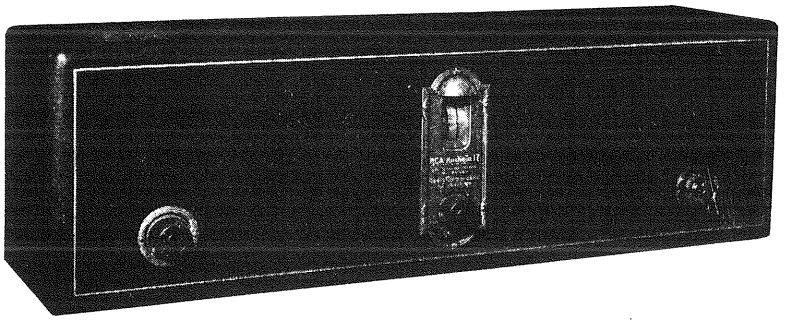
RCA
Radiola 17

SERVICE NOTES



RCA Radiola 17

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 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 Radiola owners may be entirely satisfied.

Obviously this service can best be rendered at point of contact and therefore Dealers and Distributors who are properly equipped with a knowledge of the design and operation of Radiolas occupy a favorable position to contract for this work.

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 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 to Dealer and Distributor, and it is suggested they be preserved for ready reference.

In addition to supplying the Service Notes the RCA, through its Service Stations, has available to Dealer and Distributor the services of engineers who are qualified to render valuable help in solving service problems.

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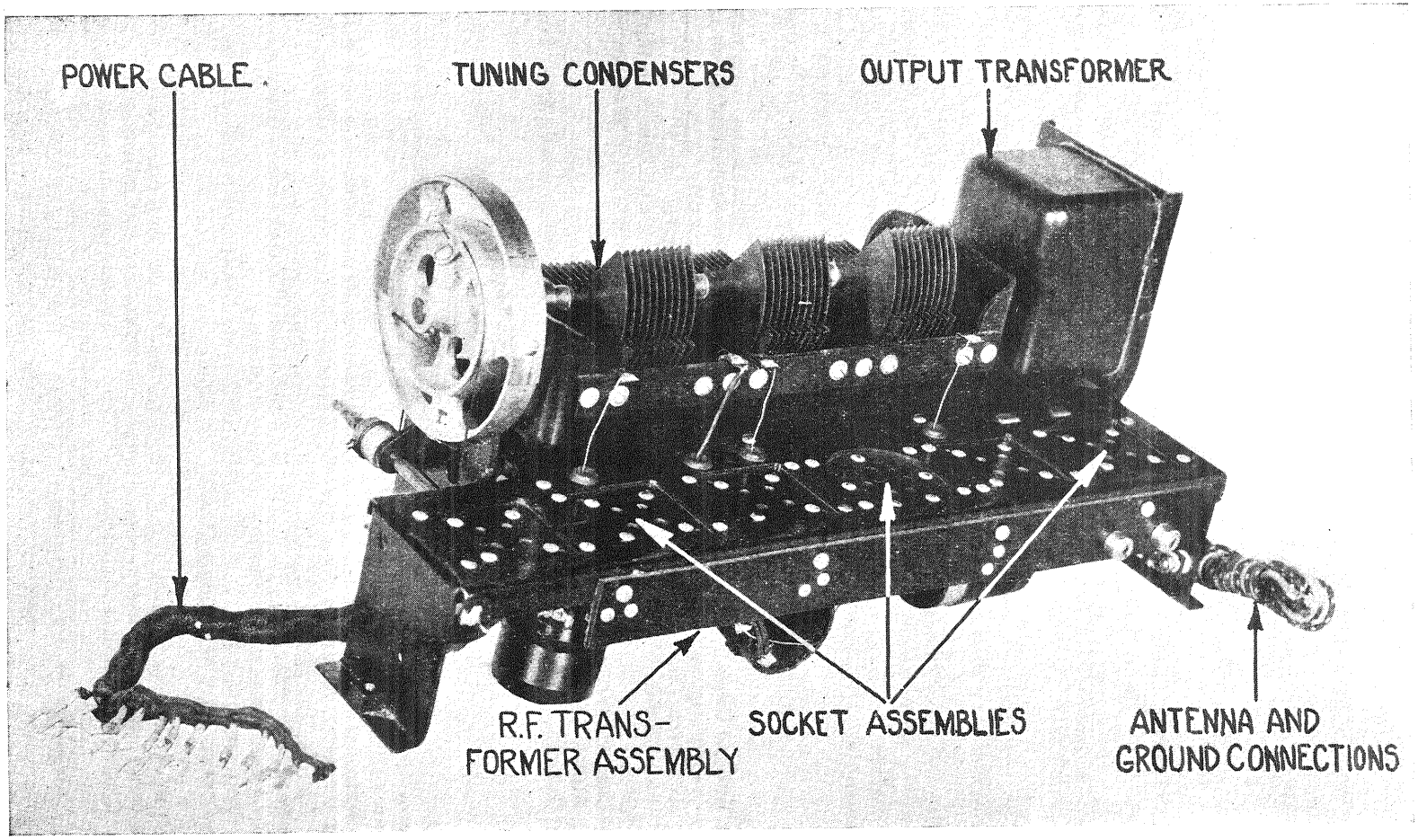

Figure 1—Top view of receiver assembly showing the principal parts.

RCA RADIOLA 17

SERVICE NOTES
PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

RCA Radiola 17 is a six-tube tuned radio frequency receiver (Figure 1), utilizing RCA Radiotrons UX-226, UY-227, UX-171A and the Radiotron full wave rectifier UX-280 in the socket power unit (Figure 2). The use of Radiotrons UX-226, UY-227, and UX-171A, using raw alternating current for filament sup-

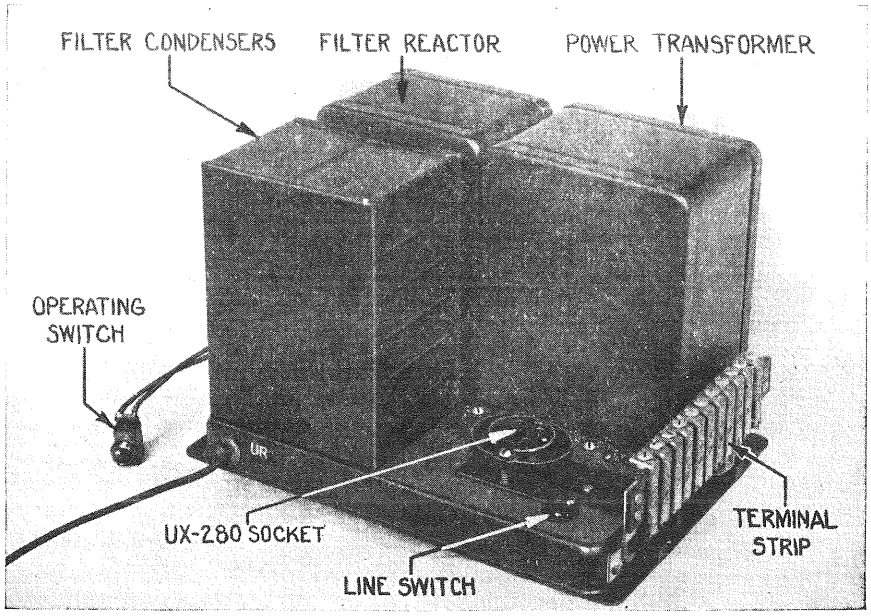

Figure 2—Socket Power Unit showing various parts.

ply, and Radiotron UX-280 in a plate and grid supply unit makes Radiola 17 a complete socket power receiver operating on 105-125 volts, 50 to 60 cycle A. C.

Very little service work should be required on Radiola 17. However, the following notes are published for the guidance of those called upon to locate and remedy any trouble that may occur.

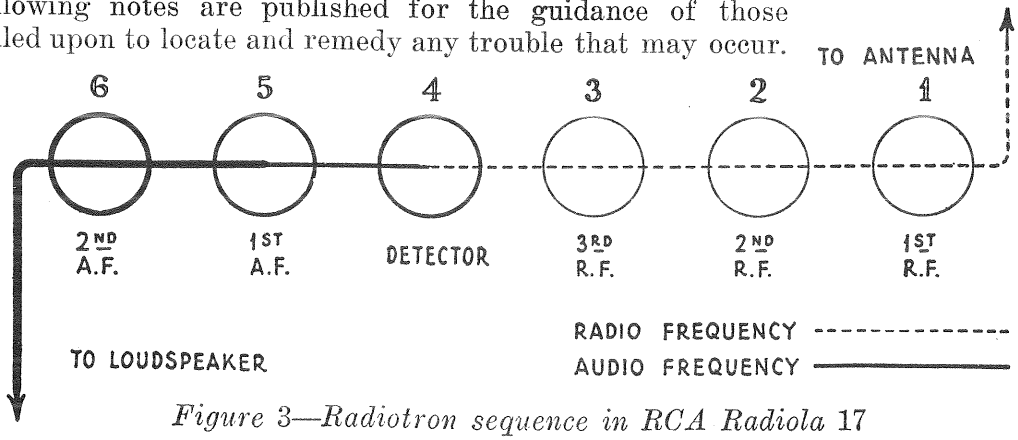

Figure 3—Radiotron sequence in RCA Radiola 17

PART I—SERVICE DATA

(1) RADIOTRON SEQUENCE

Figure 3 illustrates the sequence of the Radiotrons in the receiver proper, 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 and is not tuned in any way.

Radiotron No. 2 is a stage of tuned R. F. amplification employing a grid resistance to prevent oscillation. It is tuned by the first gang condenser.

Radiotron No. 3 is the second stage of tuned R. F. amplification. It also

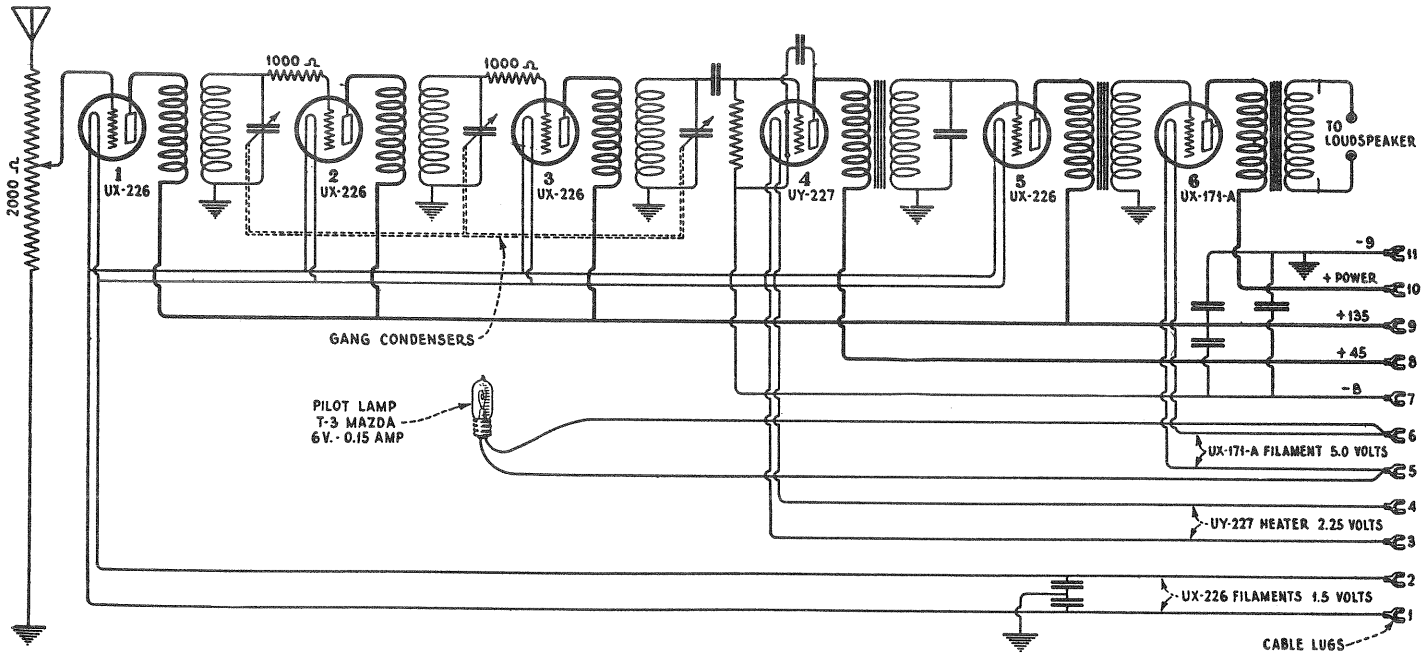

Figure 4—Schematic circuit diagram of receiver assembly.

employs a grid resistance for the purpose of stabilizing or preventing self oscillation in the circuit. It is tuned by the second of the main tuning condensers.

