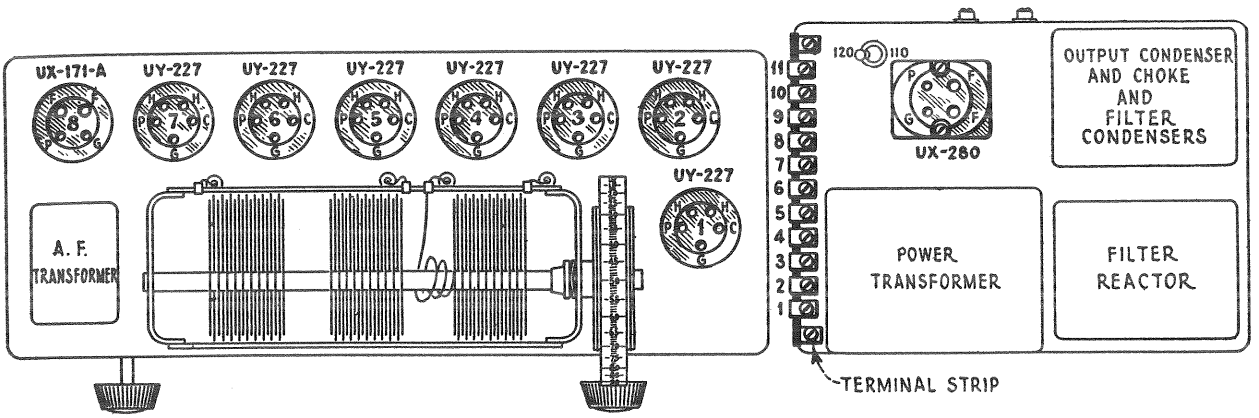


Figure 19—Radiotron socket contacts and location of parts

PART III—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 60 are readily accessible and replacements can be easily made. Figure 1 illustrates the various parts in a top view of the receiver assembly; Figure 2 shows the parts of the S.P.U., and Figure 20 illustrates the receiver sub-chassis parts. The following detailed procedure outlines the simplest method to be used in making replacements.

[1] REPLACING THE VOLUME CONTROL

(a) Remove the knobs on the volume control and station selector. These are of the push type, and they are removed by seizing them with the fingers and pulling away from the receiver. To replace, merely push them on the shaft, first matching the knob socket, with its removable flat spring, to the shaft.

(b) Release the pilot lamp and socket by pulling it from the small angle bracket to which it is clipped in place. A slight pull, upward and backward, will release it.

(c) Remove the shield from the terminal strip and then release all the lugs held in place by the screws at the top of each terminal.

(d) Remove the four machine screws that hold the receiver chassis assembly in place. These screws are located on the under side of the cabinet. When turning the cabinet on its side be careful not to place a heavy strain on the moulded feet of the cabinet, as they may be damaged.

(e) The chassis may now be lifted clear of the cabinet. (See Figure 21.)

(f) Place the receiver chassis in a convenient place to work on, and with the volume control up so that the two screws and nuts that hold it to the receiver frame can be removed. The three soldered connections must also be removed.

(g) Remove the old volume control and fasten the new one in position by means of the two machine screws and nuts, and replace the three soldered connections. The correct connections of these leads are shown in Figure 17.

(h) Replace receiver assembly in cabinet and fasten with machine screws. Return cable to its original position.

(i) Test Radiola and, if O. K., return shield to its original position.

[2] REPLACING R.F. TRANSFORMER AND OSCILLATOR ASSEMBLY

The two radio frequency transformers and the oscillator coils are mounted on a metal strip, together with free small adjustable condensers and two fixed condensers.

This assembly must be replaced as a unit—the matching of the coils being an important point in the operation of the receiver. When making replacement adopt the following procedure:

(a) Remove receiver chassis from cabinet as described in Part III, Section 1.

(b) Turn chassis on side and unsolder all leads to the assembly being replaced.

(c) Remove the five machine screws and lock washers that hold the metal supporting strip to the receiver frame.

