(15) AUXILIARY VOLUME CONTROL

On the front panel, several inches to the right of the volume control, is located a small switch. This is known as the auxiliary volume control and is used when howling occurs on powerful local stations.

This auxiliary volume control switch cuts on or off a 5,000-ohm resistance shunted across the primary of the first audio transformer. Normally, it should not be necessary to use it. In case of trouble with this switch it should be examined for dirt or other interfering substance which may prevent the blades from making contact. Also the resistance unit should be checked for a possible open.

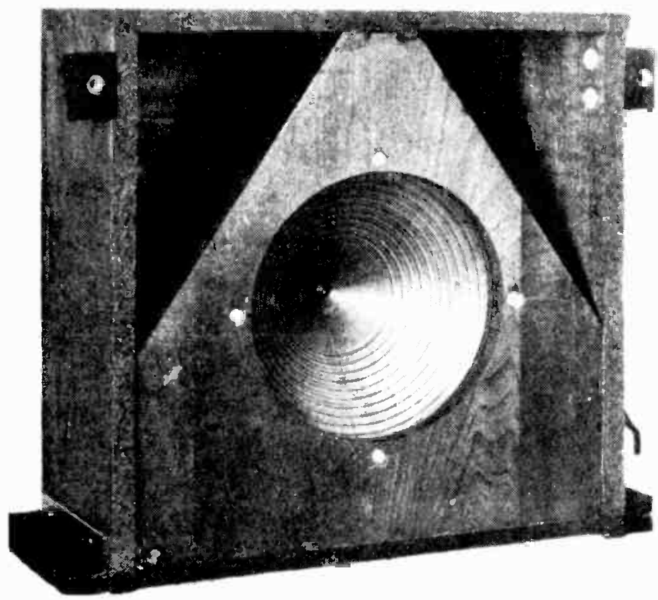


Figure 11—Reproducer unit in housing

PART II—REPRODUCER UNIT

The reproducer used in Radiola 30A is a standard RCA Loudspeaker, Model 100A, unit mounted in a special baffle housing (Figure 11). Excellent reproduction throughout the entire musical range is secured which, combined with its mechanical construction, makes an outstanding reproducing device for use with moderately powered receivers.

The simple and rugged design of the loudspeaker makes it practically trouble-proof and permits easy and simple adjustment or replacement when necessary.

The service problems of the loudspeaker deals with conditions evidenced by weak reproduction, no reproduction, distortion and rattle. These conditions and their attending causes are explained in the following text, and remedies noted so that service men may be provided with helpful information in any service work that is required.

To examine the reproducer unit it is first necessary to remove it from the cabinet (Figures 22 and 23). For removal procedure see Part IV, Section 3.

(1) IMPERFECT REPRODUCTION

Before inspecting the loudspeaker for imperfect reproduction, check the receiver output with another loudspeaker, preferably RCA Loudspeaker, Model 100A, and note any distortion that may be the cause of the imperfect reproduction experienced. This external speaker is connected across terminals 4 and 5 of the R.P.A. unit after disconnecting the leads already connected to them.

If the test indicates that the output from the receiver and power amplifier is of good quality, the loudspeaker in Radiola 30A should be examined in order to determine the cause of the imperfect reproduction obtained.

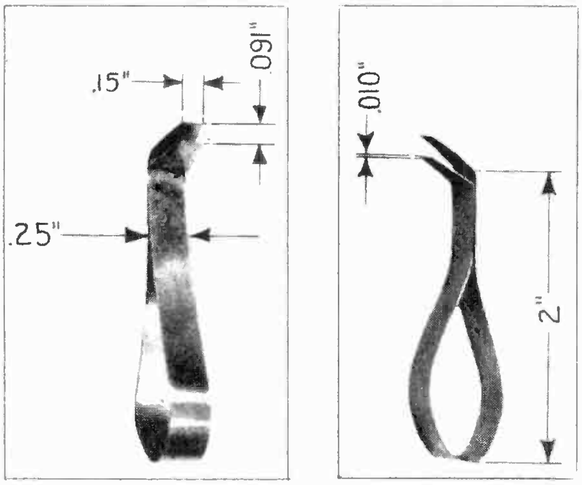


Figure 12—*General appearance and correct dimensions of armature spacing tools*

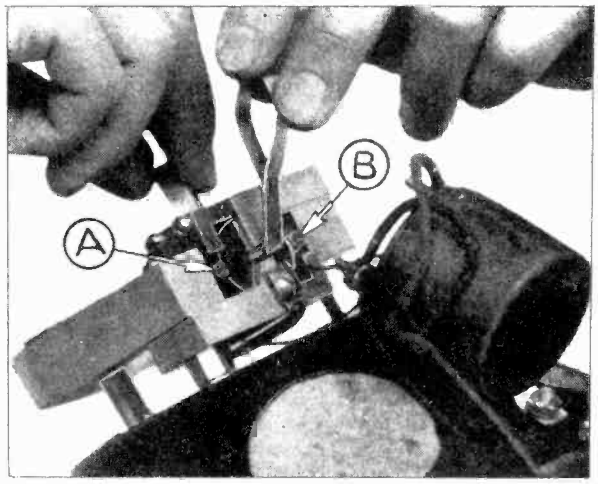


Figure 13—*Armature bracket adjusting screws A and B*

(2) FOREIGN MATERIAL INTERFERING WITH ARMATURE ACTION

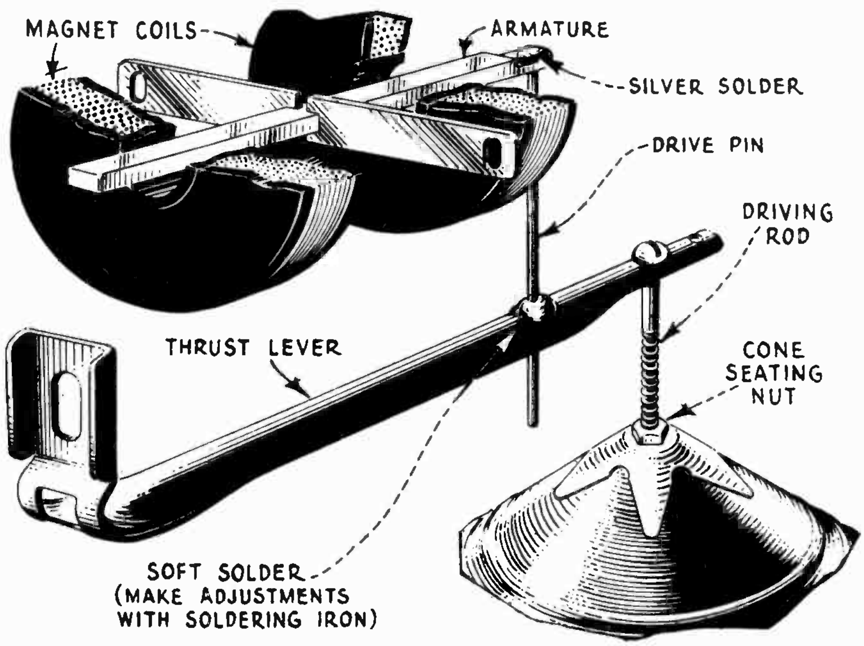
An inspection of the armature will generally disclose any foreign matter interfering with the armature action resulting in poor reproduction. A small piece of heavy paper or a piece of copper or brass not over .010 in. thick may be used between the armature and pole piece to remove dirt, dust or other interfering substance. The spacer tool, described in Part II, Section 3, may also be used for this purpose.

(3) ARMATURE STRIKING POLE PIECES

Distortion and rattle may be caused by the armature striking either or both of the pole pieces. This is generally determined by inspection, though in some cases the contact may be so slight it may be necessary to adjust the armature to check on this condition. In any case, an adjustment of the armature is necessary.

To adjust the armature a set of spacer tools are necessary. Figure 12 illustrates the general appearance and correct dimensions of these spacer tools. The stock—obtainable on the open market—should be phosphorous bronze strip .010 in. thick and .25 in. wide. It is bent as illustrated to a .15 in. width at the extremities.

Two of these tools are necessary when adjusting the armature. Place one tool in the space between the armature and pole piece of the motor mechanism at the end next to the filter unit. This is shown in Figure 13. The other tool is placed at the other end of the armature, a little to one side, in order to clear the drive pin located at this end of the armature. By loosening screws A and B, Figure 13, any tension in either direction that may have been on the armature is released and the spacer tools will provide the correct clearance or spacing. Now while the spacer tools are in place a hot soldering iron is applied to the drive pin thrust lever connection, Figure 14, and the solder heated sufficiently to allow the drive pin to find its normal position with regard to the thrust lever. The iron is now removed. Screws A and B, Figure 13, are tightened and the spacer tools removed. The armature is now correctly aligned and balanced so that no abnormal strain is being imposed upon it in any direction.



principle of the reproducer unit
Figure 14—Diagram showing constructional details and operating

(4) CONE NOT PROPERLY ADJUSTED

In some cases a cone may become improperly aligned or adjusted, causing a strain to be placed on the driving rod, due to the cone not centering or seating properly. Poor reproduction is the result, and inspection of the armature drive pin may indicate a slight torque or twist. This is most likely to occur when replacing a cone. The new cone should be carefully seated by placing the cone over the driving rod and adjusting the cone seating nut, located on driving rod next to thrust lever (See Figure 14). Then attach cone locknut and washer lightly on inside of cone before fastening the edge of cone. The holes on the edge of the cone can now be lined up with those of the metal frame and the outside ring lightly attached with screws and nuts. The cone locknut is then tightened and sealed in place with ordinary sealing wax, so that the vibration of the cone will not cause it to loosen. This nut can best be tightened by means of a small socket wrench made to fit a 3/16 in. hex. nut (Stevens' "Spintite" No. 3 can be used). The six screws at the outside edge are then seated properly. In doing this, take up on each screw a little at a time, causing a gradual seating of the screws.

(5) LOOSE THRUST LEVER, NUTS AND SCREWS

Rattle and noisy reception are sometimes caused by a loose thrust lever. To correct this condition tighten the thrust lever mounting screw (Figure 15). Sometimes when this is done a readjustment of the armature, as described in Part IV, may be necessary. Any loose screw or nut in the motor mechanism may cause an audible rattle while the speaker is in operation. If any trouble is experienced along this line, all the screws and nuts in the motor mechanism should be gone over and loose ones tightened.

(6) FILTER UNIT AND MAGNET COIL TESTS

A defective filter unit or a filter unit not properly connected in the circuit will cause distortion. Defective magnet coils will also cause imperfect reproduction. The circuit

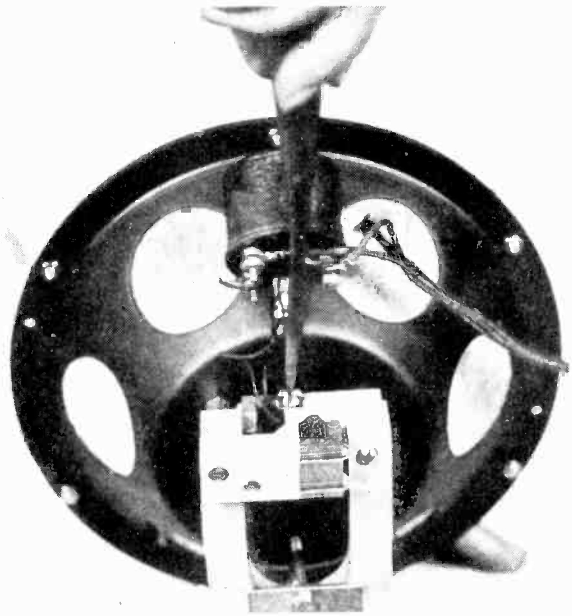


Figure 15—Adjusting the thrust lever screw

and correct connections are shown in Figure 16. The reference letters in the circuit diagram refer to the filter terminals shown in the small halftone illustration (Figure 16). These should correspond electrically, otherwise distorted or no reception will result. A click test will indicate an electrical defect, either in the coils or filter unit.

A pair of headphones and a 4½-volt battery connected together in series, or a voltmeter and sufficient battery to give a full scale deflection should be used.

FILTER UNIT CONTINUITY TEST (See Figure 16)

Disconnect Magnet Coils and Loudspeaker Cord

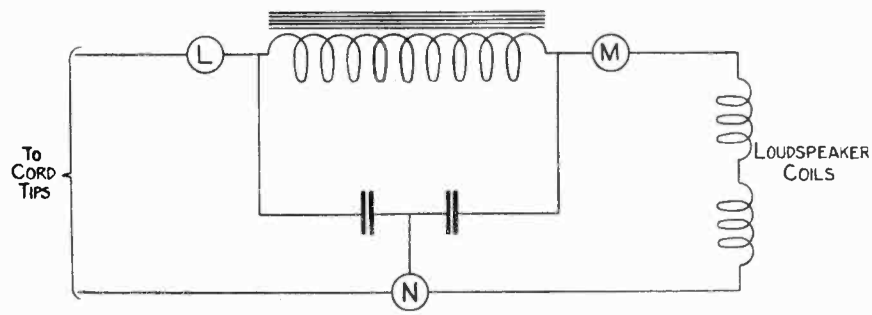
Test	*Correct Effect*	*Incorrect Effect Caused by:*
L to M	Closed	Open filter coil
L to N	Open	Shorted filter condenser
M to N	Open	Shorted filter condenser

CONTINUITY TEST FOR MAGNET COILS AND LOUDSPEAKER CORD (See Figure 16)

Connect Magnet Coils and Loudspeaker Cord

Magnet coils may be tested as indicated below. A click test from one lead to the other while they are completely disconnected from the rest of the circuit is also a simple and effective method of testing.

Test	*Correct Effect*	*Incorrect Effect caused by:*
One cord terminal to L or N	Closed	Open cord
Other cord terminal to L or N	Closed	Open cord
M to N	Closed	Open magnet coils or coil leads



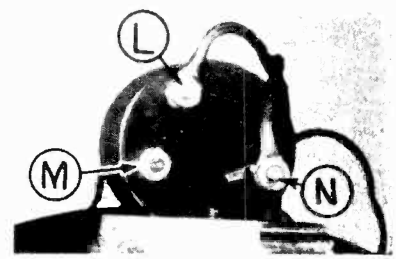


Figure 16—Schematic circuit diagram of RCA Loudspeaker Model 100A and photo of the filter unit

PART III—RECTIFIER-POWER-AMPLIFIER UNIT

The rectifier-power-amplifier unit (Figure 17), incorporated in Radiola 30A uses two Radiotrons UX-281 in a full wave rectifying circuit and one Radiotron UX-171 as a power amplifier.

The use of two Radiotrons UX-281 in a full wave rectifying circuit provides an output of rectified current in excess of the maximum requirements for this Radiola. Being operated at less than half their maximum output, excellent life and operating characteristics are obtained from these Radiotrons.

Radiotron UX-171, used as a power amplifier, provides all amplification necessary for use with Loudspeaker Model 100-A. Its maximum undistorted output gives sufficient volume for all requirements.

Radiotron UV-876, known as the "Ballast Tube," is connected in the primary circuit of the power transformer. The resistance of its filament rises and falls rapidly with an increase or decrease of current flowing through it, thus maintaining a substantially constant input current. Radiotron UV-876 is used when the frequency of the house lighting current is between 50 and 60 cycles.

A ventilating stack is provided to enclose this Radiotron, and Radiola 30A should not be operated unless it is in place.

(1) FILAMENT ACTION OF R.P.A. RADIOTRONS

Should Radiola 30A suddenly cease to operate satisfactorily, open the rear door and note whether or not the Radiotrons in the R.P.A. unit are lit. The filaments of Radiotrons UX-281 glow very dimly, and Radiotron UX-171 slightly brighter. Radiotron UV-876 glows very slightly or not at all, and its operating condition must be ascertained by its normal heat dissipation.

Should all Radiotrons fail to light or operate as indicated, look for:

(a) House current disconnected, or loose connection at outlet.
(b) Blown fuse in house lighting circuit.
(c) Operating switch not functioning properly.
(d) Input plug not making proper contact.
(e) Burned out filament in ballast tube.
(f) Poor contact in ballast tube socket.

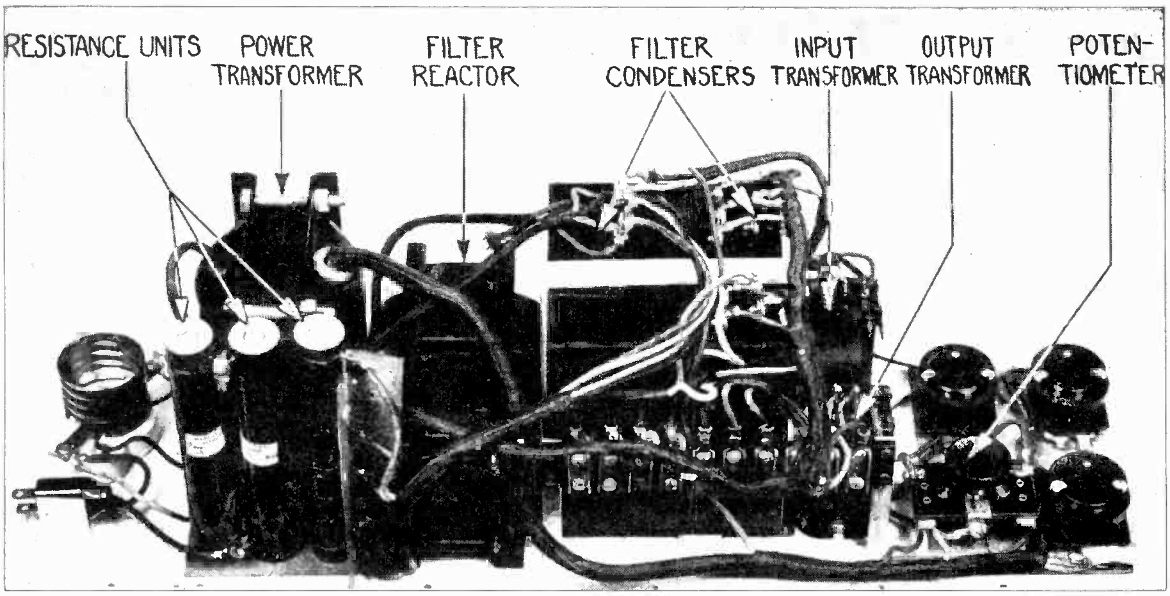


Figure 17—View of R.P.A. unit with cover removed

(g) House lighting current not A.C. (manifest by filament or Ballast tube lighting a bright red).

If the Ballast tube glows excessively and the other Radiotrons light below normal brilliancy trouble may be due to an open in one filament of Radiotron UV-876. (This Radiotron has two parallel filaments.)

(2) IF RADIOTRONS IN R.P.A. UNIT FUNCTION PROPERLY. BUT RADIOTRONS UX-199 DO NOT LIGHT

If the R.P.A. Radiotrons function properly, and the UX-199 Radiotrons located in catacomb do not light, any of the following causes may account for the trouble.

(a) Defective condenser in R.P.A. unit.
(b) Open connections in R. P. A. unit.

In both (a) and (b) the continuity test should be used to isolate the defect.

(c) Defective catacomb. (Run catacomb continuity test.)

(d) Defective connections at R.P.A. terminal board.

(e) Defective resistance strip on back of catacomb. (Use resistance strip test.)

(3) NO SIGNAL WHEN ALL RADIOTRONS ARE APPARENTLY O.K.

After the receiver has been checked according to previous continuities and all Radiotrons appear to be functioning correctly, if no signal is heard look for:

(a) Loose connections at loudspeaker.

(b) Open in coils of loudspeaker. (Try external speaker.)

(c) Filament to grid short in Radiotron UX-171.

(d) Filament to plate short in Radiotron UX-281.

(e) Dirty contacts in any Radiotron socket.

(4) IF ALL RADIOTRONS LIGHT EXCESSIVELY BRIGHT

Should all Radiotrons both in the panel assembly and R.P.A. unit light excessively bright it would be an indication that one or both resistance units R1 or R2 are open. When this occurs, it is important to immediately shut off the Radiola until the defective resistance unit is replaced, to prevent damaging the Radiotrons due to excessive filament voltage.

(5) IF VOLUME DROPS AFTER RADIOLA HAS BEEN IN OPERATION FOR SEVERAL MINUTES

This may be caused either by a Radiotron UV-876 or Radiotron UX-171. There will be a slight drop in signal strength when starting the Radiola, due to the heating of Radiotron UV-876 to its normal condition. Should there be an abnormal drop substitute a new Radiotron UV-876 or Radiotron UX-171 for those in use. This will generally indicate the cause of the trouble.

(6) EXCESSIVE HUM

Excessive hum in the reproducer unit may be due to any of the following causes.

(a) Potentiometer not properly adjusted.

(b) A.C. plug reversed.

(c) Defective condenser in R.P.A. unit.

(d) Loose laminations in power transformer or filter choke. Tighten all clamping screws in R.P.A. unit.

(7) IF PLATES OF RADIOTRONS UX-171 AND UX-281 HEAT EXCESSIVELY

Plates of Radiotron UX-171 hot. Check the following:

(a) Defective (open) resistor unit R1.

Plates of Radiotron UX-281 hot. Check the following:

(a) Shorted 12 Mfd. filter condenser.

(b) Defective transformer.

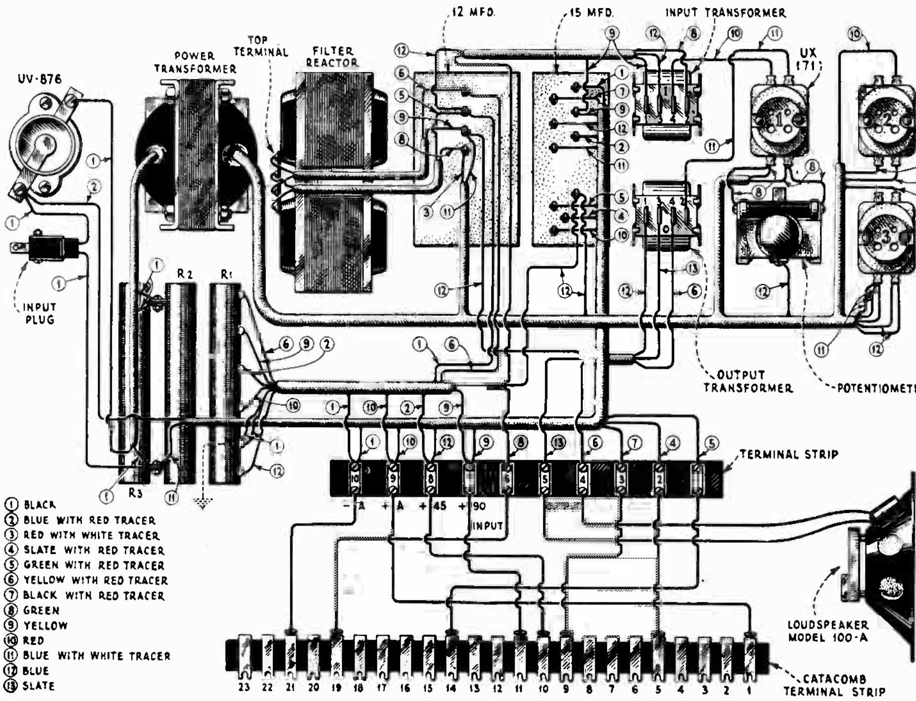


Figure 18—Pictorial view of R.P.A. unit and color scheme of R.P.A. cables

Should one Radiotron UX-281 become slightly red and the other Radiotron UX-281 be apparently normal, replace the Radiotron that is apparently O.K. This Radiotron is defective, causing the other to heat from overload.

(8) CHANGES OF SIGNAL STRENGTH WHILE RADIOLA 30A IS IN OPERATION

Should Radiola 30A change in intensity of signal strength, either greater or lower, while in operation, resistance unit R1 should be examined. The connections to this tapped resistor may have become corroded or dirty, causing a changing value of the resistance in the circuit which would cause a corresponding change in signal strength. The remedy is to heat all the connections to this resistor until a new joint is formed by the solder.

(9) COMPLETE R.P.A. CONTINUITY TEST

The continuity test covers all circuits of the Radiola 30A R.P.A. unit and the terminal numbers contained therein refer to those of Figure 19. Before running this test remove all connections from the terminal board at the rear of the R.P.A. unit (Figure 18), and also the input plug and the Radiotrons.

The testing equipment consists of a high resistance type voltmeter with battery voltage sufficient to give approximately full scale deflection when connected directly across battery terminals—for example, a 45-volt "B" battery unit connected in series with a voltmeter having a zero to 50-volt scale. The contact points of the testing equipment should be well insulated from their handles, and care should be taken not to touch any metallic part of the R.P.A. unit. Discharge the filter condensers by short-circuiting their terminals with a screwdriver before starting test.

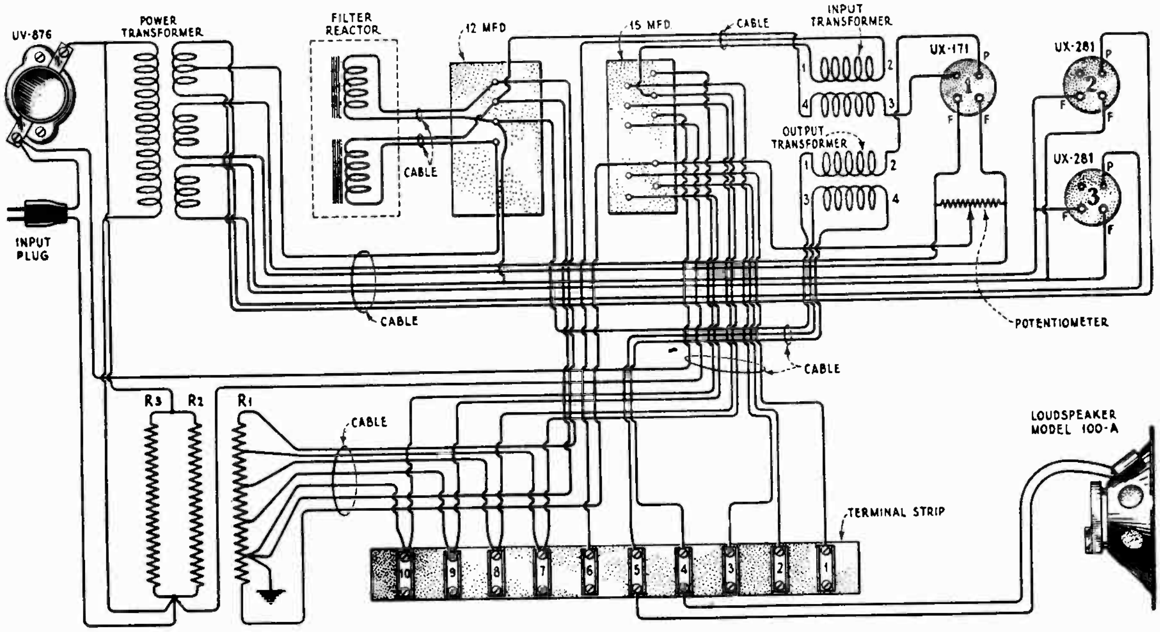


Figure 19—Continuity wiring diagram of the R.P.A. unit

R.P.A. CONTINUITY TEST

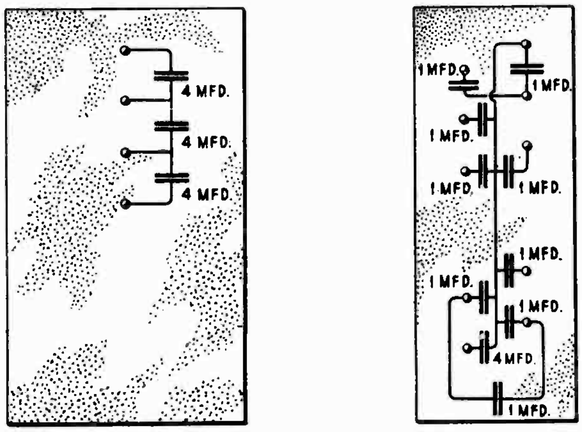
(Remove All Connections from Terminal Strip)

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
1 to 2	Open	Shorted 1 mfd condenser
3 to 7	Open	Shorted 1 mfd condenser
4 to 5	Closed	Open secondary of output transformer
6 to 7	Closed	Open primary of input transformer
7 to 10	Closed	Open resistance unit R1
10 to 3	Open	Open 1 mfd condenser
10 to both sides of input plug	Open	Open 1 mfd condenser
10 to 1	Open	Shorted 1 mfd condenser
10 to 2	Open	Shorted 1 mfd condenser
G1 to ground	Closed	Open secondary input transformer
P1 to either F2	Closed	Open primary of output transformer
P2 to P3	Closed	Open high voltage winding of power transformer
Across filament contacts of socket No. 1	Closed	Open UX-171 filament winding of power transformer and potentiometer
Across filament contacts of sockets No. 2 or No. 3	Closed	Open UX-281 filament winding of power transformer
Shell of UV-876 socket to one side of input plug (determined by experiment)	Closed	Open primary of power transformer and resistance units R2 and R3
Ground to P2 or P3	Closed	Open filter reactor or ½ high voltage secondary of power transformer
Either filament contact of socket 2 or 3 to terminal 7	Closed	Open UX-281 filament winding, filter reactor and resistance unit R1

(10) CONDENSER TESTS

The filter condensers in Radiola 30A are best tested by means of a D. C. voltage used to charge these condensers and then noting their ability to hold the charge. The correct manner to do this is to disconnect the condensers from any other part of the circuit and then charge each condenser individually and discharge it by means of a well-insulated screwdriver. These condensers should be charged with approximately 200 volts D. C., obtainable from a set of "B" batteries or a "B" eliminator. Figure 20 shows the connections of the filter condensers inside of the metal containers.

Any condenser not holding its charge is defective, and the entire assembly must be replaced. This is accomplished by releasing all leads, removing the strap that holds the two condenser blocks together, and replacing the block that contains the defective condenser. Figure 18 shows the correct connections to be used when replacing the defective assembly.



12 MFD CONDENSER   15 MFD. CONDENSER

Figure 20—Internal connections of filter condensers

PART IV—MAKING REPLACEMENTS

(1) REPLACING DEFECTIVE PARTS IN PANEL ASSEMBLY

The panel assembly of Radiola 30A is held in place by means of four bolts, these bolts being locked by a wire connecting all the bolts together. A step by step procedure for removing the panel assembly follows:

(a) Place Radiola 30A in position so that the rear door can be opened wide.

(b) Remove antenna coupler connections and power cable terminal strip from rear terminal strip of panel assembly.

(c) Cut and remove the wire connecting the heads of the four bolts holding the panel assembly to the cabinet.

(d) Remove four bolts holding panel assembly to cabinet. When removing these bolts the rubber washers should be taken off with each bolt.

(e) The panel assembly may now be lifted clear of its compartment and removed to a place convenient for making repairs or replacements.

Any defective unit may be readily replaced, wiring of all units being very accessible. When removing a unit it is good practice to first tag all wires disconnected, so that when the unit is replaced the wires may be easily connected to their original terminals. The color scheme of the panel assembly may be referred to in Figure 10.

After the repair or replacement is completed, the panel assembly should be returned to the cabinet in the reverse of the foregoing order. A piece of bare copper or brass wire, about No. 18 B. & S., should be used to lock the bolts. Special care should be taken to see that the rubber supports and rubber washers are returned to their original location. The panel should also clear the front apron and each side of the cabinet. This is very important, for unless the entire panel assembly is full-floating within the cabinet and resting upon its rubber supports, serious microphonic trouble may result.

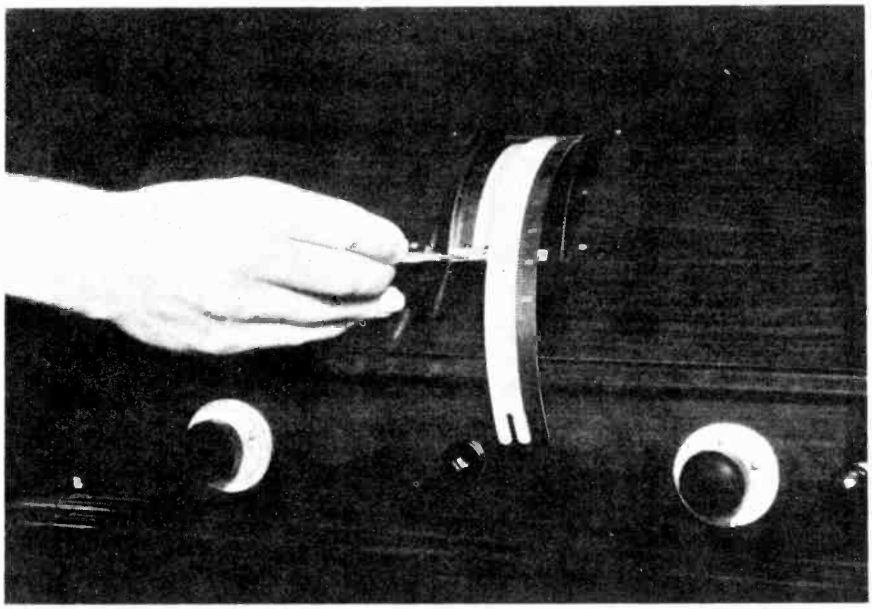


Figure 21—Replacing tuning drum dials

(2) REPLACING DIAL SCALES

The dial scales on Radiola 30A are of the renewable type, and frequently it is desirable to replace them with clean scales. This operation is very simple, and takes but a few minutes (Figure 21). A step by step procedure is as follows:

(a) Open front doors and remove escutcheon plate from control drums.

(b) Turn drums to either extreme and loosen the four screws that hold the scales. Merely loosen these screws and do not remove them. The ends of the scales may now be pulled clear of the clamping plate.

(c) Now turn tuning drums to other extreme and loosen the four screws that hold the scales in place at this end. The dial scales may now be completely removed.

(d) Place the new scales in the position occupied by the old ones, line up the scales and tighten the clamping plates.

(e) Replace the escutcheon plate.

(3) PROCEDURE TO REMOVE REPRODUCER UNIT FROM CABINET

The following procedure should be used when removing reproducer unit from the cabinet:

(a) Remove screen assembly from bottom of cabinet by removing its six retaining screws. This screen is located directly under the loudspeaker and covers the hole through which it must be removed.

(b) Remove front grille.

(c) Remove the four small nails that lock the four screws holding the assembly in place.

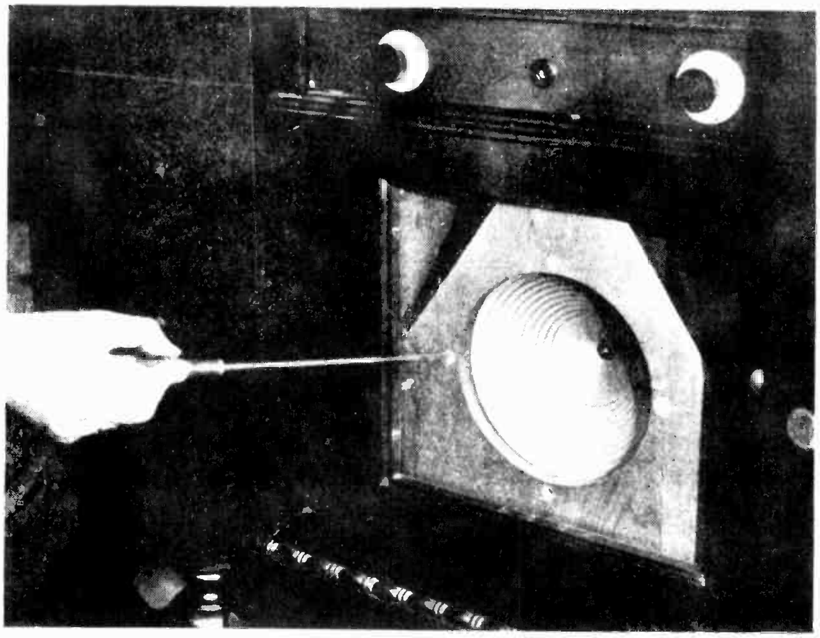


Figure 22—Releasing reproducer from housing

(d) Remove the four screws holding the speaker unit to the baffleboard (Figure 22). Before the last screw is released the speaker unit should be held from the opening at the bottom of the cabinet, so that it will not fall through.

(e) The loudspeaker unit may now be removed through the bottom of the cabinet (Figure 23). The cord should be released from its terminal posts on the filter unit and the speaker removed to a convenient place for inspection and repair.

(4) MAKING REPLACEMENTS ON RCA LOUDSPEAKER 100A

The necessary procedure for making replacement in the RCA 100A Loudspeaker unit used in Radiola 30A is fully covered in "RCA Loudspeaker 100A Service Notes." A reference to this booklet when making any replacement will be found helpful.

(5) REPLACING DEFECTIVE PARTS IN R.P.A. ASSEMBLY

In order to make any replacement in the R.P.A. unit it will be necessary to remove the unit from the cabinet and then remove its metal covers. A step by step procedure is as follows:

(a) Place Radiola 30A in a position so that its rear door can be opened wide.

(b) Cut and remove the lock wire connecting the heads of the four bolts holding the R.P.A. assembly to the cabinet. Now remove these bolts.

(c) Remove the input plug located on the left side, when facing the R.P.A. unit from the rear. Also remove the cover from the terminal strip and disconnect all the terminals from the terminal strip.

(d) The entire R.P.A. assembly may now be removed and placed in a position convenient for inspection and repair.

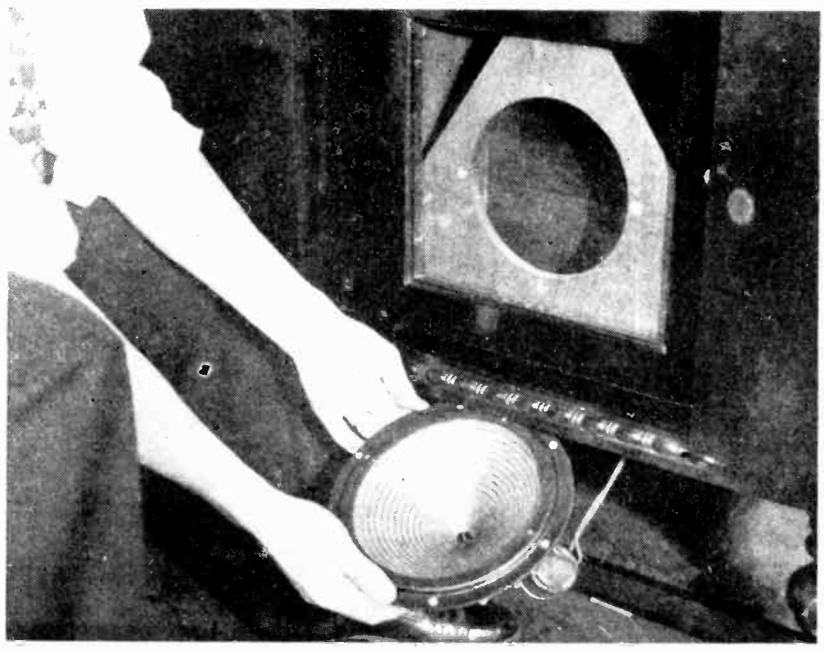


Figure 23—Removing the reproducer from the cabinet

(e) Remove the small screws and break the seals that are located around the edge of the covers. The three sections of the cover may now be removed.

Any repair or replacement may easily be made, using the color scheme of connections contained in Figure 18, which covers all parts with the exception of the power transformer. Figure 24 illustrates the color scheme of the power transformer connections.

When the repair or replacement is effected, the three cover sections should be replaced and substitute seals placed in the position of those broken. These seals will enable the dealer, at a future date, to tell whether service work is caused by ordinary wear and tear or by tampering.

The entire assembly may now be returned to the cabinet, the cable replaced, the input plug returned to its position and the bolts locked in position with a piece of No. 18 B. & S. brass or copper bare wire.

(6) REPLACING THE POWER TRANSFORMER IN R.P.A. UNIT

In replacing a power transformer the following procedure should be used:

(a) Remove R.P.A. unit from cabinet and release cover from R.P.A. unit as described in Part IV, Section 5.

(b) Cut the secondary cable about 3 inches from transformer housing.

(c) Push back the outer braid of the cable about 1 inch. Skin the ends of the seven wires, clean and tin.

(d) Disconnect the primary cable from the resistance units and the UV-876 socket.

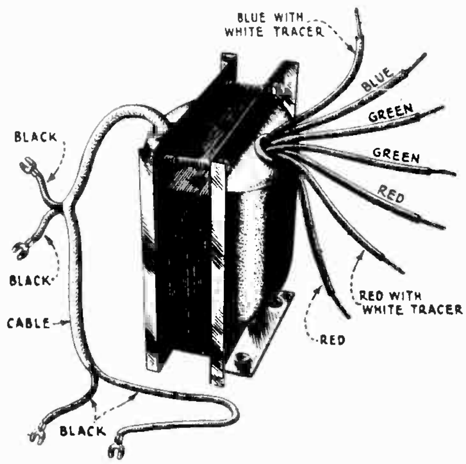


Figure 24—Power transformer cable connections, showing color scheme

(e) Release the screws holding the power transformer to the metal base of the R.P.A. unit and remove the power transformer.

(f) The new transformer is supplied with the primary cable complete and secondary leads having the same color scheme as in the secondary cable (Figure 24). Match up the secondary leads with the cable, and solder connections. Tape joints neatly, using only enough tape to properly insulate.

(g) Slip cable braid back toward connections. This work, if properly done, will present a neat appearance.

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	House current not "On"	Turn house current "On," PIII-S1
	Defective operating switch	Repair or replace operating switch, PIII-S1
	Defective input plug to R.P.A. unit	Repair or replace input plug, PIII-S1
	Defective panel assembly	Check by continuity and repair or replace, PI-S13
	Defective R.P.A. unit	Check by continuity and repair or replace, PIII-S9
	Defective reproducer unit	Check and repair Reproducer unit, PII-S6
Weak Signals	Defective antenna coil or antenna coil connections	Repair or replace antenna coupler or connections, PI-S2
	Radiola in shielded locality	Use short outdoor antenna, PI-S2
	Main tuning condensers out of alignment, or compensating condenser not adjusted	Line up main tuning condensers and adjust compensating condenser, PI-S9
	Defective R.P.A. assembly	Check R.P.A. continuity and repair or replace defect, PIII-S8
	Defective panel assembly	Check panel continuity and repair or replace defect, PI-S13
Poor Quality	Defective catacomb	Check catacomb continuity and replace if defective, PI-S13
	Defective condensers in R.P.A. unit	Check and replace, PIII-S9
	Improperly adjusted Reproducer	Adjust Reproducer unit correctly, PII-S3
Noisy or Intermittent Reception	Dirty Radiotron prongs	Clean Radiotron prongs, PI-S4
	Loose filament or volume control rheostat	Tighten filament or volume control arm and clean contact point, PI-S5
	Sprung socket contacts	Bend socket contacts, PI-S3
	Defective or loose antenna connections	Repair or tighten antenna connections, PI-S2
	Defective resistor connections	Repair connections, PIII-S8
Howling	Microphonic Radiotrons UX-199	Interchange Radiotrons UX-199, PI-S11
	Panel assembly not positioned properly	Position panel correctly, PI-S11
	Reproducer assembly not properly insulated from cabinet	See that reproducer assembly is properly insulated from cabinet, PI-S11
	Open resistor on auxiliary volume control	Replace resistor found defective, PI-S15
All Radiotrons fail to light	Operating switch not "On"	Pull operating switch "On," PIII-S1
	Defective operating switch	Repair or replace, PIII-S1
	Defective R.P.A. unit	Check R.P.A. unit and make repair or replacement, PIII-S9
Radiotrons UX-199 fail to light	Defective R.P.A. unit	Check R.P.A. unit, and make repair or replacement, PIII-S9
	Defective cables	Check and repair or replace
	Defective catacomb	Test and replace, PI-S13

RCA

Printed in U. S. A.

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(LOUDSPEAKER 104

SERVICE NOTES

Second Edition 100__December 1928

RADIO CORPORATION OF AMERICA

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

233 Broadway, New York City

CONTENTS

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 Dealers' 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.

RADIOLAS 30A D.C., 32 D.C. AND LOUDSPEAKER 104 D.C.
(SOCKET POWER OPERATED)

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION
S.P.-D.C.-1

INTRODUCTION

Radiolas 30A and 32 together with RCA Loudspeaker Model 104 are supplied in models designed for direct current socket operation.

These models using direct current as a source of power differ from those using alternating current only in the construction of the power unit. For service information on the receiver or loudspeaker assemblies the regular Service Notes on these models should be consulted.

The service problems that may be encountered in the power units of these D.C. models are somewhat different from those of A.C. driven machines. Therefore the following notes are published for the guidance of those called upon to locate and remedy any trouble that may occur.

This booklet is divided into four sections, namely;

Part I - General Service Data
Part II - Radiola 30A D.C.
Part III - Radiola 32 D.C.
Part IV - RCA Loudspeaker 104 D.C.

PART I - GENERAL SERVICE DATA

The power stage in all D.C. models consists of four Radiotrons UX-171A connected in a push-pull amplifying circuit using the 110-volt D.C. line as plate and filament supply and an external battery for grid voltage supply. Due to the greater filament current consumption, the old Radiotrons UX-171 are not interchangeable with the Radiotrons UX-171A used in the D.C. Radiolas. The output of this push-pull amplifier is equal to that of similar A.C. models.