Radiotron No. 4 is the detector tuned by the third-gang condenser.

Radiotrons No. 5 and No. 6 are respectively the first and second stages of audio frequency amplification. The last stage, Radiotron No. 6, employs power amplifier Radiotron UX-171A.

(2) CIRCUIT CHARACTERISTICS

The following principles are incorporated in the circuit design of Radiola 17 (Figure 4 and 4A.)

1. A three-gang condenser, employed to tune two of the radio frequency circuits and the detector circuit, provides one tuning control.

2. An aperiodic antenna, or first R. F. circuit, eliminates the necessity for a separate antenna tuning control.

3. The volume control regulates the input grid voltage to the first R. F. amplifier stage. This is the most practical method of volume control for use

with A. C. Radiotrons and gives a smooth control of volume without distortion.

4. No neutralizing condensers are employed. Grid resistances in the two tuned radio frequency stages effectively prevent any tendency to self oscillation.

5. Raw A. C. of the correct voltage is used for filament heating of all Radiotrons. This eliminates the use of "A" batteries.

6. The three R. F. stages and the first audio stage receive a plate voltage of 135 volts in conjunction with a negative grid bias of 9 volts. The detector receives 45 volts plate supply without grid bias. The last audio stage receives a plate supply sufficient to provide ample loudspeaker output. The plate and grid voltages are supplied by means of a built-in "B" and "C" supply using Radiotron UX-280 as the rectifying device.

7. Radiotron UX-171A in the last audio stage provides ample volume without distortion in loudspeaker reproduction.

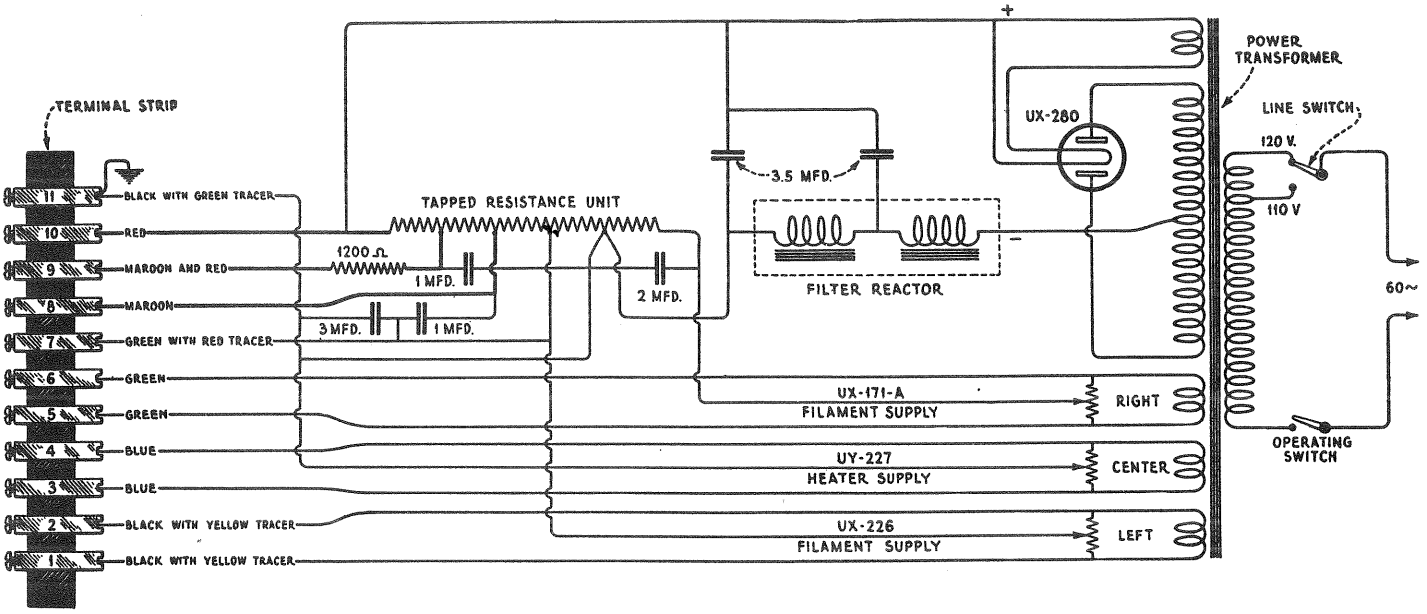

Figure 4A—Schematic circuit diagram of socket power unit.

The various circuit characteristics of Radiola 17 provide for easy installation and simple operation coupled with quality reproduction delivered to the loudspeaker.

(3) RADIOTRONS

Radiotrons UX-226 are used in all radio frequency amplifying stages and in the first audio amplifying stage. It has an oxide coated filament consuming 1.05 amperes at 1.5 volts.

Radiotron UY-227 is used for the detector. It operates on raw A. C. for filament supply, making use of an indirectly heated cathode. This Radiotron has five prongs, the extra prong being connected to the oxide coated cathode. Under normal conditions Radiotron UY-227 should give little trouble. However, in some cases a slight howl may develop in the detector circuit which will necessitate substituting another UY-227 Radiotron. Although a howl may develop in a receiver with one UY-227, in another the same tube may prove O. K. On examining a Radiotron UY-227 in operation, a slight flickering of the heater

element, incased in its insulating material, may be noticed. This condition in no way affects the normal operation of the Radiotron. The lag in the transference of heat from the heater element to the cathode, as evidenced when starting and stopping the operation of the tube, takes care of any variations indicated by this flicker, which supposedly might affect the normal operation of Radiotron UY-227. In Radiola 17 there is a positive potential of 9 volts applied to the cathode of Radiotron UY-227 with the negative side of this potential connected to the center connection of the potentiometer across the heater winding for this Radiotron. This prevents a possibility of the cathode emitting any electrons back to the heater instead of to the plate. An output transformer protects the loudspeaker windings from the high plate voltage used in conjunction with Radiotron UX-171A.

Radiotron UX-280 is a full wave rectifying Radiotron used to rectify the alternating current into pulsating direct current, which is smoothed out by means of a filtering system, and used to provide all plate and biasing voltages.

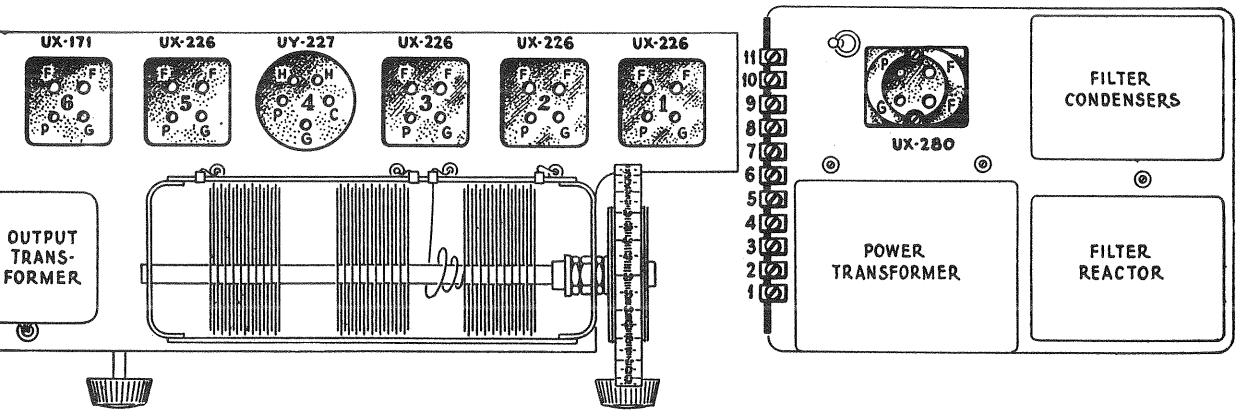

Figure 5—Radiotron socket contacts.

(4) ANTENNA INSTALLATION (Outdoor Type)

Due to the high sensitivity of Radiola 17 the most efficient antenna system is one of approximately 25 feet in length—depending upon local conditions—measured from the far end of the antenna to the ground connection. It should be erected as high as can be conveniently arranged and as far removed from all obstructions as possible. The lead-in should preferably be a continuation of the antenna itself, thus avoiding all splices which introduce additional resistance to the antenna system and which may in time corrode sufficiently to seriously affect reception. If, however, it is absolutely necessary to splice the lead-in to the antenna, the joint must be carefully soldered to insure a good electrical contact. Excess flux should be cleaned off and the connection carefully covered with rubber tape to protect it from the oxidization effects of the atmosphere.

The antenna and lead-in should be supported by high grade glass or porcelain insulators. At no point should the antenna or lead-in wire come in contact with any part of the building. The lead-in wire should be brought through the wall or window frame and insulated there from by a porcelain tube.

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 antenna. It is desirable to keep the lead-in a foot or more from the building where possible. When an outdoor antenna is used it should be protected by means of an approved lightning arrester, in accordance with the requirements of the National Fire Underwriters' Code.

(5) ANTENNA INSTALLATION (Indoor Type)

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna consisting 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. Under such conditions various arrangements of the indoor antenna should be tried to secure satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

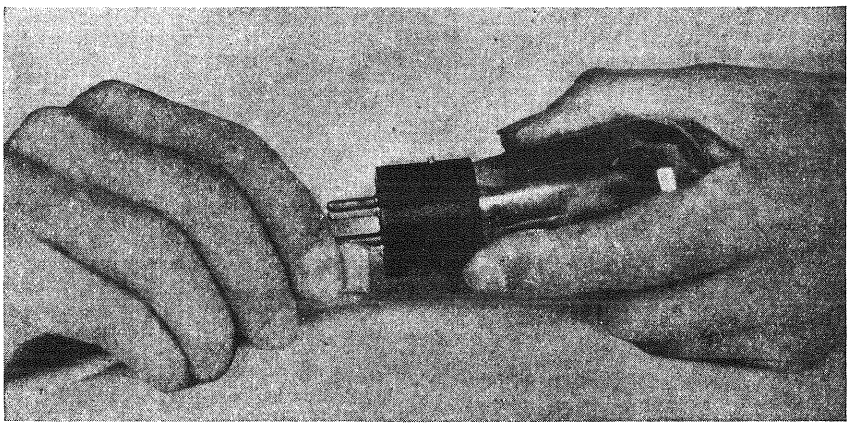

Figure 6—Method used to clean Radiotron prongs.

(6) GROUND

A good ground is quite as important as the 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.

In some instances the sensitivity of a particular set may be improved by leaving off the ground connection. The receiver, however, does not operate entirely without a ground as there is a small capacity ground through the A. C. power supply line. On the other hand, the absence of a ground connection may

cause oscillation depending upon the particular set and the antenna system installed. It is recommended that the service man experiment with grounds, and employ the arrangement giving the best results.

(7) ANTENNA SYSTEM FAILURES

Complaints of swinging signals, or of intermittent reception with probable grating noises, as distinguished from fading effects, are generally the result of antenna and ground system failures and to this, therefore, the service man should give his first attention. A grating noise may be caused by a poor lead-in connection to the antenna, or antenna touching some metallic surface, such as the edge of tin roof, drain pipe, etc. By disconnecting the antenna and ground leads from Radiola 17 and noting whether or not the grating continues, the service man can soon determine whether or not the cause of complaint is within or external to the receiver and plan his service work accordingly.