(d) The assembly may now be removed and the new assembly fastened in position with the five machine screws and washers previously removed.

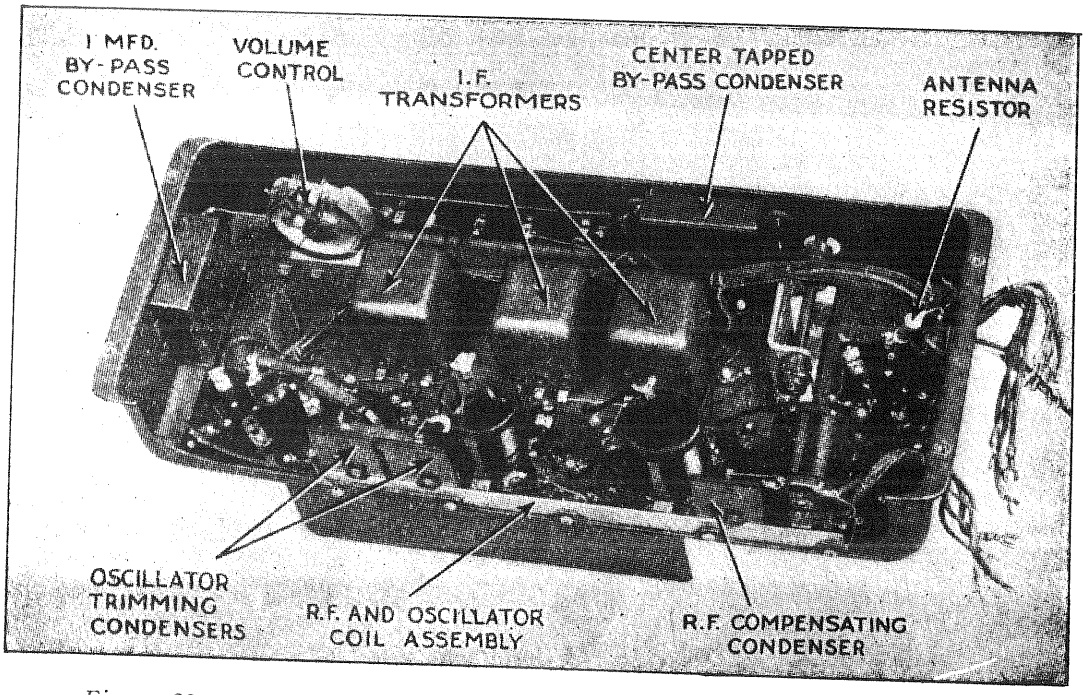


Figure 20—Receiver sub-chassis assembly, showing location of various parts

(e) Resolder all connections in their correct position on the assembly. This is shown in Figure 17.

(f) The receiver assembly may now be returned to the cabinet in the reverse order of that used to remove it.

(g) The two oscillator trimming condensers must now be adjusted as described in Part II, Section 12 and adjust the R.F. compensating condenser as described in Part II, Section 13.

(h) Test the receiver and, if O. K., replace the terminal strip shield.

[3] REPLACING RADIOTRON GANG SOCKETS

One socket assembly on the receiver chassis is of the gang variety, the others being two single units. All are held in place, together with their shields, by means of rivets which clamp them on the metal chassis frame. Use the following procedure when replacing these sockets:

(a) Remove the receiver assembly from the cabinet as described in Part III, Section 1.

(b) Unsolder all connections to the particular socket or assembly being removed. The R.F. transformer assembly should be removed as a unit to provide room for replacing the six-gang Radiotron socket.

(c) Drill out the rivets holding the Radiotron socket to be replaced. The socket and shield will be released together, in the case of the single UY socket. In the case of the single UX or the gang UY the shield will remain in place, due to overlapping both socket units, the socket or assembly not being removed serving to hold the shield in place.

(d) Remove the old Radiotron socket and fasten the new one in position by means of screws, nuts and washers. Resolder all connections and replace the R.F. assembly if removed. The correct connections are shown in Figure 17.