A series parallel filament connection is used, one tube on each side of the amplifier being connected in series and the two series circuits paralleled together. In this circuit arrangement if a filament of one tube burns out the other tube connected in series with it will also go out, thus throwing the load on the other two tubes of the parallel circuit. In some Radiolas 30A and 32 the result will be a louder signal caused by the increased filament voltage of the two remaining tubes. However, their useful life will be rapidly destroyed under such conditions. In the R.C.A. 104 Loudspeaker and later models of Radiola 30A and 32, due to a different arrangement of the resistance units, the remaining tubes will not receive excessive filament voltage. Filament burnout in one 171A Radiotron will affect the loudspeaker reproduction only slightly, though the tone quality is not so good. While damage to the two tubes will not be apparent at once, the set should not be operated until the defective Radiotron is replaced. When any D.C. installation is made the customer should be made fully aware of these conditions so as to prevent unnecessary damage to the Radiotrons.

All socket power D.C. model Radiolas and Loudspeakers are provided with a switch for compensating various line voltages. The range over which satisfactory operation is secured is from 105 to 125 volts. There are four positions of the switch, i.e. 105-110, 110-115, 115-120 and 120-125. On making an installation, the voltage of the line should be measured with an accurate voltmeter and the switch set at the correct position for that particular line. On connecting a D.C. Radiola or Loudspeaker to the D.C. lines it will be noticed that at one position of the input plug the set operates correctly and at the other position complete silence results. The correct position must be found by experiment.

An external "C" battery is used to supply the correct negative grid potential to the Radiotrons UX-171A. This is - 16 1/2 or - 18 volts on the tubes already receiving a five-volt bias through the adjacent tube filaments and - 22 1/2 volts for the other two tubes. The correct connections are noted in the schematic circuits on the following pages. It is very important when installing a socket power D.C. Radiola or Loudspeaker to connect these two biasing voltages correctly. Incorrectly connected they will operate apparently O.K. until two of the tubes lose their emission and then the reproduction becomes very poor. As this does not occur immediately the man installing the Radiola should give attention to these connections and make certain they are correct.

The following symptons and remedies apply generally to socket power D.C. Radiolas and Loudspeaker 104.

(1) WEAK SIGNALS

Should the loudspeaker output be weak even at maximum volume, the receiver must first be examined to determine that its output to the power amplifier is normal and then the following points should be examined:

(a) Line regulating switch not adjusted properly.
(b) Defective Radiotron. Try substituting a complete new set of Radiotrons.
(c) Open center tap connection on input transformer. This is accompanied by rough and unnatural reproduction.
(d) Open center connection to grid resistors.
(e) Defective grid resistor.

Any adjustments or repairs found necessary should be made.

(2) DISTORTED REPRODUCTION

If the reproduction obtained at the loudspeaker is not of good quality, and the output of the receiver to the Socket Power Unit (S.P.U.) is of good quality the trouble may be due to:

(a) Defective Radiotrons in S.P.U.
(b) "C" battery incorrectly connected.
(c) Defective "C" batteries. Under normal conditions the "C" battery should be replaced once every six months.
(d) Grid resistors defective or not in their clips.
(e) Defective input or output transformer. Under certain conditions a signal may be obtained through an open transformer winding, the quality being very poor. Test for continuity of winding.

Any replacement or repair found necessary should be made.

(3) NOISY REPRODUCTION

Sometimes noisy reception may be experienced on these instruments. The proper procedure is first to disconnect the loop or antenna and note whether or not the trouble is due to pick-up or is internal to the instrument itself. In most cases the trouble is due to pick-up caused by interfering electrical machinery connected to the same D.C. line. All commutators on D.C. motors used in connection with electrical appliances may arc or spark sufficiently to cause noisy reception in a nearby receiving set. The remedy in cases of this kind is to provide filters and chokes for the interfering apparatus or to select another antenna location that is not as susceptible to pick-up of this character. In apartments and hotels or other city locations, often an outdoor antenna substituted for an indoor antenna will eliminate the objectionable pick-up.

On Radiolas 30A and 32 there is provided a link by which the lines may be grounded through two condensers. Experimenting with the two positions of this link will determine which position gives the better results with least pick-up noise.

If the trouble is found to be internal to the Radiola the following points should be checked:

(a) Defective Radiotrons. Try replacing all Radiotrons and then isolate the defective one or the pair by interchanging with the ones formerly used.
(b) Defective grid resistors. Replace with new ones of good quality and the same rating. Only grid resistors of good construction should be used as those absorbing moisture or otherwise having changes of resistance will give noisy or distorted reproduction.
(c) Dirty line switch contacts. A dirty or high resistance contact of the line switch may cause noisy reception.
(d) Dirty or poorly soldered connections. Examine all connections in the Socket Power Unit and heat any dirty or poor connection until a new joint is formed.

(4) GRADUALLY DEVELOPED DISTORTED REPRODUCTION

Should the Radiola or Loudspeaker output become poor with distorted reproduction check the following:

(a) Incorrectly connected "C" battery. Connect "C" battery correctly and replace damaged Radiotrons.
(b) Shorted 2 Mfd. condenser. A shorted 2 Mfd. condenser will cause the wrong "C" bias to be applied to one tube with possible damage to the Radiotron. Replace the condenser and replace the Radiotron if it has become damaged.

(c) Defective or open grid resistor. This would cause one of the Radiotrons to become defective through receiving an improper grid bias in the case of a defective grid resistor or no bias in the case of an open grid resistor.

(5) RADIOTRONS UX-171A LIGHT BUT RADIOTRONS UX-199 IN RECEIVER DO NOT LIGHT

If the Radiotrons UX-171A in the socket power unit light, and the Radiotrons UX-199 in the receiver do not light the trouble is due to a shorted filter condenser. in the socket power unit. This would be the 7 MFD. condenser in the RCA 104 Loudspeaker or the 6 Mfd. condenser in the Radiola 30A and 32. The defective condenser must be replaced.

PART II - D.C. SOCKET POWERED RADIOLA 30A

D.C. socket powered Radiola 30A is identical to the A.C. Model in all respects with the exception of the Socket Power Unit consisting of four Radiotrons UX-171A connected in a push-pull amplifying circuit. The output transformer is designed for use with RCA Loudspeaker 100A.

The serviceman is referred to the regular RCA Radiola Service Notes for information about the receiver assembly. The present Service Notes deal only with the socket power unit used in the D.C. Radiola 30A.

(1) FUSE BLOCK

The fuse block is placed in the circuit to prevent a possible short in the S.P.U. from blowing the house fuses and also to prevent damage to the Radiola from such a short circuit. This fuse block contains two 3-ampere fuses and larger fuses should never be inserted in this block.

Should a fuse blow on being inserted in its socket or when the input plug is connected, disconnect the Radiola immediately from the lighting circuit and look for:

(a) Shorted input plug. Examine input plug mounted on Socket Power Unit for a possible short.

(b) Shorted or grounded wiring. The negative side of the line is not grounded and therefore all wires should be examined for a possible short or ground. Special attention should be given to the various connections.

(c) Shorted 2 Mfd. grounding condensers. Should both of these condensers become shorted they would constitute a dead short across the line. Such defective condensers must be replaced.

(2) LINE SWITCH

The line switch on D.C. socket powered Radiola 30A has four positions, the correct voltage for each position being stamped on the cover adjacent to each contact. Facing the rear of the Radiola from left to right the positions are 120-125, 115-120, 110-115, 105-110. When making an installation it is very important to measure the line voltage with a D.C. voltmeter and set the switch at the correct position for that particular voltage. If a voltmeter is not obtainable, the power company can furnish the correct rating.

(3) CONDENSER BANK

Two condenser banks are incorporated in D.C. socket powered Radiola 30A, one 10 Mfd. and one 12 Mfd. The 12 Mfd. condenser block consists of one 6 Mfd. filter condenser and two 2 Mfd. grid blocking condensers and two 1 Mfd. grounding condensers. The 10 Mfd. condenser block contains the extra filter condensers normally in the A.C. package used with the eight-tube catacomb. The internal connections of each condenser bank are shown on a diagram mounted on the side of each unit. To properly test any condenser charge it with the 110-volt line current and after waiting 30 seconds discharge it with a screw driver. A defective condenser will be identified by its inability to hold a charge.

(4) VOLTAGE READINGS

The following voltage readings should be obtained at the terminal strip located at the rear of the Socket Power Unit. The terminal numbers are shown in Figure 2 and are numbered consecutively from left to right, facing the rear of the Radiola.

VOLTAGE READINGS

Terminals	Correct Effect
1 to 2	31 volts with all Radiotrons lit and battery setting near "Soft"
2 to 3	21.5 volts normally
3 to 4	41 volts normally
11 to 12	16 1/2 or 18 volts with new "C" battery
11 to 13	22 1/2 volts with new "C" battery. If this voltage is below 20, the "C" battery should be replaced

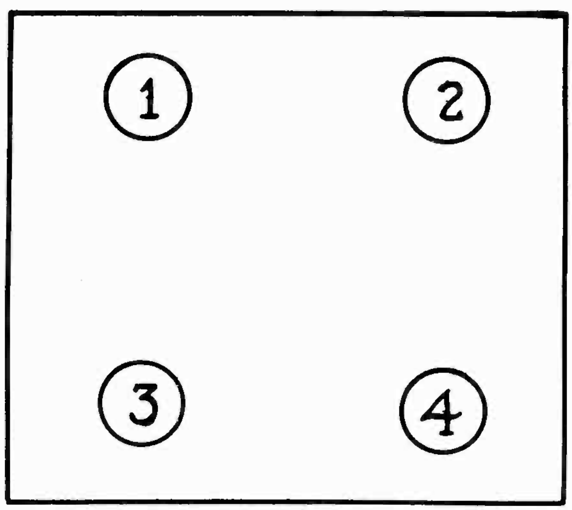

Figure 1 -- Reference numbers used in continuity test table showing location of tube sockets in S.P.U. when viewed from the rear of the Radiola.

(5) CONTINUITY TESTS FOR SOCKET POWER UNIT

The following continuity test table covers all circuits of the D.C. socket powered Radiola 30A S.P.U. The terminal numbers in the first column refer to terminal connections in the S.P.U. viewed from the rear counting from left to right. (See Figure 2.)

Tube socket contacts (G1, P4, F2, etc.) noted in column one refer to Figure 1. Before running this test remove all connections from the terminal board at the rear of the S.P.U. and also the input plug and the Radiotrons. Ascertain that fuses are screwed tight into their respective sockets.

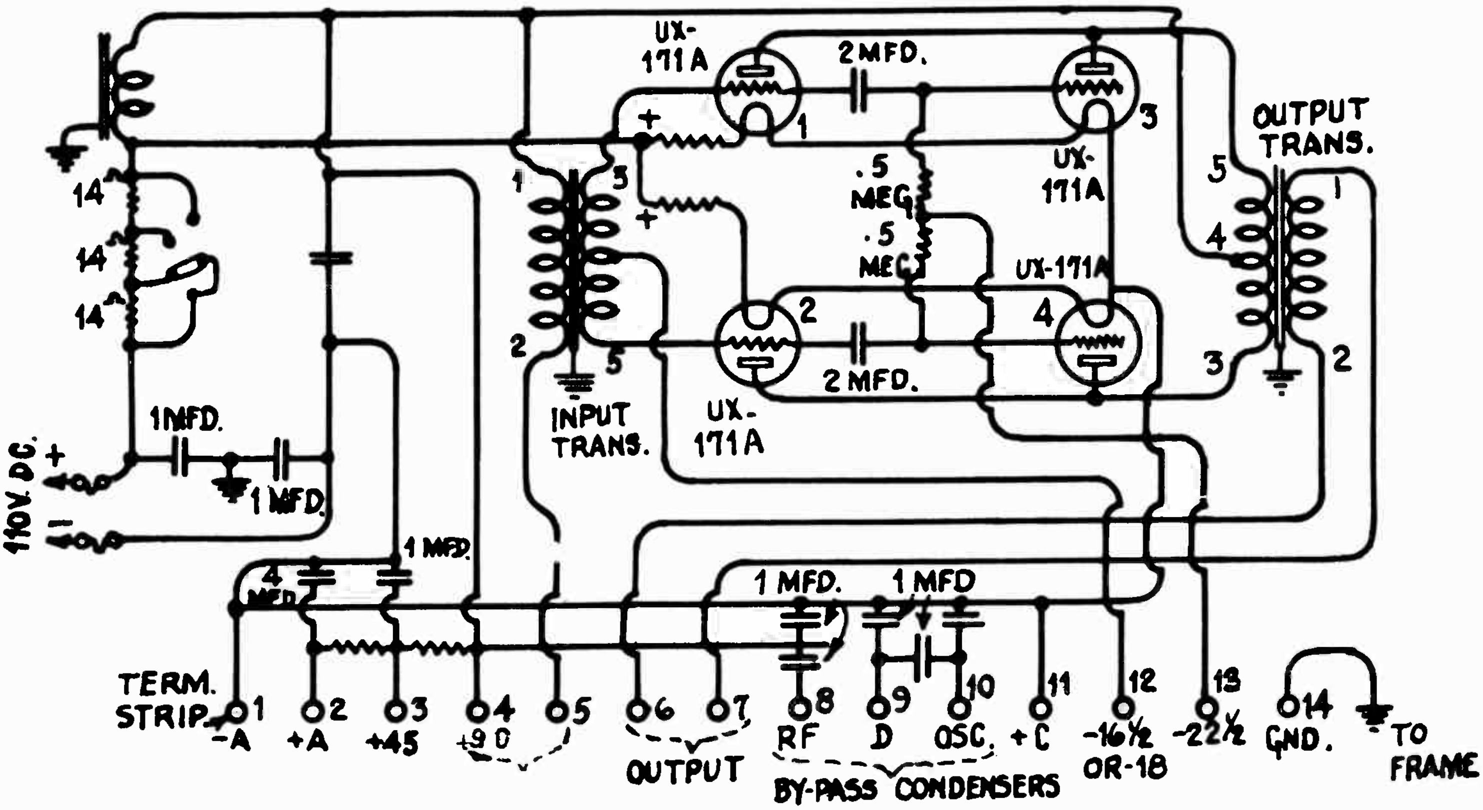

Figure 2 -- Radiola 30A D.C. Socket Power Unit schematic circuit with terminal connections, plate, grid and filament voltages.

The testing equipment consists of a voltmeter with battery voltage sufficient to give approximately full scale deflection when connected directly across battery terminals - for example, a 45-volt "B" battery unit connected in series with a voltmeter having a zero to 50-volt scale. A pair of headphones connected in series with a 4 1/2 volt "C" battery may also be used. Discharge the filter condensers by short-circuiting their terminals with a screw driver before starting test.

CONTINUITY TESTS FOR SOCKET POWER UNIT

Terminals	Correct Effect	Incorrect Effect Caused by
Outside contacts of line switch	closed	Open line resistance unit
One side of input plug to + F1	closed	Open resistance unit
One side of input plug to + F2	closed	Open resistance unit
4 to 5	closed	Open primary of input transformer
6 to 7	closed	Open secondary of input transformer
4 to 8	open	Shorted 1 Mfd. condenser
1 to 9	open	Shorted 1 Mfd. condenser
1 to 10	open	Shorted 1 Mfd. condenser
9 to 10	open	Shorted 1 Mfd. condenser
12 to G1	closed	Open 1/2 sec. input trans.
12 to G2	closed	Open 1/2 sec. input trans.
G1 to G3	open	Shorted 2 Mfd. condenser
G2 to G4	open	Shorted 2 Mfd. condenser
13 to G3	closed (weak)	Open grid resistor
13 to G4	closed (weak)	Open grid resistor
P1 to P2	closed	Open primary of output transformer
P3 to P4	closed	Open primary of output transformer
14 to Frame	closed	Open ground connection
Frame to one side of input plug	open	Shorted 1 Mfd. condenser
Frame to other side of input plug	open	Shorted 1 Mfd. condenser

PART III - D.C. SOCKET POWERED RADIOLA 32

D.C. Socket powered Radiola 32 is identical to the regular A.C. model with the exception of the socket power unit. In the D.C. Model the power amplifier consists of four Radiotrons UX-171A connected in a parallel push-pull circuit, giving an output equal to the Radiotron UX-210 used in the A.C. Models. Parts other than the S.P.U. are identical in both models and any service information needed will be found in the regular "Radiola 32 Service Notes."

The present Service Notes deal only with the Socket Power Unit used in the D.C. Radiola 32.

(1) FUSE BLOCK

The fuse block in the D.C. socket powered Radiola 32, as in the D.C. socket powered Radiola 30A already noted, is placed in the circuit to prevent a possible short in the S.P.U. from blowing the house fuses and also to prevent damage to the Radiola from such a short circuit. Two 3-ampere fuses are used and larger fuses should never be inserted in this block.

Should a fuse blow on being inserted in its socket or when the input is connected disconnect the Radiola immediately from the lighting circuit and look for:

(a) Shorted input plug. Examine input plug mounted on Socket Power Unit for a possible short.
(b) Shorted or grounded wiring. The negative side of the line is not grounded and therefore, all wire should be examined for a possible short or ground. Special attention should be given to the various connections.
(c) Shorted 2 Mfd. grounding condensers. Should both of these condensers become shorted, they would constitute a dead short across the line. Such defective condensers must be replaced.

(2) LINE SWITCH

The line switch on D.C. socket powered Radiola 32 has four positions, the correct voltage for each position being stamped on the cover adjacent to each contact. Facing the rear of the Radiola and reading from left to right the positions are 120-125, 115-120, 110-115, 105-110. When making an installation it is very important to measure the line voltage with a D.C. voltmeter and set the switch at the correct position for that particular voltage. If a voltmeter is not obtainable the power company can furnish the correct rating.

(3) CONDENSER BANK

The condenser bank of D.C. socket powered Radiola 32 consists of a 6 Mfd. filter condenser, two 2Mfd. grid blocking condensers and two 1 Mfd. line condensers all contained in one metal container. The internal connections of this condenser bank are shown on a diagram attached to the side of the container. To test these condensers the 110-volt D.C. line is used to charge each condenser and, after waiting 30 seconds, the condenser is discharged by short circuiting the terminals with a metal screw driver. A condenser that will not hold its charge is defective and should be replaced.

(4) VOLTAGE READINGS

Referring to Figure 3, the following voltages should be obtained at the terminal strip of the Socket Power Unit. The terminals noted in the first column of the tabulated text refer to the terminals viewed from the rear of the S.P.U. counting from left to right and omitting the first four terminals which are for the input and output of the S.P.U.

Terminals	Correct Voltage
1 to 3	31.0 volts, normally with all Radiotrons lit and battery setting near "Soft"
3 to 4	21.5 volts normally
4 to 5	41 volts normally

The "C" battery terminals are located on the fuse block. A check of the voltages should be made as indicated at the terminals. If the 22 1/2 volt terminal reads less than 20 volts the battery should be replaced.

(5) CONTINUITY TESTS FOR SOCKET POWER UNIT

The following continuity test table covers all circuits of the D.C. Radiola 32 S.P.U. The terminal numbers in the first column refer to terminal connections in the S.P.U. viewed from the rear counting from left to right and omitting the first four terminals which are the input and output terminals. (See Figure 3.) Tube socket contacts (F1, G3, P4, etc.) noted in column one refer to location of tube sockets in S.P.U. counting from left to right when viewed from rear of Radiola. Before running this test remove all connections from the terminal.

board at the rear of the S.P.U. and also the input plug and Radiotrons. See that fuses are screwed tight into their respective sockets.

The testing equipment consists of a D.C. voltmeter with battery voltage sufficient to give approximate full

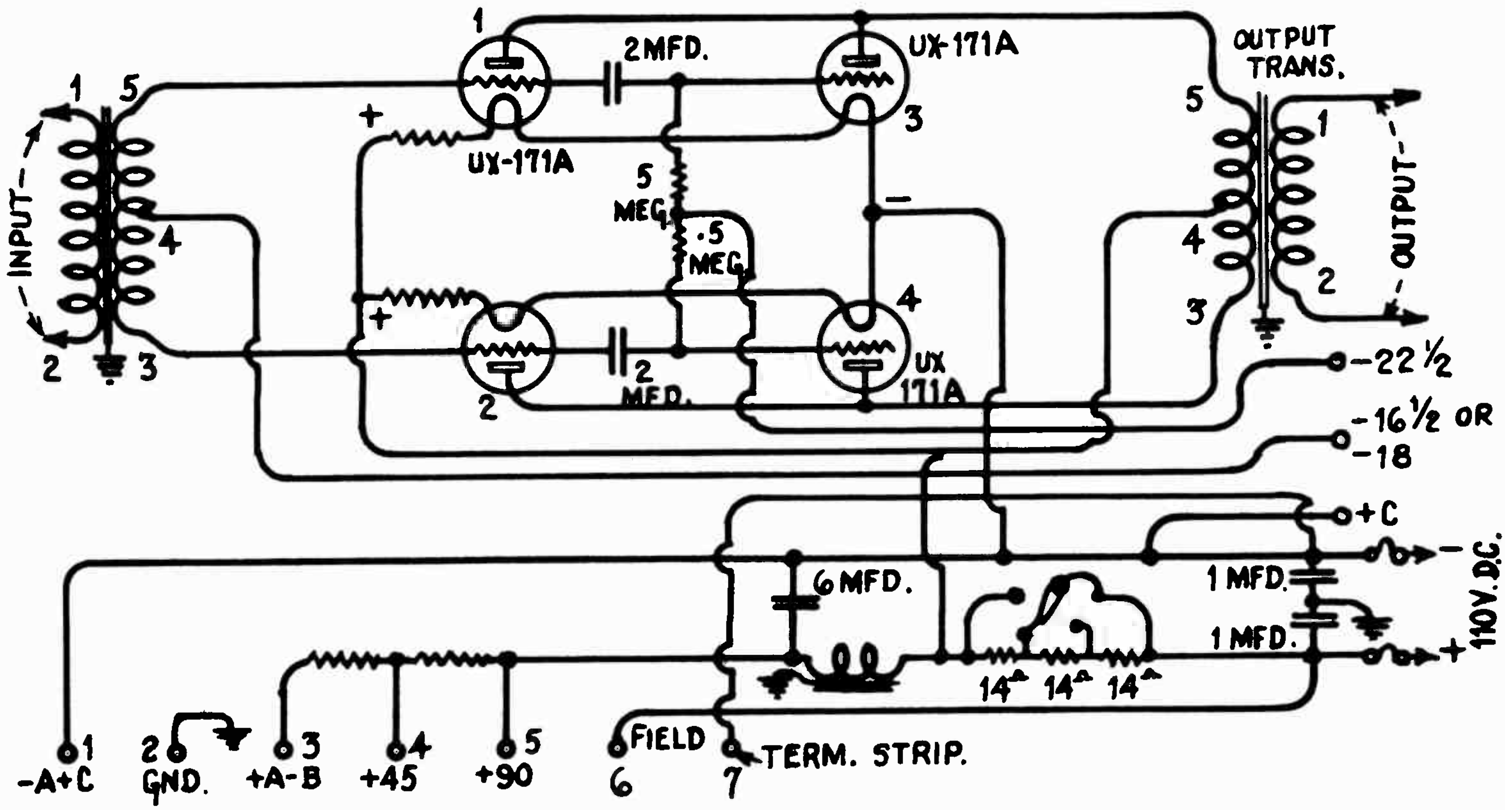

Figure 3 -- Radiola 32 D.C. socket power unit schematic circuit with terminal connections and voltages.

scale deflection when connected directly across battery terminals - for example, a 45 volt "B" battery unit connected in series with a voltmeter having a zero to 50-volt scale. A pair of headphones connected in series with a 4 1/2 volt "C" battery may also be used. Discharge the filter condensers by short - circuiting their terminals with a screw driver before starting test.

CONTINUITY TESTS FOR SOCKET POWER UNIT

Terminals	Correct Effect	Incorrect Effect Caused by
Across input terminals	Closed	Open primary of input transformer
Across output terminals	Closed	Open secondary of output transformer
3 to 5	Closed	Open tapped resistance unit
One side of input plug to ground	Open	Shorted 1 Mfd. condenser
Other side of plug to ground	Open	Shorted 1 Mfd. condenser
5 to + of input plug	Closed	Open filter reactor or tapped resistance unit
+ of input plug to P1 or P3	Closed	Open 1/2 primary of output transformer
+ of input plug to P2 or P4	Closed	Open 1/2 primary of output transformer
- 16 1/2 to G1 or G3	Closed	Open 1/2 of secondary of input transformer
- 16 1/2 to G2 or G3	Closed	Open 1/2 of secondary of input transformer
G1 to G3	Open	Shorted 2 Mfd. condenser
G2 to G4	Open	Shorted 2 Mfd. condenser
- 22 1/2 to G3	Closed (Weak)	Open grid resistor or if loud click, shorted grid resistor
- 22 1/2 to G4	Closed (Weak)	Open grid resistor or if loud click, shorted grid resistor
+ F1 to + of input plug	Closed	Open filament resistance or line resistance
+ F2 to + of input plug	Closed	Open filament resistance or line resistance

PART IV - RCA D.C. SOCKET POWERED LOUDSPEAKER 104

RCA D.C. Socket Powered Loudspeaker 104 is identical to the regular A.C. model with the exception that the Socket Power Unit is designed to operate from the regular 110-volt D.C. lines. This loudspeaker contains a power amplifier consisting of four Radiotrons UX-171A connected in a push-pull circuit and furnishes a "B" voltage supply to any receiver and complete plate grid and filament voltages for Radiolas 25 or 28 when used in conjunction with the proper A.C. Package.

The reproduction obtained and the general appearance is the same as that of the A.C. Models.

While the present Service Notes cover problems that may occur it will be found that very little service work will be required on this loudspeaker because of its excellent design and good construction.

(1) LINE SWITCH

A line switch is provided for adjusting the Loudspeaker to various line voltages - satisfactory operation being secured over the range of 105-125 volts. The knob of this switch is located on top of the Socket Power Unit and the various positions are numbered from 1 to 4. The correct voltages for these various positions are as follows:

1. 120-125
2. 115-120
3. 110-115
4. 105-110

When an installation is made the voltage of the line should be measured and the switch set at the correct position for the particular line in use. If a voltmeter is not obtainable the correct voltage may be secured from the power company. If neither can be readily obtained the switch should be set at the lowest point at which satisfactory operation may be secured.

(2) CONDENSER TESTS

The 7 Mfd. filter condenser and the two 2 Mfd. grid blocking condensers can be tested by disconnecting them from the circuit and charging them with the 110-volt D.C. line. After charging wait 30 seconds and discharge them by short circuiting their terminals by means of a screw driver. A condenser that will not hold its charge is defective and should be replaced.

(3) VOLTAGE READINGS

The following voltages should be obtained at the terminal strip located at the rear of the Socket Power Unit. The terminal strip numbers shown in Figure 4 are located consecutively from left to right when facing the Loudspeaker from the rear, omitting the first four terminals which are for the input and output of the loudspeaker. With the loudspeaker and receiver in normal operation the following readings should be obtained on a D.C. voltmeter.

VOLTAGES FOR LOUDSPEAKER SUPPLYING "B" CURRENT ONLY. LINK BETWEEN TERMINALS 1 AND 2

Terminals	Correct Voltage
1 to 4	45
1 to 5	90
1 to 6	16 1/2 or 18
1 to 7	22 1/2

VOLTAGES FOR LOUDSPEAKER SUPPLYING "A", "B" AND "C" POWER TO RADIOLAS 25 or 28. LINK BETWEEN TERMINALS 2 AND 3

Terminals	Correct Voltage
1 to 3	31
3 to 4	21.5
4 to 5	41
1 to 6	16 1/2 or 18
1 to 7	22 1/2

Should the readings on the "C" battery terminals 1 to 7, show less than 20 volts replace the "C" battery.

(4) USING RCA D.C. SOCKET POWERED LOUDSPEAKER 104 WITH RADIOLA 25 OR 28 FOR COMPLETE SOCKET POWER OPERATION

RCA D.C. Socket Powered Loudspeaker 104 may be used in conjunction with Radiolas 25 and 28 by using the regular A.C. Package furnished for this purpose. However, when making an installation of this kind the following deviations from the procedure outlined in A.C. Package Instruction Book should be observed:

1. Resistor Unit UP-591 is not used.
2. Instead of opening the link as on an A.C. machine, the position of the link is changed to terminals 2 and 3 (Figure 4).

(5) CONTINUITY CIRCUIT TESTS

The tabulated continuity tests cover all circuits of the Socket Power Unit. The terminal numbers in column one refer to the terminals in the S.P.U. viewed from the rear counting from left to right and omitting the first four terminals which are the input and output terminals, (See Figure 4). Tube socket contacts (G1, F2, etc.) noted in column one refer to location of tube sockets counting

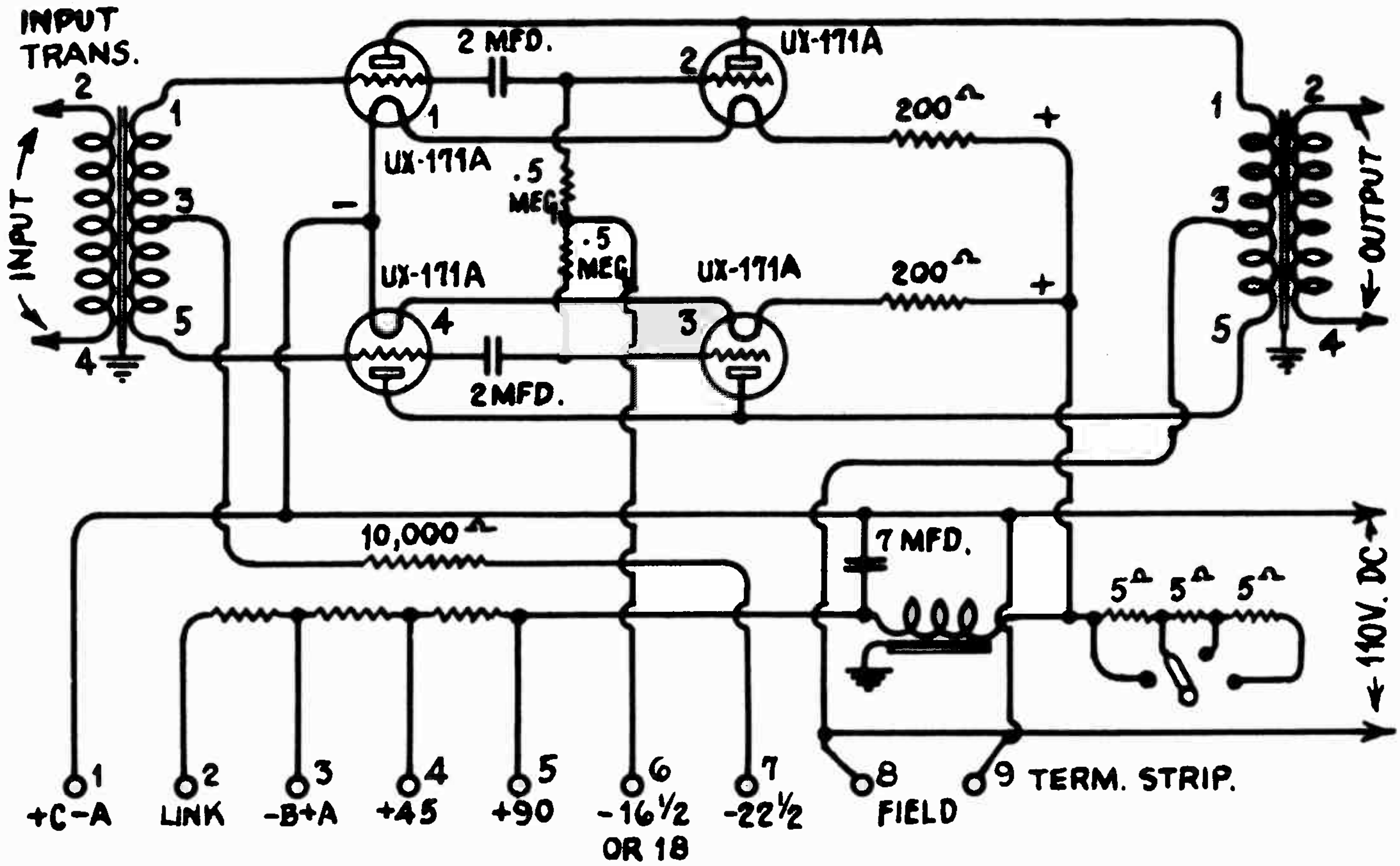

Figure 4 -- RCA Loudspeaker 104 D.C. socket power unit schematic circuit with terminal connections and "A", "B" and "C" Voltages.

from left to right when viewed from rear of Loudspeaker. Before running this test remove all connections from the terminal board at the rear of the S.P.U. and also the input plug, Radiotrons and link. A pair of headphones with at least 4 1/2 volts in series, or a voltmeter with voltage sufficient to give full scale deflection when connected directly across the terminals, should be used in making this test. Discharge the filter condenser by short-circuiting its terminals with a screw driver before starting test.

CONTINUITY TESTS FOR SOCKET POWER UNIT

Terminals	Correct Effect	Incorrect Effect Caused by
Across input terminals	Closed	Open primary of input transformer
Across output terminals	Closed	Open secondary of output transformer
G1 to G4	Closed	Open secondary of input transformer
G G1 to G2	Open	Shorted 2 Mfd. condenser
G3 to G4	Open	Shorted 2 Mfd. condenser
P1 to P4	Closed	Open primary of output transformer
1 to - 22 1/2	Closed	Open 1/2 secondary of input transformer
G4 to 7	Closed	Open 1/2 secondary of input transformer or grid resistance unit
G2 to 6	Closed (Weak)	Open or defective grid resistor If loud, shorted grid resistor
G3 to 6	Closed (Weak)	Open or defective grid resistor If loud, shorted grid resistor
+ F2 to + of input plug	Closed	Open filament resistor or tapped resistor
+ F3 to + of input plug	Closed	Open filament resistor or tapped resistor
5 to + input plug	Closed	Open filament reactor or tapped resistance unit
2 to 5	Closed	Open resistance unit

RCA
Radiola 32

SERVICE NOTES

RCA Radiola 32

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SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT
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A WORD OR TWO ABOUT SERVICE

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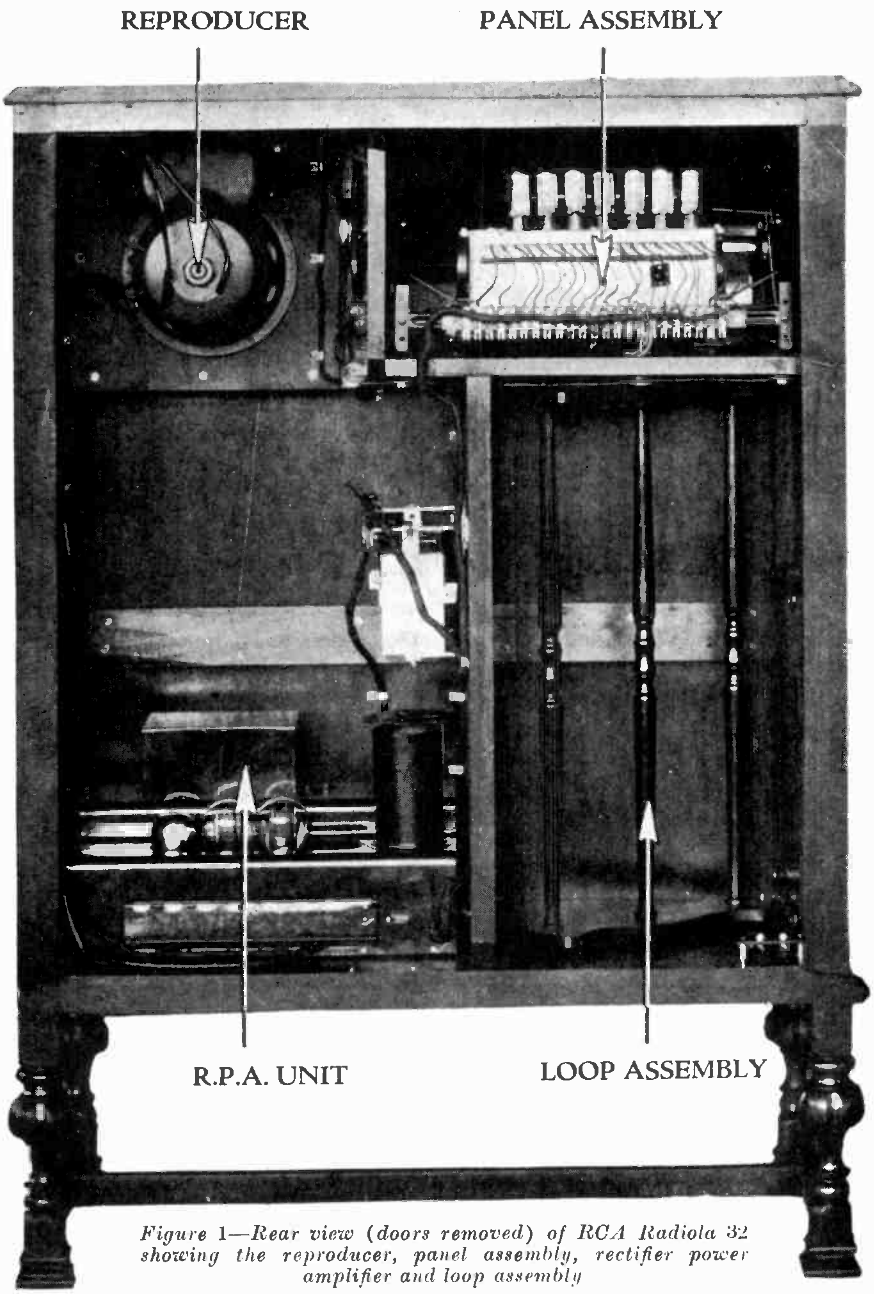


Figure 1—Rear view (doors removed) of RCA Radiola 32 showing the reproducer, panel assembly, rectifier power amplifier and loop assembly

RCA RADIOLA 32

SERVICE NOTES

Prepared By

RCA SERVICE DIVISION

R32-1

INTRODUCTION

RCA Radiola 32 is a complete, self contained socket power radio broadcast receiver of the super-heterodyne type. Essentially it consists of the well known RCA Radiola 28 and RCA Loudspeaker Model 104 combined in a de luxe cabinet with all the refinements necessary to ensure the utmost in sensitivity and selectivity together with tone quality of the reproduced signal. (See Figure 1.)

Many service problems common to receivers of this type have been eliminated in the inherent design of the Radiola.

The service notes are divided into three parts, namely, Part I, Panel Assembly and Loop; Part II, R.P.A. Assembly and Reproducer Unit; and Part III, Making Replacements.

PART I—PANEL ASSEMBLY AND LOOP

(1) RADIOTRON SEQUENCE

Radiola 32 is designed to operate with seven UX-199 Radiotrons in the receiver assembly. Facing the panel and counting from left to right, the input is brought into the third Radiotron, which is a stage of tuned radio frequency amplification.

The output of the third Radiotron then goes to the first tube on the left, which is the frequency combining tube or first detector. The output of the fifth Radiotron, which is the oscillator, is also fed into the first Radiotron, the resultant combining of frequencies forming an intermediate frequency.

The intermediate frequency signal now passes through tube No. 2, which is the first stage of intermediate frequency amplification, then skipping tube No. 3, it passes through tube No. 4, which is the second intermediate frequency stage.

From Radiotron No. 4 the signal is fed into No. 6, which is the second detector. The audio frequency current is then fed through Radiotron No. 7 and into Radiotron

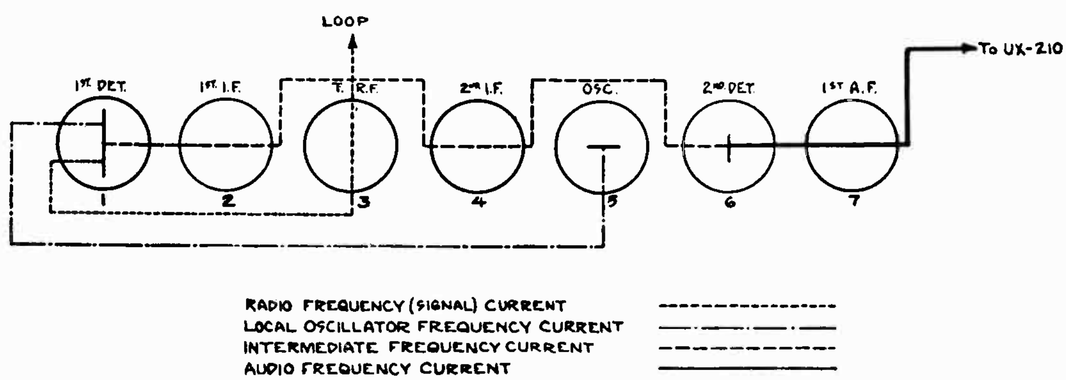


Figure 2—Radiotron sequence and path of the different currents

UX-210 of the R.P.A. unit. Figure 2 illustrates the Radiotron sequence and the path of the different currents through them.

(2) RADIOTRON SOCKETS

In placing Radiotrons in their respective sockets care should be exercised to make certain that the two large pins and two small pins of the Radiotrons are placed into the two large holes and two small holes, respectively. If a Radiotron will not fit into a socket without considerable pressure being applied, the trouble is probably due to excessive solder on one or more of the prongs. This may be removed with a file or knife. Never try to force a Radiotron into its socket. The design is such that they should fit in snugly without force. It might be possible by exerting considerable pressure, to force the prongs into the wrong holes, resulting in a filament burn-out.

(3) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation. They should therefore be carefully cleaned occasionally with a piece of fine sandpaper. The use of emery cloth or steel wool is not recommended. Before re-inserting Radiotrons in the socket shelf, wipe the prongs and base carefully to make certain that all particles of sand are removed.

(4) LOOSE RHEOSTAT CONTACTS

To get at the rheostat contacts the panel must be released and pulled out of the rear of the cabinet. This is done by removing the four bolts that hold the panel in position. First, however, the wire which is threaded through each bolt must be removed by unsoldering it at its splice. With the bolts removed, the cable connected to the terminal strip at the rear must be disconnected and dropped so as not to interfere with the removal of the panel. The panel may then be removed and the rheostats examined. (See Figure 3.)

The square head set screw holding the contact arm to the shaft may now be loosened and the contact arm readjusted or removed and bent so that it will make positive contact with the resistance strip, making certain that the resistance strip is clean where contact is made. Tighten set screw and slip panel assembly back into cabinet. When doing this it is very important to see that the panel is supported on the rubber strips it formerly rested upon and that it does not touch any part of the cabinet, including the apron hanging from the top of the cabinet. When viewed from the front this apron appears to touch the top front panel, but actually it does not. If it does touch, serious microphonic trouble will result. After ascertaining that the panel is in its proper position the four bolts, washers and locking wire should be returned to their original positions.

(5) DRUMS FAILING TO HOLD POSITION

When adjustment is necessary due to the tuning drums slipping their position, the following procedure should be used:

(a) Remove panel from cabinet and re-adjust tension screw on the inside of the drum. This screw controls the pressure of the friction shoe against the shaft of the opposite condenser. If one drum turns too hard when the other is held, the tension screw may be slightly loosened.

(b) Should the frequency range be off calibration, ascertain whether or not the drum control is in proper relation to the condenser plates. When the drum control is set for minimum frequency the rotor plates of the condenser should be entirely inside the stator ones.

(6) OUTER EDGE OF DRUM CONTROL SCRAPING AGAINST ESCUTCHEON PLATE OF PANEL

The adjustment of control drums in this condition is attended by noisy reproduction in the loudspeaker, and may be due to either or both of the following causes:

(a) Warped drum control. Check by placing a straight edge on the outer flat

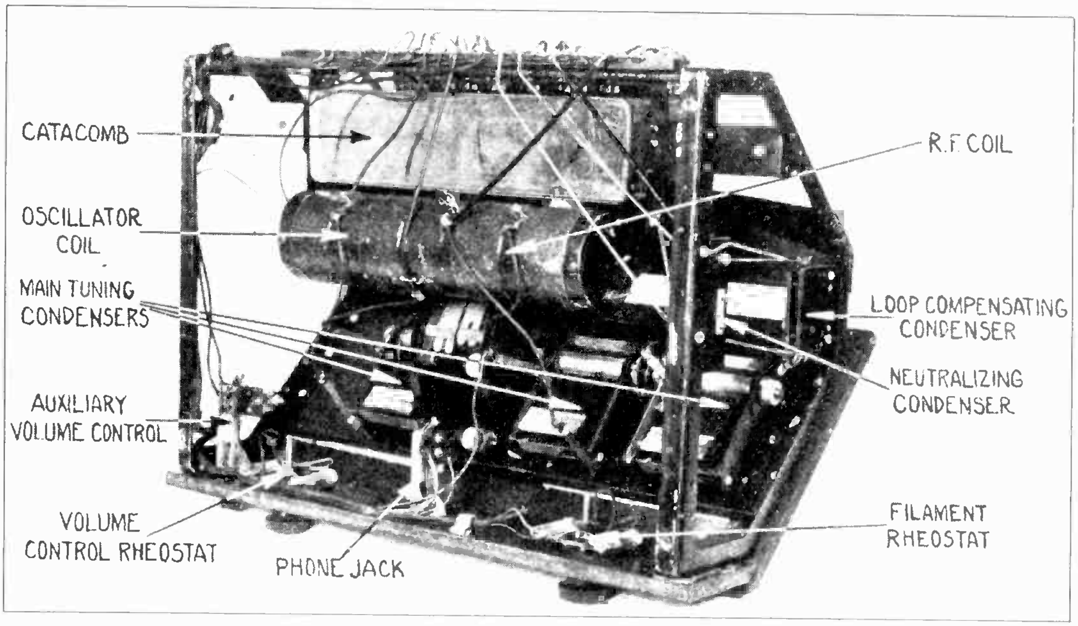


Figure 3—Rear view of panel assembly

surface of the knurled drum control and note any irregularity of movement by slowly rotating the drum. If the drum control is badly warped it will be necessary to replace it.