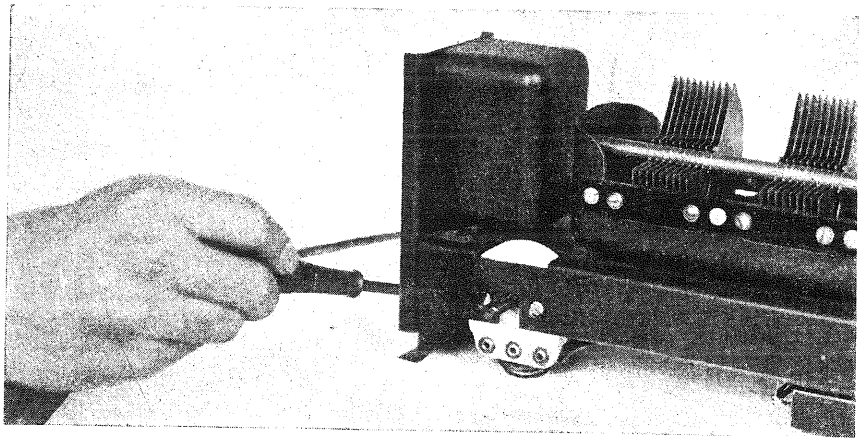

Figure 7—Releasing mounting screws holding volume control.

(8) RADIOTRON SOCKETS

The socket in Radiola 17 are of the standard gang UX and UY type (Figure 5). The three-gang socket is for the radio frequency amplifiers; the single socket—a five-prong detector socket is for Radiotron UY-227 and the two-gang socket is for the audio frequency amplifiers. Care must be exercised when inserting Radiotrons in the sockets. A socket contact may not be in its correct position and forced insertion of a tube will bend or break it. If care is exercised and the Radiotron inserted gently, little trouble will be experienced with socket contacts. A bent one will be noticeable on inspection and may be corrected by inserting a narrow instrument in the socket hole and pushing the contact into its correct position. A badly bent or broken socket contact must be replaced.

(9) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuit sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned periodically to insure good contact.

The potentiometers (Part I, Section 19) should be readjusted for the position of minimum hum whenever the Radiotron prongs are cleaned.

The prongs should be cleaned by using a piece of fine sandpaper (Figure 6). The use of emery cloth or steel wool is not recommended. Before re-inserting Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

In placing Radiotrons in the UX sockets care should be exercised to make certain that the two large pins and two small pins of the Radiotrons match the socket holes. The UY-227 Radiotron has five prongs all of the same size and will fit in the socket only one way. If a Radiotron will not fit into a socket without considerable pressure being applied, look for excessive solder on one or more of the prongs. Excessive solder on prongs may be removed with a file or knife.

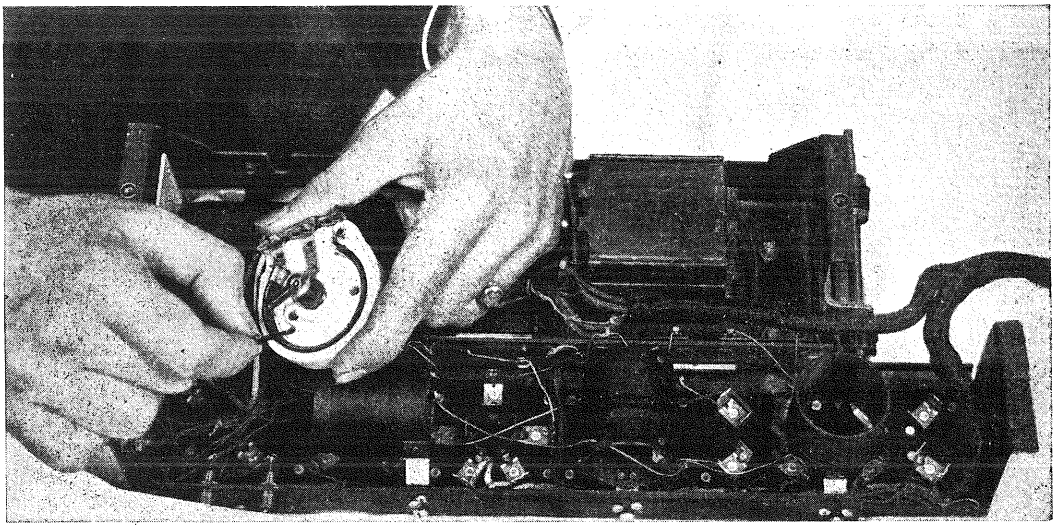

Figure 8—Adjusting the contact arm to secure improved contact with resistor strip.

(10) LOOSE VOLUME CONTROL CONTACT ARM

A loose volume control contact may cause noisy or intermittent operation and should be remedied. If the contact arm is loose, the remedy is to bend it slightly so that it makes firm contact against the resistance strip. In order to do this it is necessary to remove the chassis from the cabinet as described in Part II, Section 1. The volume control is then readily accessible. By removing the two screws (Figure 7), that hold it to the metal frame it may be completely removed. The small U-shaped washer is removed from the shaft and the spring contact arm is pulled out to clear the resistor strip. The spring contact arm may now be bent sufficiently to make a good contact. Figure 8 illustrates the bending of this contact arm. After adjusting the spring contact arm, replace the mounting screws and return the chassis to the cabinet and replace screws and control knobs.

(11) 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. (See Figure 10.)

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. (See Figure 9.) In extreme cases as might occur after considerable use and several adjustments this screw may become seated 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 II, Section 1. Remove the cable adjusting screw and clamp (see Figure 10). 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. Figure 10 illustrates this operation. It will be noted that the tapered pin in the

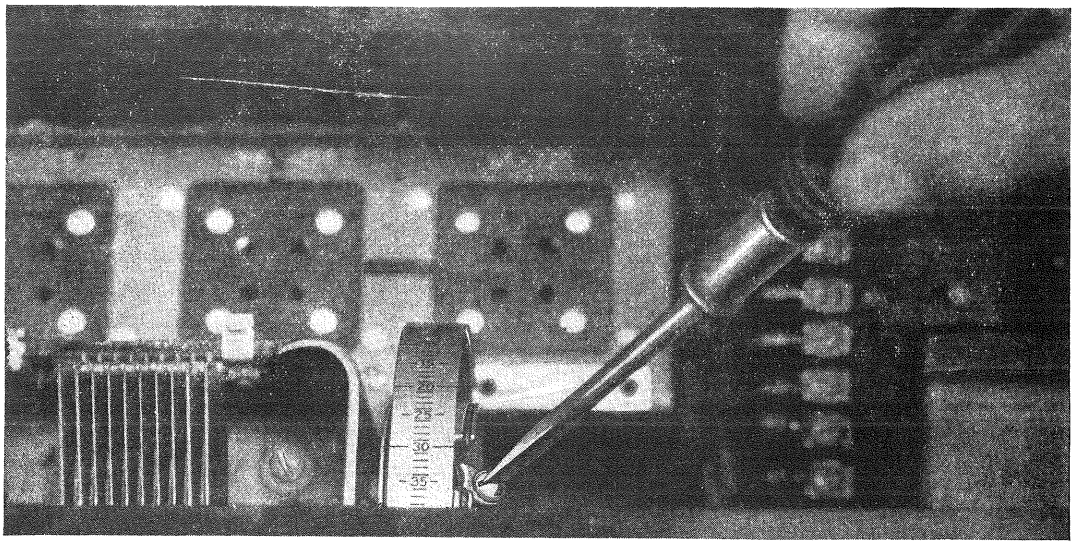

Figure 9—Turning cable adjusting screw to take up slack in tuning drum cable.

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

(12) MECHANICAL HUM

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 II, Section 12, and heating it in a slow oven. The open end of the transformer should be kept up and the wax 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.

(13) BROKEN CONDENSER DRIVE CABLE

Should a cable become broken, due to considerable use or excessive tightening, the proper remedy is to replace the cable. The procedure for making this replacement is described in Part II, Section 8. However if a new cable is not immediately available a temporary repair may be made in the following manner provided the break in the cable is not in that section that passes over the small grooved drums.

The two ends should be spliced together and then soldered. Splicing consists of interweaving the strands as with rope and not just twisting the cable

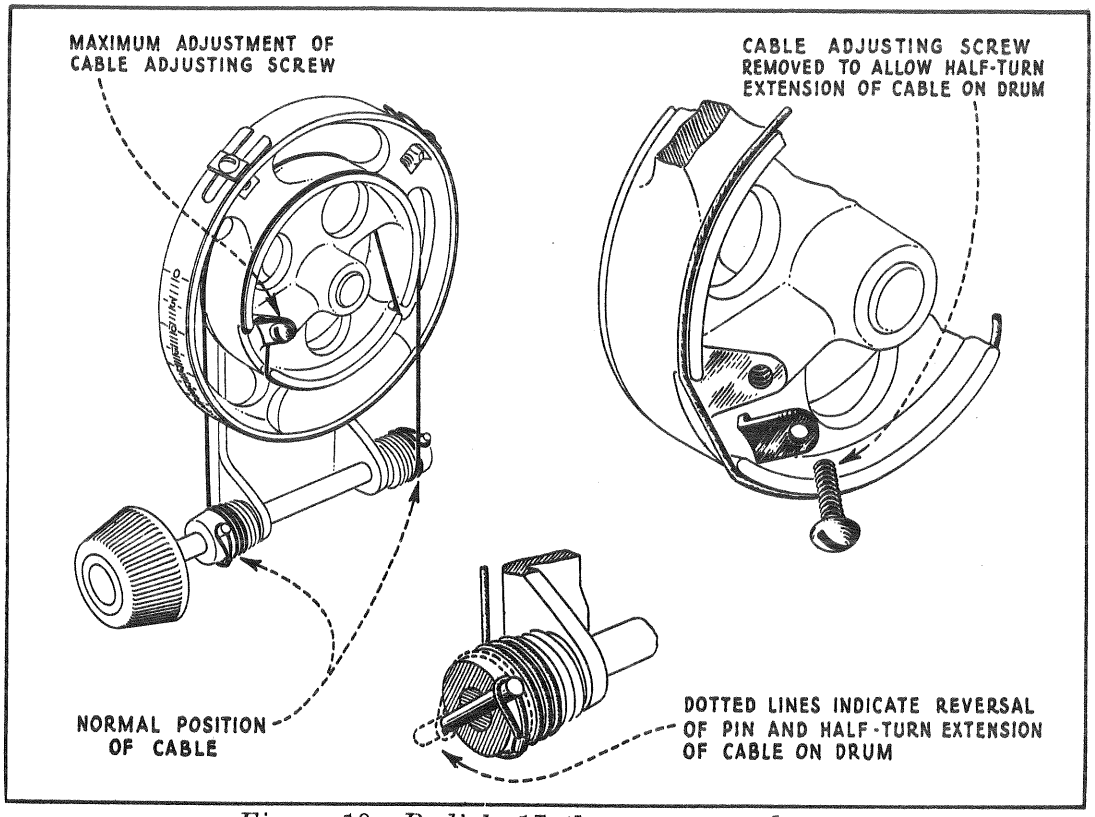

Figure 10—*Radiola* 17 *three-gang condenser cable and drum operating mechanism.*

ends together as in an electrical wiring splice. Splicing gives greater strength and results in a smaller body being formed on the cable. When soldering, use plenty of flux and a small amount of solder. Heat sufficiently long for the solder to adhere to all the small strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows any excess solder to drip away. It is to be understood that this is but a temporary repair and should be used only until a new cable can be procured and installed.

(14) LOUDSPEAKER POLARITY

Due to Radiola 17 using an output transformer, there is no polarity to the output current of the receiver. Consequently, when connecting any type of loudspeaker (either horn type or cone type) the speaker should be connected in the manner that gives the most pleasing reproduction.