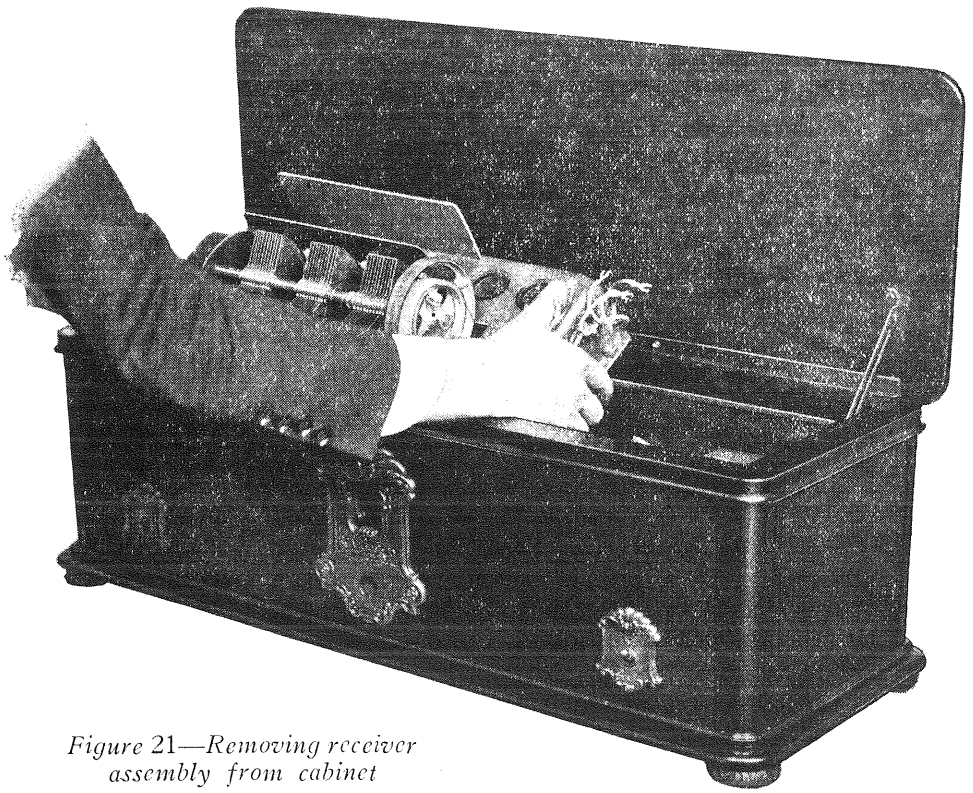


Figure 21—Removing receiver assembly from cabinet

(e) Fasten receiver assembly in cabinet, connect cable and test. If O.K., replace shield over terminal strip and return Radiola to normal operation.

[4] REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and drive are replaced as one unit. A step-by-step procedure follows:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Remove the three screws, nuts and lock washers that hold the condenser assembly to the metal frame.

(c) Now pull the condensers as far forward as possible and unsolder the four leads connected at the rear. Releasing the condensers and pulling them forward provides ample space in which to do the unsoldering job and keeps solder material clear of the tube shield. Remove the entire assembly by tilting slightly and pulling clear.

(d) Place the new assembly in the position occupied by the old one and solder the four leads to their proper connections.

(e) Fasten the three screws, nuts and lock washers in their proper position. Make sure that the screw that holds the ground connection on the under side of the chassis makes firm contact.

(f) Return the receiver to the cabinet and replace all connections in the reverse order of that used to remove them.

[5] REPLACING BY-PASS CONDENSERS

Radiola 60 employs two by-pass condensers in the receiver assembly. They are both located on the under side of this assembly, and replacement is made in the following manner:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Unsolder the connections to the condenser it is desired to replace.

(c) With a screw-driver bend up the metal tabs holding the condenser to the side of the receiver frame. These tabs bend easily, and when turned up makes possible the removal of the condenser.

(d) The new condenser should now be fastened in place in the position formerly occupied by the old one.

(e) Resolder the connections as shown in Figure 17.