(b) Condenser improperly aligned. To correct this condition remove front panel as described in Part I, Sec. 4 and adjust the mounting screws of the condenser. The two mounting screws that hold the back end plate of the condenser pass through elongated holes in the metal frame, thus allowing a degree of play sufficient for adjustment purposes.

(7) NOISY RECEPTION CAUSED BY SCRAPING DIALS

Occasionally noisy reception is encountered which cannot be traced to electrical causes. A close inspection of the dials will show the cause of this trouble.

The tuning drums may be thrown out of alignment, causing the metal dials to scrape against each other. This scraping, while not in any way connected with the electrical circuits, affects the characteristics of the circuits and results in distorted sound reproduction from the loudspeaker The remedy consists of adjusting the drum set screws to provide the necessary clearance so that scraping will not take place. If adjusting these hex nuts or set screws does not provide the necessary clearance, the points touching should be filed until the metal dials clear each other. Care should be taken when filing to prevent scratching the dials.

(8) OPEN LOOP

In the Radiola 32, the loop may be entirely disconnected from the set and nearby local stations heard when both the left and right-hand drum controls are in their normal position for a given local station. In this case, the windings of the tuned radio frequency circuit act as a small loop, furnishing the necessary pick-up.

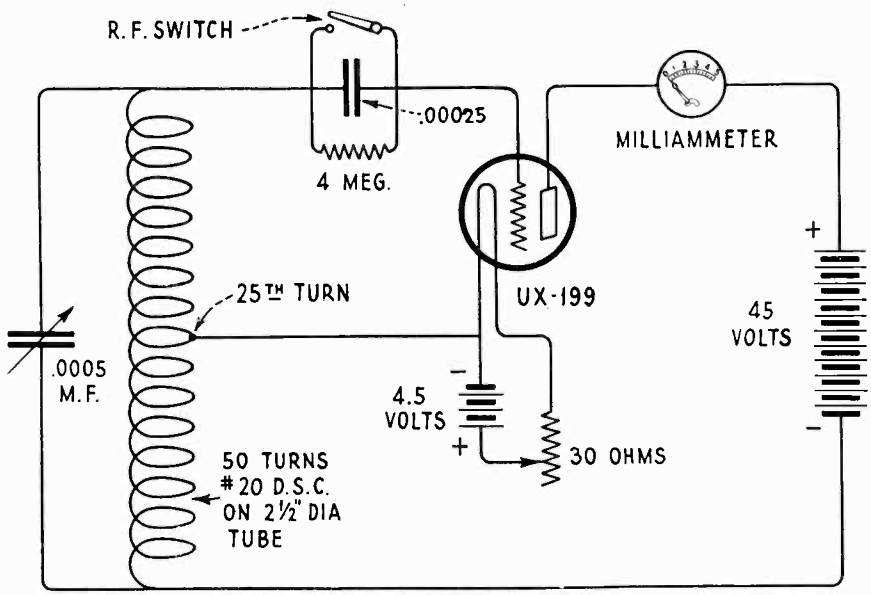


Figure 4—Schematic circuit diagram of the radio frequency and audio frequency oscillator

It will be somewhat difficult, therefore, to tell whether or not the loop circuit is open without testing it for continuity. In general, if the center terminal of the loop were open, very little effect on local stations would be noted. If either leg of the loop were open, signal strength from local stations would be considerably reduced. It is doubtful whether distant stations would be heard at all.

The complete loop circuit may be tested for continuity with a battery in series with a lamp, voltmeter or headphone. Place one battery lead on terminal No. 9 counting left to right on the catacomb terminal strip, and the other first on terminal No. 6 and then on No. 8. Terminal No. 9 goes to the center tap of the loop and terminals 6 and 8 go to the opposite sides of the compensating condenser directly across the loop. If test from 9 to 8 or 9 to 6 shows open, look for:

(a) Open at point where leads are connected to catacomb terminal strip.

(b) Broken loop connection.

The symptoms of a broken loop condenser pig-tail will be similar to those for an open loop. This pig-tail should therefore be carefully checked.

(9) LOOP COMPENSATING CONDENSER

The loop compensating condenser is connected in shunt to the loop circuit to compensate the loop for increased distributed capacity in the radio frequency windings. It is adjusted at the factory to properly balance the loop and should, therefore, not be tampered with unless proper facilities are available for correctly adjusting it.

The most noticeable need for readjusting the compensating condenser occurs when the Radiola seems to have lost its ability for distant reception. The necessary adjusting equipment consists of a calibrated R.F. oscillator and a non-metallic screw driver at least 8 inches long. The circuit diagram and general appearance of the oscillator

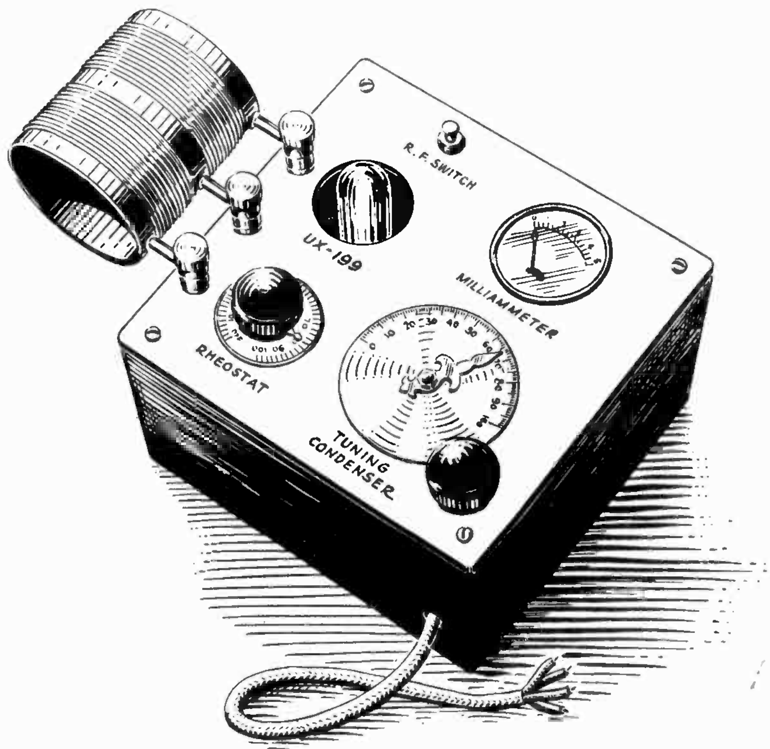


Figure 5—Complete model of R.F. and A.F. oscillator

is shown in Figures 4 and 5. The coil consists of 50 turns of No. 20 D.S.C. wire wound on a 2½-inch tube with a tap taken off at the 25th turn and connected to the negative leg of the filament. The variable condenser has a capacity of .0005. This oscillator will cover the frequency range of 550 to 1500 K.C. (200 to 546 meters) very efficiently. The grid condenser and leak will modulate the output when the oscillator is used as an A.F. oscillator. The meter is a standard 0-5 milliampere meter. A 4-megohm grid leak and .00025 grid condenser is used. A 45-volt "B" battery for plate supply and a UX-199 Radiotron will be found to have ample power output. This oscillator will be useful in servicing all types of receivers, adjusting compensating condensers on other Radiolas of this type and neutralizing Radiola 20. It will amply repay the dealer for the small outlay of material and labor required.

Having made certain that the trouble does not lie elsewhere, the following method should be employed to determine if adjustment of this condenser is necessary:

(a) Remove tubes from Radiola catacomb.

(b) Disconnect the three loop leads from terminals 6, 8 and 9 of the catacomb terminal strip.

(c) Place oscillator into operation at 1500 K.C. with the exploring coil in an inductive relation to the tuned R.F. coil of the panel assembly—Left end of long coil facing panel from the front. This can be conveniently done outside of cabinet.

(d) Now move the left tuning drum, leaving the right one in the position of the extreme low frequency end, until a dip is noted in the meter. Adjust this drum for maximum deflection.

(e) Now without disturbing the setting of the oscillator, move it to the bottom of the loop compartment in an inductive relation to the loop. Reconnect the three loop leads to the terminal strip.

(f) If the circuit is properly compensated, there will be a deflection obtained when the loop is connected with the oscillator in its new position.

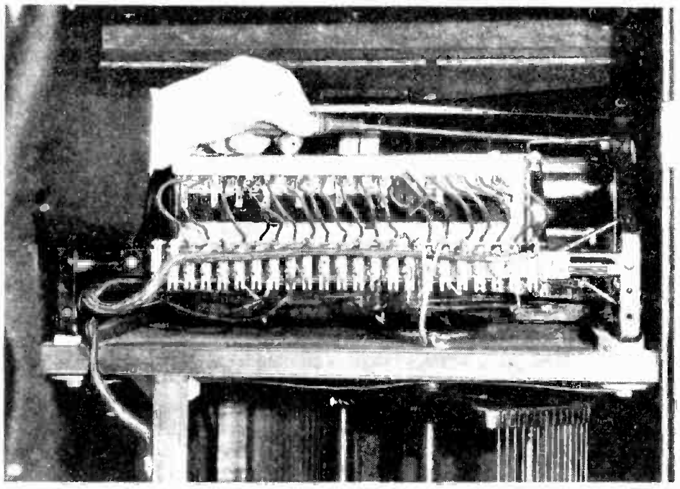


Figure 6—Adjusting the loop compensating condenser

If no deflection is obtained under these conditions, the loop compensating condenser should be adjusted until a maximum deflection is obtained with the left tuning control in the position for the maximum deflection previously obtained with the oscillator at the R.F. coil. (See Figure 6.)

Repeat operation at 550 K.C. and make readjustment if necessary. Generally when the compensating condenser is adjusted at one frequency it will be found to be correct at all other frequencies.

This method of adjusting these circuits by use of a milliammeter in the plate circuit of an R.F. oscillator is much more accurate than any method that uses an audible indication of resonant points. The reason for this is that a meter is much more sensitive to small variations of current than the human ear is to small changes of sound intensity.

(10) WEAK SIGNALS DUE TO HIGHLY SHIELDED LOCATION

There may be found an occasional location so badly shielded that an external pick-up will be necessary. Installations in steel buildings are at times troubled with this shielding effect. Should this phenomenon manifest itself, a short antenna of insulated wire not over 25 or 30 feet in length may be erected outside of the building or may be conveniently hung out of a window, although it would, of course, be better to get it away from the absorbing effect of the building, if possible. This antenna should be connected to the antenna coupling coil terminal strip at the terminal designated "A". To the other terminal designated "G", a wire should be attached and connected to a good ground. (See Figure 7.) This should preferably be a cold water pipe or radiator and should be connected by means of an approved ground clamp.

Thus installed the loop will lose its directional effect, one position giving maximum signal strength on all signals. All other tuning adjustments will remain the same as when using only the loop as a pick-up device.

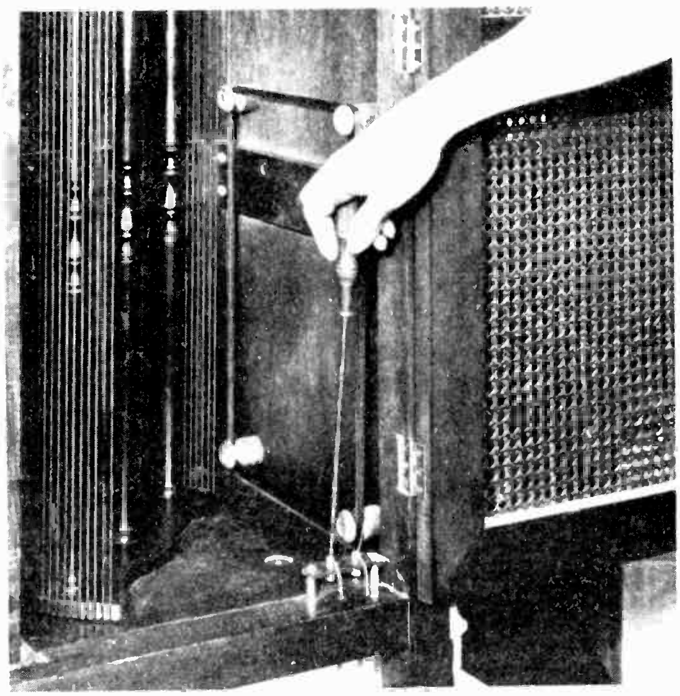


Figure 7—Connecting antenna and ground leads to the antenna coupler terminals

(11) OSCILLATION

Radiola 32 may oscillate over portions of the tuning scale or throughout its entire range. When this trouble is encountered, it may be due to one of the following causes:

(a) Defective neutralizing condenser inside of the catacomb. The remedy in this case is to replace the entire catacomb. However, before assuming this is the trouble all other possible causes should be checked.

(b) Loop neutralizing condenser connected across terminals 7 and 8 of the catacomb terminal strip out of adjustment.

A procedure for properly adjusting the loop neutralizing condenser follows. The necessary equipment is a modulated oscillator, described in Part I, Section 9, a "dummy" Radiotron (made by removing one filament prong of an otherwise O.K. Radiotron UX-199), a non-metallic screw driver and a 50-ohm compensating resistance.

1. Place the modulated oscillator into operation at 1000 K.C. about 20 feet from Radiola.

2. Tune in signal from oscillator in usual manner, adjusting all controls for loudest signal.
3. Now remove Radiotron No. 3, counting from left to right facing the front of the Radiola, and replace with the "dummy" Radiotron. Also connect the 50-ohm compensating resistance across terminals 3 and 4 of the catacomb resistance strip.
4. With the foregoing changes the oscillator signal should be very weak or not heard at all. If it is heard, even though weak, break the wax seal of the neutralizing condenser adjusting screw and alter the condenser capacity until there is a minimum signal heard in the reproducer unit. If the volume control is reduced so that the neutralizing adjustment will cause the signal to just dis-

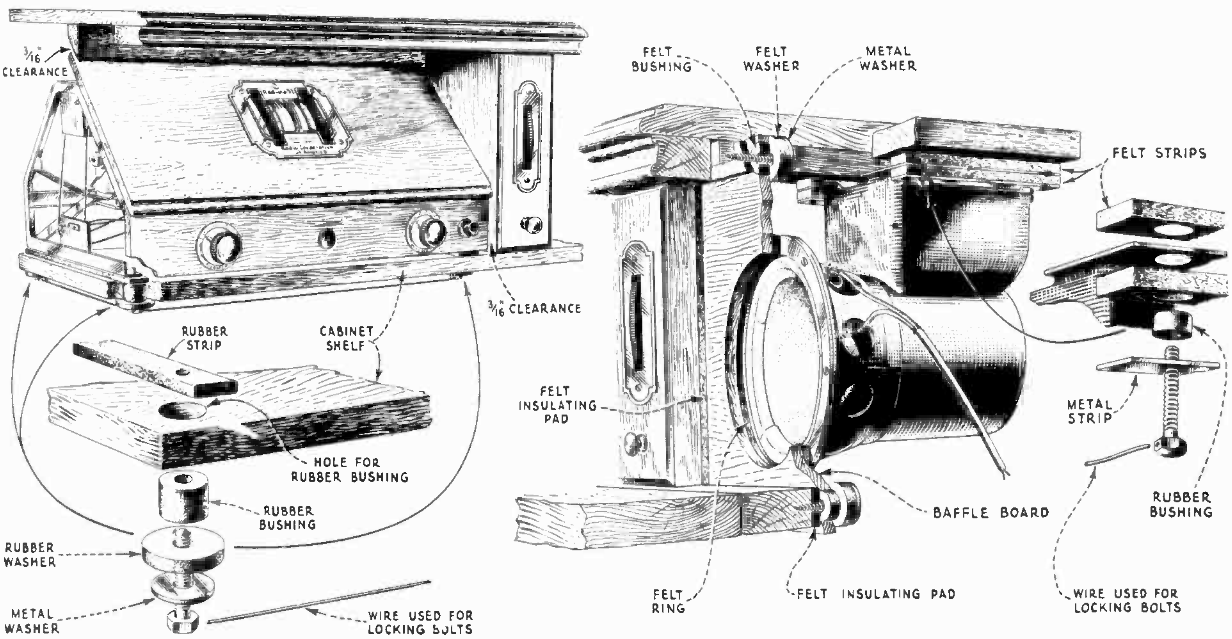


Figure 8—Panel assembly and reproducer supports with felt and rubber insulation to prevent microphonic action

appear, a proper adjustment has been found, and the adjusting screw should be again sealed with ordinary sealing compound to prevent any change.

5. The "dummy" Radiotron and the compensating resistance is now removed and the set is returned to normal operation.

(12) HOWLING

Howling may be caused either by a microphonic Radiotron in the catacomb, or by some part of the panel assembly or reproducer unit not being properly insulated from the cabinet.

In the case of a microphonic Radiotron UX-199 in the catacomb, the sound waves set its elements into vibration which in turn is reproduced in the loudspeaker. Conditions being favorable, the howl will increase in intensity. If a microphonic adapter is used with the detector tube, it should be placed so that no part of it will touch any part of the panel assembly except at the catacomb. A microphonic adapter touching the panel assembly may cause howling. After ascertaining that this is not the trouble, the Radiotrons should be interchanged, remembering that Radiotrons 1, 3 and 6 are the most sensitive to microphonic conditions.

If interchanging the Radiotrons does not remedy the howling condition, an inspection must be made of the cushion supports of the panel assembly and reproducer unit. (See Figure 8.) The panel assembly rests on rubber strips. The bolts holding this frame are provided with large rubber washers. The panel assembly resting on the rubber strips should not touch any part of the cabinet. The front panels should be carefully examined to see that they do not touch either side of the cabinet or the apron hanging from the top of the cabinet. If the panel assembly proves to be in the right position, the reproducer unit must be examined for possible microphonic action.

The reproducer unit is suspended by four bolts, these bolts having heavy felt cushions for the unit to rest upon. Also on the front, a felt ring is provided on the baffle plate. The baffle plate is also cushioned to the cabinet by means of large felt washers. The baffle plate should be examined to make sure it does not touch any of the cabinet, and the reproducer should not touch the baffle plate except at the felt ring provided for that purpose.

This series of rubber and felt cushions is what makes it possible to house the powerful 104 Loudspeaker and Radiola 28 in one cabinet and it is imperative that they function properly, otherwise the result will be very bad microphonic trouble. When looking for trouble of this nature the service man should carefully check the foregoing points.

(13) LOOP ASSEMBLY

The loop of Radiola 32 is driven from a control dial on the front of the Radiola by means of a cable and drum arrangement. This cable may become slack after considerable use, or replacement may be required.

A turnbuckle is provided to take up any slack that may develop in this cable from time to time. This turnbuckle is very accessible, being located beneath the panel assembly in the loop compartment. It is merely necessary to open the rear doors in order to make an adjustment. If the cable should be broken and require replacement, the new cable should be installed as described in Part III, Section 5.

(14) BROKEN LOOP DRIVE CABLE

Should a loop drive 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 III, Section 5. If a new cable is not immediately available a temporary repair may be made provided the break is not in the section that passes over the cable guide, or threads through the control and drive 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 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 all the strands of the cable to adhere to the solder. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows any excess solder to drip away. After the splice is finished the cable should be returned to its proper position and the slack taken up by means of the turnbuckle. Do not tighten the cable more than necessary to take up any slack, for otherwise it may break again.

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.

(15) CATACOMB AND PANEL CONTINUITY TEST

In making catacomb and panel continuity tests both filament control and volume rheostats are adjusted so that half the resistance is in the circuit; the loop connections are removed and the power supply cable is disconnected from the terminal strip at the rear of the catacomb.

A pair of headphones with at least 4½ volts in series or a voltmeter with voltage sufficient to give full scale deflection when connected directly across the battery terminals are used in making the tests. This arrangement will be found to be very sensitive in checking voltage drop in various circuits.

The contacts of the test equipment are placed across the terminals on the catacomb terminal board indicated in the test table below under the column marked "Terminal," and the results should be as indicated under the column marked "Correct Effect." If the results are negative the cause of such negative effect will be found in the last column under the heading "Incorrect Effect Caused By." The first column indicates the circuit under test.

The designations "P" and "G" refer to plate and grid contacts of the socket indicated by the number following. For example, G2 would indicate the grid contact of the second socket; P7 would indicate the plate contact of the seventh tube socket. The coil numbers referred to in the right-hand column will be found in Figure 9.

If the catacomb fails to pass any of the above tests it should be removed from the panel and replaced by a new one. Under no circumstances should the lead seals on the cover plate be broken. No marks of any kind should be made on the catacomb. To indicate the defect in the catacomb for future reference, attach a tag to the catacomb and note thereon the observed defect.

The following tests will show complete continuity for both external and internal connections of the catacomb:

CATACOMB TESTS (Coils and Connections)
The Radiotrons, Power Supply Cable and Loop Connections Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
2 to G 1	Closed	Open connection
6 to G 3	Closed	Open connection
7 to P 3	Closed	Open connection
9 to G 2	Closed	Open ½ coil No. 2 or resistance strip
9 to G 4	Closed	Open coil No. 4 or resistance strip
10 to P 1	Closed	Open coil No. 1
10 to P 6	Closed	Open coil No. 7
11 to P 2	Closed	Open coil No. 3
11 to P 4	Closed	Open coil No. 5
11 to Terminal No. 17	Closed	Open coil No. 9
12 to G 5	Closed	Open connection
13 to P 5	Closed	Open connection
16 to P 7	Closed	Open connection
22 to G 7	Closed	Open coil No. 8

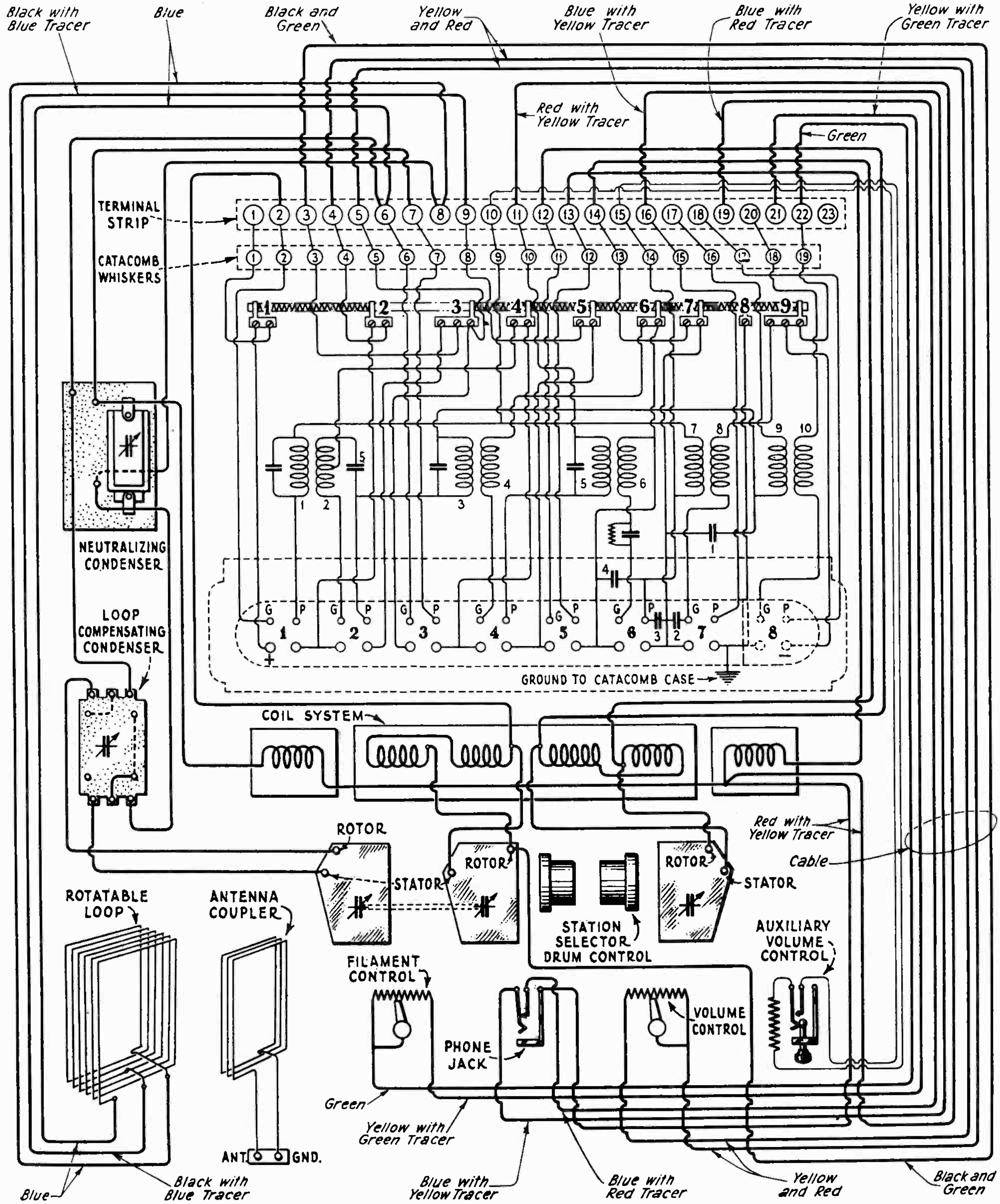


Figure 9—Panel and loop assembly continuity wiring diagram

PANEL TESTS

With Radiotrons, Power Supply Cable, Resistance Strip Removed and Loop Disconnected

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
3 to 2	Closed	Open R.F. coil
5 to 4	Closed	Open volume control
11 to 7	Closed	Open R.F. coil
13 to 11	Closed	Open oscillator coil
14 to 12	Closed	Open oscillator coil
16 to 11 (With shorted telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
19 to 16 (With no telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
22 to 21	Closed	Open filament control

PANEL TESTS (Condensers)

Loop Disconnected

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
8 to 6	Open	Shorted loop or compensating condenser
8 to 7	Open	Shorted neutralizing condenser

(16) RESISTANCE STRIP TESTS

The resistances of the strip mounted directly behind the catacomb can best be checked by a Resistance Bridge. If this is not available the voltmeter-ammeter method can be applied. A milliammeter with a scale of 0-500 should be used and a voltage applied that will give a substantial reading. A circuit diagram of this method is shown in Figure 10.

The resistance may then be calculated by the use of Ohm's law.

$$R = \frac{E}{I}$$ (where R equals ohms, E equals volts and I equals amperes)

$$\text{or ohms} = 1000 \frac{\text{Volts}}{\text{Milliamperes}}$$

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.

The allowable values in ohms for the different sections of the resistance strip in Radiola 32 are tabulated below:

Terminals	*Lower Limit*	*Normal*	*Upper Limit*
1-2	260	271	282
2-3	Open	Open	Open
3-4	230	236.5	243
4-5	191	197	203
5-6	176	183.5	191
6-7	146	154.5	163
7-8	137	145.5	154
8-9	45	50	55

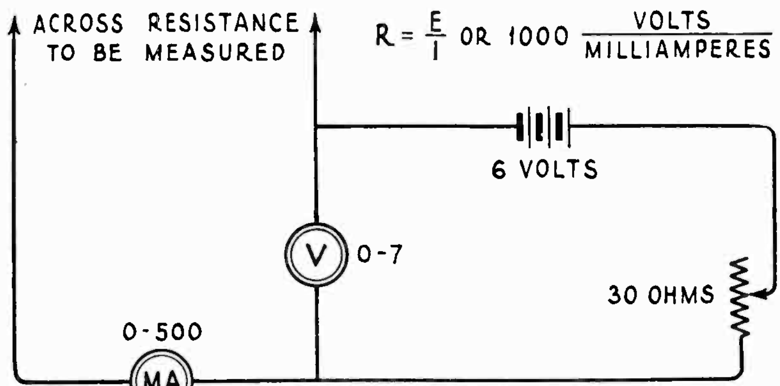


Figure 10—*Schematic circuit diagram for resistance measurement*

(17) VOLTAGE READINGS

The following are the voltages obtained at the catacomb terminal strip, when tests are taken across the terminals indicated in the table. A high resistance voltmeter of at least 600 ohms resistance per volt should be used. The allowable variation plus or minus is approximately 5 volts.

VOLTAGE READINGS OF RADIOLA 32

Taken at Catacomb Terminal Strip—Count Terminals from Left to Right When Facing Front of Radiola 32

Terminals	*Correct Effect*
1 to 21	Should measure 31 volts normally with all Radiotrons lit and battery setting near "Off." Positive terminal of voltmeter on No. 1.
1 to 10	Should measure 21.5 volts normally. Positive terminal of voltmeter on No. 10.
10 to 11	Should measure 41 volts normally. Positive terminal of voltmeter on No. 11.

PART II—R.P.A. ASSEMBLY AND REPRODUCER UNIT

The R.P.A. Unit used in Radiola 32 (See Figure 11) is known by the designation AP-832-A. Service work in conjunction with it will be along the same lines as those followed in the case of Radiola 30 R.P.A. unit and RCA Loudspeaker 104. This unit is of particularly good design and will require very little service work.

The reproducer unit in Radiola 32 is the standard RCA Loudspeaker Model 104 Pot Magnet and cone assembly. This reproducer provides the utmost in quality of reproduction, together with any desired volume without distortion.

The unit makes use of one Radiotron UV-886, two Radiotrons UX-281 and one Radiotron UX-210. Radiotron UV-886, known as the "Ballast tube," is connected in the primary circuit of the power transformer. The resistance of the filament of Radiotron UV-886 rises and falls rapidly with an increase or decrease of current flowing through it, thus maintaining a substantially constant input current. Radiotron UV-886 when used in Radiola 32 is to be used when the house lighting current is 60 cycles only. A ventilating stack is provided to enclose this Radiotron, and the R.P.A. unit should not be operated unless it is in place.

It should be understood that the electrical protective devices on Radiola 32 are adjusted at the factory. If for any reason a service man finds it necessary to remove them to adjust or replace a defective part, great care should be taken to see that they are returned to proper operation. Dealers should caution their customers not to attempt to render these protective devices inoperative or to experiment with the apparatus inside the metal cabinet or R.P.A. Unit.

(1) FILAMENT ACTION OF R.P.A. RADIOTRONS

Should Radiola 32 suddenly cease to operate satisfactorily, open the rear door and note whether or not the tubes in the R.P.A. unit are lit. Replace any of the Radiotrons whose filaments are not burning. If Radiotron UV-886 is apparently operating correctly (indicated by considerable heat dissipation), and the other tubes do not glow, the trouble may be due to an open in the filament windings of the power transformer or defective filament connections.

Should all Radiotrons fail to light or operate as indicated in the preceding paragraph, look for:

(a) House lighting current not on or loose connection at outlet.

(b) Operating switch not functioning properly.

(c) Blown fuse in house lighting circuit.

(d) Loose protective plug.

(e) Input plug not making proper contact.

(f) Burned-out filament of Ballast tube.

(g) Poor contact in Ballast tube socket.

(h) House lighting current not A.C. (Manifested by the filament of the Ballast tube lighting a bright red.)

If the Ballast tube glows excessively and the other Radiotrons light below normal brilliancy the trouble may be due to an open in one filament of Radiotron UV-886. (This Radiotron has two parallel filaments.)

(2) IF RADIOTRONS IN R.P.A. UNIT FUNCTION PROPERLY, BUT RADIOTRONS UX-199 IN CATACOMB DO NOT LIGHT

Look for:

(a) Shortened 20 Mfd. condenser in A.C. package.
(b) Open connections at A.C. package.
(c) Defective catacomb. (Run continuity test.)
(d) Defective connections at R.P.A. terminal board.
(e) Defective resistance strip on catacomb.

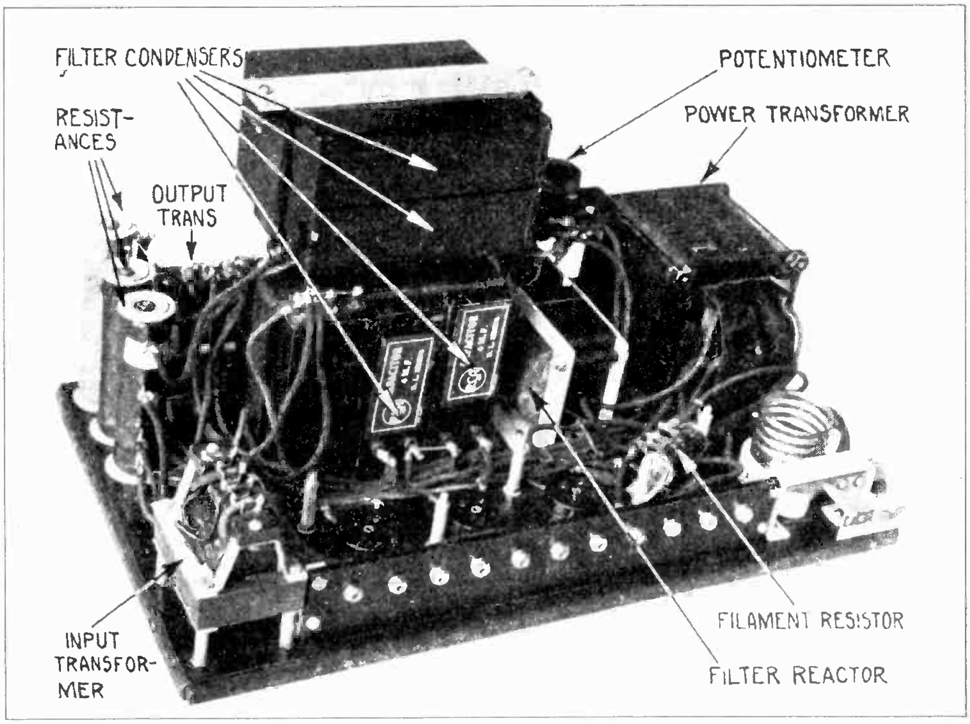


Figure 11—R.P.A. unit showing location of filter condensers, resistances, potentiometer, power transformer, input transformer, filament resistor and filter reactor

(3) NO SIGNAL WHEN RADIOTRONS ARE APPARENTLY O.K.

After the receiver has been checked according to previous continuities, and all Radiotrons and Rectrons appear to be functioning correctly, if no signal is heard, look for:

(a) Loose cone coil connections.
(b) Open in cone coil winding.
(c) Filament to grid short in Radiotron UX-210.
(d) Filament to plate short in Radiotrons UX-281.
(e) Dirty contacts in socket of Radiotron UX-210.

(4) IF VOLUME DROPS AFTER RADIOLA HAS BEEN IN OPERATION FOR SEVERAL MINUTES

This condition is usually caused by a defective Radiotron UV-886. Such a Radiotron after having been in use for considerable time may develop a tendency to increase its resistance sufficiently, when heated, to cause a drop in signal strength of Radiola 32 greater than the normal drop due to the tube heating. The Radiotron will not show any other indication of being unsatisfactory. Substituting another UV-886 or stopping the Radiola long enough for the Radiotron to cool and then starting it will be the only way of locating this trouble. When making this test an increase of signal strength will be noted when the Radiotron is cool, gradually falling off as the tube warms up.

If a drop of volume is obtained with the signal becoming distorted, the trouble is a defective Radiotron UX-210. The remedy is to replace the tube.

(5) EXCESSIVE HUM

Excessive hum may be due to any of the following causes:

(a) A. C. input plug reversed. (Change position of plug).

(b) Defective 2 Mfd. condenser (Located next to 4 Mfd. condensers).

(c) Loose laminations in power transformer or filter choke. Tighten all clamping screws in R.P.A. unit.

(d) Potentiometer not properly adjusted. Adjust potentiometer on top of R.P.A. unit for position of minimum hum.

(e) Power line interference. This can be checked by disconnecting loop from terminal strip and noticing if hum disappears.

(6) DISTORTION AFTER LOUDSPEAKER HAS BEEN CHECKED

Distortion may originate in a leaky 2 Mfd. condenser (located next to 4 Mfd. filter condenser), or it may be due to a low emission Radiotron UX-210. The 2 Mfd. condenser may be checked by temporarily disconnecting it from the circuit while operating the Radiola and noting if distortion ceases.

A low emission Radiotron UX-210 may cause a "burr" or "fringe" on each musical note accompanied by unnatural and rough speech. This Radiotron may usually be reactivated by operating the R.P.A. unit for a period of ten minutes with the two Radiotrons UX-281 removed. If this process fails it will be necessary to use a new Radiotron UX-210.

(7) IF PLATES OF RADIOTRONS UX-210 AND UX-281 HEAT EXCESSIVELY

If plate of Radiotron UX-210 is dull red—check the following:

(a) Shorted 2 Mfd. condenser. (Located next to resistance units.)

If plate of Radiotron UX-210 is white hot. Check the following:

(a) Open resistance R-1.

If plates of Radiotrons UX-281 are dull red—check the following:

(a) Shorted 4 Mfd. filter condenser. (Either of the two top condensers or the one located next to 2 Mfd. condenser.)

If plates of Radiotrons UX-281 are white hot—check the following:

(a) Shorted 4 Mfd. filter condenser. (Located next to filter reactor.)

Should one Radiotron UX-281 become a dull red while the other is apparently normal, replace the Radiotron UX-281 that is apparently normal. The apparently normal Radiotron UX-281 is defective, causing the other to heat from overload.

(8) DISTORTION IN REPRODUCER UNIT

Distortion in the Reproducer unit may be caused by any of the following:

(a) Poor input from Receiver. Examine output of receiver at input connections of R.P.A. unit.

(b) Leads from movable coil broken away from sides of cone. (Make these fast with a little shellac.)

(c) Shorting of movable coil to pole piece of pot magnet.

(d) Mis-alignment of reproducer cone.

In the case of "c" and "d" the remedy is to re-align or center the cone properly. When centered properly the cone coil is free to move in the air gap of the pot magnet without touching either side of the pole piece. The proper procedure for making this adjustment is as follows:

(a) Remove grille from front of reproducer unit.

(b) Loosen screw centering cone to pole piece.

(c) Insert three small strips of cardboard about 1/4" x 1 1/2" and the thickness of a visiting card, in the space between the inside of the cone coil and the pole piece of the pot magnet. These pieces of card should be placed in the center of the small slots in the webbing of the centerpiece of the cone. They just hold the cone so that it is evenly spaced on all sides. Figure 14 illustrates this operation in adjusting the cone.

(d) Now tighten screw in center of pole piece and then remove the strips of card.

The cone is now properly centered, and if any further distortion is experienced it is due to other causes.

(9) FILTER CONDENSER TESTS

The filter condensers in Radiola 32 are best tested by means of a high D.C. voltage used to charge these condensers and then noting their ability to hold the charge. As a high D.C. voltage is rarely obtainable either in the dealer's shop or the customer's home it will be necessary to use the high voltage source incorporated in the R.P.A. unit.

The following procedure should be used to test these condensers:

(a) Take out the R.P.A. assembly from cabinet and remove the metal cover. Replace R.P.A. assembly in cabinet without cover and connect input plug to unit. Remove all other connecting cables. Short terminals No. 10 and No. 11 which go to the reproducer unit and remove Radiotron UX-210. Have operating switch "Off."

(b) With a hot soldering iron release the leads connecting the 2 Mfd. condenser at the extreme left, looking at the R.P.A. unit from the rear of the Radiola, and the double filter reactor. This connection is at the terminal nearest the front of Radiola 32.

(c) Standing so as not to be in contact with any part of the R.P.A. unit throw the operating switch to the "On" position for about 30 seconds and then turn it "Off." Then using a well insulated screw driver or one having a wooden handle bring the lead released back to its original position. At the point of contact there will be a large flash. *When doing this do not come in contact with either of these leads as a severe shock may result.* The flash obtained will be an indication that all the filter condensers are in good operating condition, because any defective condenser would immediately discharge all the others and no spark could be obtained.

(d) If no spark is obtained each condenser should be released from the circuit by unsoldering one of its leads one at a time and the test applied to those remaining. When the defective condenser is released a good discharge will be obtained from the remaining condensers.

This test subjects these condensers to a voltage in excess of the maximum operating voltage normally received. When subjected to this test a defective condenser that might pass a click or low voltage test will immediately be identified.

(10) NO "B" VOLTAGE

A no-voltage reading obtained at the 45 or 90-volt terminals will indicate one of the following defects:

(a) Shorted 2 Mfd. condenser—located next to resistance units.
(b) Defective Radiotron UX-281.
(c) Open or shorted "B" voltage connections.

(11) COMPLETE R.P.A. CONTINUITY TESTS

The tabulated continuity tests given in the text cover all circuits of the Radiola 32 R.P.A. unit. Before running these tests remove all connections from the terminal board at the rear of the R.P.A. unit, also the Radiotrons. The reference letters and numbers used in the table will be found in Figure 12.

The testing equipment consists of a high resistance voltmeter with battery voltage sufficient to give approximately full scale deflection when connected directly across battery terminals—for example, a 45-volt "B" battery connected in series with a voltmeter having a 0-50 volt scale. The contact points of the testing equipment should not touch any metallic part of the unit except the terminals specified. *Discharge the 4 Mfd. filter condensers by short-circuiting their terminals with a screwdriver before starting test.*

R.P.A. CONTINUITY TEST

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
1 to 2	Closed	Open primary of input transformer
3 to 4	Closed	Open secondary of output transformer
4 to 7	Closed	Open connection
4 to 8	Closed	Open connection or resistor unit R-1
4 to 9	Closed	Open connection or resistor unit R-1
5 to ground	Closed	Open connection
5 to 10	Closed	Open connection
11 to P2 or P3	Closed	Open connection or high voltage winding of power transformer
G1 to top of R3 (Remove cover)	Closed	Open primary of output transformer
Across filament contacts of socket No. 1	Closed	Open UX-210 filament winding or resistance
Across filament contacts of socket 2 or 3	Closed	Open UX-281 filament winding or resistance
+ or —F3 to terminal No. 9	Closed	Open connection, filter reactor or resistor unit R-2 or R-3
P2 to P3	Closed	Open high voltage winding of power transformer
Center of socket 4 to one side of input plug (determined by experiment)	Closed	Open primary power transformer
Ground to center of socket 4	Open	Shorted 2 Mfd. condenser—located next to 4 Mfd. condenser

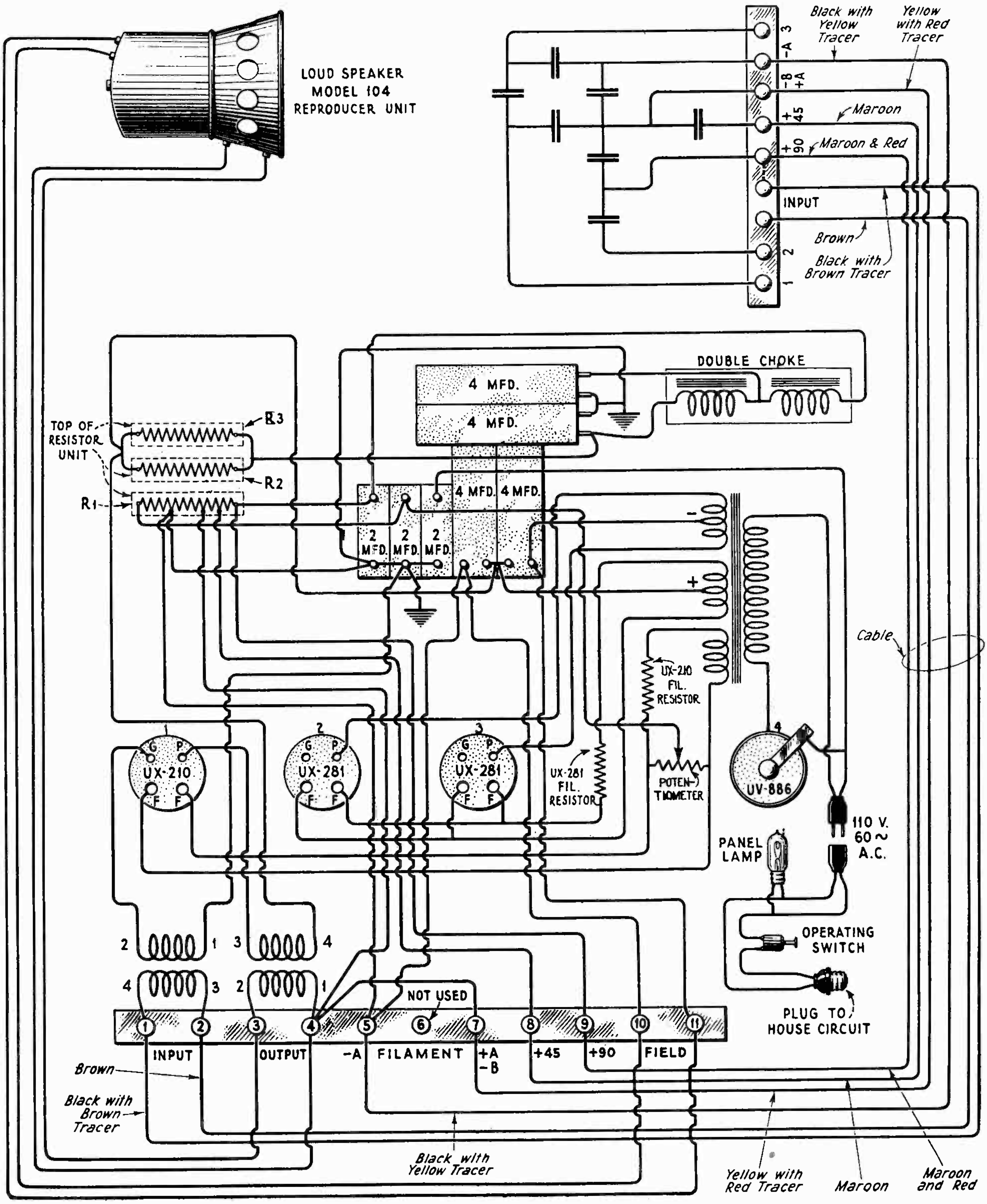


Figure 12—Rectifier power amplifier and reproducer unit continuity wiring diagram

PART III—MAKING REPLACEMENTS

(1) REPLACING DEFECTIVE PARTS IN PANEL ASSEMBLY

The panel assembly of Radiola 32 is held in place by means of four bolts, these bolts being locked by a wire connecting all the bolts together. A step by step procedure for removing the panel assembly is as follows:

(a) Place Radiola 32 in position so that both rear doors can be opened wide.