(15) UNCONTROLLED OSCILLATION

Should Radiola 17 oscillate or regenerate at any point in the tuning range the trouble is probably caused by:

(1) Defective grid resistor in second or third R. F. stages. The resistors may be checked by means of a resistance bridge, or the voltmeter ammeter method described below. Figure 4 shows the correct value of these resistors.
(2) Excessive filament voltage. Adjust line switch to high position.
(3) Excessive plate voltage. This may be caused by a defective 1200-ohm resistor in UX-226 plate supply line.
(4) Antenna lead not in proper position. The correct position is between the A. F. transformer assembly and the frame.
(5) Open ground connection. Make repair.
(6) High resistance ground. Connect the ground lead to a cold water pipe, a hot water or steam radiator or both. If these are not available connect to several other grounds until a fairly low resistance ground is obtained.
(7) Open—9 volt bias lead (black with green tracer). Make repair.
(8) Open ground lead in set. Any of the several grounding leads in the Receiver and S. P. U. Assembly being open may cause oscillation. Test for open connections and make repair.
(9) Antenna and ground leads reversed, either at their point of connection to the volume control or outside of the set. Connect properly.

In the case of No. 1 the grid resistance of Radiola 17 may be checked by means of a resistance bridge. If a resistance bridge is not avaliable the voltmeter-ammeter method gives accurate results provided the meters used are calibrated accurately. This method makes use of a milliammeter with a scale of 0-25 and a voltmeter of 0-7. A voltage is then applied that will give a substantial reading. A circuit diagram of this method is shown in Figure 12.

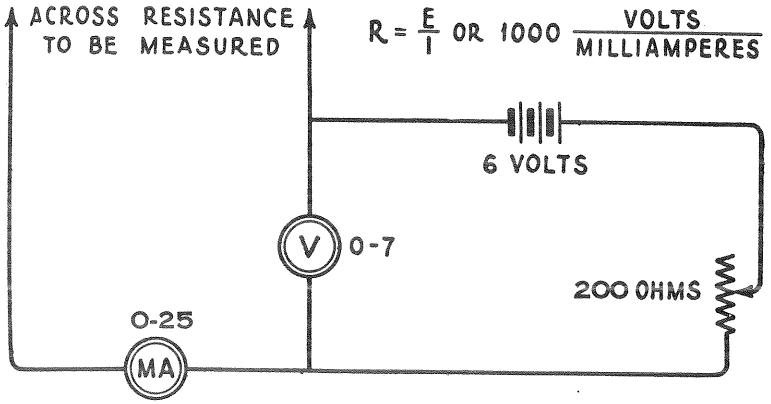

Figure 12—Schematic circuit for resistance measurement.

The resistance may then be calculated by the use of Ohms law.

$$R = \frac{E}{I}\left(\begin{array}{l}\text{Where R equals ohms}\\ \text{E equals volts and I equals amperes}\end{array}\right) \text{ or } 1000\,\frac{\text{Volts}}{\text{Milliamperes}}$$

Since the current reading is taken in milliamperes (or $\frac{1}{1000}$ ampere) it is necessary to multiply by 1000 to get the resistance value in ohms.

A detector tube may cause oscillation or a howl, very similar to a microphonic howl. The remedy in this case is to interchange the detector Radiotron with another UY-227 Radiotron. A tube may howl in one Radiola 17 and perform normally in another.

In some cases with certain antennas, the Radiola may oscillate even though everything is O. K. The remedy is to change the antenna length or interchange the UX-226 Radiotrons in the R. F. stages.

(16) DISTORTED REPRODUCTION

Under normal conditions Radiola 17 will deliver a strong signal of good quality to the loudspeaker. If the loudspeaker production is poor test the loudspeaker output from the receiver. A pair of phones or a loudspeaker of known quality may be used for this purpose. Poor quality or distortion may be due to any of the following causes:

1. High or low plate and grid voltages from socket power unit. This may be due to a defective Radiotron UX-280 or tapped resistance unit. The remedy is to replace the Radiotron UX-280 with one of known quality or check the various resistances of the tapped resistor for a possible short or open.

2. 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, 1st and 2nd audio stages and the rectifier tube.

3. Potentiometers not properly adjusted. Unless the potentiometers are correctly adjusted sufficient hum may be present to cause distortion. The correct adjustment of these potentiometers is described in Part I, Section 19.

Should Radiola 17 become noisy in operation or signals come in and die out abruptly with periods of hum or no reception, test in the following manner:

(a) Disconnect antenna and ground leads. If the Radiola becomes quiet and signals from local stations, though weak, are received it would be an indication that the trouble is either in the antenna system or is caused by nearby interfering electrical apparatus. The remedy in the first case is to repair the antenna system and in the second place Radio Frequency chokes on any offending nearby apparatus. The location of interfering electrical machinery and the cure will require patience, skill and experimenting.

(b) If disconnecting the antenna and ground system does not eliminate the noise the trouble is in the Radiola. A defective tube, one having poorly welded elements would cause a disturbance of this kind and this point should be checked by interchanging the Radiotrons in the Radiola with others of the same type. If it is definitely established that the Radiotrons are O. K. then the contact between the Radiotron prongs and the socket contacts should be examined for a dirty or poor contact. The three potentiometers in the Socket Power Unit and the Volume Control should be examined for a dirty or poor contact between the contact arm and the resistor strip.

(17) AUDIO HOWL

Radiola 17 may have a tendency to howl when first installed. This can usually be remedied by interchanging the detector Radiotron with another UY-227 Radiotron. If this does not remedy the trouble try the following:

(a) Put the line control switch in the position that gives the least light at the pilot lamp. This reduces the filament voltage on all the Radiotrons which may be high, causing oscillation on the part of the R. F. amplifiers.

(b) Place antenna lead between the A. F. transformer and frame.

If the Radiola has been in operation for a considerable time and a howl develops, the following points should be checked for possible defect:

(a) Defective Radiotrons. A Radiotron after considerable use may cause a howl. Substituting a Radiotron of known condition will isolate the defective one.

(b) Open audio by-pass condensers.

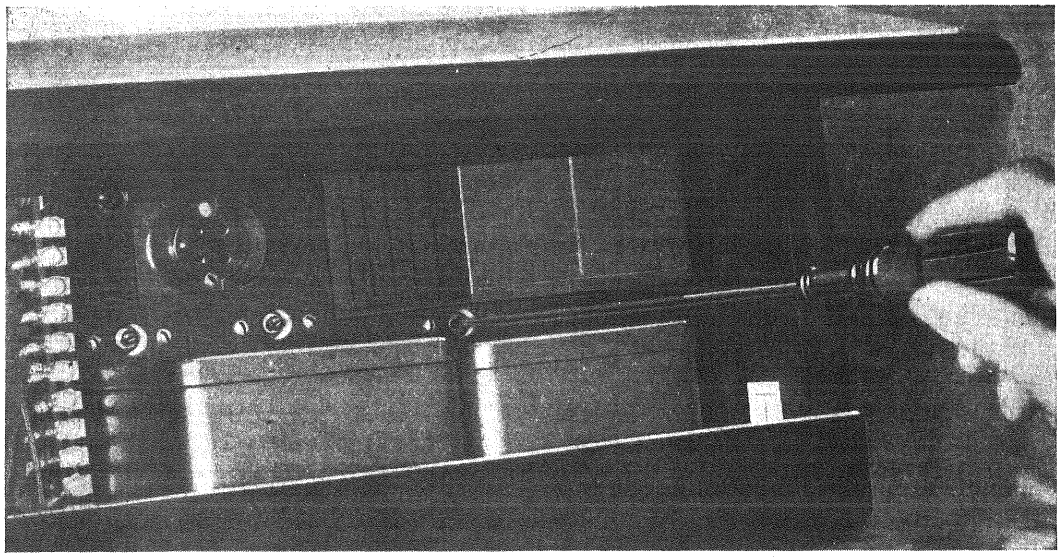

Figure 13—Using a long screwdriver in adjusting the potentiometer for minimum hum.

(c) Defective grid leak or open grid connection of any tube in the Radiola except Radiotron UX-280.

(d) Open R. F. grid resistor.

Any part found defective should be replaced and any open or poor connection should be repaired.

(18) ACOUSTIC HOWL

Generally speaking, Radiola 17 is much less susceptible to acoustic howling due to microphonic tubes than receiving sets using other than A. C. tubes. However, on some occasions acoustic howling may be experienced and the loudspeaker location must be chosen with care. This howl is somewhat different from the usual microphonic howl in that it disappears when a station is tuned in, but still causes some distortion in the received signal. The remedy is to interchange the UY-227 detector tube with another of a similar type or change the position of the loudspeaker. In extreme cases both remedies may be necessary.

(19) HUM

Three potentiometers are provided in Radiola 17 for the suppression of any A. C. hum. These potentiometers are adjusted for the correct electrical center of

the filaments of Radiotrons UX-226, UY-227 and UX-171A. The following procedure should be used in eliminating hum:

(a) Place set in normal operation with loudspeaker connected.

(b) Remove Radiotrons 2 and 3, counting from left to right (first audio and detector stages facing front of Radiola).

(c) Locate position of three potentiometers in power unit.

(d) Adjust potentiometer, located at extreme right when facing front of Radiola (Figure 13), for position of minimum hum.

(e) Now replace Radiotron No. 2 (UX-226), .previously removed, and

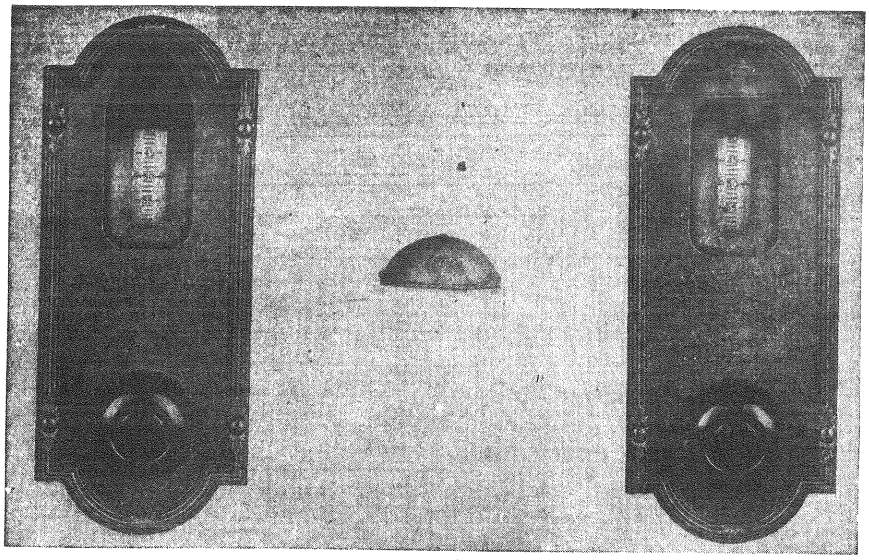

Figure 14—*Detailed view of the pilot light socket and canopy.*

adjust the potentiometer located at the extreme left (facing the front of the Radiola) for position of minimum hum.

(f) Replace Radiotron UY-227 and with the Radiotron in normal operation adjust the center potentiometer for minimum hum.

Under normal conditions these three adjustments will suppress any noticeable hum in the loudspeaker.

If the foregoing procedure does not reduce hum, try the following:

(a) In some cases when adjusting the potentiometers there may be no apparent point of minimum hum. This is due to low line voltage and may be remedied by throwing the line switch to the position that gives maximum brilliancy of the pilot lamp. If this does not remedy the trouble, try changing the position of the line switch to each location several times. There may be a dirty contact in this switch, making a high resistance connection which may cause the filaments to glow below normal brilliancy. When this condition is present, it will be impossible to adjust the potentiometers for minimum hum until the filament temperature of all Radiotrons is normal.

(b) When adjusting the UX-226 potentiometer (at the left) it may be noted that the position of minimum hum is at one extreme of the potentiometer. When this is encountered the potentiometer should be arbitrarily placed at its center position and then the UY-227 Radiotron placed in its socket and the center poten-

tiometer adjusted for minimum hum. The left potentiometer may now be re-adjusted for a further minimum value, which will not now be located at one of the extreme positions.