(f) Fasten the reciver assembly in the cabinet in the reverse order of that used to remove it.

[6] REPLACING THE AUDIO TRANSFORMER

Radiola 60 employs one audio transformer, located at the left side of the receiver assembly facing the front of the Radiola. Should a replacement become necessary use the following procedure:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Place the receiver chassis on its side and unsolder all connections to the audio transformer.

(c) Now turn up the four tabs that hold the transformer in place and remove it. The new one is then fastened in position.

(d) Resolder the leads from the new transformer to their correct points of connection as indicated in Figure 17.

(e) Fasten the receiver assembly in the cabinet in the reverse order of that used to remove it.

[7] REPLACING CONDENSER DRIVE CABLE

(a) Remove receiver assembly from cabinet as described in Part III, Section 1. Place chassis on a table so that the cable on the grooved drums is accessible.

(b) Release the cable adjusting screw and clamp, and remove old cable from drums completely.

(c) Starting from the rear grooved drum, place eye of new cable over pin, which should be in a horizontal position and next to side of the assembly that is closest to the Socket Power Unit when in the cabinet, and wind on three complete turns and then bring cable up to large drum.

(d) Now pass cable over large drum. Turn the drum so the cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing the cable to the track on the other side of the drum.

(e) Follow on around other track in same direction until a point is reached where cable is directly above front grooved drum.

(f) Starting on the third groove back from the front of the drum, wind on two and a half turns and slip eye over pin. The cable is now in its correct position, although probably slack.

(g) The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the grooves are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of its controls. Care should be taken not to take up too much, as the cable may be stretched or possibly broken.

(h) Return receiver assembly to cabinet in the reverse order of that used to remove it.

[8] REPLACING DIAL SCALES

After considerable use a dial scale may become soiled or illegible and a new scale desired. A step-by-step procedure to make replacement follows:

(a) Open lid of Radiola 60.

(b) Turn dial so that the two screws that hold the dial in place are on top.

(c) Loosen screws, washers and nuts that hold dial in place.

(d) The old dial may now be pulled clear and the new one placed in the position occupied by the old one. Examine dial from the front of the Radiola to see that the numbers on the dial are in their correct position.

(e) Tighten screws holding dial in place and close lid of cabinet.

[9] REPLACING EITHER POWER CABLE

Two laced cables are employed in Radiola 60 receiver assembly, one for filament supply and one for the plate and grid supplies. Should it be necessary to replace either of these cables, use the following procedure:

(a) Remove receiver assembly from cabinet as described in Part III, Section 1.

(b) Turn assembly bottom side up and unsolder all connections to the cable being replaced.

(c) Remove old cable and connect up the new cable as indicated in Figure 17, soldering all connections.

(d) Return assembly to cabinet in reverse order of that used to remove it.

[10] REPLACING INTERMEDIATE TRANSFORMERS

Should it be found necessary to replace or adjust the I.F. transformers, the Dealer should send the receiver chassis to his Distributor. See Part II, Section 14. This is of utmost importance, as the entire performance of the Radiola 60 is based on the correct functioning of its intermediate stages.

[11] REPLACING TAPPED RESISTANCE UNIT IN RECEIVER ASSEMBLY

A tapped resistance unit in the receiver assembly of Radiola 60 provides the various grid and cathode voltages. To replace this tapped resistance unit proceed as follows:

(a) Remove receiver assembly as described in Part III, Section 1.

(b) Unsolder all connections to the tapped resistance unit.

(c) Remove the two screws, nuts and washers that hold the resistance unit in place.

This will release the unit and the new one can be fastened in place with the screws, nuts and washers previously removed.

(d) Solder all the leads to their correct connections. (See Figure 17.)

(e) Fasten receiver assembly to cabinet in the reverse order used to remove it.