(b) Remove loop connections and power cable terminal strip from rear terminal strip of panel assembly.

(c) Cut and remove the wire connecting the heads of the four bolts holding the panel assembly to the cabinet.

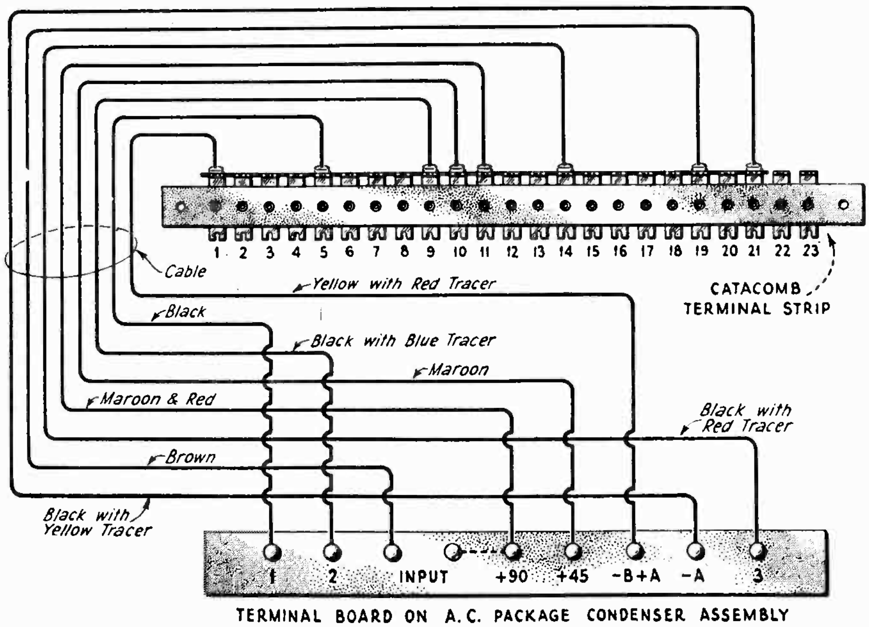


Figure 13—Panel and R.P.A. connecting cable with color scheme

(d) Remove four bolts holding panel assembly to cabinet. When removing these bolts the rubber washers should be taken off with each bolt.

(e) The panel assembly may now be lifted clear of its compartment and removed to a place convenient for repair or replacing.

Any defective unit may be readily replaced, wiring of all units being very accessible. When removing a unit it is good practice to first tag all wires disconnected so that when the unit is replaced the wires may be easily connected to their original terminals. The color scheme of the panel assembly may be referred to in Figure 9.

After the repair or replacement is completed the panel assembly should be returned to the cabinet in the reverse of the foregoing order. A piece of bare copper or brass wire about No. 18 B.&S. should be used to lock the bolts so that the vibration of the loudspeaker will not cause them to loosen. Special care should be taken to see that the rubber supports and rubber washers are returned to their original location. The panel should also clear the front apron and each side of the cabinet. This is very important for unless the entire panel assembly is free from contact with the cabinet and resting upon its rubber supports, serious microphonic trouble will result.

(2) REPLACING DEFECTIVE PARTS IN R.P.A. ASSEMBLY

In order to make any replacements in the R.P.A. unit it will be necessary to remove the unit from the cabinet and then remove its metal cover. A step by step procedure is as follows:

(a) Place Radiola 32 in a position so that both rear doors can be opened wide.

(b) Cut and remove the wire connecting the heads of the four bolts holding the R.P.A. assembly to the cabinet.

(c) Remove the four bolts holding R.P.A. assembly to cabinet.

(d) Disconnect input plug and close sliding safety door. Now open cover of terminal strip and remove all connections to the terminals.

(e) The R.P.A. unit may now be lifted clear of the cabinet.

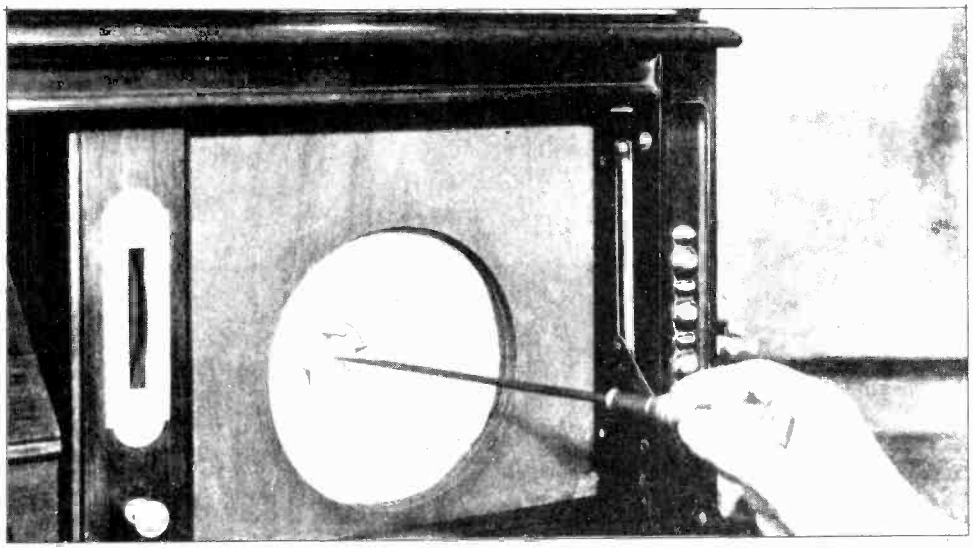


Figure 14—Method of adjusting the cone. Note the three pieces of cardboard used in centering the cone

(f) At each end of the R.P.A. unit is located a seal. Each of these seals may be released with a screw driver. The small screws around the lower edge of the cover should then be removed.

(g) Now remove the small pin protruding at the safety door.

(h) The cover may now be removed allowing access to any part.

When the repair or replacement is effected the cover should be replaced and substitute seals placed in the position occupied by those broken. These seals will enable the dealer at a future date to tell whether service work is caused by ordinary wear and tear or by tampering.

The entire assembly may now be returned to the cabinet, the cables replaced and the bolts locked in position with wire in the reverse order of that used to remove it.

(3) REPLACING LOUDSPEAKER CONE

The cone assembly of Radiola 32 is a standard RCA 104 pot magnet and cone assembly suspended by means of a special felt cushion arrangement. In order to replace a cone the entire assembly must be removed from the cabinet. A step by step procedure is as follows:

(a) Place cabinet in position so that left door (facing Radiola 32 from the rear) may be opened.

(b) Cut and remove the wire locking the four bolts that hold the pot magnet to the cabinet.

(c) Release the field and output wires from the terminal strip of the R.P.A. unit and also from the sides to provide clearance when the pot magnet is removed.

(d) Holding the pot magnet in one hand, release the four bolts that hold it. Be careful not to drop the pot magnet as it is very heavy and would damage the R.P.A. unit should it fall. The felt strips should be removed and the pot magnet placed in a position convenient for removing the cone.

(e) Release the two leads connecting the cone coil to the terminals.

(f) Remove the six screws on the ring holding the cone and the screw centering the cone to pole piece. Remove ring and slip cone clear of pot magnet.

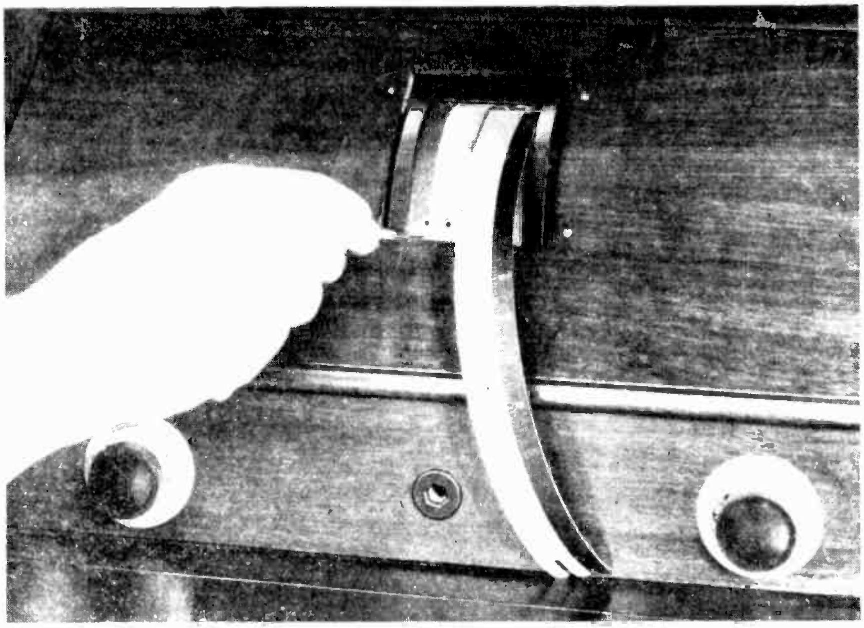


Figure 15—The correct method of replacing dial scales

(g) Place the new cone in the position occupied by the old cone. Replace the cone ring and the six screws that hold it, but do not draw them up tight. Put centering screw in place, but do not tighten it.

(h) Now insert three small strips of cardboard about 1½″ x ¼″ and the thickness of a visiting card—through the center web of the cone into the space between the pole piece and cone. This will cause the cone coil to have the same clearance on all sides of the pole piece. Figure 14 shows this operation, but with the pot magnet in its position in the cabinet. Refer to Part II Section 3.

(i) Tighten center screw of cone and then the six small screws holding the cone ring in position. Remove the three pieces of card.

(j) Connect the two cone coil leads to their binding posts.

(k) The pot magnet may now be replaced in the cabinet in the reverse of the procedure used to remove it. Special care should be taken to see that the assembly is suspended by the felt strips provided for that purpose. The entire reproducer unit should be insulated from the baffle board and from the cabinet by the felt ring and strips.

(4) REPLACING DIAL SCALES

The dial scales on Radiola 32 are of the renewable type, permitting the replacement of clean scales for soiled ones when desirable. This operation is very simple. A step by step procedure is as follows. (See Figure 15.)

(a) Open front drop and remove escutcheon plate from control drums.

(b) Turn drums to either extreme and loosen the four screws that hold the scales. The ends of the scales may now be pulled clear.

(c) Now turn tuning drums to other extreme and loosen the four screws that hold the scales in place at this end. The scales may now be completely removed.

(d) Place the new scales in the position occupied by the old ones, line up the scales and tighten the clamping plates.

(e) Replace the escutcheon plate.

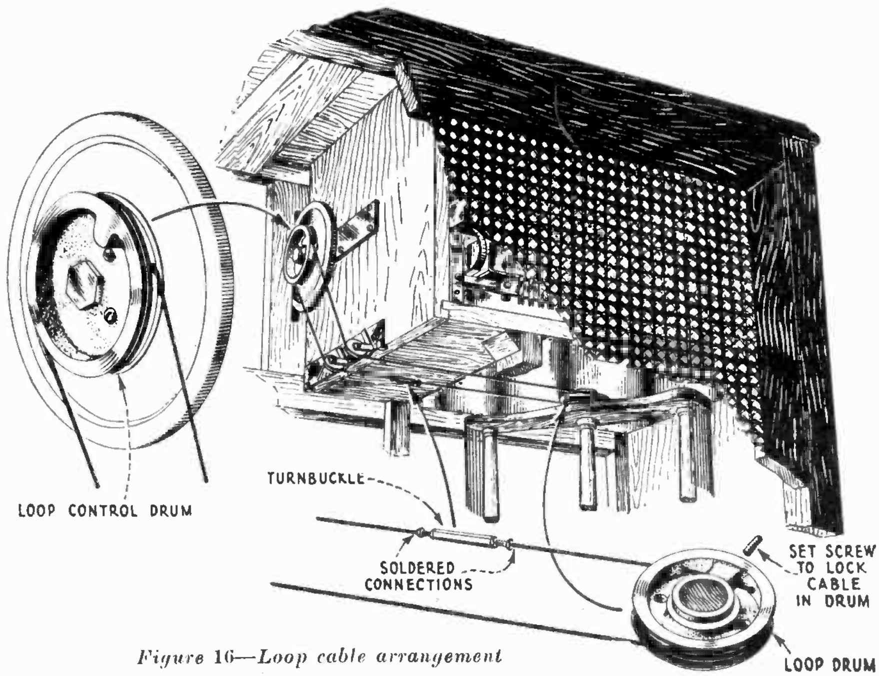


Figure 16—Loop cable arrangement

(5) REPLACING THE LOOP DRIVE CABLE

The rotation of the loop in Radiola 32 is controlled from a drum protruding on the front of the cabinet. The motion of the control drum is transmitted to the loop by means of a stranded drive cable. This cable gives a positive control with no lost motion. After considerable use or abuse it may become broken or for other reasons require replacement. The following procedure should be followed when this is necessary.

(a) Open rear doors of cabinet and release old cable from control drum on panel and drive drum at top of loop.

(b) As replacement cables are stocked complete with turnbuckles, it will be necessary to first remove one end of the cable from the turnbuckle so that the cable may be threaded through the holes on the drums. The position for placing the new cable is shown in Figure 16 which must be followed closely. Special attention should be given the position of the turnbuckle to clear the drums and guides.

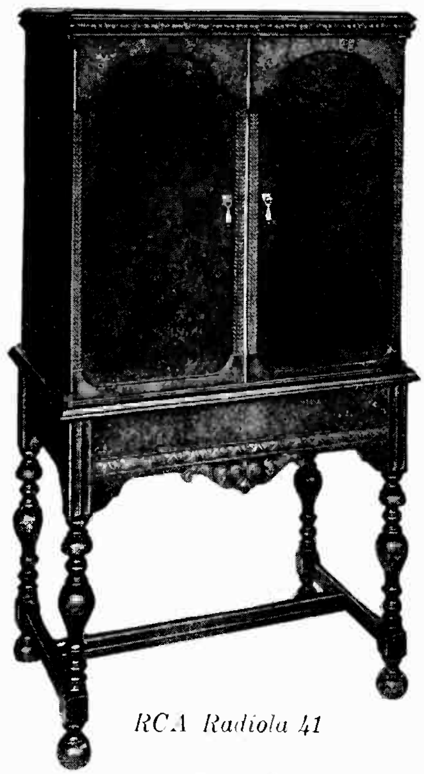
(c) After placing the cable in position, the turnbuckle end is soldered to the cable end and then threaded into the turnbuckle. The turnbuckle should be adjusted to take up all slack in the cable, but not tight enough to cause friction at the control drum.

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. If imperfect operation is not due to defective tubes the "Service Data Chart" should be consulted for further detailed causes.

Indication	*Cause*	*Remedy*	See Service Notes *Part I*	See Service Notes *Part II*
No signals	House current not "On"	Turn house current "On"	—	Sec. 1
	Defective operating switch	Repair or replace operating switch	—	—
	Defective input plug to R.P.A. unit	Repair or replace input plug	—	Sec. 1
	Defective panel assembly	Check by continuity and repair or replace	Sec. 15	—
	Defective R.P.A. Unit	Check by continuity and repair or replace	—	Sec. 11
	Defective A.C. Package condenser bank	Check and replace defective condenser	—	—
	Defective pot magnet or open cone coil	Check for continuity and replace	—	—
	Defective cables connecting various assemblies	Check and repair or replace defective cables	—	—
Weak Signals	Defective loop or loop connections	Repair loop or loop connections	Sec. 8	—
	Radiola in shielded locality	Use short outdoor antenna	Sec. 10	—
	Main tuning condensers out of alignment or loop compensating condenser not adjusted.	Line up main tuning condensers and adjust loop compensating condenser	Sec. 9	—
	Defective R.P.A. Assembly	Check R.P.A. continuity and repair or replace defect	Sec. 17	Sec. 11
	Defective panel assembly	Check panel continuity and repair or replace defect.	Sec. 15	—
Poor Quality	Defective catacomb	Check catacomb continuity and replace if defective	Sec. 15	—
	Defective condensers in R.P.A unit	Check and replace	—	Sec. 9
	Cone of Reproducer unit not centered properly	Center cone of Reproducer or replace cone	—	Sec. 8
	Wires loose on side of cone	Fasten wires with shellac	—	Sec. 8
Noisy or Intermittent Reception	Dirty Radiotron prongs	Clean Radiotron prongs	Sec. 3	—
	Loose filament or volume control rheostat	Tighten filament or volume control arm and clean contact point	Sec. 4	—
	Sprung socket contacts	Bend socket contacts	Sec. 2	—
	Defective or loose loop connections	Repair or tighten loop connections	Sec. 8	—
Howling	Microphonic Radiotrons UX-199	Interchange Radiotrons UX-199	Sec. 12	—
	Panel assembly not positioned properly	Position panel correctly	Sec. 12	—
	Reproducer not properly insulated from cabinet	See that reproducer is properly insulated from cabinet	Sec. 12	—
	Baffle board not properly insulated	Check baffle board insulation	Sec. 12	—
	Open resistor on auxiliary volume control	Replace resistor found defective	—	—
All Radiotrons fail to light	Operating switch not "On"	Pull operating switch "On"	—	Sec. 1
	Defective operating switch	Repair or replace	—	Sec. 1
	Defective R.P.A. unit	Check R.P.A. unit and make repair or replacement	—	Sec. 11
Radiotrons UX-199 fail to light	Defective R.P.A. unit	Check R.P.A. unit, and make repair or replacement	—	Sec. 11
	Defective cables	Check and repair or replace	—	—
	Defective A.C. package condenser bank	Test and replace defective condenser	—	—
	Defective catacomb	Test and replace	Sec. 15	—

RCA
Radiola 41
SERVICE NOTES



RCA Radiola 41

Regular Edition—25M

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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 RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

To assist in promoting this phase of the Dealer and Distributor's business the RCA Service Division 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 and Distributors' 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.

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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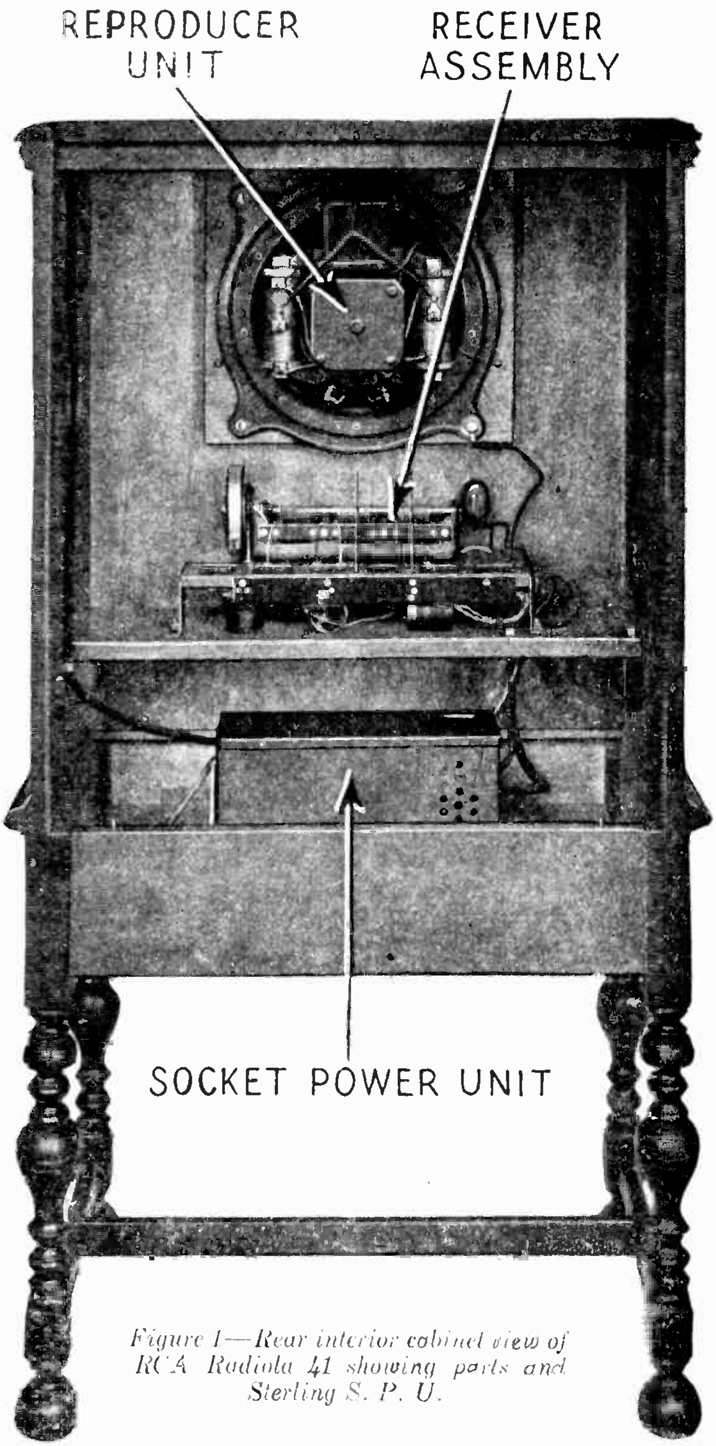

Figure 1—Rear interior cabinet view of RCA Radiola 41 showing parts and Sterling S. P. U.

RCA RADIOLA 41

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

SERVICE NOTES

Prepared by RCA Service Division

RCA Radiola 41 is a six-tube tuned radio-frequency receiver employing four Radiotrons UX-226, one Radiotron UY-227, one Radiotron UX-210 and one Radiotron rectifier UX-280 in the socket power unit. Combined with the receiver in the console cabinet is a new dynamic speaker, giving exceptional tone quality to the output from the receiver assembly

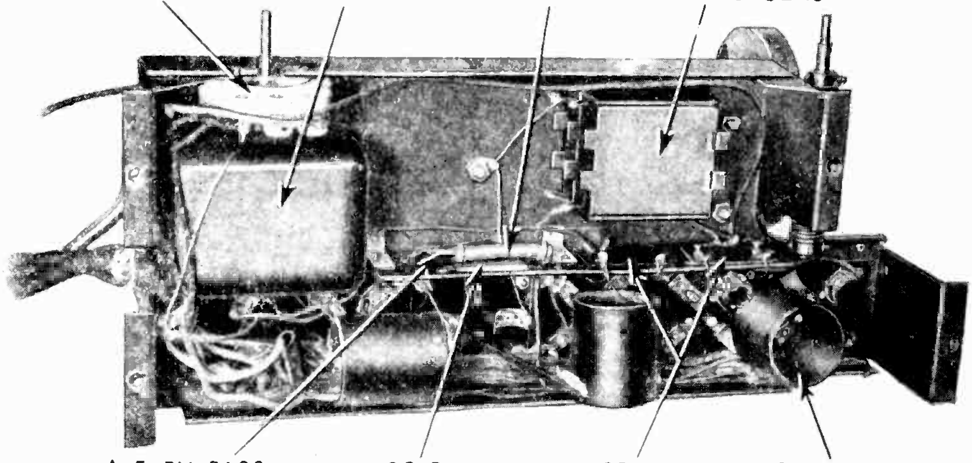

Figure 2—Sub-chassis view of receiver assembly showing parts

A disc type rectifier furnishes direct current of the proper voltage for field supply to the reproducer unit. Figure 1 is a rear interior view.

This combination of a tuned R. F. receiver (Figure 2) with a Radiotron UX-210 power amplifier and the new dynamic reproducer unit results in a radio receiver of excellent sensitivity, selectivity, volume and tone quality.

Radiola 41 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 41 is also made in models designed for 105-125 volts, 25-40 cycles A. C. operation. In this model the power transformer is different from that used in the 50-60 cycle models. All other parts are identical in both models and the Service Notes apply to each equally well.

The following design characteristics are incorporated in Radiola 41:

(a) The circuit consists of one untuned coupling stage, two tuned radio frequency stages, a tuned detector and two audio stages—the last stage using Radiotron UX-210 as a power amplifier.

(b) The volume control regulates the input grid voltage to the coupling stage. This gives a smooth control of volume without distortion.

(c) Grid resistances in the two tuned radio frequency stages effectively prevent any tendency to self oscillation in these circuits.

(d) A new type dynamic reproducer unit similar to that in Loudspeaker 106 is used.

(e) Field current for the dynamic speaker is supplied by a full wave disc rectifier, mounted directly on the reproducer unit. There is also mounted on the reproducer unit a suitable output transformer for coupling the output from Radiotron UX-210 to the low impedance cone coil on the reproducer unit. Two .1 mfd. condensers

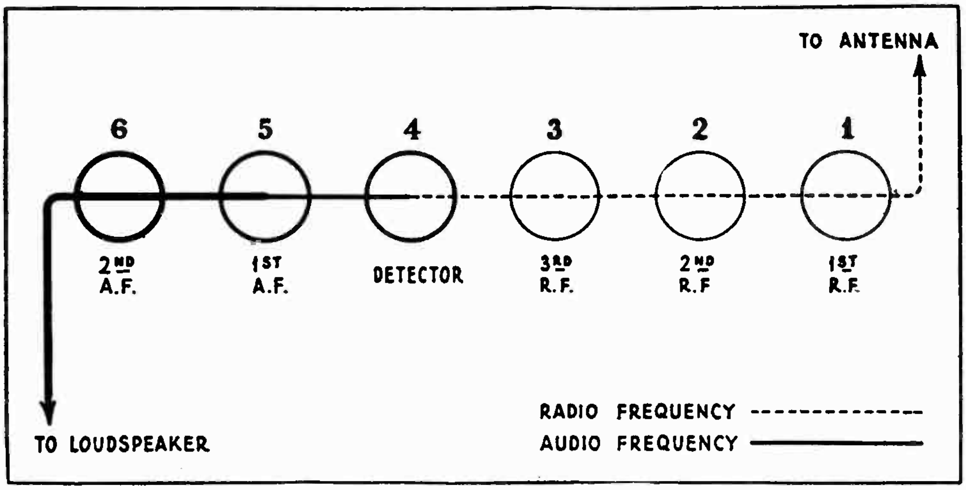

Figure 3—Radiotron sequence

connected together in series with their mid-point grounded are provided to prevent any possible R. F. current, set up in the rectifier, from affecting the receiver.

Figure 3 illustrates the electrical sequence of the Radiotrons used in the receiver assembly.

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground by the volume control.

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 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-210.

PART I—INSTALLATION

[1] ANTENNA (Outdoor Type)

Due to the sensitivity of Radiola 41 the antenna length need only be 25 to 50 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 absolutely 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.

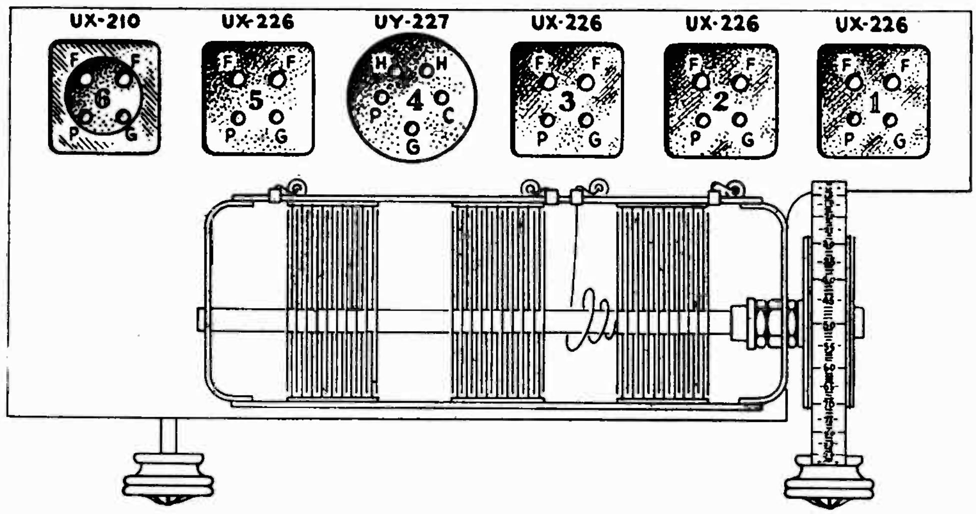

Figure 4—Radiotron socket contacts

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 to 40 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 41 will generally give entirely satisfactory reception with an indoor antenna.

[3] GROUND

A good ground is quite as important as a good antenna. Nc 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.

A spark will occur if the power supply is "on" when making the ground connection. This action is normal, being caused by the discharge of one of the .1 mfd. condensers con-

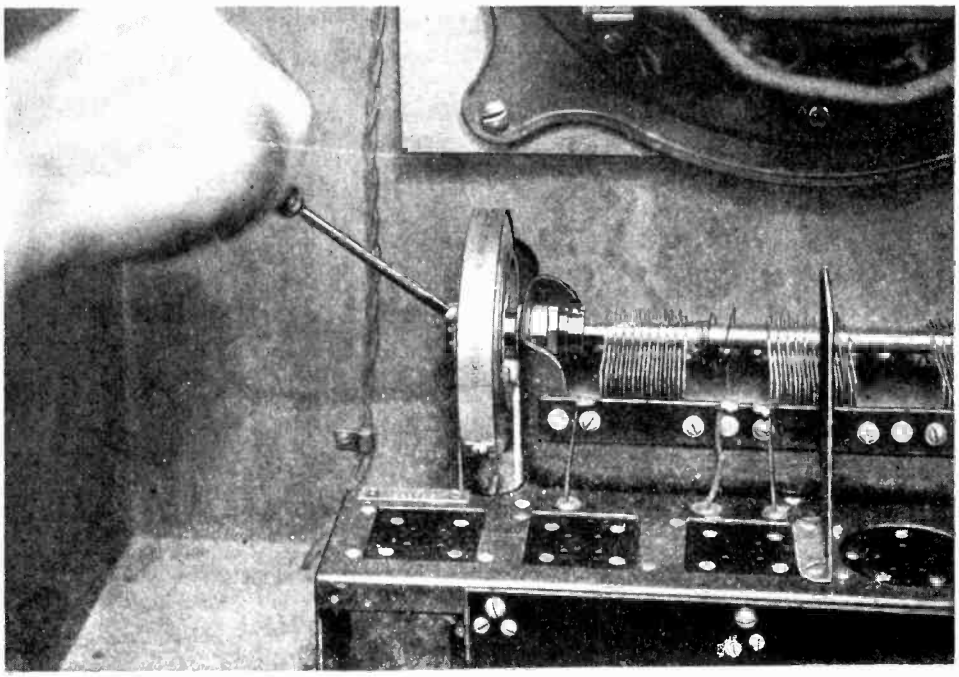

Figure 5—Tightening condenser drive cable

nected across the power input to the disc rectifier. No current is consumed as no load is being drawn through the condenser.

[4] 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.

Radiotron UX-210 is used in the last audio stage and provides ample power without distortion. Be careful not to insert any Radiotrons UX-226 in the UX-210 socket as immediate filament burnout will result.

Radiotron UX-280 (in the Socket Power Unit) 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.

[5] LOCATION OF RADIOLA IN ROOM

As with other musical instruments, the location of Radiola 41 in the room should be chosen with care. Various positions should be tried until the most desirable reproduction is obtained. If this position is outside the radius of the connection cord to the A. C. outlet, an extension cord can be used.

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 in Radiola 41 are of the standard gang UX and UY type (Figure 4). 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.

[3] 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 prongs should be cleaned by using a piece of fine sandpaper. 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.

[4] 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 IV, Section 1. The volume control is then readily accessible. By removing the two screws 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. After adjusting the spring contact arm, replace the mounting screws and return the chassis to the cabinet and replace screws and control knobs.

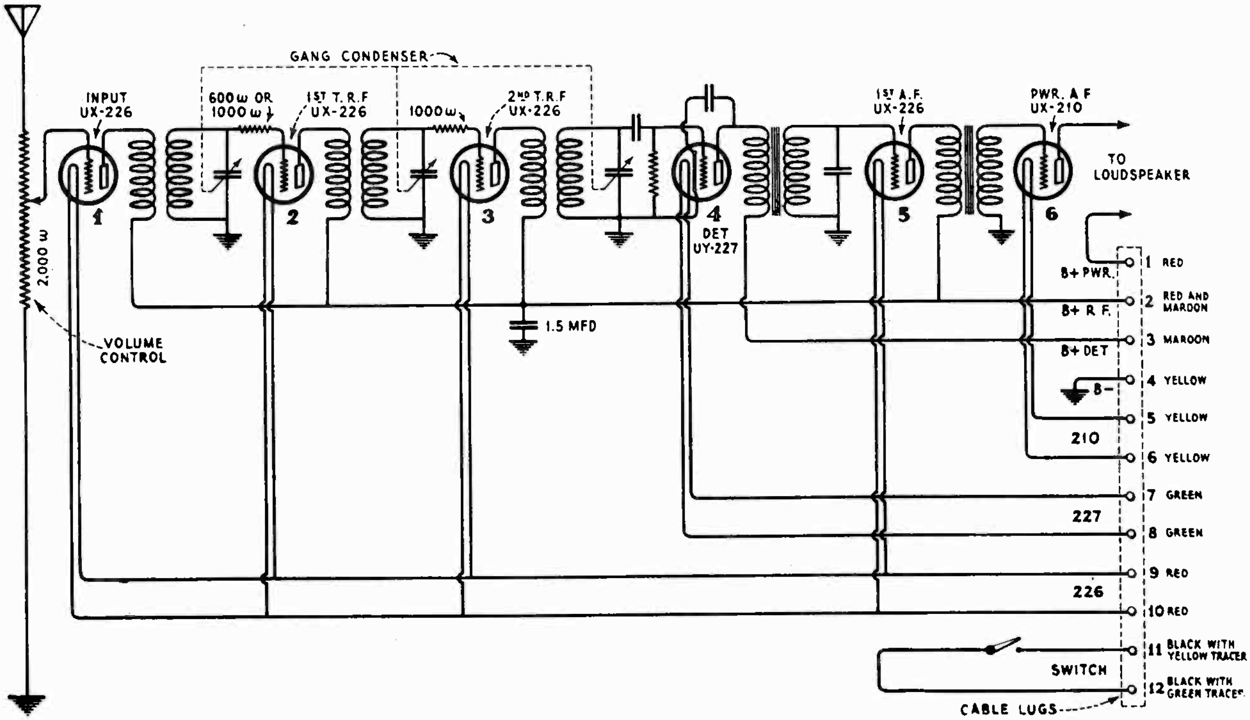

Figure 6—Schematic circuit diagram of the receiver assembly in Radiola 41

[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 remove the back of the cabinet and turn the cable adjusting screw with clamp until the cable is taut (Figure 5). 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 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. A sufficient number of grooves are provided on the drum for this purpose.

[6] BROKEN CONDENSER DRIVE CABLE

A broken condenser drive cable can be replaced. See other RCA Service Notes for making this replacement. 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.

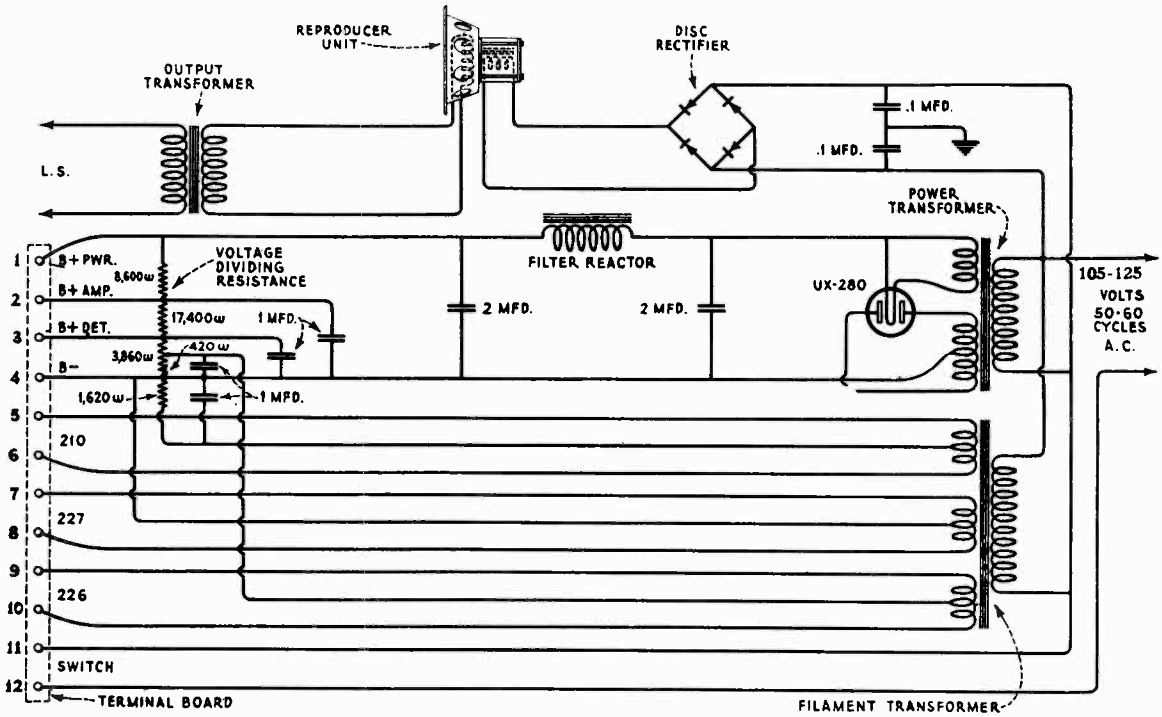

Figure 7—Schematic circuit diagram of Sterling S. P. U.

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.

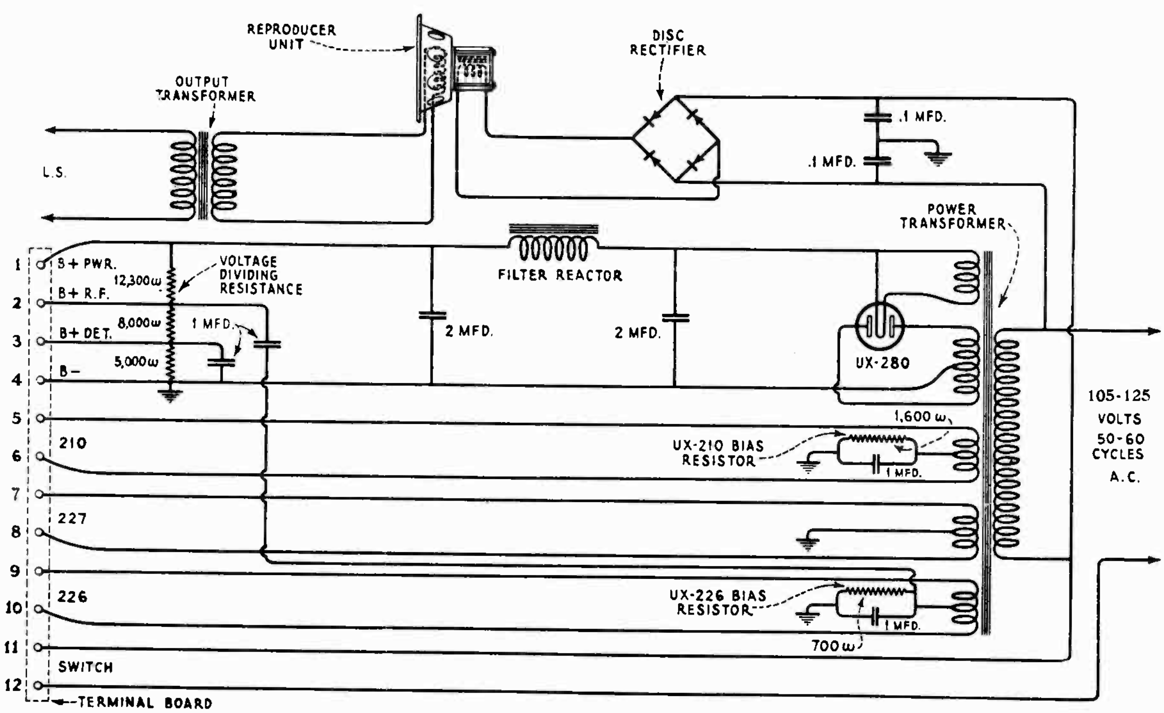

Figure 8—Schematic circuit diagram of Receptor S. P. U.

[7] HUM

Refer to the schematic circuits, Figures 6, 7 and 8, in connection with the following service data. If a pronounced hum develops look for:

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

(b) Filament center taps not correctly placed. Should a center tap connection to one of the filament windings of the power transformer be off center, excessive hum will result. In this case the power transformer must be replaced or a center tapped resistance must be connected across the faulty winding and the center connection made to the resistance center.

(c) Antenna and ground leads reversed. This may occur either at their point of connection or at the volume control.

(d) Any of the several grounding leads in the Radiola not connected.

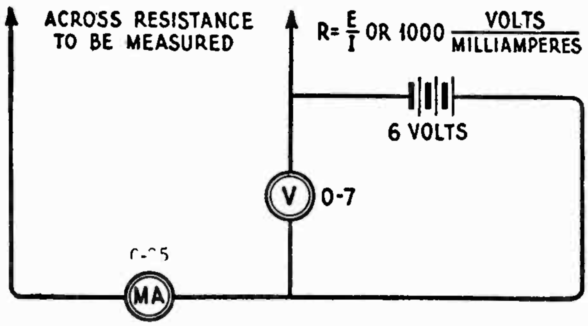

Figure 9—Schematic diagram of resistance measurement method

(e) Defective disc rectifier. This may be checked by removing Radiotron UX-210 and noting if the hum disappears. If it does not the trouble is in the disc rectifier and it must be replaced.

(f) Sometimes reversing the S. P. U. 180 degrees from its original position will reduce low frequency hum. This applies only to Receptor Units.

(g) A mechanical hum caused by loose laminations of the power transformer or filter reactor (Receptor only) may be eliminated by removing the S. P. U. from its container as described in Part III, Section 4, and tightening the clamps that hold the loose laminations until the hum disappears.

(h) Radiotron UY-227 shield not in place. Some models of Radiola 41 use a shield to entirely enclose the detector tube. Should this shield not be in place a high frequency hum may develop. In models not equipped with this shield that have excessive hum, the use of the shield may remedy this condition. A small can, such as a cocoa can, that will fit snugly over the tube shields already in place, and make connection to ground, may be used to check on this condition.

[8] DISTORTION IN REPRODUCER UNIT

Distortion in the reproducer unit may be due to any of the following causes.

(a) Cone out of alignment. Refer to Part II, Section 17.

(b) Leads from cone coil broken away from side of cone. Make these leads fast with a little shellac.

(c) Loose escutcheons, baffle board or rear cover. Any loose part in the cabinet will cause a rattle. Tighten all loose parts.

[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) Defective A. F. transformers or output transformer. 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.

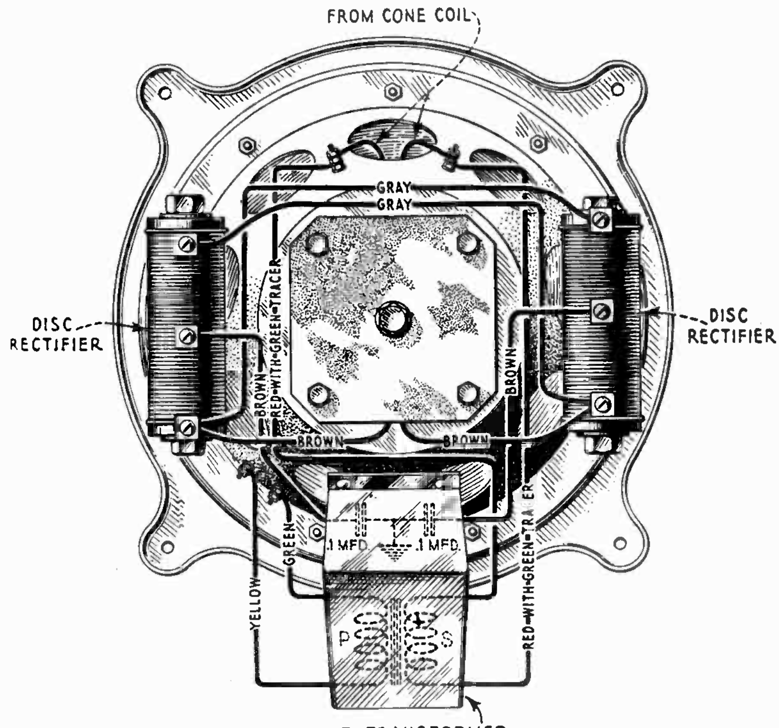

Figure 10—Wiring diagram of reproducer assembly

(d) Low voltage from S. P. U. Check S. P. U. voltages at terminal strip with readings given in Part II, Section 18. Low voltages may be caused by a low emission rectifying tube or defective resistances in the S. P. U. Check by means of continuity test.