(c) After making any potentiometer adjustment, further reduction of hum may be attempted by reversing the input plug.

When adjusting the potentiometer at the extreme right with a metallic screw driver a flash will occur from the screw driver to any part of the frame that the screw driver may touch. This is normal and does no harm. If it is desired to avoid this condition, an insulated shaft screw driver or a metallic screw driver wrapped with insulating tape should be used.

(d) If these various adjustments suppress the A. C. hum correctly, but after a short time the hum reappers it is a good indication that some of the

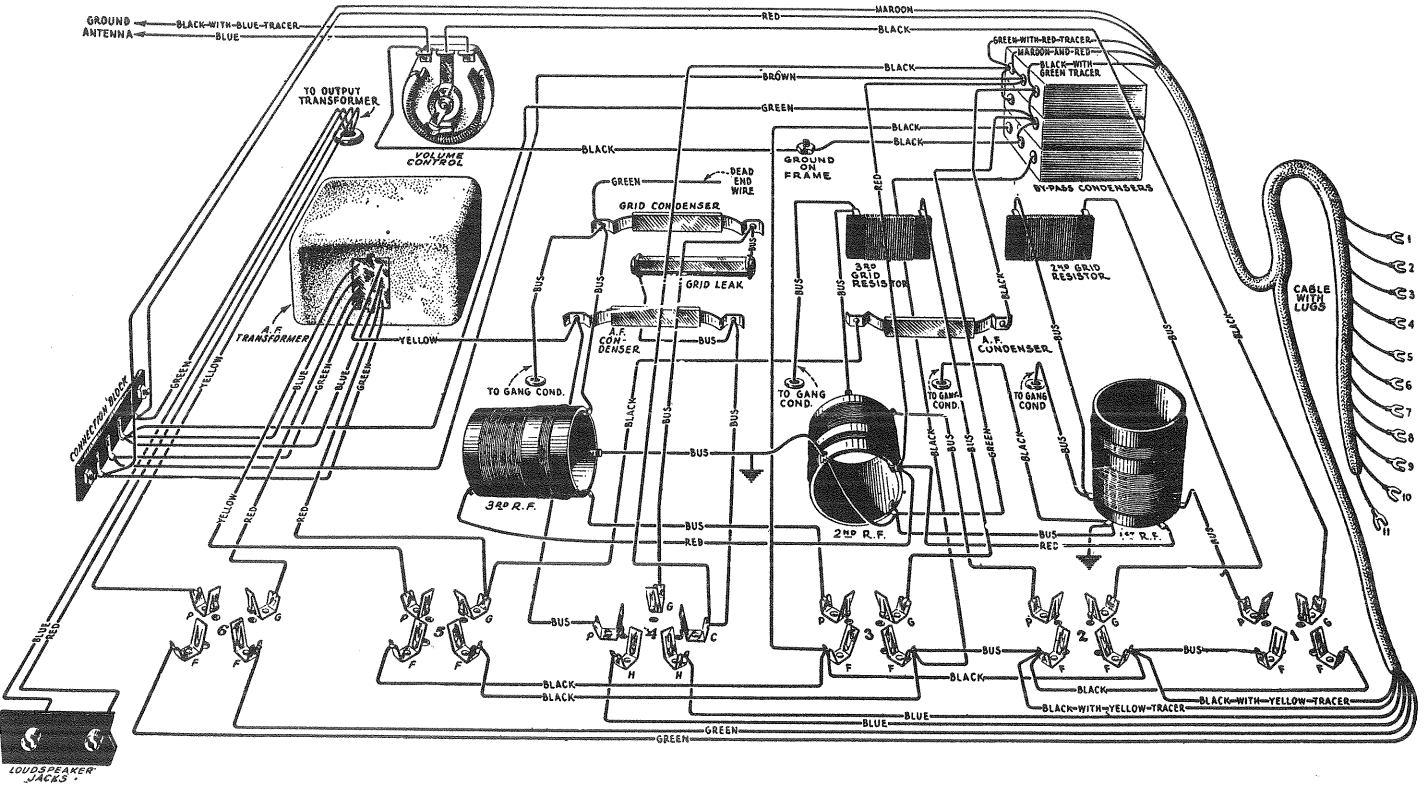

Figure 15—Wiring diagram of receiver assembly showing color scheme and connections with relative location of parts.

Radiotrons are making poor socket contacts, thus destroying the electrical center of the filament potentiometers. These prongs should be cleaned as described in Part I, Section 9.

If at any time the Radiola is changed from one electrical outlet to another outlet or Radiotrons are interchanged or replaced with others it may be necessary to readjust one or more of the potentiometers.

(20) LINE CONTROL SWITCH

A two-way switch is provided in the S. P. U. for adjustment to line voltages. Unless it is definitely known that the line is *always* below 115 volts the

switch should be placed at the 120-volt 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.

(21) WIRING CABLE

On examination of the chassis wiring in some models of Radiola 17 there will be noticed a green dead end wire, about 6 inches long, connected to the third

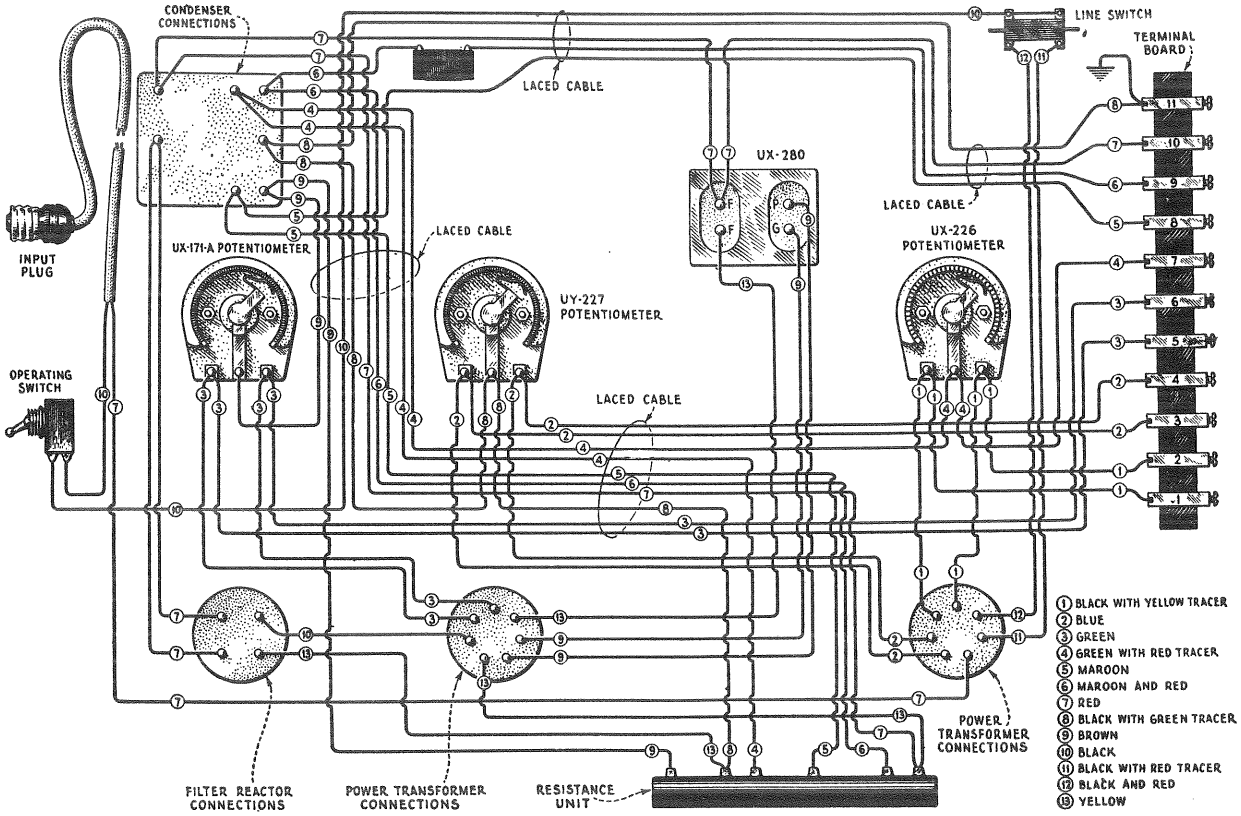

Figure 16—Continuity wiring diagram of socket power unit and color scheme of wiring.

R. F. coil. This is normal and no attention should be paid to the presence of this lead.

(22) PILOT LAMP AND CANOPY

Radiola 17 is equipped with a small pilot lamp (Figure 14), operating from the UX-171A filament winding for illuminating the dial and indicating that the Radiola is in operation. The latter use is quite important because when starting Radiola 17 approximately 30 seconds are required to bring the detector UY-227 into operating condition. The lamp and canopy are packed separately and must be installed when the Radiola is first placed in operation. The pilot lamp

is a standard T-3 Mazda, miniature base, 6 volt, 0.15 ampere light and is screwed into its base directly over the tuning dial. The canopy has three projections which fit three holes directly over this light. Should this lamp be damaged or burn out a new one can be obtained on the open market.

(23) FILTER CONDENSERS

In general a defective filter condenser will be indicated by the plates of Radiotron UX-280 heating excessively, with the set giving weak, distorted or no reproduction and a loud hum. When this condition is experienced, the condenser bank should be disconnected from the circuit and the condensers tested with a reasonably high voltage, not over 200 volts. The correct way to test filter condensers is to charge and discharge them, being careful not to come in contact with the terminals. Figure 17 illustrates filter condenser connections.

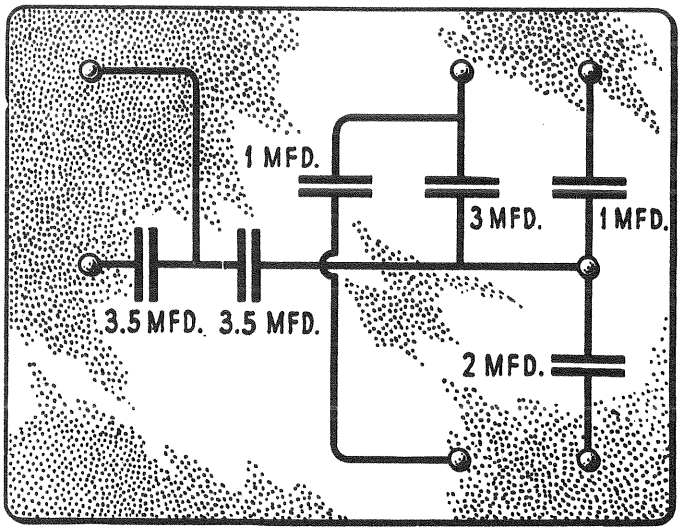

Figure 17—Internal connections of filter condensers.

(24) VOLTAGE READINGS

When checking a Radiola 17 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 a D. C. voltmeter, the D. C. meter to be of at least 600 ohms per volt in resistance. The following voltages should be obtained at the terminal strip when the set is in operation with full load on the socket power unit (Figure 4A). The terminal strip numbers are from front to rear, No. 1 being closest to the front of the Radiola and No. 11 closest to the rear.

Terminals	*Correct Voltage*
1 to 2	1.5 A. C.
3 to 4	2.25 A. C.
5 to 6	5.0 A. C.
7 to 8	45 D. C.
7 to 9	135 D. C.
Gnd. to 10	165 D. C. (Approx.)
7 to 11	9 D. C.
11 to adjusting screw of UX-171A potentiometer	30 D. C.

Any serious variation from these voltages indicates a defective resistance strip or power transformer. An easy method to determine whether the defect is in the power transformer or the resistance strip follows:

Defective power transformer.

(a) Any A. C. voltages off the correct value.

(b) All D. C. voltages, high or low, their differences remaining constant.

Defective resistance unit.

(a) Any D. C. voltages being either high or low, but not all consistently high or low with all A. C. voltages correct.