[12] REPLACING FILTER CONDENSERS AND OUTPUT CONDENSER AND CHOKE

The filter condensers, by-pass condensers, and output condensers and choke are all enclosed as a unit in a metal container. Should replacement be necessary use the following procedure:

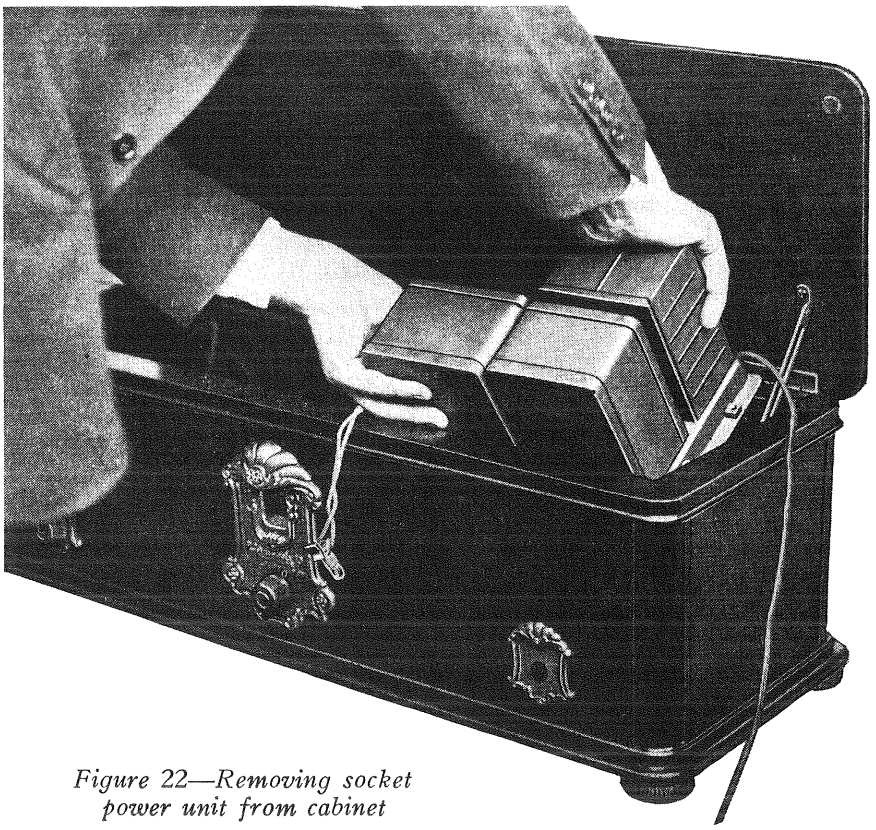


Figure 22—Removing socket power unit from cabinet

(a) Remove the shield and all connections from the Socket Power Unit terminal strip.

(b) Remove the four machine screws that hold the S.P.U. to the cabinet.

(c) Remove the collar holding the operating switch to the escutcheon plate on the front panel. Removing the escutcheon and turning the switch from the rear makes removal of the collar much easier and prevents marring of the escutcheon.

(d) The S.P.U. may now be lifted clear of the cabinet and placed in a convenient position to work upon.

(e) Unsolder all connections to the unit being replaced, also release the two resistors attached to its connecting terminals.

(f) Bend up the tabs that hold the unit to the S.P.U. base. Remove the old unit and fasten the new one in position by bending the tabs down so that it is held tightly to the S.P.U. base.

(g) Replace and solder all connections and resistance units removed. Their correct connections are shown in Figure 18.

(h) Return the Socket Power Unit to the cabinet in the reverse order of that used to remove it. Replace all connections and test. If O.K., replace the shield over the terminal strip.

[13] REPLACING POWER TRANSFORMER OR FILTER REACTOR

The power transformer and filter reactor are both held in place by means of tabs which form a part of their case, being turned over on the under side of the S.P.U. base. A step-by-step replacement procedure follows:

(a) Remove S.P.U. from cabinet as described in Part III, Section 12.

(b) Unsolder all connections to unit being replaced. If the power transformer is being replaced release the two screws that hold the center tapped resistance units in place, so they may be pulled clear when bending the tabs on the power transformer.