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

(f) Defective loudspeaker field supply.

(g) Open loudspeaker field or connections.

(h) Grounded loudspeaker input terminals.

[10] AUDIO HOWL

Audio howl may be caused by:

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

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

(c) 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.
(d) 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.
(e) Poor ground. Install ground system as suggested in Part I, Section 3.
(f) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause a howl.
(g) 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.
(h) 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."

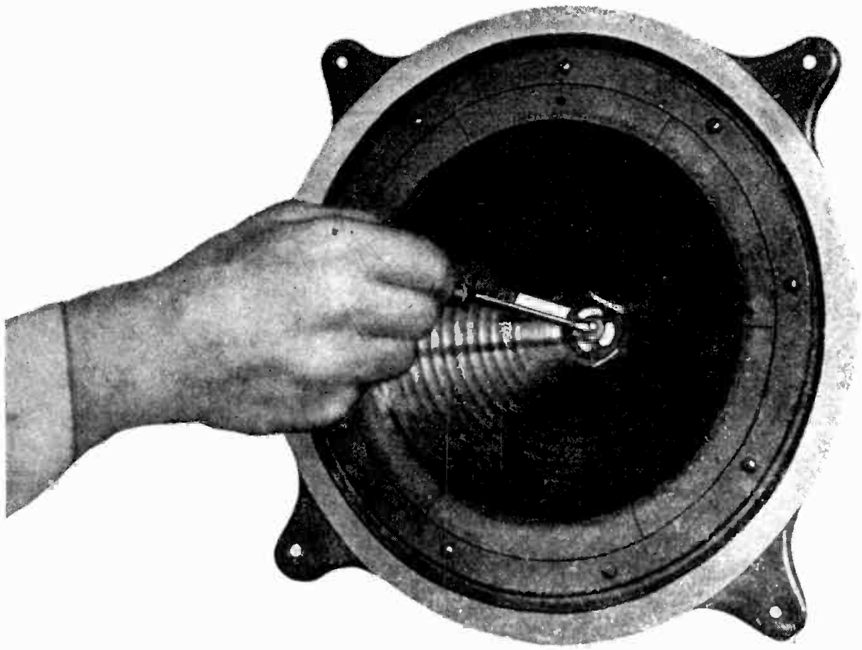

Figure 11—Centering reproducer cone

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.
(i) Defective grid leak or open grid connection in the Radiola, except Radiotron UX-280.

[11] DISTORTED REPRODUCTION

Under normal conditions Radiola 41 will deliver a strong signal of good quality to the loudspeaker. If the loudspeaker reproduction 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) 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.

(b) 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.

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

Should Radiola 41 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 are received, though weak, 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 connect Radio Frequency chokes on any offending nearby apparatus.

(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.

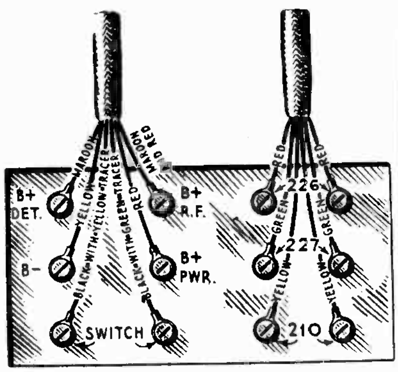

Figure 12—Receptor S. P. U. terminal board and color of connections

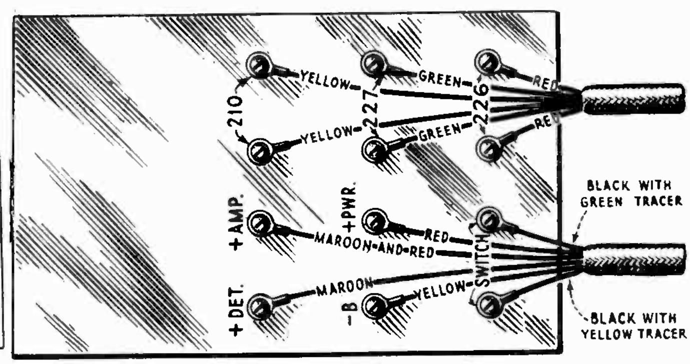

Figure 13—Sterling S. P. U. terminal board showing color scheme of connections

[12] UNCONTROLLED OSCILLATION

Should Radiola 41 oscillate or regenerate at any point in the tuning range the trouble is probably caused by:

(a) 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 6 shows the correct value of these resistors.

(b) Open ground connection. Make repair.

(c) 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.

(d) Open UX-226 bias lead. Make any repair necessary.

(e) 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.

(f) 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 (a) the grid resistance of Radiola 41 may be checked by means of a resistance bridge. If a resistance bridge is not available 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 9.

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.

Where everything tests O. K. and the Radiola still oscillates, the following remedy should be applied:

Connect an 800-ohm fixed resistance in series with the plate supply to all Radiotrons UX-226. This will reduce the plate voltage to these tubes and should prevent any oscillation. If, however, the oscillation continues, do not put the resistor in the plate supply to the UX-226 Radiotrons, but connect it across the primary of the second R. F. transformer This will effectively prevent any case of oscillation.

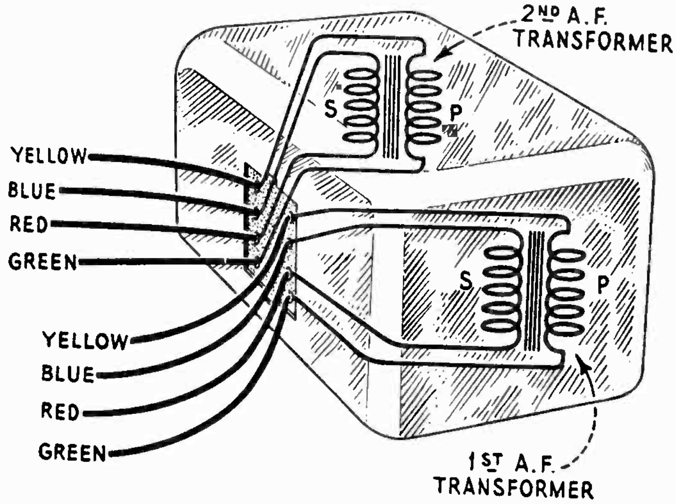

Figure 14—Internal connections of A. F. transformers

[13] ACOUSTIC HOWL

Microphonic or acoustic howling may be corrected by interchanging the tubes in the receiver assembly. This can be done with Radiotrons UX-226. If this does not eliminate the howl try changing the detector Radiotron UY-227 with another of the same type A tube that is unsatisfactory in one set may be O. K. in another.

[14] TESTING FILTER AND BY-PASS CONDENSERS

The filter and by-pass condensers in Radiola 41 can be checked by noting the voltage readings given in Part II, Section 20. A no-voltage reading at any position will indicate a shorted condenser or an open resistance unit. The resistance unit can be checked by the continuity tests given in Part II, Section 19. After determining that the resistance units are not a fault, the individual condensers should be tested by removing all connections and charging them and then noting their ability to retain the charge. Figures 16 and 17 show the interior connections of the condenser banks. The condensers should be discharged by shorting their terminals with a screwdriver. A defective condenser will not hold its charge. If it is completely short-circuited a flash at the condenser terminals will occur when an attempt is made to charge it.

[15] TESTING DISC RECTIFIER

The disc rectifier may be checked by measuring the output voltage that is delivered to the field of the reproducer unit. This should be approximately 80 volts with the field connected. With the field disconnected it should rise slightly to about 95 volts.

Precaution—The operation of the disc rectifier depends on the pressure to which the discs are held. *Do not* loosen the bolts that hold them together as it is highly improbable they can be returned to normal operation without special instruments. Should replacement become necessary, remove the bracket and unit together. The replacement part is supplied with brackets so that replacement is comparatively easy.

[16] REPRODUCER UNIT

Radiola 41 uses a new type eight-inch dynamic reproducer, similar to that used in Loudspeaker 106. The cone is an eight-inch corrugated type, giving a smooth response to all frequencies and having a treatment to make it weatherproof and free from rattle.

A check on the continuity of the cone coil or field can be made by disconnecting them from all other terminals and click testing for continuity. An open of either coil will indicate a defect which must be remedied by replacing the entire cone or the field coil. Also check either of the coils or their connections for shorts. The color scheme of connections of the reproducer and rectifier assembly is shown in Figure 10.

[17] CENTERING CONE OF REPRODUCER UNIT

To properly center a new cone or one out of center (Figure 11) use the following procedure:

(a) Remove reproducer assembly from cabinet as described in Part III, Section 2.

(b) Loosen center screw of cone, but do not remove it.

(c) Insert three cardboard strips about the thickness of a visiting card, 1½ inches by ¼ inch in size, through the center web of the cone into the space between the pole piece and the cone. This will give the cone coil the same clearance on all sides of the pole piece.

(d) Tighten the center screw holding the web of the cone and remove the three strips The cone is now properly centered. Replace the reproducer assembly in the cabinet in the reverse manner of that used to remove it.

[18] OBTAINING ACCESS TO S. P. U. TERMINAL BOARDS

In order to make voltage readings or click tests at the S. P. U. terminal boards it is first necessary to uncover them. The Receptor S. P. U. terminal board (Figure 12) is uncovered by removing the guard held in place by two machine screws. In the Sterling S. P. U. (Figure 13), however, the procedure is more involved. A step-by-step procedure follows:

(a) Remove the rear cabinet panel, which is fastened by two wood screws.

(b) Remove the four screws on the sides of the S. P. U. near the top.

(c) The S. P. U. cover can now be removed by pushing the two sides together so that the small catches are released and lifting the cover. The terminal board is now accessible and any tests necessary may be made.

(d) To return the cover, just place top on S. P. U. and push down. It will snap in place easily. The four screws should then be replaced and the rear cabinet panel returned to its normal position.

[19] RADIOLA 41 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly and socket power unit of Radiola 41. Access may be gained to the S. P. U. terminal boards as described in Part II, Section 18.

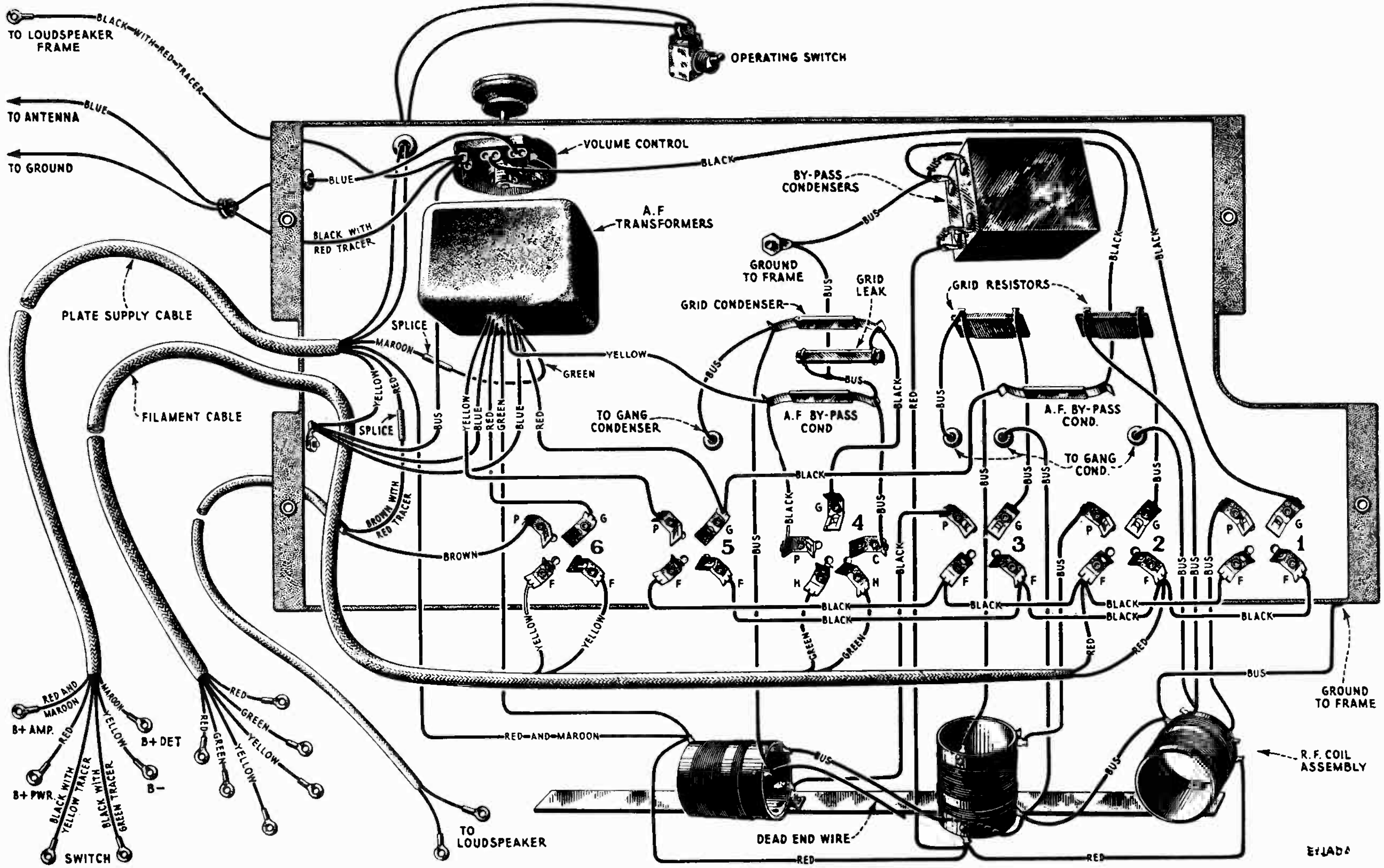

Figure 15—Wiring diagram of receiver assembly

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove all Radiotrons and the cables connected to the S. P. U. terminal board. See Figure 6 for lug numbers, and Figure 15 for socket numbers.

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Ant. to ground	Closed	Open volume control
	G1 to ground	Closed	Open volume control or contact arm
	G2 to ground	Closed	Open secondary of 1st R. F. transformer or grid resistor
	G3 to ground	Closed	Open secondary of 2nd R. F. transformer or grid resistor
	Stator Condenser No. 3 to ground	Closed	Open secondary of 3rd R. F. transformer
	G5 to ground	Closed	Open secondary of 1st A. F. transformer
	G6 to ground	Closed	Open secondary of 2nd A. F. transformer
Plate	P1 to Lug No. 2	Closed	Open primary of 1st R. F. transformer
	P2 to Lug No. 2	Closed	Open primary of 2nd R. F. transformer
	P3 to Lug No. 2	Closed	Open primary of 3rd R. F. transformer
	P4 to Lug No. 3	Closed	Open primary of 1st A. F. transformer
	P5 to Lug No. 2	Closed	Open primary of 2nd A. F. transformer
	P6 to Lug No. 1 (Loudspeaker connected)	Closed	Open primary of output transformer
Filament	One filament contact of sockets Nos. 1, 2, 3 and 5 to Lug No. 9	Closed	Open connection
	Other filament contact of sockets Nos. 1, 2, 3 and 5 to Lug No. 10	Closed	Open connection
	One filament contact of socket No. 4 to Lug No. 8	Closed	Open connection
	Other filament contact of socket No. 4 to Lug No. 7	Closed	Open connection
	One filament contact of socket No. 6 to Lug No. 5	Closed	Open connection
	Other filament contact of socket No. 6 to Lug No. 6	Closed	Open connection
Misc.	Lug No. 10 to Lug No. 11	Closed or Open	Throw operating switch to each position. Circuit should test "closed" when switch is "on" and "open" when switch is "off"
	Across Loudspeaker cone coil connections (Cone coil disconnected)	Closed	Open secondary of output transformer
	P4 to ground	Open	Shorted detector by-pass condenser
	Lug No. 2 to ground	Open	Shorted 2 mfd. by-pass condensers
	Lug No. 4 to ground	Closed	Open connection

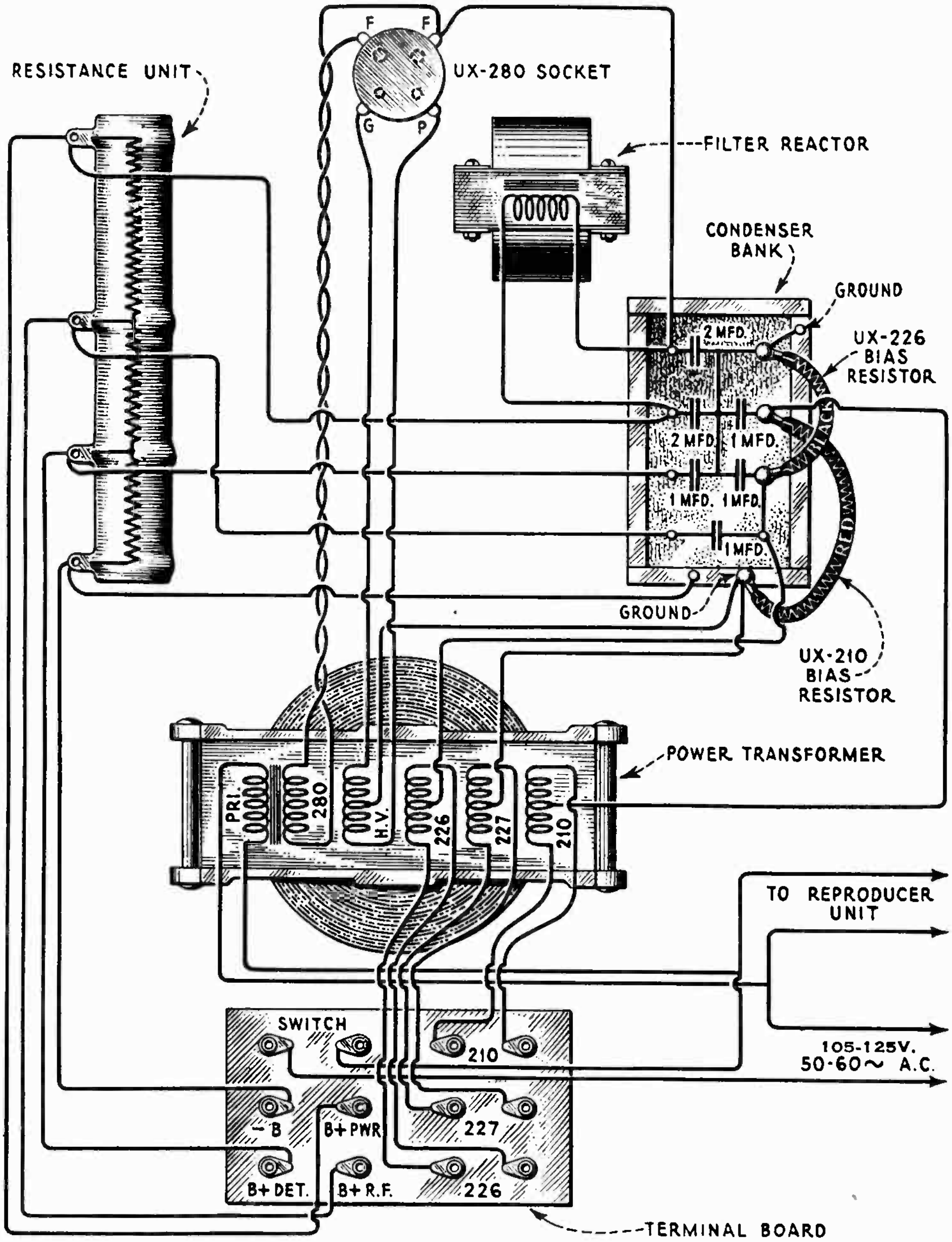

Figure 16—Wiring diagram of the Receptor S. P. U.

S. P. U. CONTINUITY TESTS—Receptor—Figure 16—See Figure 8 for terminal numbers

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across UX-280 filament contacts	Closed	Open UX-280 filament winding
G to P of UX-280 socket	Closed	Open high voltage winding of power transformer
1 to either filament contact of UX-280 contact	Closed	Open filter reactor
1 to 4	Closed	Open voltage dividing resistance
5 or 6 to 4	Closed	Open UX-210 grid bias resistor
5 to 6	Closed	Open UX-210 filament winding
7 to 8	Closed	Open UY-227 filament winding
9 or 10 to 4	Closed	Open UX-226 grid bias resistor
9 to 10	Closed	Open UX-226 grid filament winding
11 to 12	Open	Shorted wiring

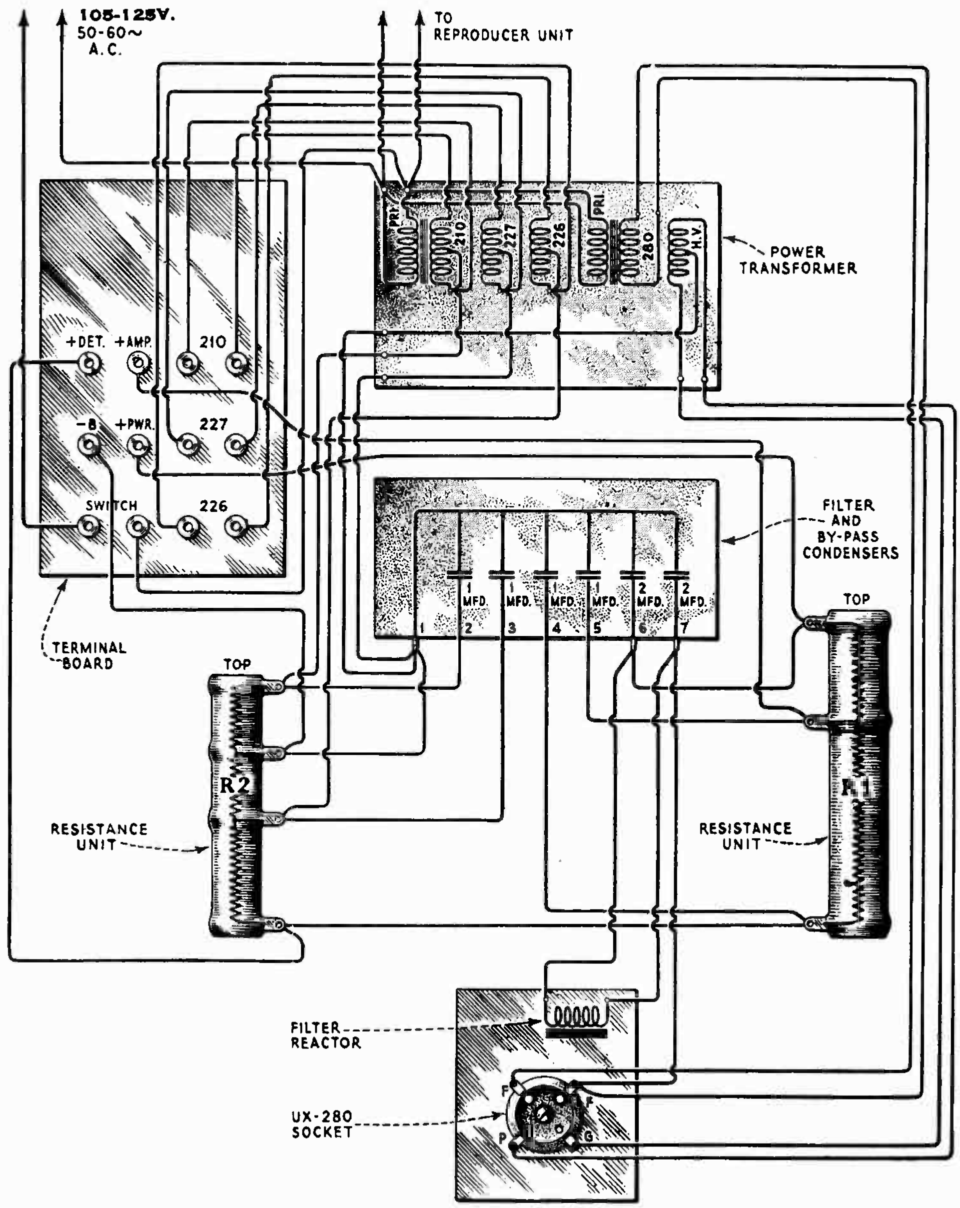

Figure 17—Wiring diagram of Sterling S. P. U.

S. P. U. CONTINUITY TESTS—Sterling—Figure 17—See Figure 7 for terminal numbers

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across UX-280 filament contacts	Closed	Open UX-280 filament winding
G to P of UX-280 socket	Closed	Open high voltage winding of power transformer
1 to either filament contact of UX-280 contact	Closed	Open filter reactor
1 to 3	Closed	Open Resistor R1 (3 Terminals)
3 to 5 or 6	Closed	Open Resistor R2 (4 Terminals)
5 to 6	Closed	Open UX-210 filament winding
7 to 8	Closed	Open UY-227 filament winding
9 to 10	Closed	Open UX-226 filament winding
11 to 12	Open	Shorted wiring

[20] VOLTAGE READINGS

When checking Radiola 41 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 Radiola connected to a 115-volt A. C. line. The tubes must be in good condition, otherwise the D. C voltages will be high.

VOLTAGE READINGS AT S. P. U. TERMINAL STRIP

The S. P. U. cover must be removed to expose the terminal strip

Sterling—Figure 13

Terminals	*Volts*
—B to B+ Det.	25 D. C.
—B to B+ Amp.	135 D. C.
—B to B+ PWR.	320 D. C.
UX-210 Filament	7.5 A. C.
UY-227 Filament	2.5 A. C.
UX-226 Filament	1.5 A. C.

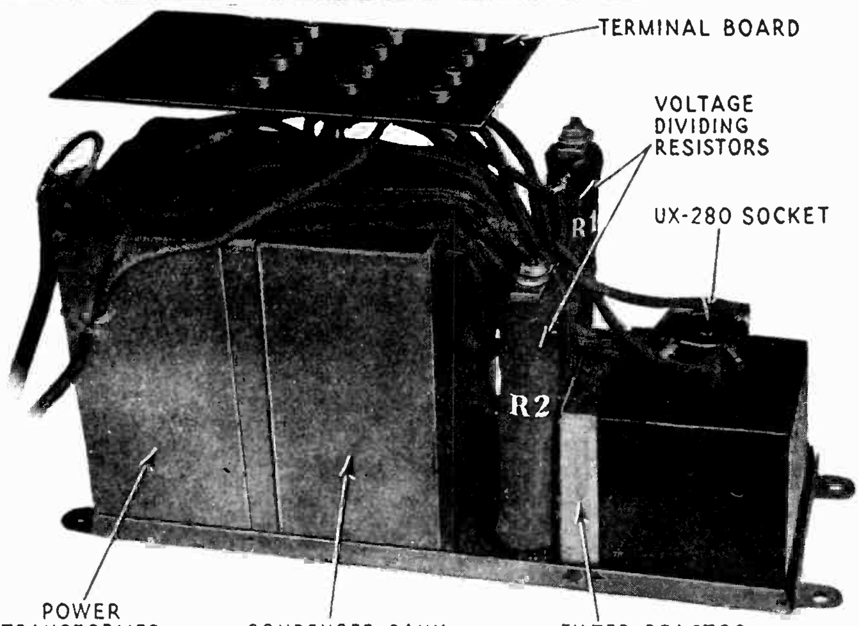

Figure 18—Sterling socket power unit showing parts

Receptor—Figure 12

Terminals	*Volts*
—B to B+ Det.	33 D. C.
—B to B+ R. F.	100 D. C.
—B to B+ PWR.	335 D. C.
UX-210 Filament	7.5 A. C.
UY-227 Filament	2.5 A. C.
UX-226 Filament	1.5 A. C.

VOLTAGE READINGS AT RADIOTRON SOCKETS

Taken with Weston Model 537 Type 2 test set or others giving similar readings,—115-volt A. C. line and volume control at zero—No station tuned in. For tube numbers refer to Figure 4.

Sterling

Tube No.	*Filament to Grid Volts*	*Cathode or Filament to Plate Volts*	*Plate Current Millamps*	*Filament or Heater Voltage*
1	10	125	3.5	1.5
2	10	125	3.5	1.5
3	10	125	3.5	1.5
4	—	25	2.0	2.5
5	10	125	3.5	1.5
6	20	300	16.0	7.5

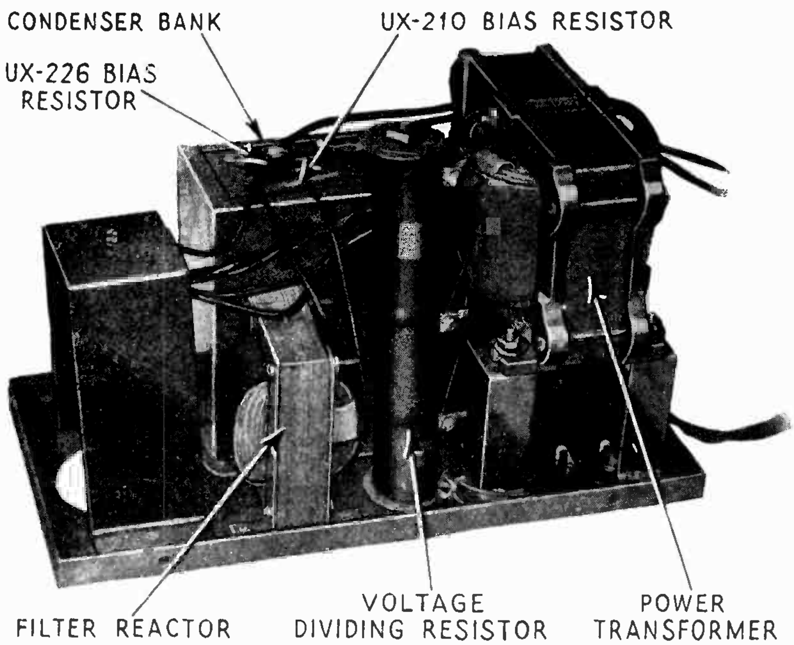

Figure 19—Receptor socket power unit showing parts

Receptor

Tube No.	*Filament to Grid Volts*	*Cathode or Filament to Plate Volts*	*Plate Current Millamps*	*Filament or Heater Voltage*
1	7	93	2.5	1.5
2	7	93	2.5	1.5
3	7	93	2.5	1.5
4	—	33	2.0	2.5
5	7	93	2.5	1.5
6	22	310	16.0	7.5

PART III—MAKING REPLACEMENTS

The various assemblies and parts of Radiola 41 are readily accessible and replacements can be easily made. Figure 2 illustrates the parts in the receiver assembly, Figure 19 the Receptor S. P. U. and Figure 18 the Sterling S. P. U. The following procedure outlines the simplest method to be used when making replacements.

[1] REPLACING PARTS IN RECEIVER ASSEMBLY

Should it be necessary to replace any part in the receiver assembly proceed as follows:

(a) Remove terminal board covers as described in Part II, Section 18.

(b) Release the two receiver assembly cables from their terminal board and pull them clear of the S. P. U. container.

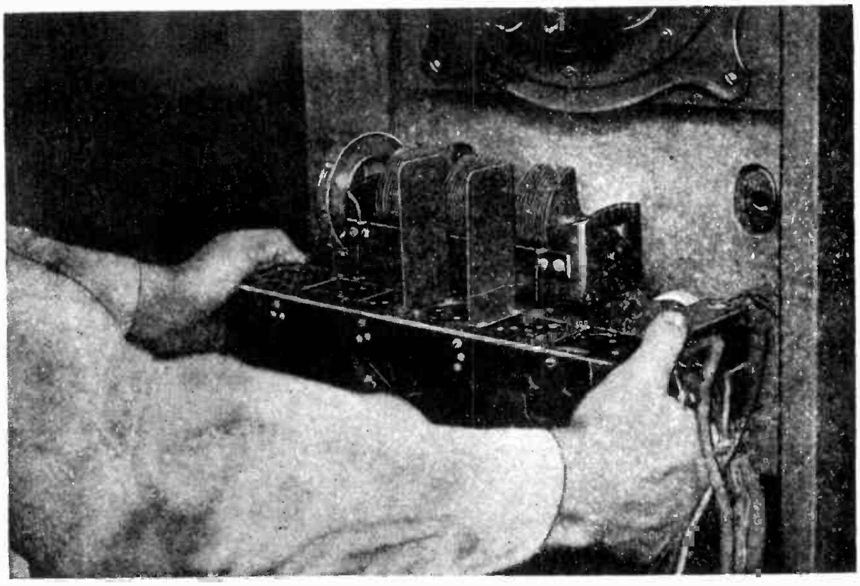

Figure 20—Removing receiver assembly from cabinet

(c) Release the antenna and ground leads from the clamps that hold them in place.

(d) Release the ground lead to the reproducer unit frame.

(e) Release the output leads from the receiver assembly to the output transformer on the loudspeaker frame. These leads must also be released from the clamps that hold them to the sides of the cabinet.

(f) Remove the collar that holds the operating switch in place. Pull it clear from the escutcheon.

(g) Remove the two knobs on the front panel—the station selector and volume control.

(h) Remove the four screws that hold the receiver assembly on its shelf. It may now be lifted clear and placed in a position convenient for work (Figure 20). The parts are readily accessible and any repair or replacement may be easily made. The correct connections to all parts are shown in Figure 15.

(i) After all work is completed the receiver assembly should be returned to the cabinet in the reverse manner of that used to remove it.

[2] REPLACING PARTS IN LOUDSPEAKER ASSEMBLY

To replace a part in the loudspeaker assembly (Figure 21) proceed as follows:

(a) Disconnect the A. C. input connections to the disc rectifiers.

(b) Disconnect the receiver output leads to the terminal on the reproducer frame.

(c) Remove the four bolts that hold the reproducer assembly to the baffle board. It may be lifted clear and placed in a position convenient for work. After the necessary repairs or replacements are made it should be returned in the reverse manner of that used to remove it. When attaching the reproducer assembly to the baffle board be sure to have the ground lead from the receiver assembly fastened under one of the bolts holding the reproducer in place.

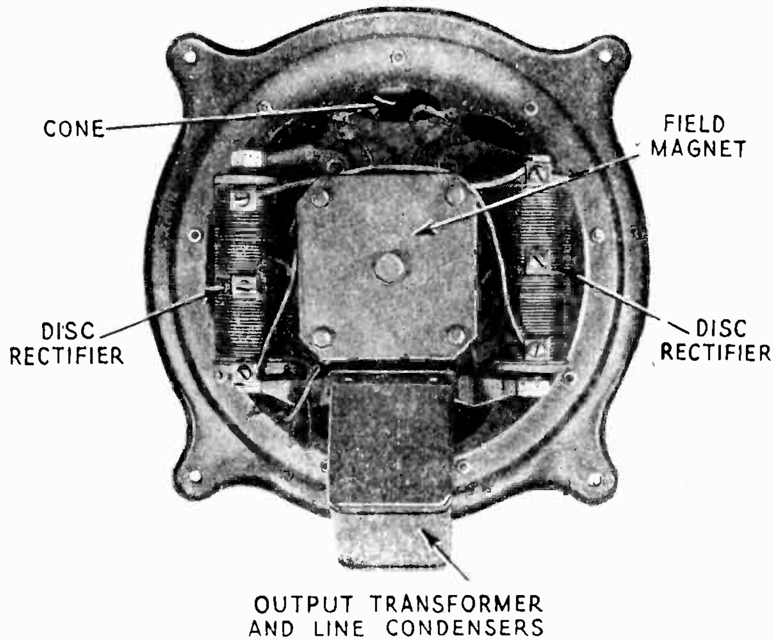

Figure 21—Reproducer assembly showing parts

[3] REPLACING PARTS IN STERLING S. P. U.

To replace any parts in the Sterling S. P. U. (Figure 18) proceed as follows:

(a) Gain access to the S. P. U. terminal board as described in Part II, Section 18

(b) Release the cables connected to the S. P. U. terminal board. Also release the two A. C. input leads from the S. P. U. to the disc rectifier at its connection to the rectifier.

(c) Release the machine screws and brackets that hold the S. P. U. to the cabinet. It may now be lifted clear and placed in a position for work.

(d) Release the four machine screws that hold the terminal board in place.

(e) Release the four machine screws that hold the bottom of the container to its sides.

(f) Push the terminal board a small distance toward the UX-280 socket. Now push the side of the container together so that it releases from the bottom. The side may now be pulled back on the input A. C. cord so that all the parts of the S. P. U. are exposed for any necessary repair or replacement.

(g) After all work is finished the S. P. U. can be reassembled and replaced in the cabinet in the reverse manner of that used to remove it.

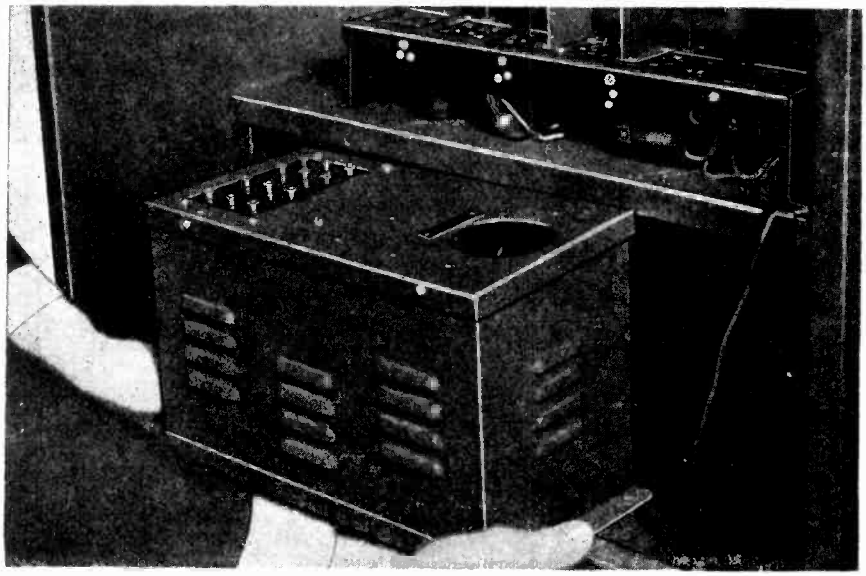

Figure 22—Removing Receptor S. P. U. from cabinet

[4] REPLACING PARTS IN RECEPTOR S. P. U.

To make replacements in the Receptor S. P. U. (Figure 22), proceed as follows:

(a) Remove terminal board cover as described in Part II, Section 18.

(b) Remove the two cables attached to the S. P. U. terminal board.

(c) Release the A. C. cord from the S. P. U. to the disc rectifier on the reproducer. Take the plug from the A. C. input cord so that it may be pulled clear.

(d) Remove the four machine screws that hold the top of the S. P. U. to the container.

(e) The top of the S. P. U. to which all apparatus is attached may be pulled clear and placed in a position convenient for work.

After all repairs or replacements are completed it should be returned to the container and reconnected in the reverse manner 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. 1
	Defective R. F. transformer	Replace R. F. transformer assembly, P. III, S. 1
	Defective A. F. transformer	Replace A. F. transformer assembly, P. III, S. 1
	Defective By-pass condenser	Replace By-pass condenser, P. III, S. 1
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 19
	Open grid resistor	Replace grid resistor, P. III, S. 1
	Open cone coil of reproducer unit	Check cone coil—if open replace cone, P. II, S. 16
	Grounded input terminals to loud-speaker	Check for grounds, P. II, S. 9
Weak Signals	Defective power cable	Repair or replace cable, P. III, S. 1
	Defective line switch	Clean contacts or replace line switch
	Defective R. F. transformer	Replace R. F. transformer assembly, P. III, S. 1
	Defective A. F. transformer	Replace A. F. transformer assembly, P. III, S. 1
	Dirty Radiotron prongs	Clean prongs with fine sandpaper, P. II, S. 3
	Defective By-pass condenser	Replace defective By-pass condenser, P. III, S. 1
	Defective main tuning condensers	Replace defective tuning condensers, P. III, S. 1
	Defective output transformer	Replace defective transformer, P. III, S. 2
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D. C. voltmeter and A. C. voltmeter, P. II, S. 20
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 19
	Defective rectifier unit	Replace defective unit, P. III, S. 2
Poor Quality	Defective A. F. transformer	Replace A. F. transformer assembly, P. III, S. 1
	Defective output transformer	Replace output transformer, P. III, S. 2
	Defective By-pass condenser	Replace defective By-pass condenser, P. III, S. 1
	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. II, S. 3
Howling	Defect in audio system	Check and repair any defect, P. II, S. 10
	Open grid circuit in any stage	Check circuits and repair defect, P. II, S. 19
	Microphonic Radiotrons	Interchange Radiotrons, P. II, S. 10
Excessive Hum	Socket plug position	Reverse socket plug
	Dirty or defective line switch	Clean or replace line switch
	Antenna and ground leads reversed	Connect antenna and ground leads correctly, P. II, S. 7
	Defective disc rectifier	Replace defective unit, P. III, S. 2
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. 3-4
	No A. C. line voltage	Turn A. C. line voltage "On"

RCA

RCA

Radiola 41 (D. C.)

SERVICE NOTES

RCA Radiola 41 (D. C.)

First Edition—2½M

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PREFACE

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 RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

To assist in promoting this phase of the Dealer and Distributor's business the RCA Service Division 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 and Distributors' 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.

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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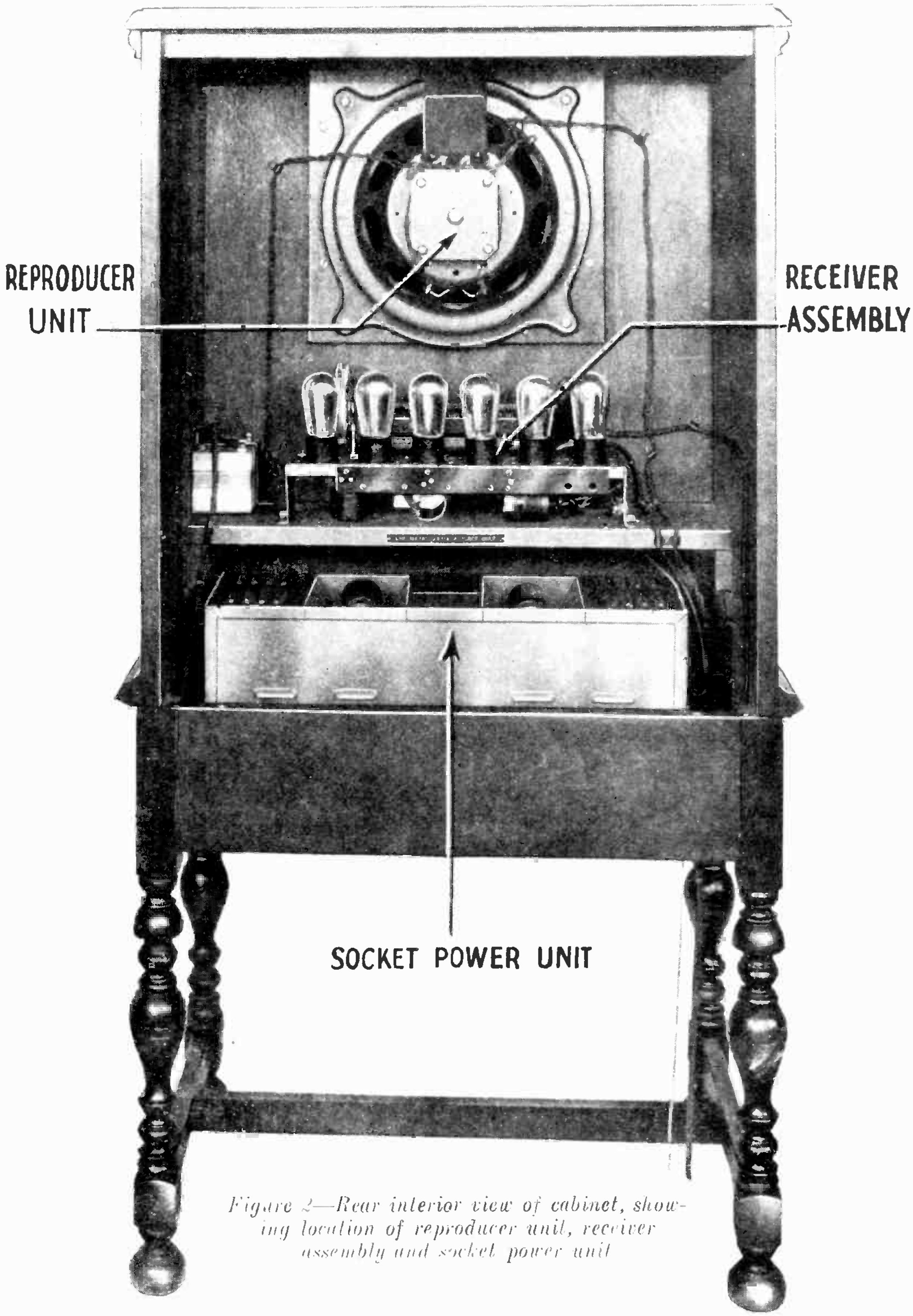


Figure 2—Rear interior view of cabinet, showing location of reproducer unit, receiver assembly and socket power unit

RCA RADIOLA 41 (D. C.)