(25) GRID AND PLATE VOLTAGES

In order to intelligently service Radiola 17 it is well to have a good understanding of how the various circuits function. The plate supply and filament

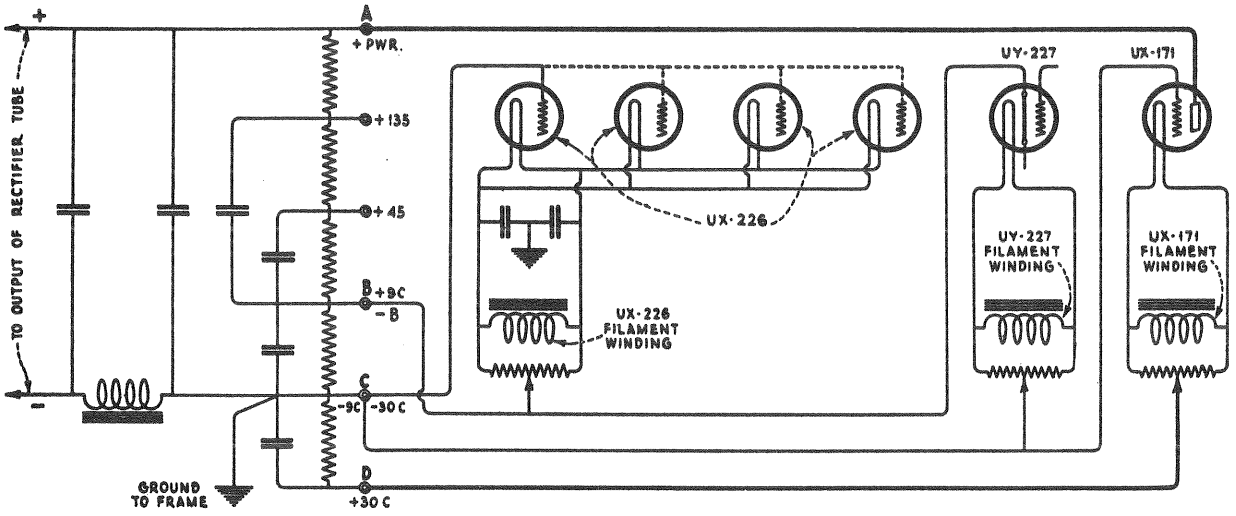

Figure 18—*Schematic circuit for securing grid biasing voltages.*

supply systems present no special features not used in similar circuits. However, the grid biasing voltages are obtained in a slightly different manner from that usually employed to obtain "C" bias voltage. Also the —9 volt "C" used to bias the Radiotron UX-226 is also used to keep the heater element of the detector Radiotron at a negative potential.

Figure 18 illustrates the grid and plate supply circuit.

(a) The three plate voltages and the —9 volt "C" potential are obtained from a series resistance unit in the regular manner, using the drop of voltage through the resistance unit to obtain the desired voltage. The —9 volt "C" supply is used as a bias voltage for all Radiotrons UX-226 and is also impressed on the UY-227 heater through the center connection to the UY-227 potentiometer. The +9 volt "C" is connected to the cathode of this Radiotron. The net result of such an arrangement is to keep the heater element of the detector tube at a sufficiently high negative potential to eliminate any tendency of the cathode to emit electrons back to the heater rather than to the plate of the tube.

(b) Referring to Figure 18 we note that the —9 "C" is also marked —30 "C" and connected to the grid of Radiotron UX-171A. Also a series resistance is placed in the grid return from this resistance and connected to the center tap of

Radiotron UX-171A potentiometer. This connection is marked +30 "C" The action of this arrangement is somewhat different from the method used for obtaining the —9 volts "C" for the UX-226 Radiotrons.

In obtaining the —9 volt "C" potential for the Radiotron UX-226, the voltage drop across a portion of the resistance strip (see A to C, Figure 18) is used for this potential. Any point on the strip from any other point is either positive or negative, depending on whether the other point is toward the positive side "A" or the negative side "C". For example point "B" would be negative in regards to point "A" and positive in regards to point "C". Now using this same principle, but taking the current flow from "A" to "C" through the plate and filament of Radiotron UX-171A and the resistance in series with the center connection to the potentiometer we may find either a positive or negative drop depend-

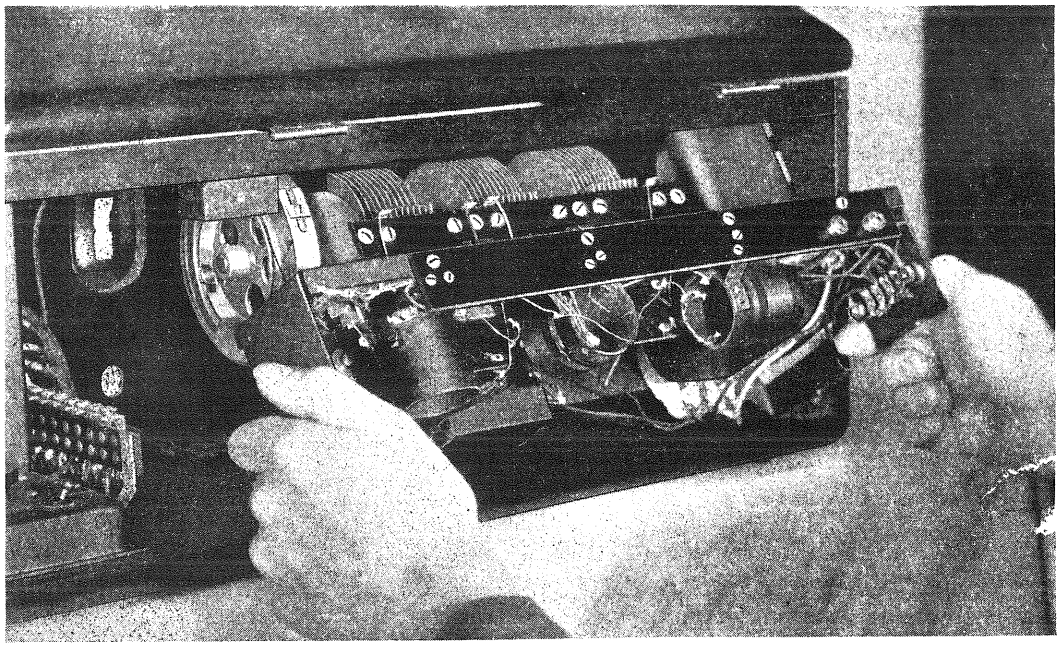

Figure 19—Removing the receiver assembly from the cabinet.

ing on where the point of connection is made. By connecting point "D" (Figure 18), as a source of positive potential any point toward "C" will have an increasingly negative potential. The value of this negative potential will depend on the resistance connected between "C" and "D". In Radiola 17 this negative potential is 30 volts and, as shown, gives the proper bias for Radiotron UX-171A.

This parallel circuit across the resistance isolates the "C" potential for Radiotron UX-171A from the plate and "C" voltages for the other Radiotrons. Doing this keeps fluctuations in the various plate supplies from varying the "C" potential on this tube. More stable operation and less distortion is the net result.

(26) HEATING OF CABINET

Under normal conditions when the lid of Radiola 17 is closed the interior parts in the vicinity of Radiotron UX-280 will become quite warm. This is a normal condition. It keeps all the mechanism dry and maintains maximum operating efficiency even under severe climatic conditions.

(27) RADIOLA 17 CONTINUITY TESTS

The following tests will show complete continuity for the Receiver Assembly (Figure 15) and the S. P. U. (Figure 16). 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. Do not tamper with the main tuning condensers.

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 this test.

RECEIVER ASSEMBLY CONTINUITY TESTS
Remove All Radiotrons and Disconnect Cable at Terminal Strip

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Lug No. 1 to ground	Open	Shorted by-pass condenser
Lug No. 2 to ground	Open	Shorted by-pass condenser
Lug No. 1 to Lug No. 2	Open	Shorted UX-226 socket
Lug No. 3 to Lug No. 4	Open	Shorted UY-227 socket
Lug No. 5 to Lug No. 6	Open	Shorted UX-171A socket
Lug No. 1 to one side of filament contact of sockets Nos. 1, 2, 3 and 5	Closed	Open connection
Lug No. 2 to other filament contact of sockets Nos. 1, 2, 3 and 5	Closed	Open connection
Lug No. 3 to one side of heater contacts of socket No. 4	Closed	Open connection
Lug No. 4 to other side of heater contacts of socket No. 4	Closed	Open connection
Lug No. 5 to one side of filament contact of socket No. 6	Closed	Open connection
Lug No. 6 to other side of filament contact of socket No. 6	Closed	Open connection
Lug No. 7 to cathode contact of socket No. 4	Closed	Open connection
Lug No. 8 to plate contact of socket No. 4	Closed	Open primary of first audio transformer or connection
Lug No. 9 to plate contact of sockets Nos. 1, 2, 3 and 5	Closed	Open primary of 1st, 2nd or 3rd R.F. transformers or primary of 2nd A.F. transformer
Lug No. 10 to plate contact of socket No. 6	Closed	Open primary of output transformer
Across loudspeaker pin jacks	Closed	Open secondary of output transformer
Antenna lead to ground lead	Closed	Open volume control
Grid contact of socket No. 1 to ground	Closed	Open volume control or poor contact of volume control arm
Grid contact of socket No. 2 to ground	Closed	Open secondary of 1st R.F. transformer or grid resistance
Grid contact of socket No. 3 to ground	Closed	Open secondary of 2nd R.F. transformer or grid resistance
Stator of condenser No. 3 (nearest output transformer) to ground	Closed	Open secondary of 3rd R.F. transformer
Grid contact of socket No. 5 to ground	Closed	Open secondary of 1st A.F. transformer
Grid contact of socket No. 6 to ground	Closed	Open secondary of 2nd A.F. transformer

SOCKET POWER UNIT CONTINUITY TESTS
Remove Radiotron UX-280 and Disconnect Cable at Terminal Strip

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across terminals 1 to 2	Closed	Open UX-226 filament winding and potentiometer
Across terminals 3 to 4	Closed	Open UY-227 filament winding and potentiometer
Across terminals 5 to 6	Closed	Open UX-171A filament winding and potentiometer
Across filament contacts of UX-280 socket	Closed	Open UX-280 filament winding
Grid contact to plate contact of UX-280 socket	Closed	Open high voltage winding of power transformer
UX-171A potentiometer adjusting screw to terminal No. 10	Closed	Open resistance strip
Terminal No. 11 to plate contact of UX-280 socket	Closed	Open high voltage winding of power transformer or filter reactor
Across input plug	Closed	Open primary of power transformer or line switch. If open throw switch to other position and test. If both open test switch separately.

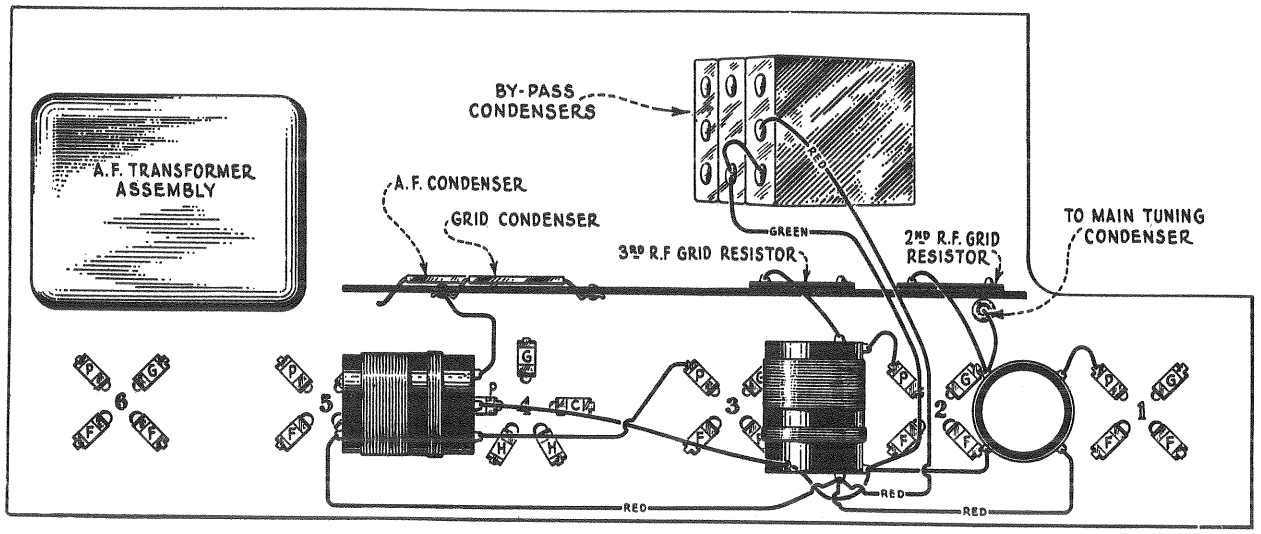

Figure 20—R. F. transformer connections and color scheme of wiring.