(c) Bend up the tabs that hold the unit to the S.P.U. base.

(d) The old unit may now be removed and the new one placed in position. Bend over the tabs on the new one so that it is fastened tightly to the S.P.U. base.

(e) Solder all connections as shown in Figure 18.

(f) Fasten the S.P.U. in the cabinet in the reverse order of that used to remove it.

[14] REPLACING TERMINAL STRIP

Should the terminal strip on the S.P.U. require replacement use the following procedure:

(a) Remove the S.P.U. from cabinet as described in Part III, Section 12.

(b) Unsolder all leads to the terminal strip.

(c) Release two screws holding strip to S.P.U. base.

(d) The strip may now be removed and replaced by a new one.

(e) Fasten new strip in position by means of two machine screws, lock washers and nuts previously removed.

(f) Solder all leads to terminal strip. The color scheme and correct connections are shown in Figure 18.

(g) Return S.P.U. to cabinet in the reverse order, and connect to receiver assembly.

[15] REPLACING MISCELLANEOUS PARTS IN S. P. U.

The center tapped resistors, plate supply resistors, line switch and UX-280 socket in Radiola 60 may require replacement. They are all attached to the base by means of machine screws and nuts, and replacement is very simple. The following general outline will apply to all these units:

(a) Remove S.P.U. from cabinet as described in Part III, Section 12.

(b) Unsolder leads from defective unit.

(c) Remove defective unit from base and replace with new unit.

(d) Solder leads to new unit as indicated in Figure 18.

(e) Return S.P.U. to cabinet in reverse order of that used to remove it.

SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, or a poor antenna system. If imperfect operation is not due to these causes the "Service Data Chart" should be consulted for further detailed causes. Reference to Part No. and Section No. in the "Service Notes" is also noted for further details.

Indication	*Cause*	*Remedy*
No Signals	Defective operating switch	Repair or replace switch
	Loose volume control arm	Tighten volume control arm, P. II, S. 4
	Defective power cable	Replace power cable, P. III, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective I.F. transformer	See P. III, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Defective Oscillator coil	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective by-pass condenser	Replace by-pass condenser, P. III, S. 5
	Defective socket power unit	Check socket power unit by means of continuity test, and make any repairs or replacements necessary, P. II, S. 19
Weak Signals	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 13
	Trimming condensers out of adjustment	Adjust trimming condensers, P. II, S. 12
	I.F. transformers not correctly aligned	See P. II, S. 14
	Defective power cable	Repair or replace cable, P. III, S. 9
	Defective R.F. transformer	Replace R.F. and oscillator coil assembly, P. III, S. 2
	Defective I.F. transformer	See P. III, S. 10
	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Dirty prongs of Radiotrons	Clean prongs with fine sandpaper, P. I, S. 3
	Defective by-pass condenser	Replace defective by-pass condensers, P. III, S. 5
	Defective main tuning condenser	Replace defective tuning condensers, P. III, S. 4
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. II, S. 17
	Defective socket power unit	Check socket power unit by means of continuity tests and make any repairs or replacements necessary, P. II, S. 19
Poor Quality	Defective A.F. transformer	Replace A.F. transformer, P. III, S. 6
	Defective by-pass condenser	Replace defective by-pass condenser, P. III, S. 5
	Dirty contact arm of volume control	Clean contact arm on volume control, P. II, S. 4
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper, P. I, S. 3
	Volume control advanced too far	Reduce setting of volume control, P. I, S. 7
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 13
	Defect in audio system	Check and repair any defect, P. II, S. 10
	Open grid circuit in any stage	Check circuit and repair defect
Excessive Hum	Defective center tapped resistance unit	Replace defective resistance unit, P. III, S. 15
	Socket plug position	Reverse socket plug
	Line voltage low	Set line switch for low line voltage, P. I, S. 5
Radiotrons Fail to Light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer, P. III, S. 13
	No. A.C. line voltage	Turn A.C. line voltage "On"
Play in Station Selector	Slack cable	Take up on cable adjusting screw, P. II, S. 5