(107.5-127.5 Volts Direct Current)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Radiola 41 D.C. is a direct current socket powered radio receiver having excellent sensitivity, selectivity, and tone quality. A special audio system using two push-pull audio stages, gives fine quality and ample power to the output. The new dynamic loudspeaker used responds favorably to the excellent features built into the audio system.

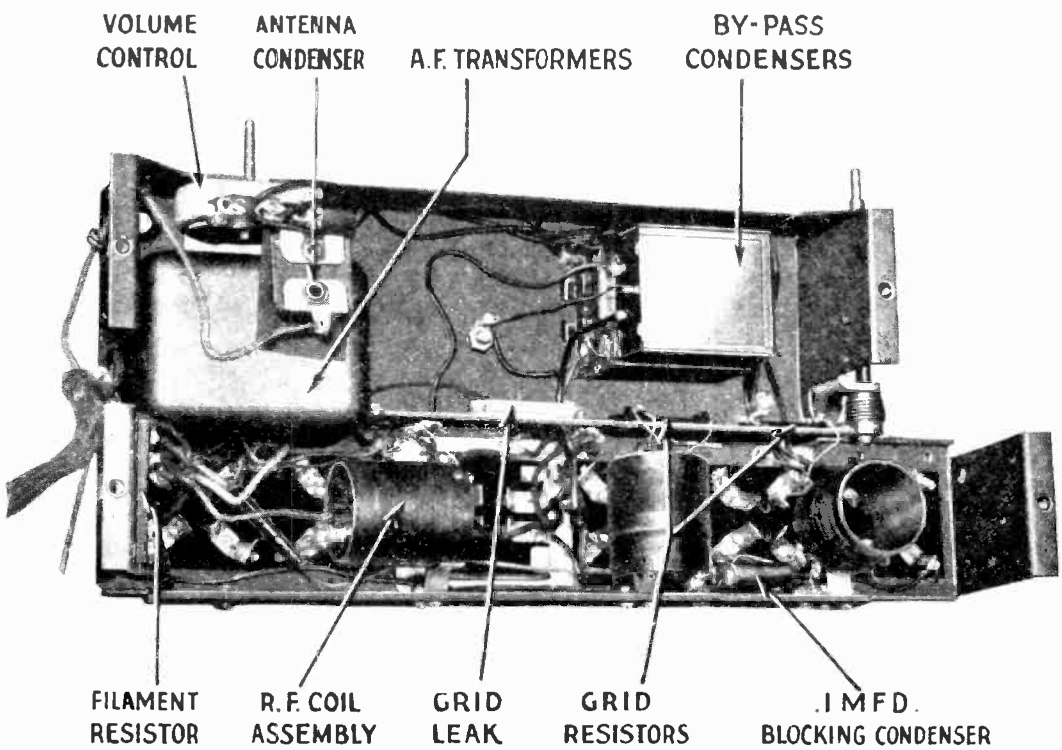


Figure 3—Sub-chassis view of receiver, showing parts

Figure 2 illustrates the rear interior view of the cabinet showing the location of the reproducer, receiver and socket power unit.

The receiver uses a tuned radio frequency circuit employing six Radiotrons UX-112A and four Radiotrons UX-171A. Figure 3 illustrates a sub-chassis view of the receiver and Figure 4 the S.P.U.

RCA Radiola 41 D.C. is designed to operate on direct current of 107.5-127.5 volts as used for house lighting. Connection to direct current lines of other rating or to A.C. lines may damage the Radiola or the Radiotrons. When installing Radiola 41 (D.C.) the position of the input D.C. plug must be tried for operation. Connected one way the Radiola will operate. Reversed, silence will result.

The following design characteristics are incorporated in Radiola 41 D.C.:

(a) The circuit consists of one untuned coupling stage, two tuned radio frequency stages, a tuned detector, a push-pull first audio stage employing two Radiotrons UX-112A and a parallel push-pull second audio stage employing four Radiotrons UX-171A.

(b) The volume control regulates the input grid voltages to the coupling stage. This gives smooth control of volume without distortion.

(c) Grid resistors in the two tuned radio frequency stages effectively prevent any tendency to self oscillation in these circuits.

(d) The reproducer is a regular RCA 106 dynamic speaker minus the disc rectifiers which are not necessary in D.C. socket power operation.

The electrical sequence of the Radiotrons used in the receiver assembly is shown in the schematic diagram Figure 5.

PART I—INSTALLATION

[1] ANTENNA (Outdoor Type)

Due to the sensitivity of Radiola 41 D.C. the antenna length need only be 25 to 50 feet. It should be erected as high as possible and 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 absolutely 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.

[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 to 40 feet of insulated wire strung aroung 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 41 D.C. will generally give satisfactory reception with an indoor antenna.

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.

[3] GROUND

A ground lead is provided in Radiola 41 D.C. which may or may not be used. The use of the ground lead is entirely dependent on local conditions. As practically all D.C. lines have one side grounded, and no transformers are used, a direct ground connection occurs through the input D.C. line. The ground lead should be experimentally tried and if improved results are obtained it should be used. The ground should be connected to a steam radiator or water pipe if available. This ground will generally reduce the noise background, sometimes encountered in D.C. locations, and in most instances will make the receiver more stable.

[4] LOCATION OF RADIOLA IN ROOM

As with other musical instruments, the location of Radiola 41 D.C. in the room should be chosen with care. Various positions should be tried until the most desirable reproduction is obtained. If this position is outside the radius of the connection cord to the D.C. outlet, an extension cord can be used.

[5] "C" BATTERY

An external "C" battery is used to bias the power amplifier Radiotrons UX-171A. The use of this battery makes possible the use of the highest possible plate voltage on these tubes which gives maximum undistorted output. The battery should be 22½ volts, tapped at 16½ volts. Eveready battery No. 768 or Burgess No. 5156, or others having equivalent voltages may be used. The battery should be held under the clamp at one side of the receiver assembly. Connection should be made as follows:

Green	C—22½ volts
Brown	C—16½ volts
Black	C+

This battery should be replaced about once a year.

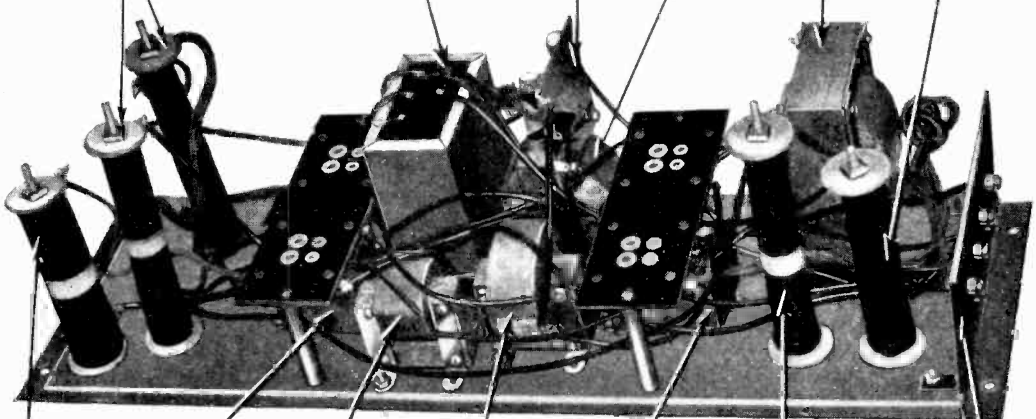


Figure 4—Socket power unit, showing parts

[6] RADIOTRONS

The Radiotrons UX-112A should be placed in the receiver assembly and the UX-171A's in the Socket Power Unit. Interchanging the tubes in the R.F. stages may give improved operation. Also in cases where oscillation occurs, interchanging the Radiotrons may clear up the condition. Always turn "off" the current before removing any tube and do not turn the current "on" unless all tubes are in place.

If any Radiotron UX-112A burns out the filament supply to all the Radiotrons in the receiver assembly will be cut off and the receiver will become inoperative. A burn-out of one of the UX-171A Radiotrons in the S.P.U. will cut off the filament supply to one other UX-171A, but the receiver will not become inoperative, although the quality of reproduction will be affected. The defective tube should be replaced.

While in most Radiolas, or other receiving sets using Radiotrons UX-112A and UX-171A, the older type Radiotrons UX-112 and UX-171 are interchangeable with the A tubes, this is not the case in Radiola 41 D.C. The greater filament current consumption makes the UX-112 and UX-171 unsuitable for use in the Radiola 41 D. C.

[7] ACOUSTIC HOWL

Radiola 41 D.C. may be more susceptible to microphonic howl than the A.C. model. Trouble of this kind while rare, may be corrected by interchanging the Radiotrons in the receiver assembly. The tube selected for the detector socket should have a minimum howl characteristic when touched or thumped, with the Radiola in operation.

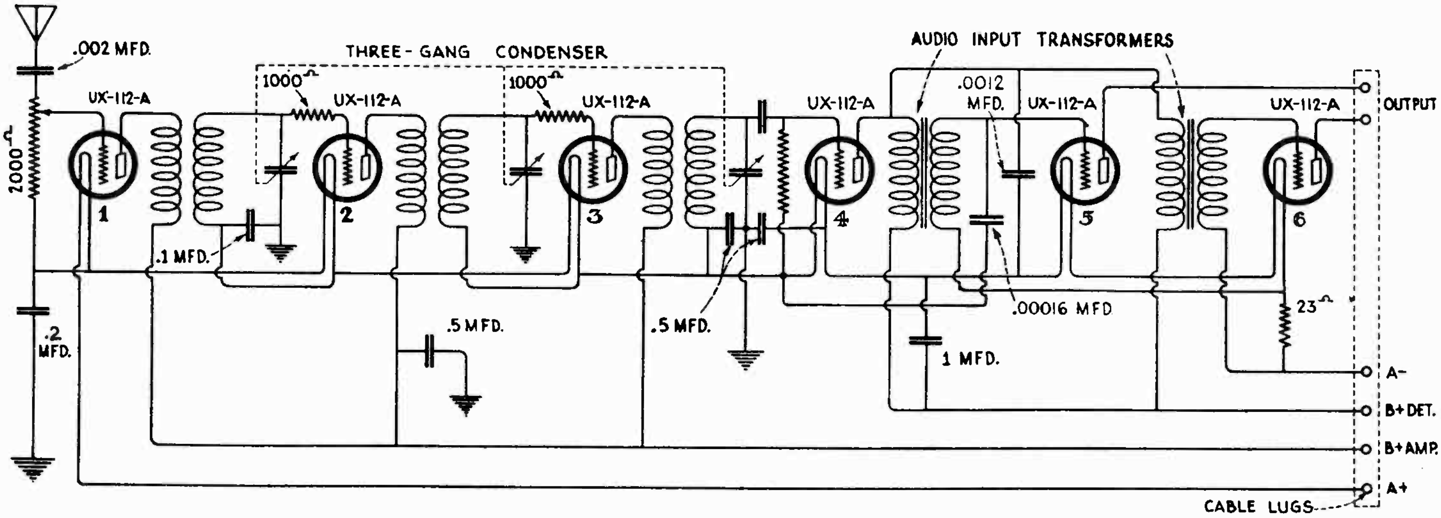


Figure 5—Schematic circuit diagram of receiver

PART II—SERVICE DATA

[1] WEAK SIGNALS

Should the loudspeaker output be weak at maximum volume, check the following points:

(a) Defective Radiotrons. Take one of each type known to be in good operating condition and interchange successively with those in the receiver and S.P.U.

(b) Open secondary center tap connection of interstage push-pull transformer or secondary of either A.F. transformer in receiver assembly.

(c) Open center connection to grid resistors in S.P.U. This will also give distorted reproduction.

(d) Defective receiver assembly or S.P.U. Check by means of the continuity tests given in Part III, Section 2, and make any repair or replacement necessary.

[2] UNCONTROLLED OSCILLATION

Should Radiola 41 D.C. oscillate or regenerate at any point in the tuning range the trouble is probably caused by:

(a) 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 in the regular Radiola 41 Service Notes. Figure 5 shows the correct value of these resistors.

(b) Open ground connection. Make repair.

(c) Ground not connected. Connect the ground lead to a cold water pipe, a hot water or steam radiator or both.

(d) Open UX-112A bias lead. Make any repair necessary.

(e) 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.

(f) Antenna and ground leads reversed, either at their point of connection to the volume control or outside of the set. Connect properly.

Where everything tests O.K. and the Radiola still oscillates, connect an 800-ohm fixed resistance across the primary of the second R.F. transformer. This will effectively prevent any case of oscillation.

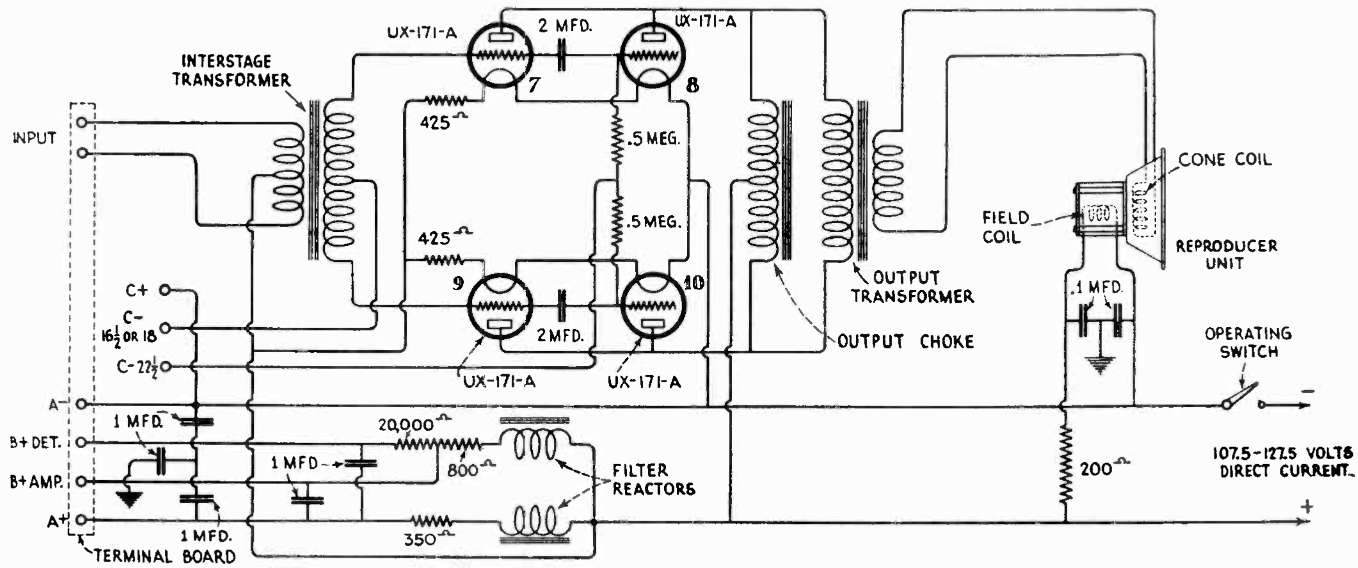


Figure 5A—Schematic circuit diagram of socket power unit

[3] DISTORTED REPRODUCTION

If the reproduction obtained at the loudspeaker is not of good quality, the trouble may be due to:

(a) Defective Radiotrons. A burned-out Radiotron in the S.P.U. cuts off the filament supply of another Radiotron, unbalancing the amplifier and causing distortion.

(b) "C" battery incorrectly connected. If the Radiola has been operated for a period of time with a wrongly connected "C" battery, the Radiotrons in the S.P.U. will probably be damaged. This will necessitate replacement of the tubes.

(c) Defective "C" battery. The "C" battery should be replaced at least once a year.

(d) Defective audio transformers in receiver, S.P.U., or on reproducer unit. Check all A.F. transformers by means of continuity test.

Any replacement or repair found necessary should be made.

[4] GRADUALLY DEVELOPED DISTORTED REPRODUCTION

Should the output gradually become poor after several hours of use, check the following:

(a) Incorrectly connected "C" battery. Connect "C" battery correctly and replace damaged UX-171A Radiotrons.

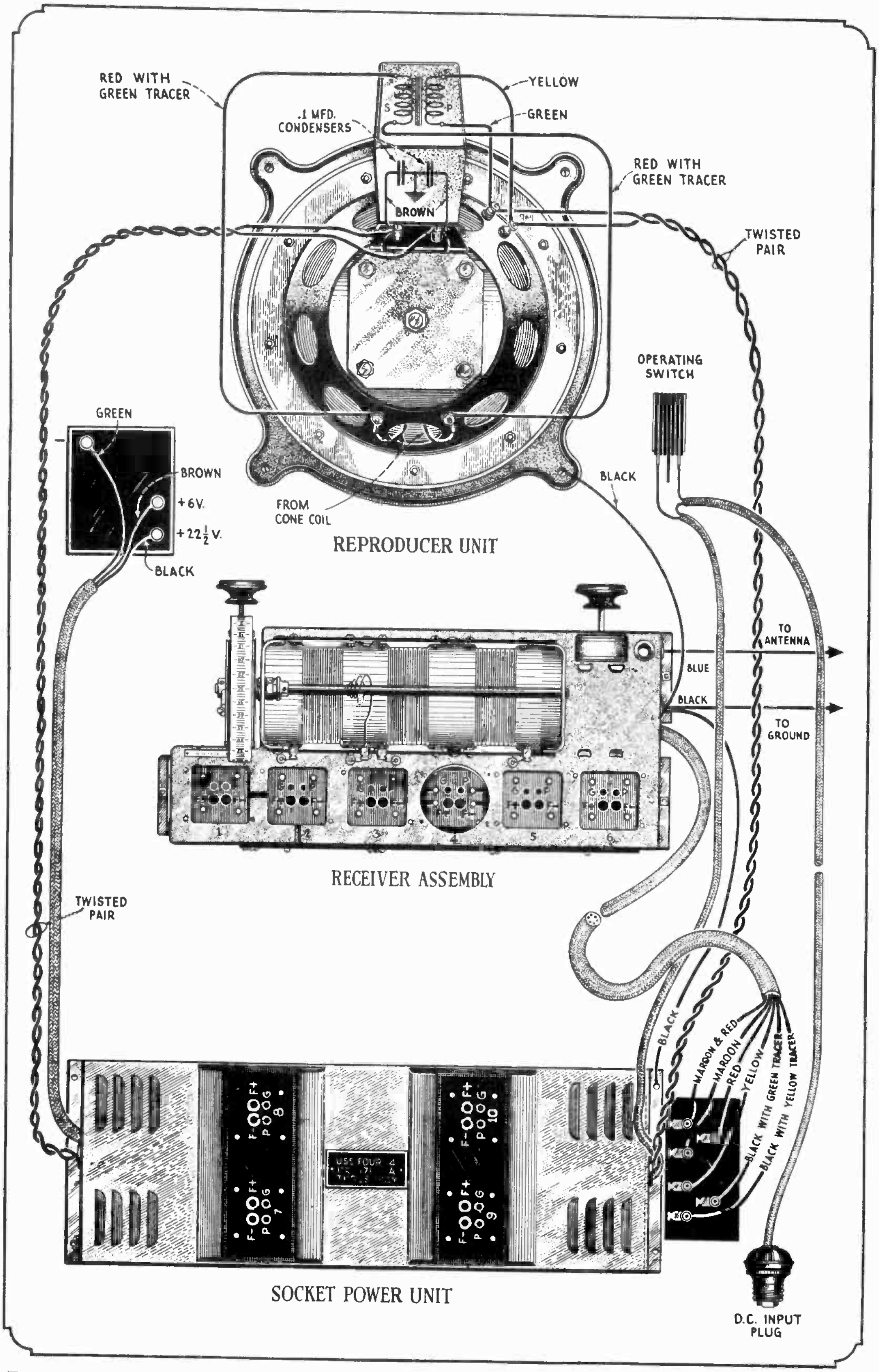


Figure 6—Complete layout and connections of reproducer, receiver and socket power unit

(b) Shorted 2 mfd. condenser. A shorted 2 mfd. condenser will cause the wrong "C" bias to be applied to one tube and may damage the tube if operated very long. Replace the condenser and replace the Radiotron if it has been damaged.

(c) Defective or open grid resistor in S.P.U. This will damage one of the Radiotrons because of improper grid bias and result in distorted output.

PART III—ELECTRICAL TESTS

[1] VOLTAGE READINGS

When checking Radiola 41 D.C. for possible defects, it is good practice to check the voltage of the various sources of current. To do this a service man should use a good D.C. voltmeter, preferably of the high resistance type. The following voltages at the S.P.U. terminal strip are correct for the particular line voltage noted (120 volts) with all Radiotrons in operating condition and in their correct positions. The terminals are indicated in Figures 5 and 8.

TERMINAL VOLTAGES

120-Volt D. C. Line

Terminals	*Voltage*
A— to A+	35
A+ to B+ Det.	5
A+ to B+ Amp.	21

If it is desired to check the voltages at the individual sockets the following readings are correct. The readings are taken with a Weston Model 537, Type 2, test set or others giving similar readings.

RADIOTRON SOCKET VOLTAGES

120-Volt D. C. Line

Tube No.	*+Filament to Grid Volts*	*Filament to Plate Volts*	*Plate Current Milliamperes*	*Filament Voltage*
1	4.2	22	1.5	4.3
2	4.1	26	2.0	4.4
3	4.2	31	2.4	4.5
4	4.0	15	1.0	4.6
5	10.0	95	6.0	4.8
6	10.0	100	7.0	5.0
9	27.0	100	6.5	4.8
10	4.0	95	6.5	5.0
7	27.0	100	7.0	5.0
8	4.0	95	6.5	5.0

The grid voltages given are not those under which the tubes operate, due to the necessity of reading them from one side of the filament. Also those taken on the two tubes, Nos. 8 and 10, that are biased through .5 megohm resistors are low, due to the drop across the resistor caused by the load of the meter. Actually these tubes receive the same bias as the others in the S.P.U.

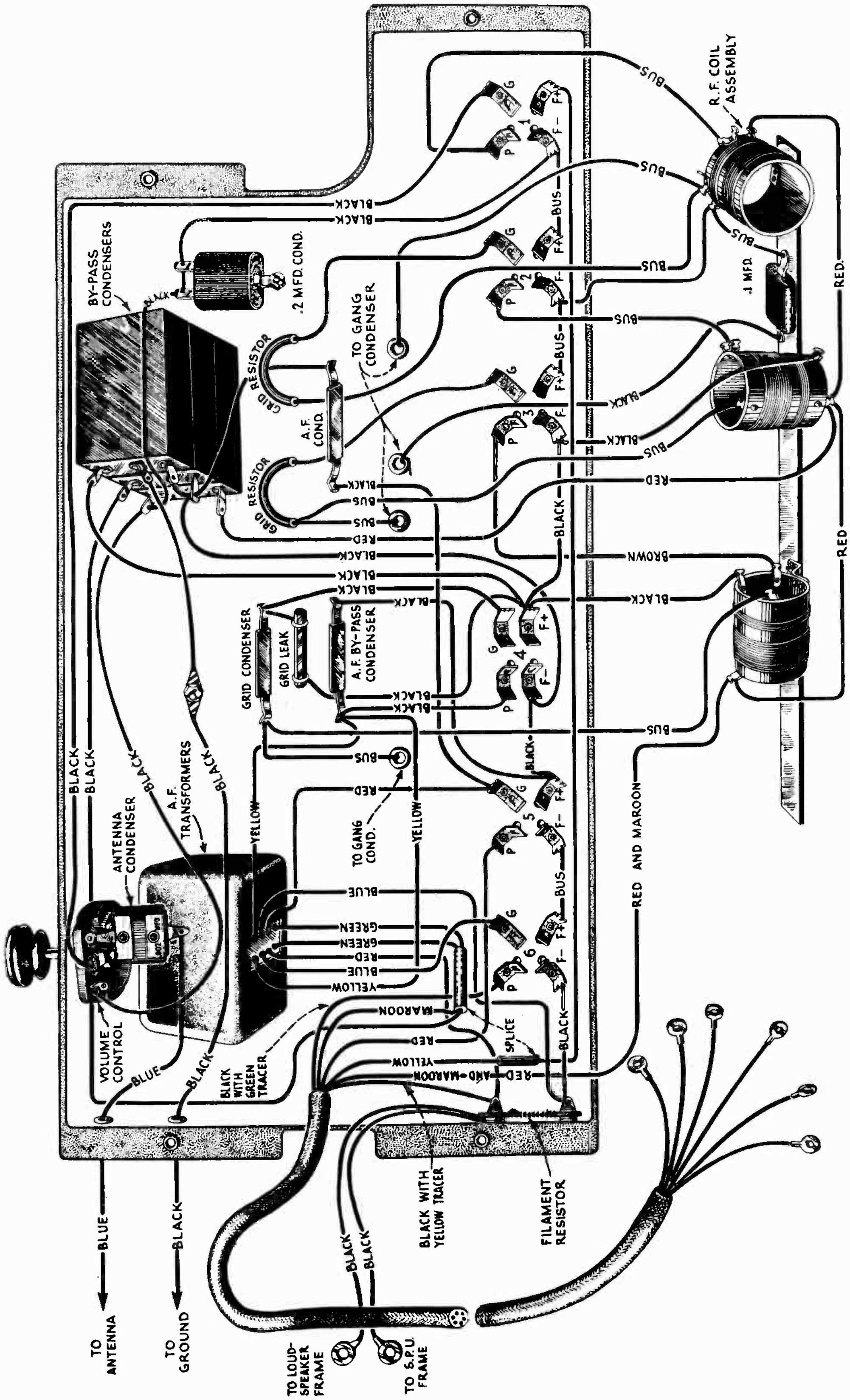


Figure 7—Wiring diagram of receiver assembly

[2] RADIOLA 41 D. C. CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly and the socket power unit of Radiola 41 D.C. See Figures 7 and 8 for wiring diagrams. All Radiotrons should be removed, the S.P.U. released from the bottom of the cabinet, and the receiver cable released from the S.P.U. Also release all other cables from the S.P.U. and receiver assembly and the antenna and ground leads from their respective connections. See Figure 6 for socket numbers and terminal board and cable designations.

RECEIVER ASSEMBLY CONTINUITY TESTS

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	G1 to antenna lead	Open	Shorted antenna condenser
	G1 to ground lead	Open	Shorted .2 mfd. condenser
	G1 to —F1	Closed	Open volume control
	G2 to —F2	Closed	Open grid resistor or secondary of 1st R.F. transformer
	—F2 to frame	Open	Shorted .1 mfd. condenser
	G3 to —F3	Closed	Open grid resistance or secondary of 2nd R.F. transformer
	—F3 to frame	Open	Shorted .5 mfd. condenser
	Stator condenser No. 3 to +F4	Closed	Open secondary of 3rd R.F. transformer
	—F4 to frame	Open	Shorted 5 mfd. condenser
	G5 to —F6	Closed	Open secondary of 1st A.F. input transformer
	G6 to —A (Black with yellow tracer)	Closed	Open secondary of 2nd A.F. input transformer
Plate	P1 to B+ Amp. (Maroon and red)	Closed	Open primary of 1st R.F. transformer
	P2 to B+ Amp. (Maroon and red)	Closed	Open primary of 2nd R.F. transformer
	P3 to B+ Amp. (Maroon and red)	Closed	Open primary of 3rd R.F. transformer
	P4 to B+ Det. (Maroon)	Closed	Open primary of 1st and 2nd A.F. input transformers
	P5 to one output terminal (Red)	Closed	Open connection
	P6 to other output terminal (Black with green tracer)	Closed	Open connection
Filament	A+ (Black with yellow tracer) to +F1	Closed	Open connection
	—F1 to +F2	Closed	Open connection
	—F2 to +F3	Closed	Open connection
	—F3 to +F4	Closed	Open connection
	—F4 to +F5	Closed	Open connection
	—F5 to +F6	Closed	Open connection
	—F6 to —A (Yellow)	Closed	Open filament resistor
Miscellaneous	B+ Amp. (Maroon and red) to frame	Open	Shorted .5 mfd. condenser
	+F4 to B+ Det.	Open	Shorted 1 mfd. condenser
	P4 to —F4	Open	Shorted .0012 mfd. condenser
	G5 to +F4	Open	Shorted .00016 mfd. condenser

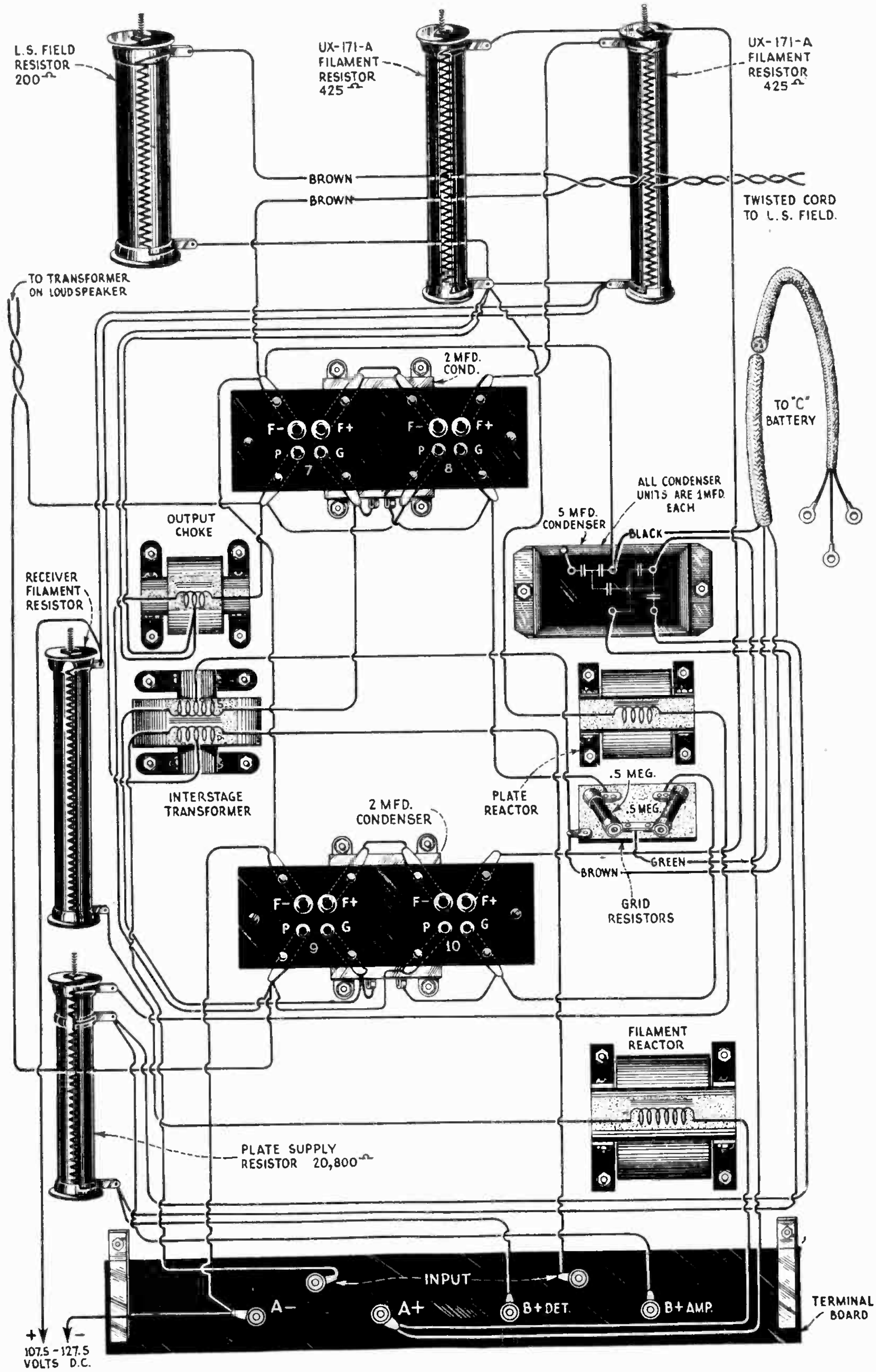


Figure 8—Wiring diagram of socket power unit

S. P. U. CONTINUITY TESTS

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
S.P.U.	Across input terminals	Closed	Open primary of interstage transformer
	G7 to G9	Closed	Open secondary of interstage transformer
	G7 to G8	Open	Shorted 2 mfd. condenser
	G9 to G10	Open	Shorted 2 mfd. condenser
	C—22½ (Green) to G8	Closed (Weak)	Open .5 meg. resistor
	C—22½ (Green) to G10	Closed (Weak)	Open .5 meg. resistor
	P8 to P10	Closed	Open primary of output transformer and output choke
	Disconnect connections to cone coil on L.S. and test across cone coil	Closed	Open cone coil
	Test across leads connected to cone coil terminals	Closed	Open secondary of output transformer
	Test across two terminals or bakelite strip	Closed	Open field coil
	Test across D.C. input plug	Closed	Open field coil or field resistance in S.P.U.
	+ of D.C. input plug to B+ Det. (Disconnect field)	Closed	Open plate reactor or plate resistor
	+ of D.C. input plug to A+ (Disconnect field)	Closed	Open filament reactor or filament resistor

The condensers may be tested by click testing or charging and noting their ability to retain the charge. This can be done by removing the S.P.U. cover and disconnecting one lead to the condenser to be tested. The internal connections of the condensers are shown in Figure 8.

MAKING REPLACEMENTS

The various assemblies and parts of Radiola 41 (D.C.) are readily accessible and replacements are easily made.

The reproducer unit, receiver assembly and socket power unit are removable individually after the cable connections to the other units are disconnected and the cabinet mounting screws are released.

A suitable place should be provided in advance for working on the unit to be removed so that the cabinet will not become marred nor any further damage occur to the apparatus when making a replacement.

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. For further detailed information refer to the text of "Service Notes."

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
	Open grid resistor	Replace grid resistor
	Open cone coil of reproducer unit	Check cone coil—if open replace cone
	Grounded input terminals to loudspeaker	Check for grounds
	Socket plug position	Reverse socket plug
Weak Signals	Defective power cable	Repair or replace cable
	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
	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
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper
Howling	Defect in audio system	Check and repair any defect
	Open grid circuit in any stage	Check circuits and repair defect
	Microphonic Radiotrons	Interchange Radiotrons
Radiotrons fail to light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input D. C. cord	Repair or replace D. C. input cord
	No. D. C. line voltage	Turn D. C. line voltage "On"

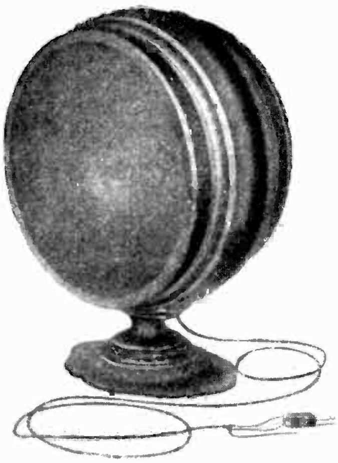
RCA LOUDSPEAKER MODEL 100

Reg. U. S. Pat. Office

SERVICE NOTES

NS-100-2

Second Edition—November, 1926



RADIO CORPORATION OF AMERICA

Prepared by

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A Word or Two About Service

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RCA Loudspeaker Model 100 Service Notes

NOTE.—*Cone assembly of RCA Loudspeaker Model 102 is identical to Model 100 less the filter unit*

Prepared by

NATIONAL SERVICE DIVISION

Instructions NS-100-2

PART I

RCA Loudspeaker Model 100 is of the free floating cone type. It is suspended at the outer edge by means of a strip of soft kid which holds the cone in a central position but does not impede its movement to any great degree. The cone is attached rigidly to the speaker mechanism at the center.

In servicing Model 100 Loudspeaker always make certain that the output of the Radio Receiver used in conjunction with it, is of good quality. If distortion is present in the Radio Receiver, RCA Model 100 Loudspeaker will reproduce that distortion as faithfully as it does the tone variations of the program.

Rattling sounds, or the so-called "paper rattles," are generally caused by a distortion in the lower tone registers of the amplifying system of the Radio Receiver. It is therefore quite important to first check the Receiver for quality of signal. This may be done by substituting another loudspeaker of known quality or else by replacing the loudspeaker with a pair of headphones. If distortion is present either in the second loudspeaker or the headphones it is a positive indication that the trouble is originating in the Radio Receiver.

Similarly, if the Radiotrons in the Receiver are overloaded by an abnormally strong signal being forced through the amplifiers, distortion will follow.

If it is definitely established, however, that the distortion or rattle complained of is not due to a defect or improper adjustment of the Radio Receiver, but is apparently caused by the Loudspeaker itself, it may be the result of one of the following conditions:

(A) Foreign material interfering with armature vibration.
(B) Armature striking the pole piece.
(C) Cone misaligned.
(D) Excessive pressure on the stylus.
(E) Bent stylus.
(F) Loose or bent connecting rod.

Figure 1 shows a rough sketch of the complete armature assembly and its relation to the cone. The armature vibrates between the pole pieces (not shown), this motion being transmitted through the stylus to the thrust lever. The thrust lever is held rigidly to one of the motor side pieces. It is attached rigidly to the cone by the connecting rod. Dirt at any of these points may cause distortion.

On inspecting the RCA Model 100 Loudspeaker, note whether or not the stylus is bent, if so straighten it. The cone is attached to the connecting rod by means of a small nut "B", Figure 1. The end of the connecting rod is threaded. Make certain that the cone is drawn up tight to the connecting rod.

If the two foregoing points have been checked and found to be O.K., note whether or not the armature is striking the pole pieces. Figure 1a and Figure 2 show the relation of the armature to the pole pieces. There should be a space approximately .010 inch Between the armature and the pole pieces, Figure 1a. This is true at both ends of the armature.

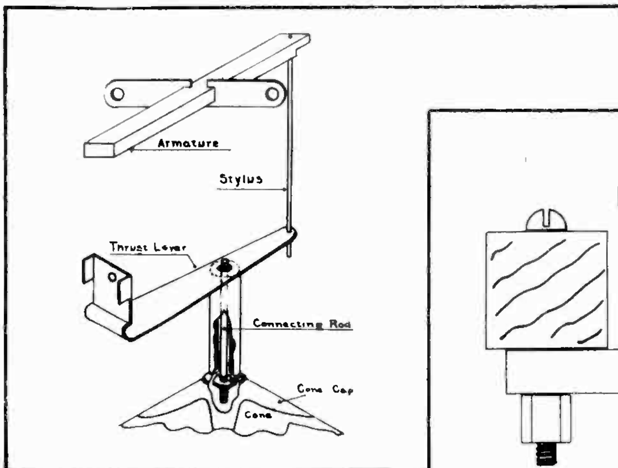


Fig. 1—Moving part of motor

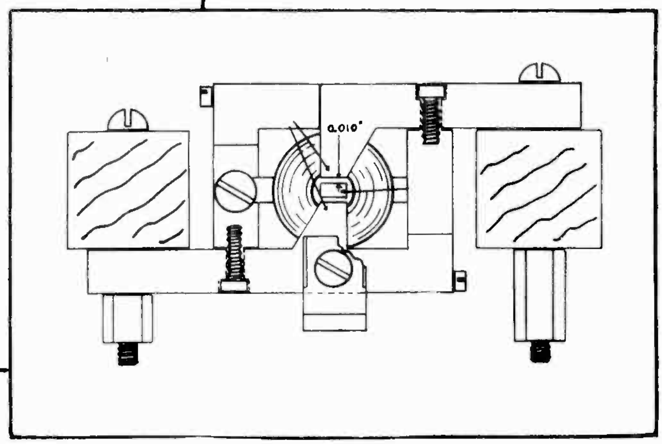
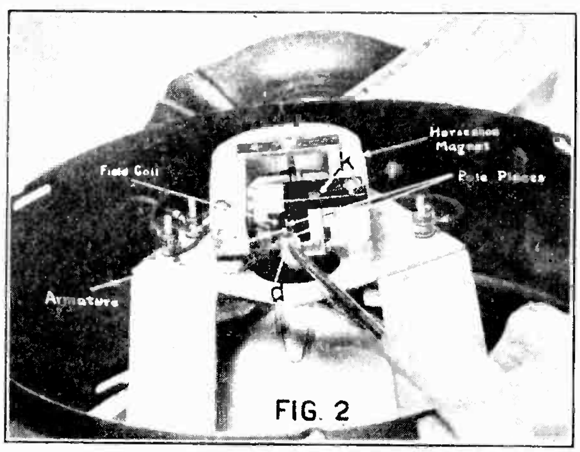


Fig. 1a—End view of motor



Method of adjusting armature clearance

If either end of the armature strikes the pole piece a very disagreeable rattle will result. To correct a misalignment of the armature a pair of spacer tools, shown in Figure 3, and a screwdriver will be necessary. These spacer tools should be made of .010 phosphor bronze stock about 1/8 inch wide. The distance between the open ends of the tool should be .091 inches. See Figure 3a.

Any loose screws, nuts or parts in the speaker may cause rattles and for that reason in making adjustments all screws should be seated properly, which means that all screws and nuts should be drawn up firmly enough to prevent their loosening when the speaker is placed in operation. Care should be taken to prevent stripping of the threads on the screws and nuts as well as to prevent torsion of the elements held in place by such screws and nuts.

To readjust the armature it will be first necessary to free it. Figures 4 and 5 show the method of doing this. The screws shown as "C" should be backed off about two turns. Do not remove them entirely.

When the two screws are loosened it is a simple matter to insert one of the spacer tools between each of the two armature ends and the pole pieces as shown in Figures 6 and 7.

When the spacing tools are inserted the clearance between the armature and the pole pieces must necessarily be the required ten thousandths as this is the thickness of the blades of the two spacers.

After the spacer tools have been inserted, one at each end, the two screws "C" that were loosened (Figures 4 and 5) should be tightened firmly. Figure 8 shows the method of tightening the upper screw with the spacers in place.

After the two screws have been tightened the spacer tools should be removed and the Loudspeaker tested. If the rattle has been eliminated no further adjustment will be necessary. If, however, the rattle is still present it may be due to the fact that the cone is out of centre with respect to the connecting rod.

To correct this, again refer to Figure 2. The screw "d" holds the thrust lever. When this screw is loosened the cone will automatically assume the proper position and the screw "d" should then be tightened down. Care should be taken that the sides of the thrust lever, visible in Figure 2, be held at right angles to the pole pieces as shown when tightening "d".

The Loudspeaker should again be tested. If the rattle still persists it is probably due to an excessive pressure on the connecting rod which may be corrected as shown in Figure 9. A soldering iron should be applied to the point where the inner end of the stylus is soldered to the thrust lever. The solder at that point should be softened sufficiently to allow free movement of the stylus. Here again the adjustment is automatic and it is only necessary to keep the solder soft until this readjustment takes place.

PART II

Should it become necessary to replace the field coils due to burn-out or other causes, it will be necessary to remove the entire reproducer unit.

The procedure is as follows:

1. Remove the flexible leads of the coils from the binding posts. Tag the leads as they are removed so that when the unit is reassembled they may be connected to the proper binding posts. THIS IS IMPORTANT.

2. Remove the small nut holding the cone to the connecting rod shown in Figure 1.

3. Remove the nuts F, Figure 10, from the upper supporting screws "H". A small open end wrench will be necessary for this operation as it is necessary to remove these nuts by inserting the wrench between the cone and the frame.

4. Unscrew the lower supporting screw G, Figure 9, and remove the strap "N".

5. Remove the unit by pulling out. Do not strain the cone or the connecting rod when removing the unit. Make certain that the connecting rod slides out freely as the unit is removed.

6. Remove the two screws "H", Figure 10, holding the motor in place. These screws thread into the spacer bushings "E".

7. Place a piece of iron on the ends of the horseshoe magnet and slide the motor off. The piece of iron takes the place of the motor and acts as a keeper on the magnet.

8. Remove the screw holding the thrust lever to the motor frame "D", Figure 2.

9. Unsolder the thrust lever from the stylus and remove Point "E", Figure 1.

10. Remove the two armature screws "C", Figures 4 and 5.

11. Dissemble the motor by removing the two countersunk screws. One of these screws "K" is shown in Figure 2. The coils are then accessible, but the armature is still in position in the center of the coils. Figure 11.