PART II — MAKING REPLACEMENTS

(1) REPLACING VOLUME CONTROL

The following procedure should be used when replacing the volume control.

1. Remove the seven screws holding the wooden back to the cabinet.
2. Remove knobs on "Station Selector" and "Volume Control."
3. Release the cable connecting the socket power unit to the receiver assembly and the two leads to the pilot lamp. This is done by loosening the screws holding them to the terminal strip of the socket power unit.
4. Remove four screws holding chassis in place to bottom of cabinet. The chassis may now be removed by rocking it in the cabinet and slipping it out of

the back opening. See Figure 19. This will allow an examination of the parts and provide access to those requiring replacement.

5. Remove the two screws that hold the volume control to the metal chassis. (Figure 7.)

6. Tag and unsolder all leads to the volume control. The volume control may now be removed and the new one placed in position occupied by the old one. The connections should be placed on the new volume control as indicated on the tags attached to the wires or refer to Figure 15.

7. The volume control should now be fastened to the chassis and the Radiola reassembled in the reverse order of that already given.

(2) REPLACING RADIO FREQUENCY COILS

The three radio frequency transformers together with a mounting strip and two pin jacks are stocked as one complete unit.

A step by step procedure for replacing this assembly is as follows:

1. Remove chassis from cabinet as described in Part II, Section 1.

2. Unsolder and tag all connections to the three transformers and the two pin jacks.

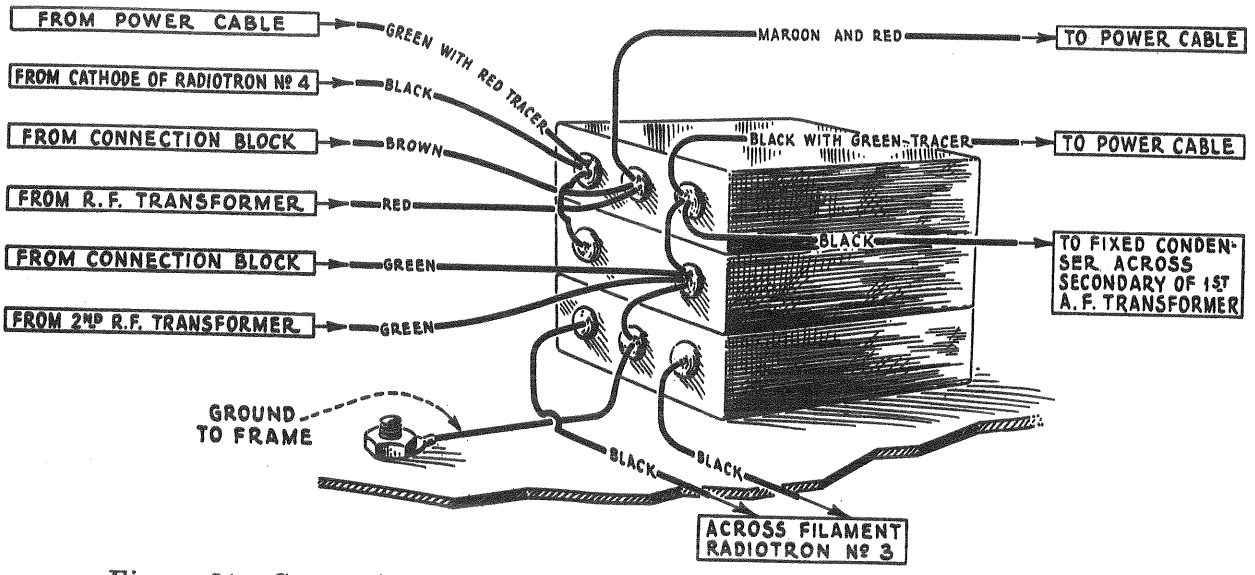

Figure 21—Connections and color scheme of wiring to by-pass condensers

3. Remove four screws that hold mounting strip to metal chassis. The entire assembly is now released and may be removed. The new assembly should be placed in the same position occupied by the one just removed.

4. Replace the four screws that hold the mounting strip to the metal chassis.

5. Replace and resolder all leads to the three transformers and two pin jacks as indicated by the tags previously attached to them. The connections to the transformer are shown in Figure 20 and those to the pin jacks in Figure 15. These figures should be referred to when making these connections. After finishing the connections, they should be carefully checked before reassembling the Radiola.

6. Connect power cable to chassis assembly and give Radiola an operating test before fastening to the cabinet to determine that replacement has been properly made.

7. Fasten chassis assembly to cabinet and replace all screws.

(3) REPLACING RADIOTRON GANG SOCKETS

The Radiotron sockets of Radiola 17 are of the gang variety, using one detector socket, a two-gang A.F. socket strip and one three-gang socket strip for the radio frequency amplifier tubes.

These sockets are riveted to the metal chassis. To replace them drill out the old rivets and use screws, nuts and lock washers for securing the new sockets. A step by step procedure follows for making a replacement:

1. Remove chassis assembly from cabinet as described in Part II, Section 1.
2. Remove and tag all leads to the terminals of the sockets.

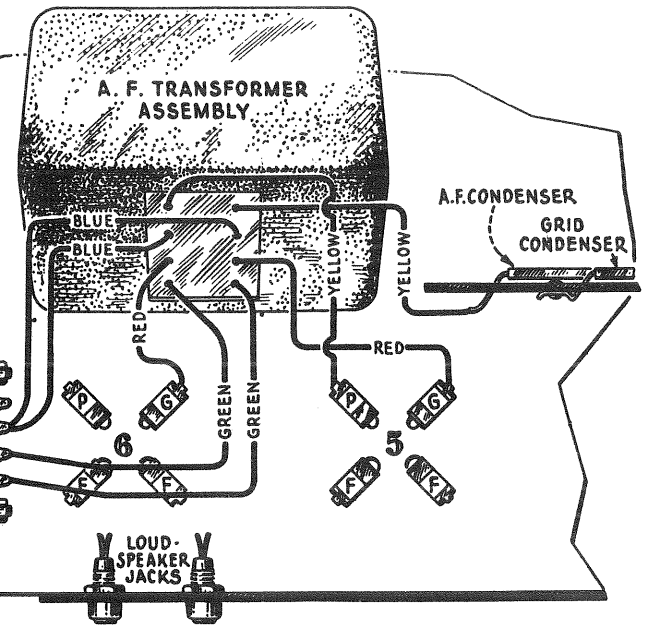

Figure 22—Detail of A. F. transformer connections and color scheme of wiring.

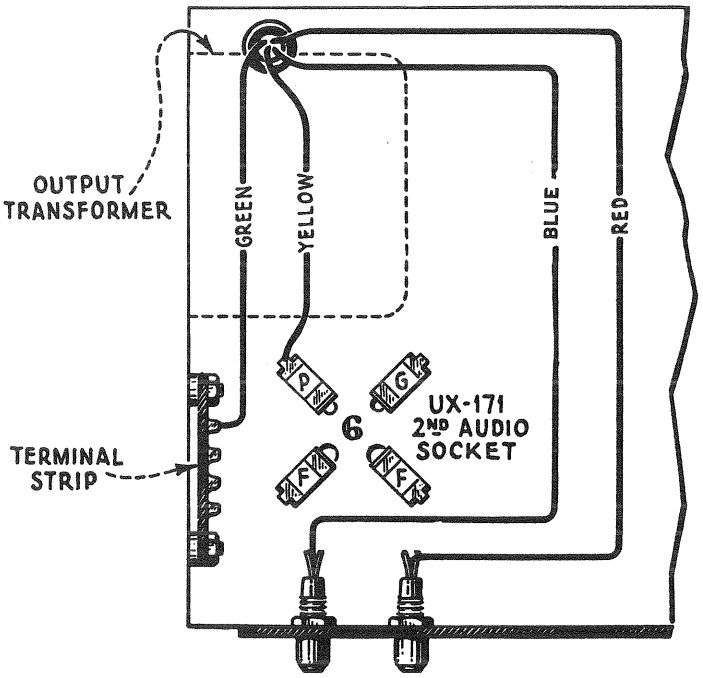

Figure 23—Output transformer connections.

3. Drill out rivets holding sockets to metal chassis frame.

4. The socket assembly may now be removed and the new one placed in the position occupied by the old one.

5. Fasten new socket in place by using small head machine screws, nuts and lock washers in place of the rivets previously drilled out.

6. Replace connections as indicated on tags attached or refer to Figure 15 for the correct socket connections.

7. Return chassis to cabinet.

(4) REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and the driving mechanism is replaced as one complete unit. The step by step procedure follows:

1. Remove chassis assembly from housing. See Part II, Section 1.

2. Unsolder four connections to consdenser.

3. Remove three screws from under side of chassis that holds condenser assembly.

4. The assembly may now be removed and the new assembly placed in the position occupied by the old assembly.

5. Replace three screws that hold assembly in place and resolder leads.

6. Replace chassis assembly in cabinet.

(5) REPLACING LARGE BY-PASS CONDENSERS

These condensers, located on the under side of the chassis frame, are held together by means of clamps that form part of the condenser case fastened to the frame. To replace proceed as follows:

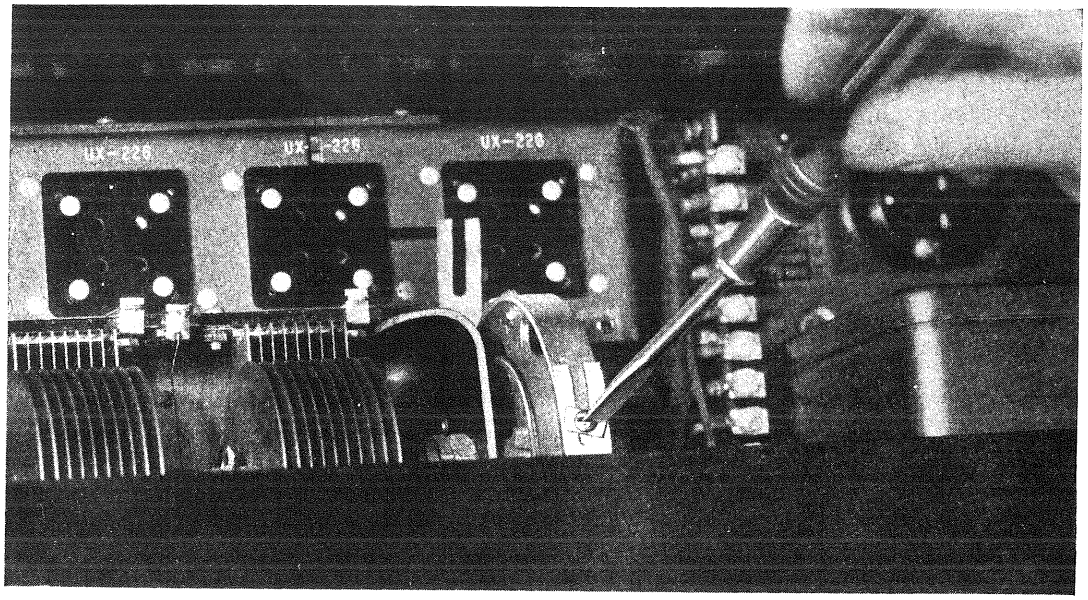

Figure 24—Method used in replacing dial scales.