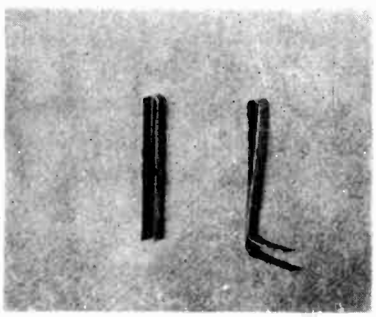


Fig. 3—Spacer tools

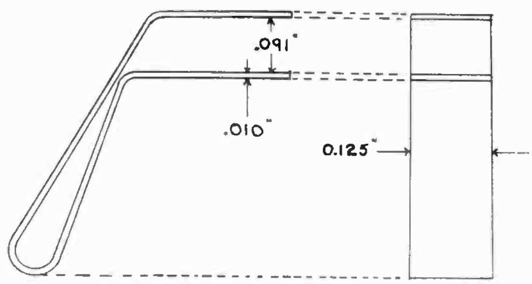
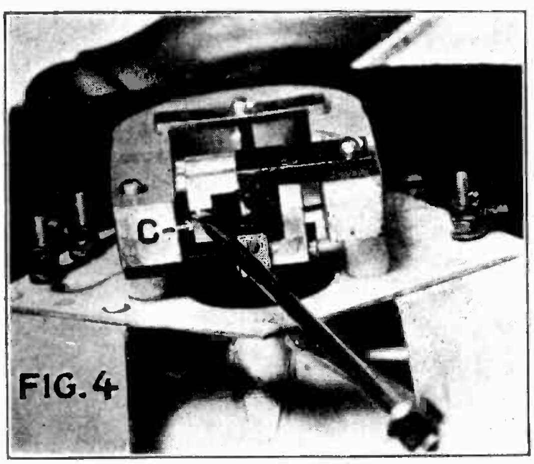
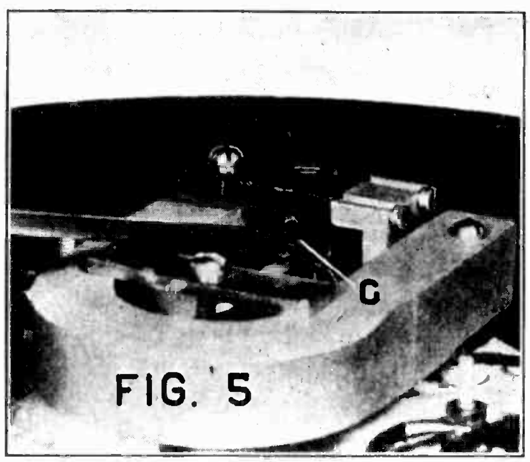


Fig. 3a—Spacer tool dimensions





Freeing the armature

12. Slip one coil over the free end of the armature and then slip the second coil off the armature and stylus. All parts before re-assembling should be thoroughly cleaned and freed from all traces of dust or dirt and metal filings, etc. Use a brush to remove foreign matter from the parts. Avoid the use of liquid cleaners as they often induce corrosion.

The re-assembly should be a reversal of the operation just described.

1. Place the coils "P"-"P", Figure 11, in proper position around the armature. The small length of wire connecting the two coils in series should be at the outside of each coil when assembled, "L", Figure 11.

2. Place the coils with armature in position on one of the motor side pieces, Figure 12. Place the other motor side pieces in place and screw the assembly together by means of the screw. In making this assembly make certain that the small pins "M", Figure 12, projecting from the inner side of the motor side piece, separate the two field coils as shown in "B", Figure 12.

3. Place the thrust lever in position and screw it in place "d", Figure 2, but do not solder to the stylus at this time.

4. Replace the armature screws "C", Figures 4 and 5, but do not seat them firmly.

5. Insert the spacer tools (Figure 3) in position at the top and bottom of the armature and tighten down the armature screws as described for adjusting the armature in Part I of these instructions.

6. It will sometimes happen that in tightening the armature screws the armature may be strained slightly and when the spacer tools are removed the strain causes the armature to spring out of the central position. Remove the spacer tools and note carefully whether or not the armature is centered between the pole pieces. If not repeat operation No. 5.

7. Remove the keeper and place the motor in position on the horseshoe magnet. Before seating the screws "H", Figure 10, that hold the motor to the magnet push both sides of the motor down toward the curved part of the magnet. The motor should be horizontal with respect to the sides of the magnet.

8. Replace these assembled units on the Loudspeaker frames. Place the connecting rod through the cone. Place the lower supporting strap "N", Figure 9, in place and tighten screw "G" until the unit is held in position, but not firmly.

9. Adjust the position of the unit until the connecting rod in passing through the center of the cone does not exert a vertical or horizontal pressure on the cone.

10. Seat the screw "G" holding the lower strap "N", Figure 9, and then fasten the upper portion of the unit to the frame by means of the nuts "FF", Figure 10, on the upper screws "HH". When tightening these last two mentioned nuts be careful not to disturb the central position of the unit as established in 9.

11. Lock the cone to the connecting rod by the nut provided for that purpose. The thread on this nut has a pitch of 80 threads to the inch and it may be stripped very easily if too great a pressure is applied to it.

12. Solder the stylus to the thrust lever (Figure 1).

13. Reconnect the leads to the binding post.

14. Test the loudspeaker and if further adjustments are necessary follow the procedure outlined in Part I of these instructions.

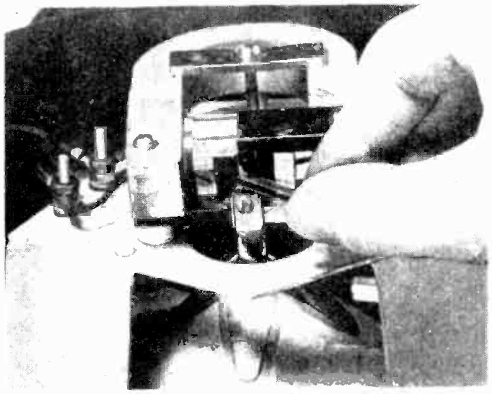


Fig. 6—Spacer tool in place, upper armature end

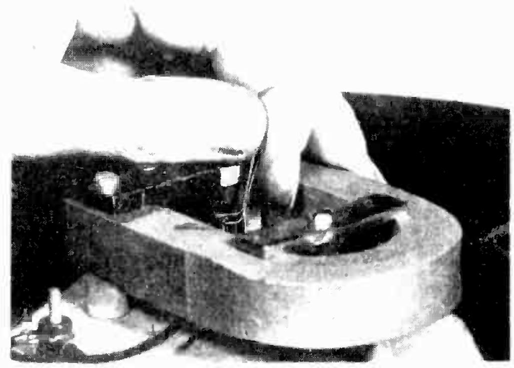
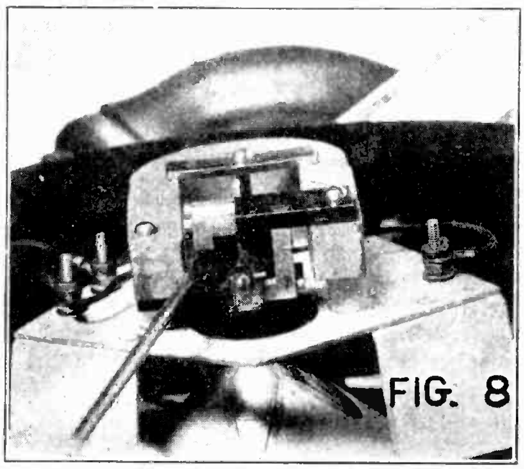
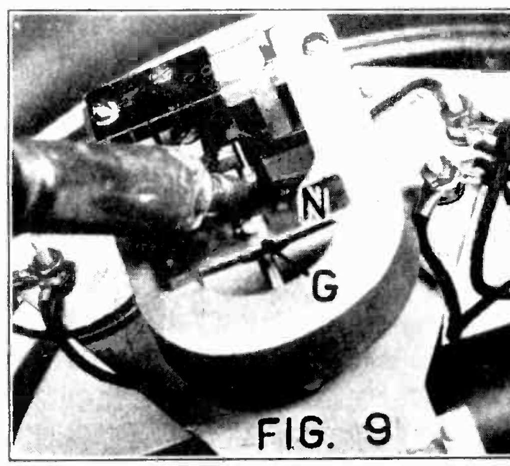


Fig. 7—Spacer tool in place, lower armature end



Tightening upper armature holding screw



Soldering the stylus to the thrust lever

PART III

To replace a defective cone:

1. Remove the small nut that holds the cone to the connecting rod.

2. Remove the four screws "a", "b", "c" and "d" shown in Figure 13. When these screws are removed the entire aluminum frame may be removed from the casing. If desirable, the leads may be disconnected, but this is not necessary.

3. Remove the remaining eight screws shown in Figure 13 as "e", "f", "g", "h", "i", "j", "k" and "l".

4. Remove the outer clamping ring.

5. Remove the cone.

6. Put new cone in place. Make certain that the connecting rod passes through the center hole in the aluminum cone cap.

7. Place the cone and outside clamping ring so that all screw holes correspond with the screw holes in the casing.

8. Replace the screws, "e", "f", "g", "h", "i", "j", "k" and "l" (Figure 13). These screws should be tightened down uniformly. Do not seat one screw at a time, but tighten each little by little until all are seated properly.

9. Provide supports and lay the casing on them in a horizontal position.

10. Allow the aluminum frame to rest on the four cleats "O", Figure 13, on the front edge of the casing.

11. Center the frame in the center of the casing and replace the four screws "a", "b", "c", "d", Figure 13.

12. Test the speaker and make final adjustments.

While making these adjustments the loudspeaker should be kept in a clean place free from dirt or filings. Small particles of metal are easily attracted to the mechanism in the loudspeaker due to its magnetic qualities.

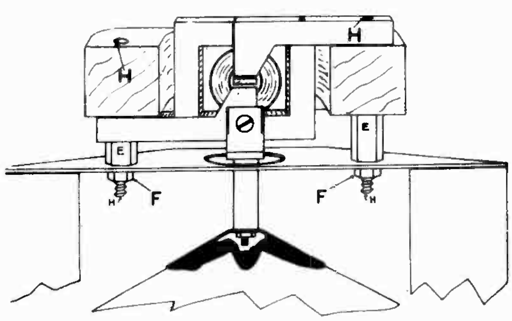


FIG. 10

Motor and connection to cone

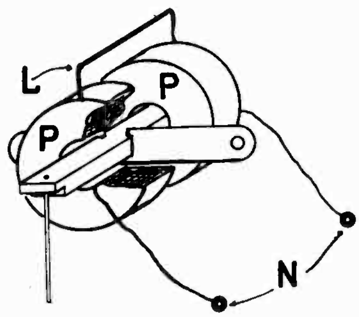


FIG. 11

Coils in place around armature

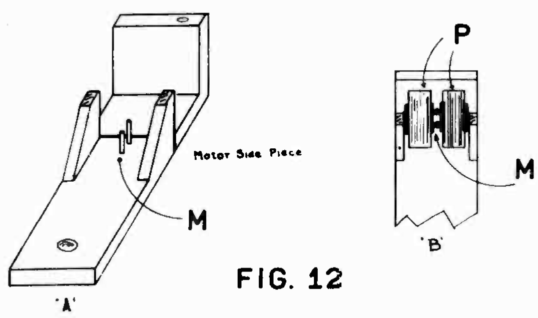


FIG. 12

Motor side piece showing separator pins

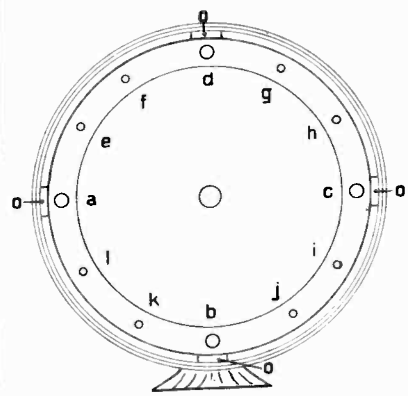


FIG. 13

Frame, front view

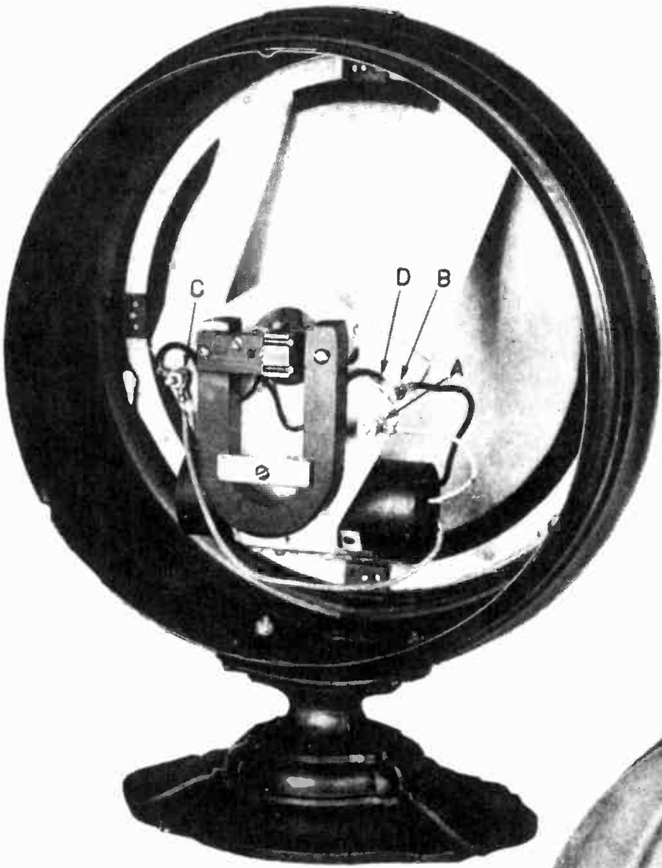


Fig. 14
Cylindrical filter type

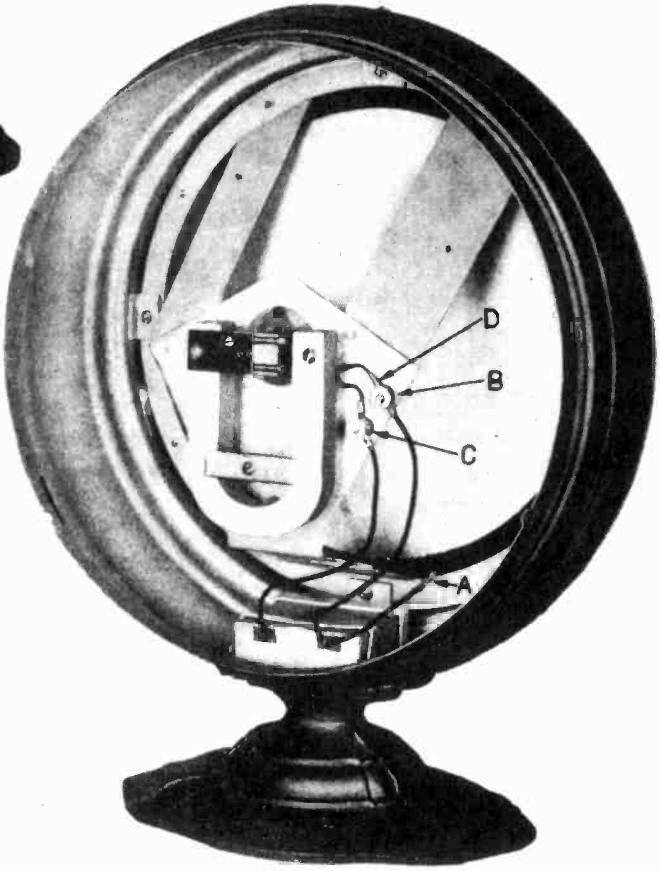
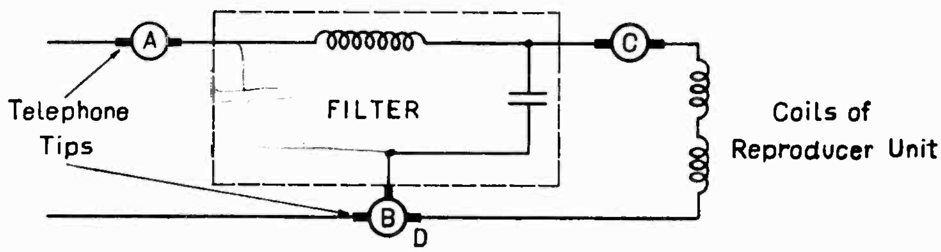


Fig. 15
Square filter type

CONTINUITY DIAGRAM



MODEL 100 LOUD SPEAKER

FIG. 16

PART IV

Continuity and Filter Tests

There are two types of filters appearing in the Model 100 Loudspeaker, one contained in a cylinder and the other in a square box. Both of these filters are electrically identical, the only difference being in the type of container employed.

In the model employing the cylindrical type of filter (Fig. 14) the input leads (phone tips) are connected to the two binding posts at A and B on the frame. In the square filter type (Fig. 15), however, one of the phone tips is soldered to point A and taped, the other being connected to the binding post at B.

The only equipment required to test the electrical circuit of Model 100 Loudspeaker is a pair of head phones connected in series with a 4½-volt C battery. The test points are shown in capital letters in the circuit diagram and illustrations, Figs. 14, 15 and 16.

Before starting the "click" test, disconnect terminal D from the binding post at B. This free terminal D will then become a separate test point. In case terminal A is a taped connection, as it is in the square box filter type of Model 100 Loudspeaker, the tape will have to be temporarily removed to expose the metallic surface for the "click" test.

Remove loudspeaker plug from radio receiver jack before proceeding with test.

Contact Points	Correct Effect	Defect
A to D	Click, closed thru filter coil and reproducer coils.	Open in circuit.
A to C	Click, closed thru filter coil.	Open filter coil.
C to D	Click, closed thru reproducer coils.	Open reproducer coil.
C to B	No click, open thru filter condenser.	Filter condenser or telephone plug shorted.
A to B	No click, open thru filter coil and condenser.	Filter condenser or telephone plug shorted.

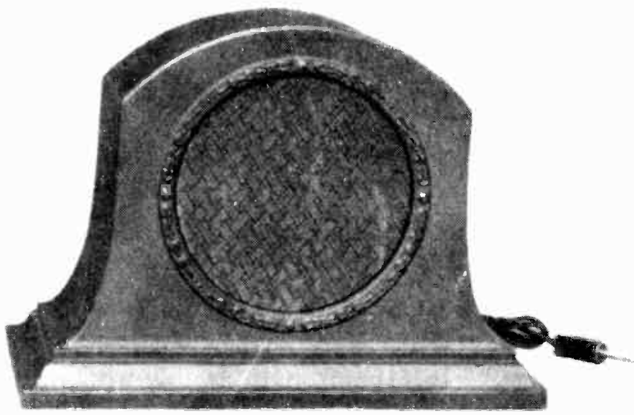
Note.—Care should be taken to replace terminal D on binding post at B after completion of "click" test.

RCA LOUDSPEAKER MODEL 100A

SERVICE NOTES

100A-1

First Edition—June, 1927



RCA Loudspeaker Model 100A

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CONTENTS

ILLUSTRATIONS

RCA LOUDSPEAKER MODEL 100A

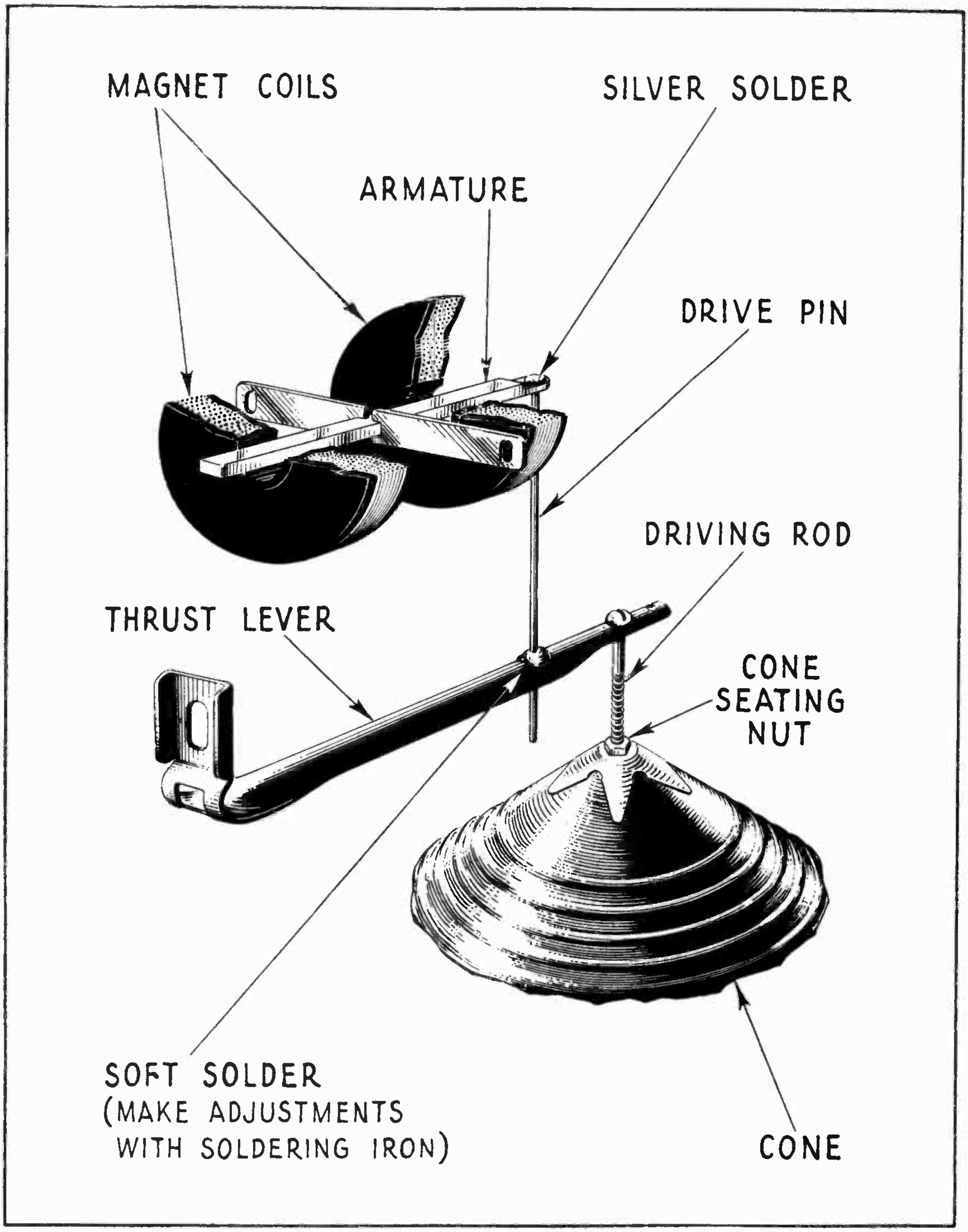


Figure 1—Diagram showing constructional details and operating principle of RCA Loudspeaker 100A

SERVICE NOTES

RCA LOUDSPEAKER MODEL 100A

Prepared by

RCA SERVICE DIVISION

100A-1

INTRODUCTION

RCA Loudspeaker, Model 100A is a new type of loudspeaker operating on the cone principle and especially designed for use with Radiolas and standard receivers. An inspection of the interior mechanism reveals a compact unit of rugged construction and simplicity of design. The loudspeaker consists essentially of a cast metal housing with an ornamental grille at the front and back, a cone, frame, magnet, motor mechanism and filter unit. The four screws on the front of the housing support the grille and mechanism assembly on the inside. This method of mounting provides easy access to the different parts.

When Loudspeaker Model 100A is used in conjunction with receivers using plate voltages passing current in excess of 10 milliamperes some method of coupling the output of the receiver to the Loudspeaker should be employed. A choke and condenser arrangement or an output transformer of proper design will function satisfactorily for this purpose. Figure 2 illustrates the correct connections for employing either of these methods.

The service data contained in the present text deals with the problems of imperfect loudspeaker reproduction generally and the cause and cure specifically as it applies to RCA Loudspeaker 100A. The simple and rugged design of RCA Loudspeaker 100A makes it practically trouble proof and permits easy and simple adjustment or replacement when necessary.

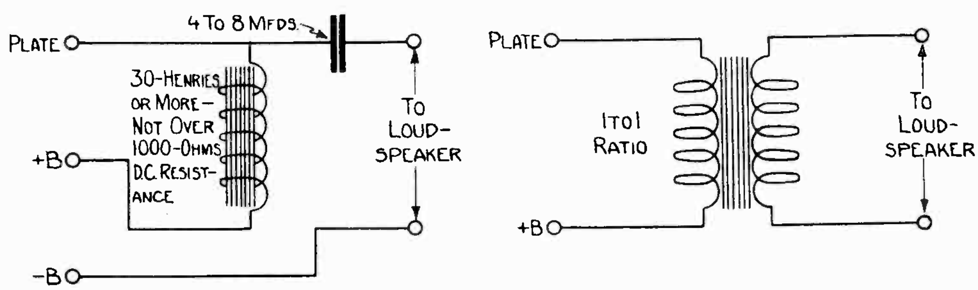


Figure 2—Typical output circuits

PART I—SERVICE DATA

The service problems of loudspeakers deal with conditions evidenced by weak reproduction, no reproduction, distortion, noise and rattle. These conditions and their attending causes, while not common to Loudspeaker 100A, are explained in the following text, and remedies noted so that service men may be provided with helpful information in any service work that may be required on Loudspeaker 100A.

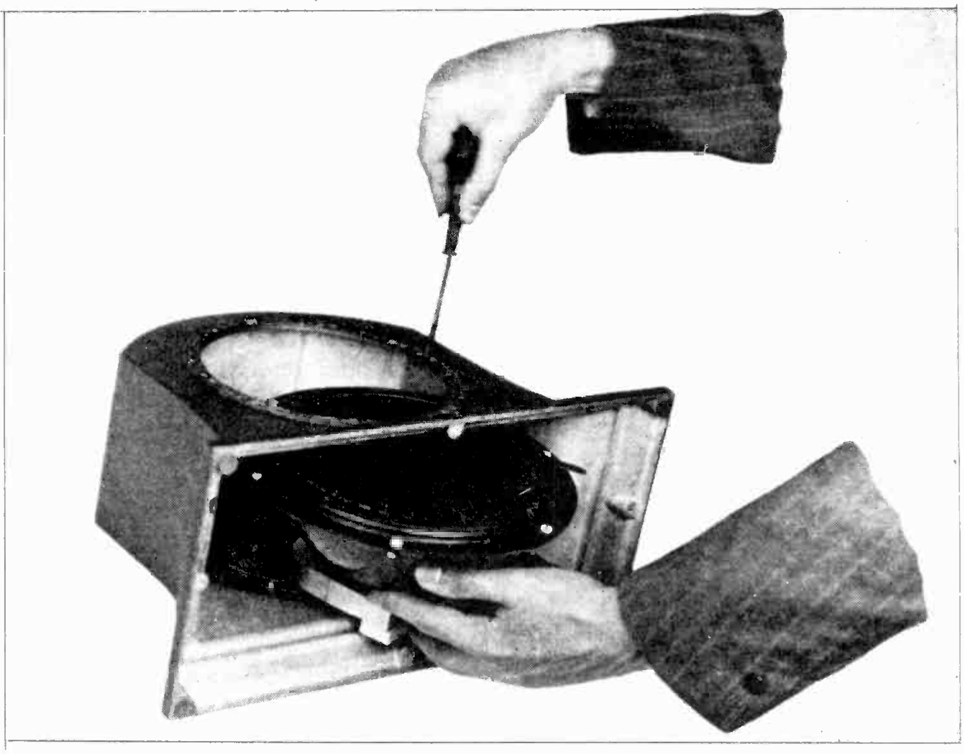


Figure 3—Removing mechanism assembly from housing

(1) RECEIVER OUTPUT

Before inspecting the loudspeaker for imperfect reproduction check the receiver output with headphones. Any distortion in the receiver will be faithfully reproduced in the loudspeaker. If a signal of good quality and volume is being delivered by the receiver the loudspeaker will have to be examined for the cause of any imperfect reproduction that may occur.

(2) PROCEDURE TO REMOVE HOUSING

To examine Loudspeaker 100A the mechanism assembly must be removed from the housing. This is accomplished by removing the four screws and the fibre sheet at the bottom of the housing. Then supporting the mechanism assembly inside of the housing with one hand loosen the four screws that hold the front grille in place. These screws also fasten the mechanism assembly. After removing the screws the unit can be lifted clear of the housing, Figure 3. The cord should be pulled inside of the housing sufficiently to allow enough slack for this operation. The cone and motor mechanism is now readily accessible for any inspection or adjustment that may be necessary.

(3) FOREIGN MATERIAL INTERFERING WITH ARMATURE ACTION

An inspection of the armature will generally disclose any foreign matter interfering with the armature action resulting in poor reproduction. A small piece of heavy paper or a piece of copper or brass not over .010″ thick may be used between the armature and pole piece to remove dirt, dust or other interfering substance. The spacer tool, described in Section 4, may also be used for this purpose.

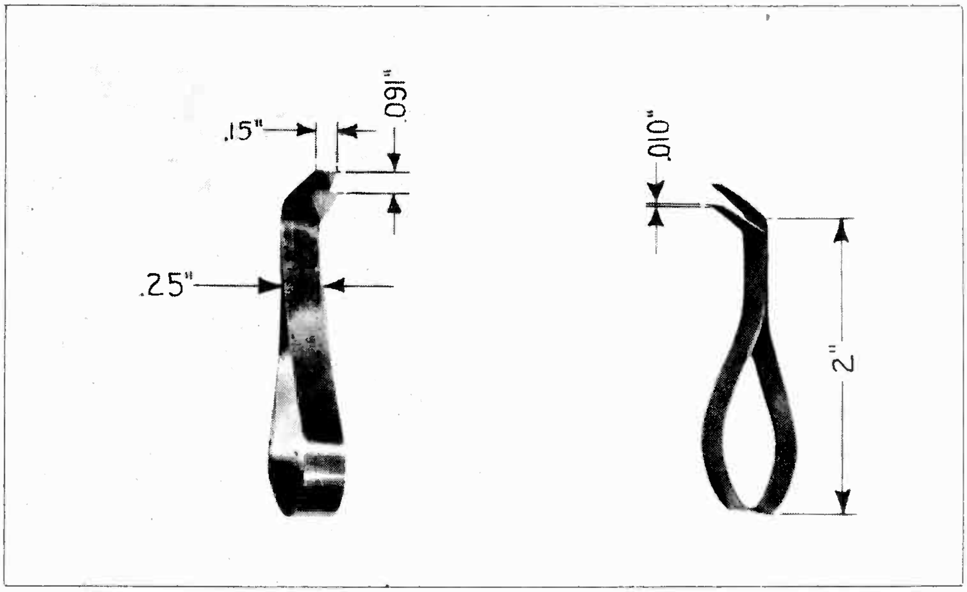


Figure 4—General appearance and correct dimensions of armature spacing tools

(4) ARMATURE STRIKING POLE PIECES

Distortion and rattle may be caused by the armature striking either or both of the pole pieces. This is generally determined by inspection, though in some cases the contact may be so slight it may be necessary to adjust the armature to check on this condition. In any case an adjustment of the armature is necessary.

To adjust the armature a set of spacer tools are necessary. Figure 4 illustrates the general appearance and correct dimensions of these spacer tools. The stock—obtainable on the open market—should be phosphorous bronze strip .010″ thick and .25″ wide. It is bent as illustrated and soldered to hold the opening fairly rigid. The two ends are tapered as illustrated to a .15″ width at their extremities.

Two of these tools are necessary when adjusting the armature. Place one tool in the space between the armature and pole piece of the motor mechanism at the end next to the filter unit. This is shown in Figure 5. The other tool is placed at the other end of the armature a little to one side in order to clear the drive pin located at this end of the armature. By loosening screws A and B, Figure 5, any tension in either direction that may have been on the armature is released and the spacer tools will provide the correct clearance or spacing. Now while the spacer tools are in place a hot soldering iron is applied to the drive pin thrust lever connection point C, Figure 6, and the solder heated sufficiently to allow the drive pin to find its normal position with regard to the thrust lever. The iron is now removed. Screws A and B, Figure 5, are tightened and the spacer tools removed. The armature is now correctly aligned and balanced so that no abnormal strain is being imposed upon it in any direction.

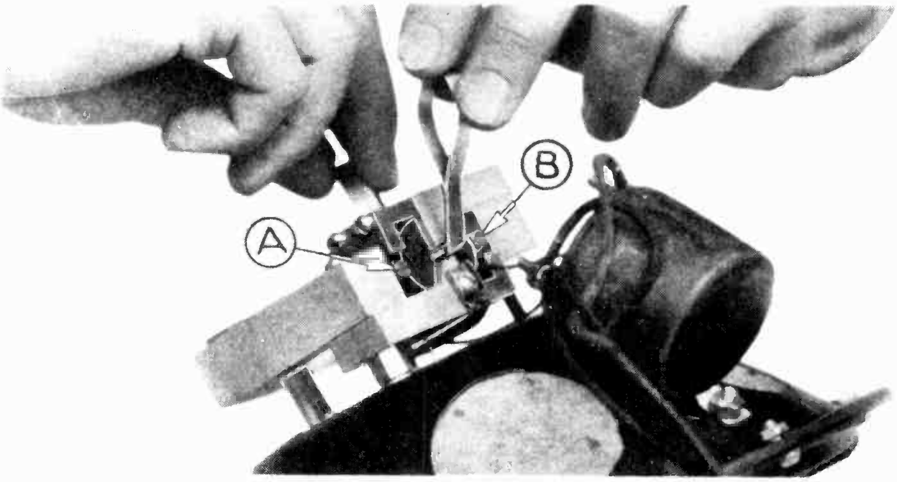


Figure 5—Armature bracket adjusting screws A and B

(5) CONE NOT PROPERLY ADJUSTED

In some cases a cone may become improperly aligned or adjusted, causing a strain to be placed on the driving rod, due to the cone not centering or seating properly. Poor reproduction is the result and inspection of the armature drive-pin may indicate a slight torque or twist. This is most likely to occur when replacing a cone. The new cone should be carefully seated by placing the cone over the driving rod and adjusting the cone seating nut located on driving rod next to thrust lever (See Figure 1, page 4). Then attach cone lock nut and washer lightly on inside of cone before fastening the edge of cone. The holes on the edge of the cone can now be lined up with those of the metal frame and the outside ring lightly attached with screws and nuts. The cone lock nut is then tightened and sealed in place with ordinary sealing wax so that the vibration of the cone will not cause it to loosen. This nut can best be tightened by means of a small socket wrench made to fit a 3/16" hex. nut (Stevens "Spintite" No. 3 can be used). The six screws at the outside edge are then seated properly. In doing this take up on each screw a little at a time causing a gradual seating of the screws.

(6) LOOSE THRUST LEVER, NUTS AND SCREWS

Rattle and noisy reception are sometimes caused by a loose thrust lever. To correct this condition tighten the thrust lever mounting screw G, Figure 9. Sometimes when this is done a readjustment of the armature, as described in Section 4, may be necessary. Any loose screw or nut in the motor mechanism may cause an audible rattle while the speaker is in operation. If any trouble is experienced along this line all the screws and nuts in the motor mechanism should be gone over and loose ones tightened.

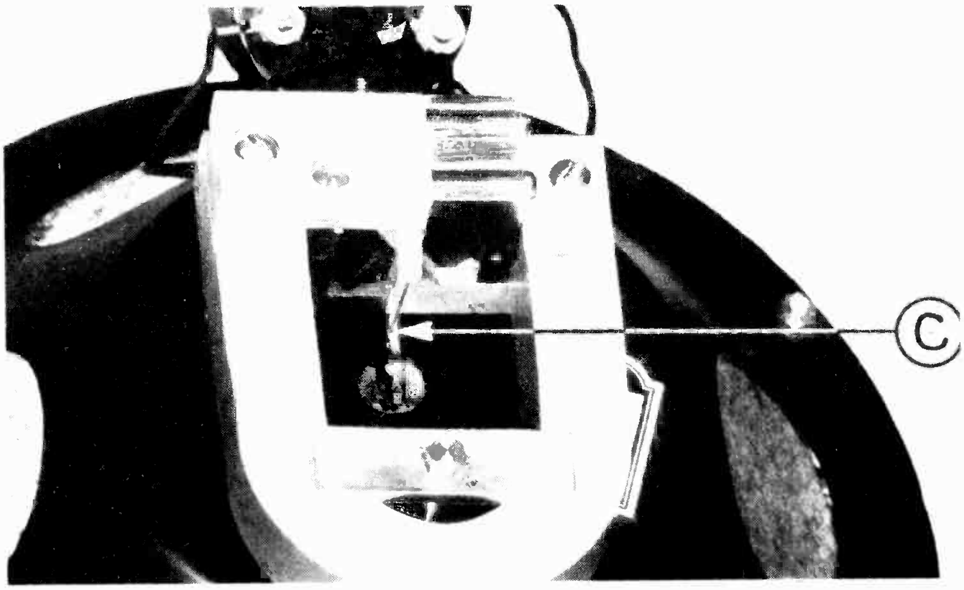


Figure 6—The drive-pin thrust-lever connecting point (C) which is soldered

(7) FILTER UNIT AND MAGNET COIL TESTS

A defective filter unit or a filter unit not properly connected in the circuit will cause distortion. Defective magnet coils will also cause imperfect reproduction. The circuit and correct connections are shown in Figure 8. The reference letters in the circuit diagram refer to the filter terminals shown in the small halftone illustration Figure 8. These should correspond electrically, otherwise distorted or no reception will result. A click test will indicate whether or not the unit is electrically O. K. The following continuity test will indicate an electrical defect either in the coils or filter unit.

A pair of headphones and a $4\frac{1}{2}$-volt battery connected together in series or a voltmeter and sufficient battery to give a full scale deflection should be used.

FILTER UNIT CONTINUITY TEST (See Figure 8)

Disconnect Magnet Coils and Loudspeaker Cord

Test	*Correct Effect*	*Incorrect Effect Caused by*
L to M	Closed	Open filter coil
L to N	Open	Shorted filter condenser
M to N	Open	Shorted filter condenser

CONTINUITY TEST FOR MAGNET COILS AND LOUDSPEAKER CORD (See Figure 8)

Connect Magnet Coils and Loudspeaker Cord

Magnet coils may be tested as indicated below. A click test from one lead to the other while they are completely disconnected from the rest of the circuit is also a simple and effective method of testing.

Test	*Correct Effect*	*Incorrect Effect Caused by*
Jack tip to L or N	Closed	Open cord
Jack sleeve to L or N	Closed	Open cord
M to N	Closed	Open magnet coils or coil leads

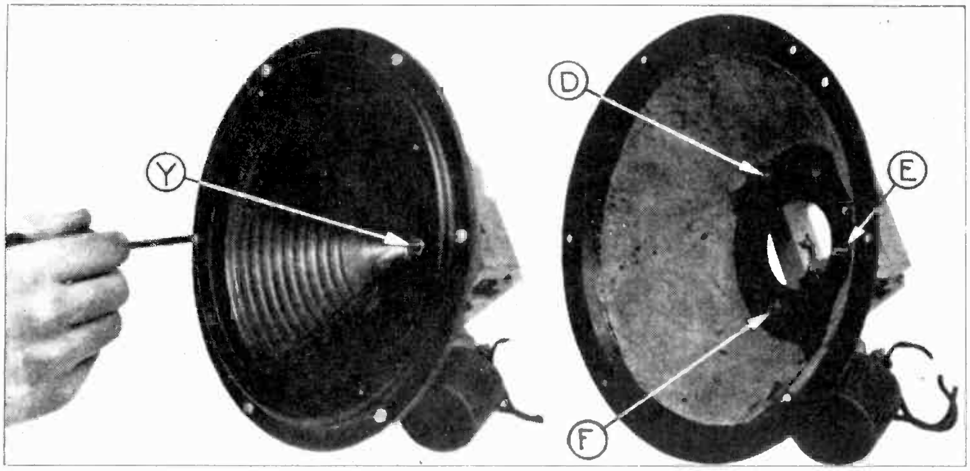


Figure 7—Cone, showing six mounting screws around edge and lock nut (Y) and motor mechanism mounting screw nuts D, E, F

(8) TESTING LOUDSPEAKER CORD AND LOUDSPEAKER CONNECTIONS

A defective connection, either in the loudspeaker cord or coil connections may cause distorted, noisy or no reproduction. As there is not much wear and tear on the coil connections, the most likely place to find trouble of this nature is in the connecting cord. The point where the cord enters the loudspeaker housing and the end on which the connecting plug is located may become frayed and worn causing a possible short or open circuit. Also the connecting lugs inside of the plug may become broken or loose after long use. If these points prove O. K. and there are no indications of any defects external to the speaker housing, the bottom fibre piece should be removed and the lugs of the cord connected to the filter unit examined. If there is no apparent defect the cord should be disconnected and tested by means of a battery and pair of phones. It should be click tested for the continuity of the leads and also for a short between the leads. Shake the cord a bit while conducting the continuity test to disclose any breaks which will be indicated by interrupted clicks.

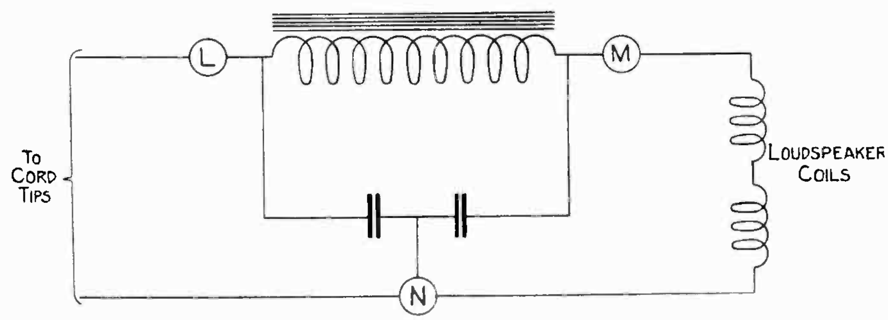
PART II—MAKING REPLACEMENTS

(1) REPLACING MAGNET COILS

The following procedure should be used when replacing magnet coils.

(a) Remove mechanism assembly from housing as described in Part I, Sec. 2.

(b) Remove the cone by breaking the wax seal and releasing the cone lock nut (Y, Figure 7) and the six retaining screws with nuts and washers around the edge of cone. Then release nuts D, E, F, Figure 7, from the three magnet supporting screws.



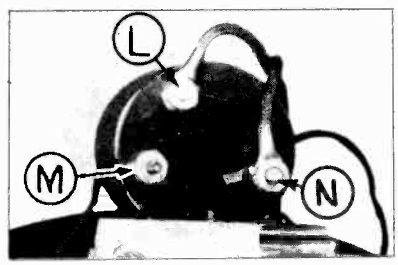


Figure 8—Schematic circuit diagram of RCA Loudspeaker Model 100A and photo of the filter unit

(c) Disconnect magnet coil leads at filter terminals M and N, Figure 8. The magnet and motor mechanism with supporting screws S, T, V and bushings X, Z, Figure 9, may now be removed from the supporting frame and separated by releasing the bushings X, Z, and removing the supporting screws S, T, V, Figure 9. Place a large nail or soft iron bar across the poles of the permanent magnet to act as a keeper (See Figure 10).

(d) Remove the thrust lever supporting screw G, Figure 9, and apply a hot soldering iron to thrust lever armature drive pin connection point C, Figure 6. The thrust lever and driving rod may now be removed.

(e) Disassemble the motor mechanism by removing screw O, Figure 10, and the corresponding screw P, on the other side of the mechanism. Also remove screws A and B, Figure 10. The magnet coils may now be removed by slipping them separately off the ends of the armature, one end of which has the drive pin fastened to it.

The reassembling is a reversal of the preceding operation.

(f) Insert the armature into the new coils in the same position occupied in old coils.

(g) Reassemble motor mechanism and replace thrust lever. Do not solder thrust lever to armature pin at this time.

(h) Replace motor mechanism on magnet with supporting screws and bushings; remove keeper and mount the assembly on supporting frame.

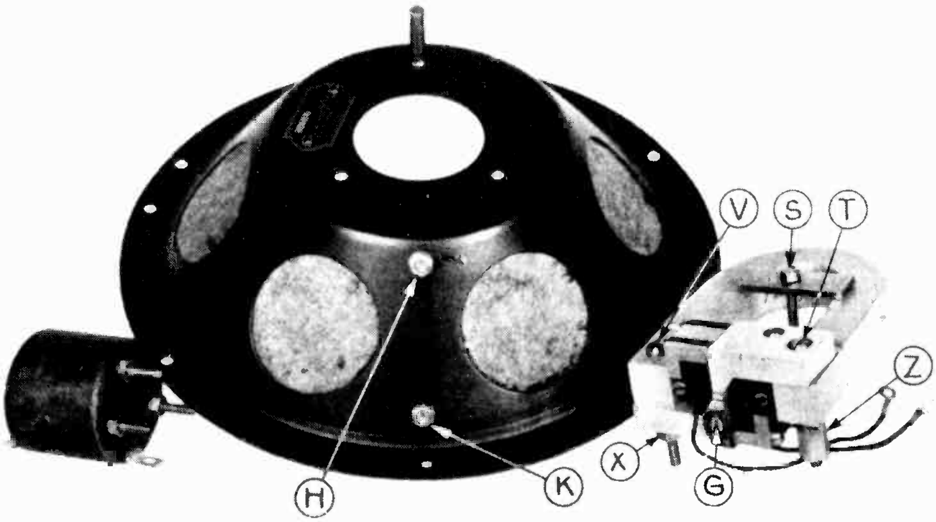


Figure 9—Loudspeaker disassembled, showing the frame, filter and motor mechanism with their respective mounting screws

(i) Replace cone and center carefully. Replace, but do not seat screws, nuts and lock washers around edge. Tighten cone lock nut and seal with sealing wax. Seat screws around edge.

(j) Place spacer tools in position to adjust the armature as indicated in Figure 5 and tighten screws A and B.

(k) Resolder drive pin to thrust lever and allow it to fall in its normal position. Remove spacer tools.

(l) Connect coil leads to filter terminals M and N, Figure 8. At this point it is good practice to test the unit on a receiver of good quality and make any further adjustments that may be necessary.

(m) Replace mechanism assembly in housing and replace bottom fibre sheet.

(2) REPLACING ARMATURE AND DRIVE PIN

The procedure for replacing the armature and drive pin is identical with that of replacing magnet coils (Part II, Sec. 1), with the exception of the new part substituted. The new armature should be clean and free from any dust or dirt.