1. Remove chassis from cabinet as described in Part II, Section 1.

2. Remove condenser assembly as described in Part II, Section 4.

3. The tabs holding the condensers to the chassis may now be bent up by using a screw driver.

4. The three fixed condensers are now released as a unit from the chassis frame. The defective condenser may be released by bending the tabs that hold it to the other condensers.

5. Unsolder the leads of the condenser that are to be replaced. Insert the new condenser in the place occupied by the old one and fasten it to the adjacent condenser. The condensers are now fastened together as a unit and are fastened to the frame by insetting the tabs of the condenser into their respective slots and bending the tabs on the top side of the frame.

6. Replace condenser assembly as described in Part II, Section 4.

7. Reconnect all wire leads removed from the large fixed condensers. The correct connections are shown in Figure 21.

8. Connect power cable to Socket Power Unit and test Radiola. If Radiola is in correct operating condition fasten chassis assembly to cabinet in reverse order of that used to remove it.

(6) REPLACING AUDIO TRANSFORMERS

The audio transformers of Radiola 17 are built together as a unit. In making a replacement the following procedure should be used:

1. Remove receiver chassis from cabinet as described in Part II, Section 1.
2. Remove output transformer from chassis by removing four screws holding it in place.
3. Unsolder and tag all leads.
4. Remove transformer assembly by turning up tabs holding it to chassis frame with screw driver.
5. Under the old transformer, between the chassis frame and the transformer, is located a piece of insulating paper. This must be replaced to its normal position, as there is a possibility of grounding the core of the transformers to the frame of the chassis unless it is in place.
6. Place the new transformer assembly in position occupied by the old and fasten to frame by bending over metal tabs that hold it in place.
7. Solder all leads in place as indicated by tags attached. The correct connections are shown in Figure 22.
8. Replace receiver chassis assembly in cabinet in the reverse order of that used to remove it.

(7) REPLACING OUTPUT TRANSFORMER

The output transformer of Radiola 17 is held in place by means of four tabs which hold the output transformer to the vertical part of the chassis frame. A step by step procedure for replacing this unit is as follows:

1. Remove receiver chassis assembly from cabinet as described in Part II, Section 1.
2. Unsolder and tag the connecting points to the four leads of the output transformer.
3. Remove four screws, nuts and lock washers used to fasten bracket to chassis.
4. The transformer may now be removed and the new one placed in the position occupied by the old one.
5. Push the four leads from the transformer through the frame. Fasten bracket to chassis with screws previously removed. Connect leads as indicated by tags, previously attached to proper connection. These connections are shown in Figure 23.
6. Return receiver assembly to cabinet in reverse order of that used to remove it.

(8) REPLACING CONDENSER DRIVE CABLE

The condenser drive cable of Radiola 17 is made of phosphor bronze and is very rugged. If replacement becomes necessary proceed as follows:

1. Remove receiver chassis assembly from cabinet as described in Part II, Section 1. Place chassis on table in normal position with controls to the front.
2. Release the cable adjusting screw and clamp, and remove old cable from large drum and grooved drums completely.

3. Starting from the rear grooved drum place eye of cable over pin, which should be in a horizontal position facing the socket power unit, and wind on three complete turns, and then bring cable up to large drum.

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

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

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

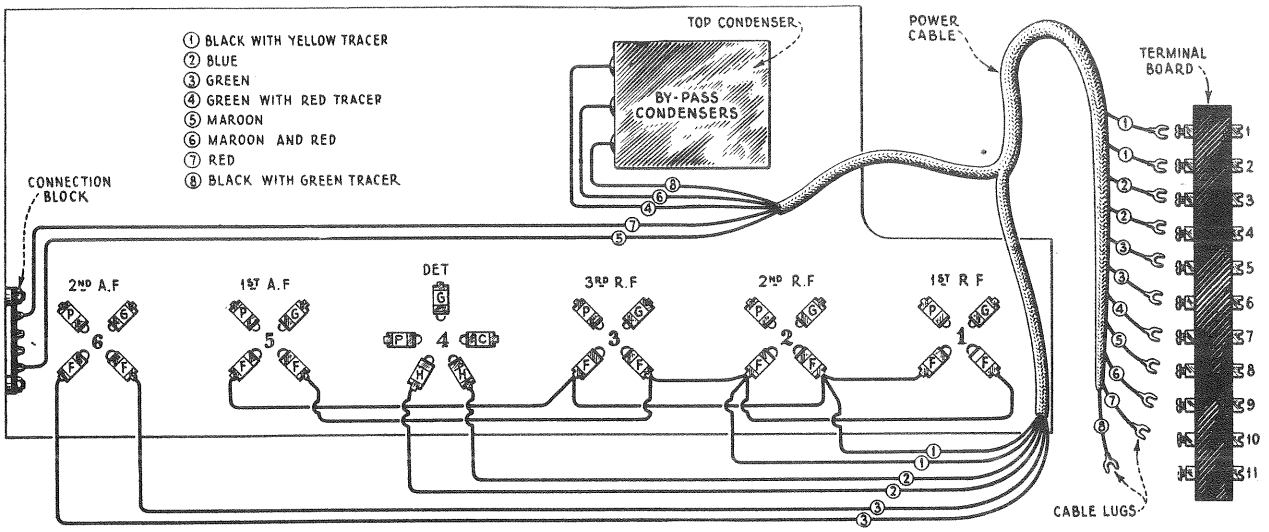

Figure 25—Color scheme of power cable connections.

7. The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the groove 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 the controls. Care should be taken not to take up too much, as the cable may be stretched or possibly broken.

8. Return receiver assembly to cabinet in the reverse order used to remove it.

(9) REPLACING DIAL SCALES

After considerable use a dial scale may become dirty or illegible and a new scale desired. A step by step procedure for making replacement follows:

1. Open lid of cabinet of Radiola.
2. Turn dial so that the two screws that hold the dial in place are on top.
3. Remove screws, washer and nuts that hold dial in place. (Figure 24.)
4. Replace old dial with new one and replace screws, but do not tighten.
5. Examine new dial from front of Radiola to see that numbers on dial are in the correct position.
6. Tighten screws holding dial in place and close lid of cabinet.

(10) REPLACING POWER CABLE

Attached to the receiver assembly is a heavy cable, connecting all A, B and C voltage supplies for this assembly. If this cable requires replacement the following procedure should be used.

1. Remove receiver chassis assembly from cabinet as described in Part II, Section 1.

2. Turn assembly so that bottom side is exposed and unsolder all the connections to the cable. Attach tags to points of connection.

3. Remove old cable from chassis and replace with new cable. Solder the connections of the new cable as indicated on tags attached to connection points. The correct connections for the power cable are shown in Figure 25.

4. After connecting power cable attach it to the Socket Power Unit and test Radiola. If O. K. fasten receiver chassis assembly to cabinet in reverse order of that used to remove it.

(11) REPLACING FILTER CONDENSER ASSEMBLY

The following procedure should be used when replacing the filter condensers of Radiola 17:

1. Remove the seven screws holding the wooden back to the cabinet.

2. Remove collar on operating switch at front of Radiola.

3. Release the cable connecting the socket power unit to the chassis assembly and the two leads to the pilot lamp. This is done by loosening the screws holding them to the terminal strip on the socket power unit.

4. Remove four screws at bottom of cabinet holding Socket Power Unit in place. The Socket Power Unit may now be removed by slipping it out of the back opening. This will allow an examination of the parts and provide access to the ones necessary to replace.

5. Unsolder and tag the connections to the seven terminals on the under side of the condenser bank.

6. Now turn up the six tabs that hold the unit to the S. P. U. base. The entire assembly may now be removed.

7. The new condenser should be placed in the position occupied by the old, taking care that the terminal connections are in the same position.

8. Clamp the assembly in place by turning the tabs over the under side of the base.

9. Solder the connections to the assembly as indicated on the tags attached. These connections are shown in Figure 16.

The S. P. U. should be tested by connecting the cable on the receiver unit to the terminal strip and if found O. K. fastened to the cabinet in the reverse order of that used to remove it.

(12) REPLACING EITHER POWER TRANSFORMER OR FILTER REACTOR

The power transformer and the filter reactor are each encased in a metal container. Either unit may be replaced in the following manner:

1. Remove S. P. U. from cabinet as described in Part II, Section 11.
2. Unsolder the leads of the unit being replaced and tag connection points.
3. Bend up tabs that hold unit to base. It may be necessary to remove the resistance unit in order to bend all the tabs. The particular assembly being replaced may now be removed and the new assembly placed in the position occupied by the old one.
4. The tabs on the new assembly should be bent so as to properly fasten the unit to the S. P. U. base.
5. Connect all leads from the assembly to the points of connection as indicated by tags previously attached. These connections are shown in Figure 16, which should be followed exactly when any S. P. U. part is replaced.
6. Connect cable from receiver assembly to terminal strip of Socket Power Unit. If found O. K. fasten unit to cabinet in the reverse order.

(13) REPLACING TERMINAL STRIP

The following procedure should be used in replacing a terminal strip on the Socket Power Unit.

1. Remove S. P. U. from cabinet as described in Part II, Section 11.
2. Unsolder and tag all leads soldered to terminal strip.
3. Release two screws holding strip to S. P. U. base.
4. The strip may now be removed and replaced by a new one.
5. Fasten new strip in position occupied by old strip by means of two machine screws, lock washers and nuts previously removed.
6. Solder all leads to terminal strip as indicated on tags attached. The color scheme and correct connections are shown in Figure 16.
7. Connect cable from receiver assembly and test Radiola. If found operating properly fasten S. P. U. to cabinet in the reverse order.

(14) REPLACING MISCELLANEOUS PARTS IN S. P. U.

The potentiometers, line switch, UX-280 socket and resistance unit in Radiola 17 may become defective and 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 of these units:

1. Remove S. P. U. from cabinet as described in Part II, Section 11.
2. Unsolder leads from defective unit and tag each lead.
3. Remove defective unit from base and replace with new unit.
4. Solder leads to new unit as indicated on tags or see Figure 16.
5. Connect cable to S. P. U. from receiver assembly. Test and if found O. K. fasten 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.

Indication	*Cause*	*Remedy*
No signals	Defective operating switch	Repair or replace switch
	Loose volume control arm	Tighten volume control arm
	Defective power cable	Replace power cable
	Defective R.F. transformer	Replace R.F. transformer assembly
	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective By-pass condenser	Replace By-pass condenser
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary
Weak Signals	Defective power cable	Repair or replace cable
	Defective line switch	Clean contacts or replace line switch
	Defective R.F. transformer	Replace R.F. transformer assembly
	Defective A.F. transformer	Replace A.F. transformer assembly
	Dirty Radiotron prongs	Clean prongs with fine sandpaper
	Defective By-pass condenser	Replace defective By-pass condenser
	Defective main tuning condensers	Replace defective tuning condensers
	Defective output transformer	Replace defective transformer
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary
Poor Quality	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective output transformer	Replace output transformer
	Defective By-pass condenser	Replace defective By-pass condenser
	Dirty contact arm of volume control	Clean contact arm on volume control
	Potentiometers not property adjusted	Adjust potentiometers correctly
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper
Howling	Open grid resistor	Check by means of continuity and replace any defective grid resistor
	Radiotron UY-227 howl	Interchange Radiotron UY-227 with another
	Defect in audio system	Check and repair any defect
	Detector tube oscillating	Place antenna lead between A.F. transformer and chassis frame
	Open grid circuit in any stage	Check circuits and repair defect
Excessive Hum	Potentiometers not properly adjusted	Adjust potentiometers correctly
	Socket plug position	Reverse socket plug
	Line voltage low	Set line switch for low line voltage
	Dirty or defective line switch	Clean or replace line switch
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
	No A.C. line voltage	Turn A.C. line voltage "On"
Play in Station Selector	Loose knob	Tighten or replace knob
	Slack cable	Take up on cable adjusting screw