(3) REPLACING THRUST LEVER AND DRIVING ROD

Ordinarily the driving rod and thrust lever are not likely to become damaged or require replacement. However, should it be necessary remove the mechanism assembly from housing as described in Part I, Sec. 2. Then remove the cone, the magnet and motor mechanism and the thrust lever as described in Part II, Sec. 1.

The thrust lever and driving rod are supplied in assembled form. Attach the new thrust lever to the pole piece by means of the supporting screw G, Figure 9, and reassemble the loudspeaker as described in Part II, Sec. 1.

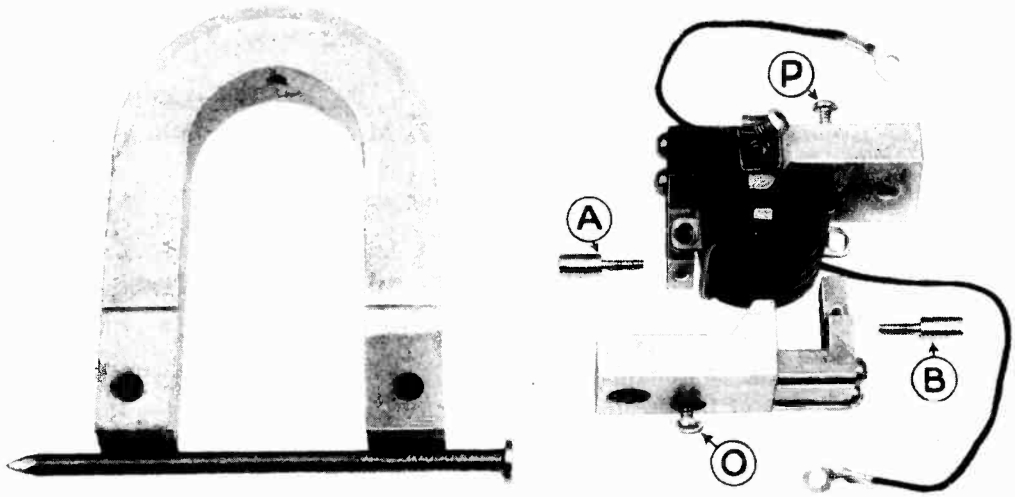


Figure* 10—*Motor mechanism partly exploded

Note the nail in position as keeper—it is important to place the keeper on the magnet before removing the motor mechanism and retaining it until the motor mechanism is replaced

(4) REPLACING MOTOR ASSEMBLY COMPLETE

When replacement of the complete motor mechanism is necessary remove mechanism assembly from housing as described in Part I, Sec. 2. Then remove the cone, the magnet and motor as described in Part II, Sec. 1.

The reassembly will be a reversal of the above procedure.

(5) REPLACING CONES

When replacing a cone remove the old cone as already described in Part II, Sec. 1. The replacement of the new cone is a reversal of the foregoing procedure.

(a) Place cone over the driving rod in center.

(b) Adjust cone seating nut (See Figure 1, page 4), so as to properly seat cone and provide clearance for thrust lever from pole piece.

(c) Replace retaining rim over cone and replace six screws, lock washers and nuts but do not seat the screws at this time.

(d) Replace washer and cone lock nut Y, Figure 7, on driving rod. Tighten and seal with ordinary sealing wax. Gradually seat the six retaining screws around edge of cone.

(e) For final adjustment apply a hot soldering iron at the thrust lever armature drive pin connection point C, Figure 6, until the armature drive pin has found its new position with regard to the tension produced by the new cone.

(6) REPLACING FILTER UNITS

The following procedure is used when replacing filter units:

(a) Remove mechanism assembly from housing as described in Part I, Sec. 2.

(b) Disconnect all leads to filter terminals L, M and N, Figure 8, and tag each lead. This is important so that the proper connections may be made when replacing these connections on the new unit.

(c) Remove filter mounting nuts H and K, Figure 9. The unit may now be removed and replaced with a new one.

(d) Replace filter mounting nuts H and K, Figure 9 on the filter.

(e) Reconnect leads to filter terminals L, M and N, Figure 8, as indicated on tags attached to same.

(f) Place mechanism assembly in housing and replace fibre sheet on base.

(7) REPLACING FRONT OR REAR GRILLE

Grilles are furnished complete with the frame. The following procedure in replacing a grille is to be used:

Front Grille

(a) Remove the mechanism assembly from housing as described in Part I, Sec. 2 and lift grille from mechanism assembly.

(b) The new grille may now be placed in position occupied by the old one. Preserve the diagonal position of the cloth pattern as originally installed. The reassembly is a reversal of the foregoing procedure.

Rear Grille

To replace the rear grille the mechanism assembly and front grille is first removed from the housing as already described. Then remove the eight screws, lock washers and nuts used to fasten the rear grille to the housing.

The rear grille may now be replaced and the speaker reassembled in the reverse order.

(8) REFITTING GRILLE CLOTH

The grille cloth on the front and rear of the loudspeaker may become wrinkled and loose after considerable use or due to extreme climatic changes. A wrinkled grille presents a poor appearance and should be refitted so that it will be tight and smooth. This is a simple procedure.

(a) Remove grille from housing, either front or rear, as described in Part II, Section 7.

(b) Carefully hold the edges of the grille frame and press the inside clamping ring from the cloth side until the grille assembly comes apart.

(c) Place the inside clamping ring with its rounded edge up on a table. Lay the grille cloth over this ring completely covering the edge.

(d) Now place the protruding edge of the grille frame over the inner clamping ring resting on the table, and gently press grille frame over the cloth and ring. The grille will now be assembled with the cloth tight and smooth over its entire surface.

(e) The entire grille assembly may now be returned to the loudspeaker housing in the usual manner.

SERVICE DATA CHART

The following table of information provides a handy reference when servicing Loudspeaker Model 100A, and a working knowledge of it will enable service men to handle service problems readily and efficiently. Column 1 headed "Indication" contains the symptom of the trouble experienced. Column 2 gives the cause. Column 3 states the remedy in brief form, and column 4 refers to detailed instructions in the Service Notes.

Indication	*Cause*	*Remedy*	See Service Notes	
			Part I	*Part II*
No Reproduction	No output from receiver	Examine receiver	Sec. 1	—
	Defective coils	Replace coils	Sec. 7	Sec. 1
	Defective filter	Replace filter	Sec. 7	Sec. 6
	Defective cord	Repair or replace cord	Sec. 7-8	—
	Loose or broken connections	Repair connections	Sec. 8	—
	Drive pin not soldered	Solder drive pin	Sec. 4	Sec. 1
Weak Reproduction	Weak receiver output	Examine receiver	Sec. 1	—
	Dirt interfering with armature action	Remove foreign matter from mechanism	Sec. 3	—
	Loose thrust lever mounting screw	Tighten screw and resolder drive pin	Sec. 6	Sec. 3
	Improperly aligned cone	Align cone correctly	Sec. 5	—
	Drive pin poorly soldered	Solder drive pin	—	Sec. 1
	Weak magnet	Remagnetize	—	—
Distorted or noisy Reproduction (Rattle)	Distorted output from receiver	Examine receiver	Sec. 1	—
	Improperly adjusted cone	Adjust cone correctly	Sec. 5	Sec. 5
	Filter incorrectly connected	Connect filter correctly	Sec. 7	Sec. 6
	Filter defective	Replace filter	Sec. 7	Sec. 6
	Loose screws or nuts in assembly	Tighten all loose screws or nuts	Sec. 6	—
	Armature striking pole piece	Adjust armature correctly	Sec. 4	Sec. 1
	Excessive pressure on drive pin	Resolder drive pin to thrust lever	Sec. 4	Sec. 1
	Filter unit not connected	Connect filter unit	Sec. 7	Sec. 6

RCA LOUDSPEAKER 100A REPLACEMENT PARTS

No.	*Description*
1964	Motor mechanism complete (less magnet)
1965	Armature with mounting bracket and drive pin
1966	Magnet coils with leads
1968	Thrust lever with driving rod to cone
1969	Filter unit complete
9190	Cone
5634	Screen assembly

Printed in U. S. A. 1927

RCA

RCA Loudspeaker 103

SERVICE NOTES

Prepared Especially for
RCA Distributors

Second Edition—5M

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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 Distributors.

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 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.

The Distributors edition of the RCA Service Notes—of which this booklet is a part—contains full information on the service problems that may be encountered on a particular model.

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.

CONTENTS

RCA Loudspeaker 103

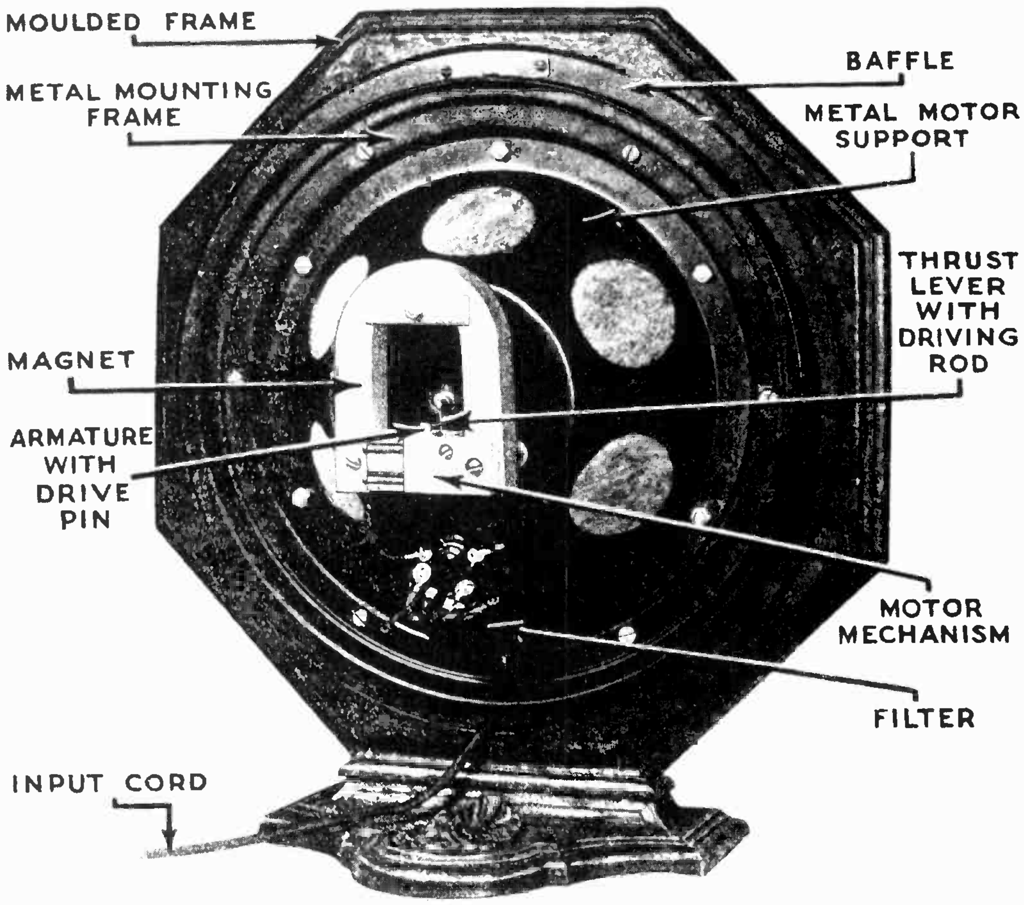

Figure 1—Rear view showing principal parts

RCA LOUDSPEAKER 103

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Loudspeaker 103 is an improved design of the extensively used RCA Loudspeaker 100A—the improvements resulting in better reproducing qualities and an artistic appearance which entirely removes it from any semblance to a mechanical device. It is especially designed for use with RCA Radiolas and standard receivers. The loudspeaker consists essentially of a moulded frame with a tapestry grille, a baffle board, cone support, cone, motor mechanism and filter unit. (See Figure 1.)

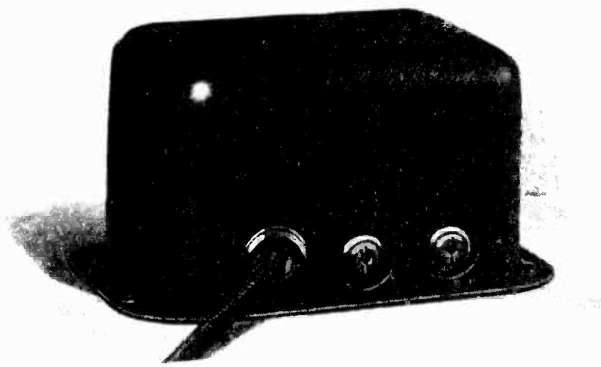

Figure 2—RCA output transformer

A fibre frame is provided to cover the entire mechanism, and a silk cover is tied over this frame to give an artistic finish and provide easy access to the mechanism when necessary.

Some method of coupling the output of the receiver to the loudspeaker should be employed when Loudspeaker 103 is used in conjunction with receivers using plate voltages passing current in excess of 10 milliamperes through the loudspeaker windings. The RCA output transformer (Figure 2) is especially designed for this purpose and should be used wherever it is found necessary. A choke and condenser arrangement will also give satisfactory results for this purpose when properly connected. Figure 3 shows the correct values and connections of either a transformer, or choke and condenser to the loudspeaker.

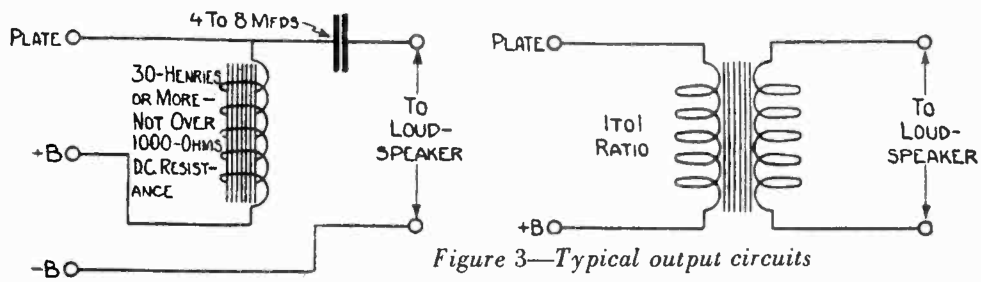

Figure 3—Typical output circuits

PART I—SERVICE DATA

The service problems of loudspeakers deal with conditions evidenced by weak reproduction, no reproduction, distortion, noise and rattle. These conditions and their attending causes, while not common to Loudspeaker 103, are explained in these notes and corrections noted so that service men may be provided with helpful information in any service work that may be required on Loudspeaker 103.

[1] RECEIVER OUTPUT

Before inspecting the loudspeaker for imperfect reproduction check the receiver output with headphones. Any distortion in the receiver will be faithfully reproduced in the loudspeaker. If a signal of good quality and volume is being delivered by the receiver, the loudspeaker must be examined for the cause of any imperfect reproduction that may occur.

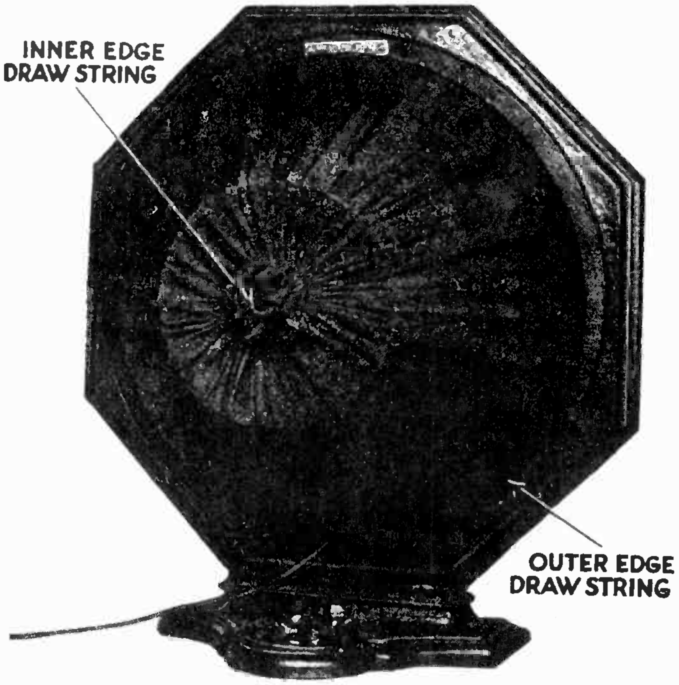

Figure 4—Location of draw strings used to fasten silk cover over canopy

[2] PROCEDURE FOR REMOVING MECHANISM COVER

To examine the mechanism it is first necessary to remove the cover that protects the mechanism from dust and dirt. Proceed as follows (See Figure 4):

(a) Untie the draw cord in the center of the silk cover and loosen the cord around the entire inside edge of the cover.

(b) Untie the cord on the outer edge of the cover. This cord is accessible only after untying the inner cord. The entire silk cover may now be removed.

(c) Gripping the fibre cover with the right hand at its point of contraction (See Figure 5) press the cover together until its edges are free from the metal edge that holds it in place.

The entire mechanism is now exposed to view and any necessary adjustment or repair may be easily made.

[3] FOREIGN MATERIAL INTERFERING WITH ARMATURE ACTION

An inspection of the armature will generally disclose any foreign matter interfering with the armature action, resulting in poor reproduction. A small piece of heavy paper or a piece of copper or brass not over .010" thick may be used between the armature and pole pieces to remove dirt, dust or other interfering substances. The spacer tool, described in Section 4 may also be used for this purpose.

[4] ARMATURE STRIKING POLE PIECES

Distortion and rattle may be caused by the armature striking either or both of the pole pieces. This is generally determined by inspection, though in some cases the contact may be so slight it may be necessary to adjust the armature to check on this condition. In any case an adjustment of the armature is necessary.

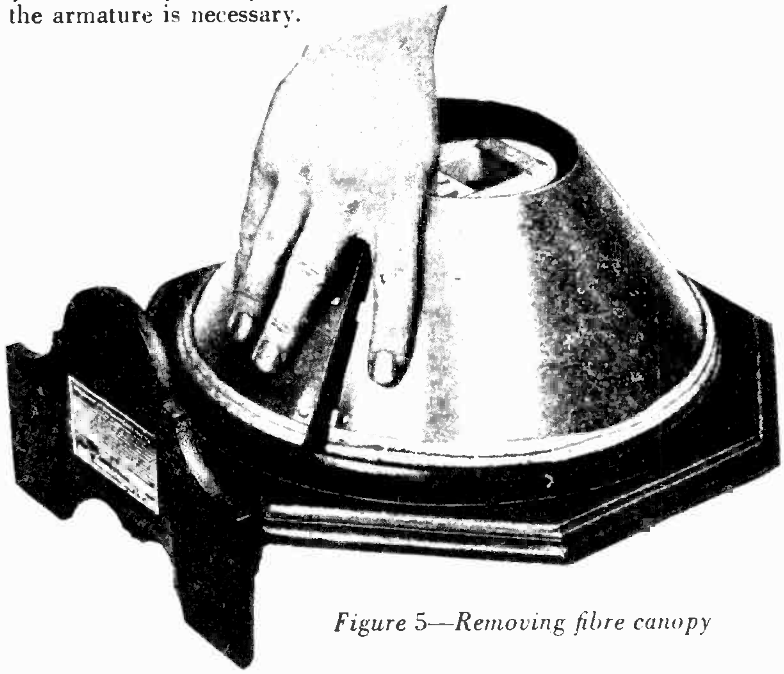

Figure 5—Removing fibre canopy

To adjust the armature use a set of spacer tools. Figure 6 illustrates the general appearance and correct dimensions of these tools for the information of those who desire to construct them. However, they may be purchased from the RCA Service Division (Stock No. 2321). The material—obtainable on the open market—should be phosphor bronze strip .010" thick and .25" wide. It is bent as illustrated and soldered to hold the ends fairly rigid. The two ends are tapered as illustrated to a .15" width at their extremities.

Two of these tools are necessary when adjusting the armature. Place one tool in the space between the armature and pole pieces of the motor mechanism at the end next to the filter unit. This is shown in Figure 7. The other tool is placed at the other end of the armature a little to one side in order to clear the drive pin located at this end of the armature. By loosening the two screws A and B, Figure 7, any tension in either direction, that may have been on the armature is released, and the spacer tools will provide the correct clearance or spacing. Now while the spacer tools are in place apply a hot soldering iron to the drive pin thrust lever connection point F, Figure 8, and heat the solder sufficiently to allow the drive pin to find its normal position with regard to the thrust lever. The iron is then removed, screws A and B are tightened and the spacer tools removed. This adjustment correctly aligns and balances the armature so that no abnormal strain is imposed upon it in any direction.

[5] CONE IMPROPERLY SEATED

In order to inspect the cone it is necessary to remove the mechanism assembly from the baffle board in the following manner:

(a) Remove mechanism cover as described in Part I, Section 2.

(b) Remove the six machine screws holding the metal mounting frame to the baffle board. Be careful to support the assembly so that it will not fall and become damaged.

(c) Remove the six bolts and nuts holding the motor metal mounting support and cone to the mounting frame.

In some cases a cone may be off center or improperly seated. Poor reproduction is the result and inspection of the armature drive-pin may indicate a slight torque or twist.

This trouble is most likely to occur when replacing a cone. The new cone should be carefully seated by placing the cone over the driving rod and adjusting the cone seating nut located on the driving rod next to the thrust lever. Then attach the cone lock nut and washer lightly on the inside of the cone before fastening the edge of the cone. The holes on the edge of the cone

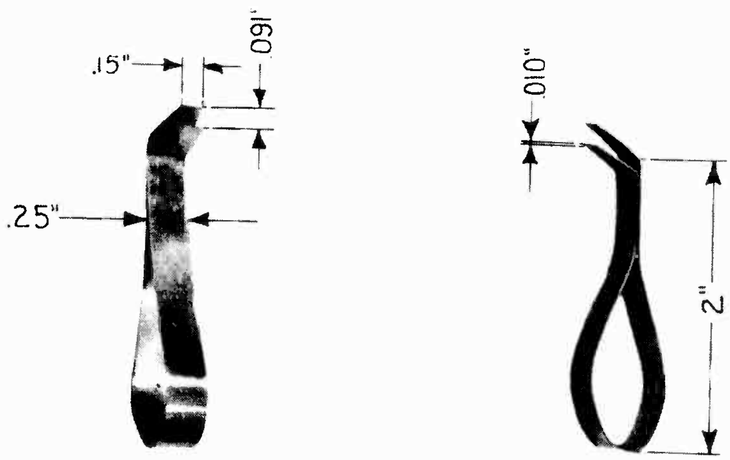

Figure 6—General appearance and correct dimensions of armature spacing tools

can now be lined up with those of the metal frame, and the outside frame lightly attached with screws and nuts. The cone lock nut is then tightened and sealed in place with ordinary sealing wax so that the vibration of the cone will not cause it to loosen. This nut can best be tightened by means of a small socket wrench made to fit a 3/16" hex nut (Stevens "Spintite No. 3 can be used). The six screws at the outside edge are then seated properly. In doing this take up on each screw a little at a time, causing a gradual seating of the screws.

[6] LOOSE THRUST LEVER, NUTS AND SCREWS

Rattle and noisy reception are sometimes caused by a loose thrust lever. To correct this condition tighten the thrust lever mounting clamps by means of screw G, Figure 9. Sometimes when this is done a readjustment of the armature as described in Part I, Section 4 may be necessary. Any loose screw or nut in the motor mechanism may cause an audible rattle when the speaker is in operation. If any trouble is experienced along this line all the screws and nuts in the motor mechanism should be gone over and the loose ones tightened.

[7] FILTER UNIT AND MAGNET COIL TESTS

A defective filter unit or a filter unit not properly connected in the circuit will cause distortion. Defective magnet coils will also cause imperfect reproduction. The circuit diagram and correct connections are shown in Figure 10. The reference letters in the circuit diagram refer to the filter terminals shown in the small halftone illustration in Figure 10. These should correspond electrically, otherwise distorted or no reception will occur. A click test will indicate whether or not the unit is electrically O. K. The following continuity will indicate an electrical defect either in the coils or in the filter unit.

A pair of headphones and a 4½-volt battery connected together in series or a voltmeter and sufficient battery to give a full scale deflection should be used.

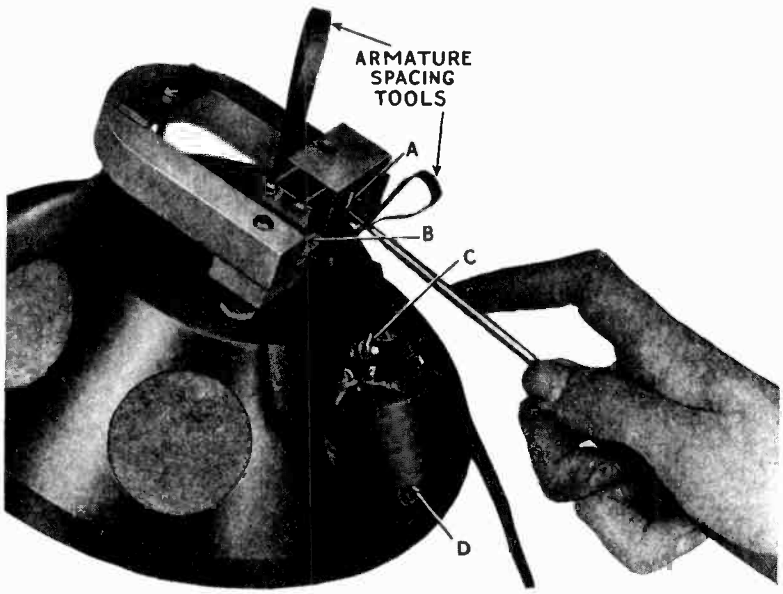

Figure 7—The use of the spacing tools in adjusting the armature

FILTER UNIT CONTINUITY TESTS

Remove all connections and refer to Figure 10

Test	*Correct Effect*	*Incorrect Effect Caused By*
N to M	Open	Shorted Condenser
N to L	Closed	Open Coil

A short of the condenser across the coil can be determined by checking the resistance of the coil with a resistance bridge or the method indicated in R-17 Service Notes. The correct resistance for this coil is 230 ohms.

The magnet coils may now be checked for an open by testing from one lead to the other. An open indicates a defective coil which must be replaced.

[8] LOUDSPEAKER CORD AND CONNECTIONS

A defective connection, either in the loudspeaker cord or coil connections may cause distorted, noisy or no reproduction. As there is not much wear and tear on the coil connections, the most likely place to find trouble of this nature is in the connecting cord. The point where the cord enters the loudspeaker housing and the ends on which the pin terminals are located may become frayed and worn, causing a possible short or open circuit. If these points prove O. K. and there are no indications of any defects external to the speaker housing, the cover should be removed and the lugs of the cord soldered to the filter unit examined. If there is no apparent defect the cord should be disconnected and tested by means of a battery and pair of phones. It should be click tested for the continuity of the leads and also for a short between the leads. Shake the cord while conducting the continuity test to disclose any breaks which will be indicated by interrupted clicks.

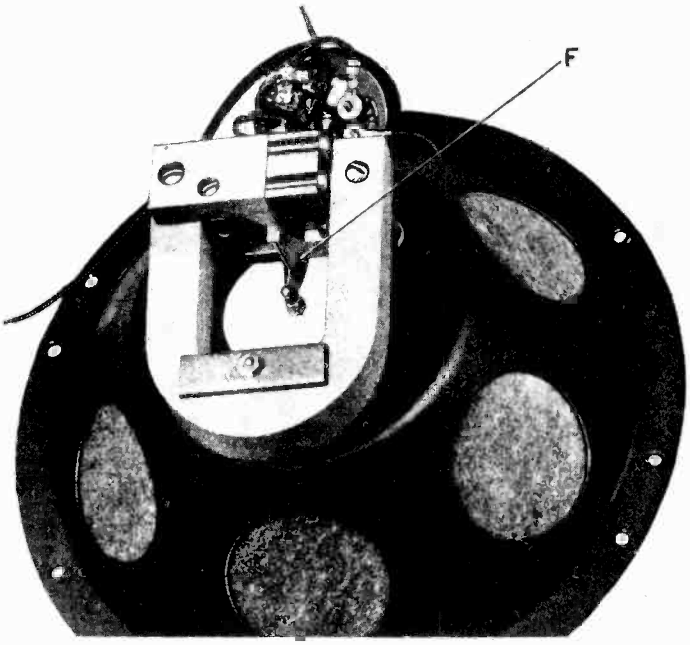

Figure 8—Drive-pin thrust-lever soldered connection (F)

[9] REMAGNETIZING LOUDSPEAKER MAGNETS

At times there may be occasion to remagnetize the large permanent magnet used in Loudspeaker 103. In order to do this a powerful electro-magnet is necessary. The construction of such a magnet is quite difficult and requires direct current of considerable amperage. It is suggested that this work be turned over to automobile or ignition shops specializing in the repair of magnets. Distributors maintaining contact with shops of this character are in a position to obtain immediate service on remagnetizing jobs.

[10] CHECKING OUTPUT OF REPAIRED LOUDSPEAKERS

After a repair job has been completed it is always desirable to have a definite means of checking the output of the speaker against a speaker known to be in good condition. Two general methods can be used to accomplish this—one by alternately connecting each speaker to a radio receiver tuned to a nearby broadcasting station, the other by alternately connecting each speaker to the output of a power amplifier being driven from a phonograph pick-up. The latter method is preferable as a standard record may be used that has a much wider frequency range than would be obtained by random tuning with a broadcast receiver. When checking a speaker under these conditions a volume control should be used and the speaker checked at both the soft and loud positions. At the minimum position the speaker under test can be compared with the standard for sensitivity and at the loud position a check can be made on its ability to handle volume without distortion or rattle. These checks should be made at both high and low frequencies. The sections of the record containing these frequencies can be indicated to run such a test.

A test of this kind is quite conclusive for quality and volume of reproduction and will indicate if further repair work or adjustments are necessary.

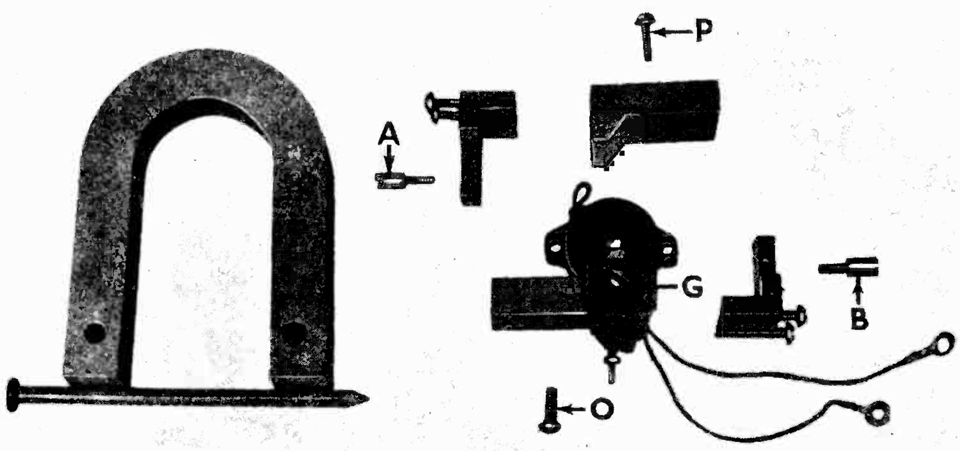

Figure 9—Motor mechanism partly exploded

PART II—MAKING REPLACEMENTS

Due to the simple design of Loudspeaker 103 replacement of any particular part is easily and quickly accomplished. The following detailed procedure should be used when performing work of this kind.

[1] REPLACING MAGNET COILS

To replace the magnet coils:—

(a) Remove mechanism cover as described in Part I, Section 2.

(b) Remove mechanism from baffle by removing the six machine screws that hold it to the the baffle board (See Figure 11).

(c) Remove the cone by removing six bolts and nuts around the edge and the cone center nut located at Y, Figure 12.

(d) The motor mechanism may now be removed by removing nuts F, G, H, Figure 12. The magnet coil leads must be unsoldered before the motor can be cleared of the frame. Place a large nail or soft iron bar across the poles of the permanent magnet to act as a keeper (See Figure 9).

(e) Remove the thrust lever supporting screw G, Figure 9, and apply a hot soldering iron to the thrust lever armature drive pin connection point F, Figure 8. The thrust lever and driving rod may now be removed.

(f) Disassemble the motor mechanism by removing screw O, Figure 9, and the corresponding screw on the other side of the mechanism. Also remove screws A and B, Figure 9. The magnet coils may now be removed by slipping one off the armature and the other off the armature and drive pin.

The reassembling is a reversal of the preceding operation.

(a) Place the new coils over the armature in the same position occupied by the old ones.

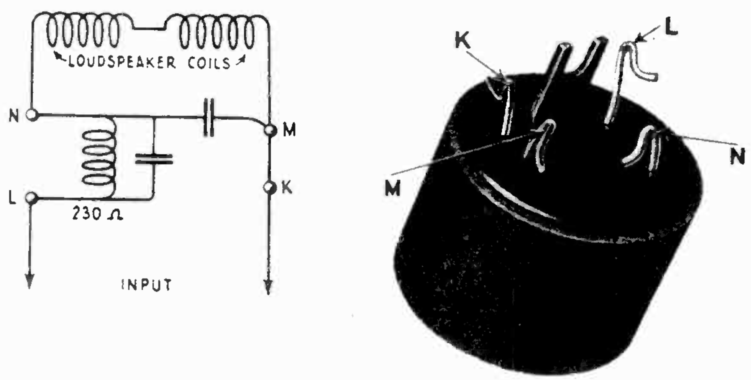

Figure 10—Schematic circuit of Loudspeaker 103 coils and filter and photo of filter unit

(b) Reassemble the motor mechanism and replace the thrust lever. Do not solder the thrust lever to the drive pin at this time.

(c) Remove keeper and replace motor mechanism on magnet with supporting screws and bushings. Mount the reassembled unit in its correct position on the frame.

(d) Replace cone and center carefully. Replace, but do not seat the screws, nuts and lock washers around the edge. Tighten the cone lock nut and seal with sealing wax. Seat screws around edge.

(e) Place spacer tools in position to adjust the armature and tighten screws A and B, Figure 7.

(f) Resolder drive pin to thrust lever and allow it to find its normal position. Remove spacer tools.

(g) Solder coil leads to filter unit as indicated in Figure 10. At this point it is good practice to test the mechanism on a receiver of good quality and make any further adjustments that may be necessary.

(h) Replace the fibre cover and silk cloth as described in Part I, Section 2.

[2] REPLACING ARMATURE AND DRIVE PIN

The procedure for replacing the armature and drive pin is identical with that of replacing the magnet coils with the exception of the new part substituted. The new armature should be clean and free from any dust or dirt.

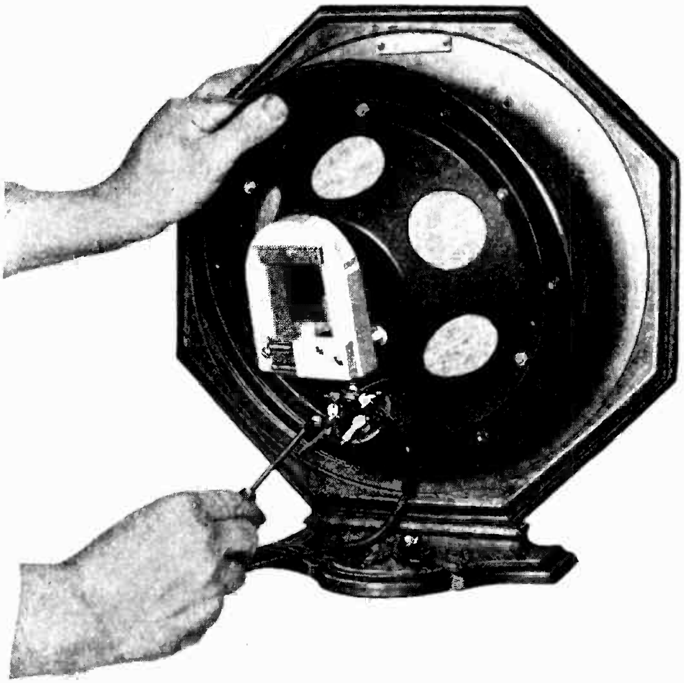

Figure 11—Removing reproducer assembly from baffle

[3] REPLACING THE THRUST LEVER AND DRIVING ROD

Ordinarily the driving rod and thrust lever are not likely to become damaged or require replacement. However, should it be necessary, remove the cover from the mechanism as described in Part I, Section 2. Then disassemble the mechanism as described in Part II, Section 1 until the thrust lever and driving rod are removed.

The new one should be placed in the position occupied by the old one, making sure the clamp holds it tightly in place. Reassemble in the reverse order of that used to disassemble it. The armature should be checked for adjustment as described in Part I, Section 4. The cover should now be replaced and the speaker returned to normal operation.

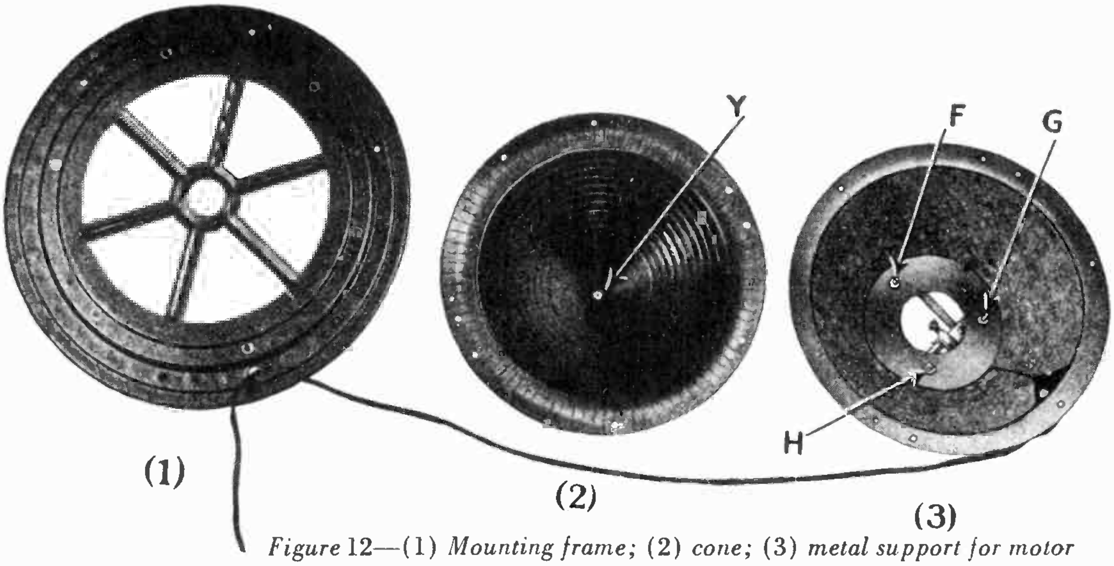

Figure 12—(1) *Mounting frame;* (2) *cone;* (3) *metal support for motor*

[4] REPLACING THE MOTOR ASSEMBLY COMPLETE

When replacement of the complete motor mechanism is necessary remove the cover from the mechanism as described in Part I, Section 2. Then remove the cone, the motor and magnet and install the new motor.

The reassembly will be a reversal of the foregoing procedure.

[5] REPLACING CONE

When replacing a cone remove the old one as described in Part II, Section 1. The installation of the new cone is a reversal of the removal procedure.

(a) Place cone over driving rod in center.

(b) Adjust the cone seating nut so as to properly seat the cone and provide clearance for the thrust lever from the pole piece.

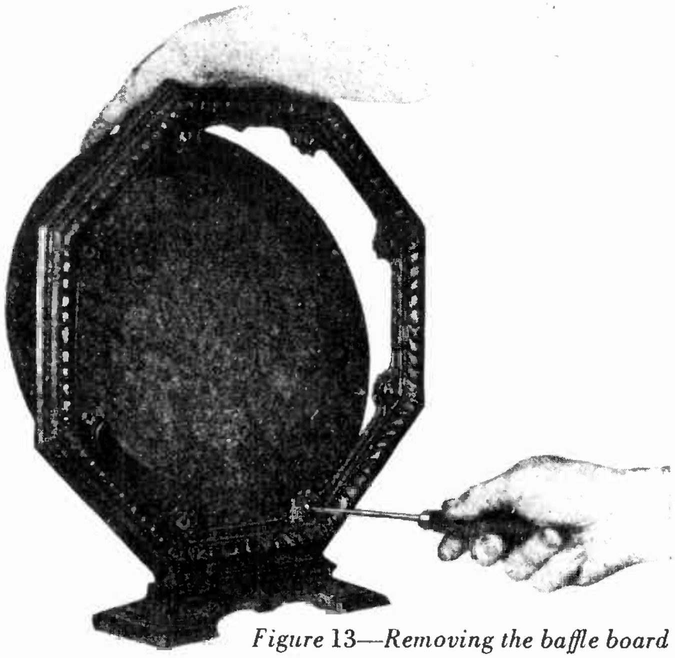

Figure 13—*Removing the baffle board*

[6] REPLACING FILTER UNIT

The following procedure should be used when replacing the filter unit.

(a) Remove cover from mechanism as described in Part I, Section 2.

(b) Unsolder all leads to the filter terminals.

(c) Remove the filter unit mounting nuts and washers C and D, Figure 7. The unit may now be removed and replaced by a new one.

(d) Replace the mounting nuts and washers previously removed. Then resolder the leads that were removed from the filter terminals.

(e) Replace mechanism cover previously removed and return loudspeaker to normal operation.

Figure 14—Tacking the grille tapestry in place on the baffle board

[7] REPLACING GRILLE CLOTH

RCA Loudspeaker 103 uses a tapestry grille that is tacked in place and used to cover the front opening of the speaker. To replace this tapestry proceed in the following manner:

(a) Remove the mechanism by removing the six machine screws that hold it to the baffle board and remove the baffle board by removing the eight wood screws that hold it to the moulded frame (See Figure 13).

(b) This releases the mechanism and the frame and permits access to the baffle board on which the tapestry is tacked.

(c) Remove all the tacks that hold the tapestry to the baffle board.

(d) The tapestry may now be removed and the new one placed in position. If the material used is different from the original tapestry its porosity should be checked to see that it is approximately the same. This may be tested by blowing through the cloth and noticing any difference in the opposition of one compared with the other.

(e) Tack the new tapestry tightly in position (See Figure 14).

(f) Replace entire assembly in the moulded frame and return the eight screws to their original position.

The speaker may now be returned to normal operation.

SERVICE DATA CHART

The following table of information provides a handy reference when servicing Loudspeaker Model 103, and a working knowledge of it will enable service men to handle service problems readily and efficiently. Reference to Part No. and Section No. in the "Service Notes" is noted for detailed information.

Indication	*Cause*	*Remedy*
No Reproduction	No output from receiver	Examine receiver, Part I, Sec. 1
	Defective coils	Replace coils, Part I, Sec. 7; Part II, Sec. 1
	Defective filter	Replace filter, Part I, Sec. 7; Part II, Sec. 6
	Defective cord	Repair or replace cord, Part I, Sec. 8
	Loose or broken connections	Repair connections, Part I, Sec. 8
	Drive pin not soldered	Solder drive pin, Part I, Sec. 4
Weak Reproduction	Weak receiver output	Examine receiver, Part I, Sec. 1
	Dirt interfering with armature action	Remove foreign matter from mechanism, Part I, Sec. 3
	Loose thrust lever mounting screw	Tighten screw and resolder drive pin, Part I, Sec. 6; Part II, Sec. 3
	Improperly aligned cone	Align cone correctly, Part I, Sec. 5
	Drive pin poorly soldered	Solder drive pin, Part I, Sec. 4
	Weak magnet	Remagnetize
Distorted or noisy Reproduction (Rattle)	Distorted output from receiver	Examine receiver, Part I, Sec. 1
	Improperly adjusted cone	Adjust cone correctly, Part I, Sec. 5; Part II, Sec. 5
	Filter incorrectly connected	Connect filter correctly, Part I, Sec. 7; Part II, Sec. 6
	Filter defective	Replace filter, Part I, Sec. 7; Part II, Sec. 6
	Loose screws or nuts in assembly	Tighten all loose screws or nuts, Part I, Sec. 6
	Armature striking pole piece	Adjust armature correctly, Part I, Sec. 4; Part II, Sec. 1
	Excessive pressure on drive pin	Resolder drive pin to thrust lever, Part I, Sec. 4; Part II, Sec. 1
	Filter unit not connected	Connect filter unit, Part I, Sec. 7; Part II, Sec. 6

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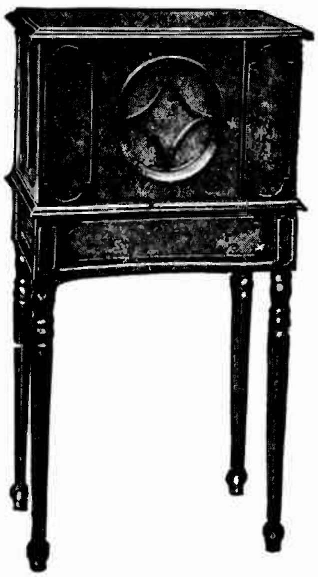
RCA

Loudspeaker 104

SERVICE NOTES

Third Edition—5M—June, 1928



Radio Corporation of America

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

326 Broadway New York City	2001 West Pershing Road Chicago, Ill.	274 Brannan St. San Francisco, Cal.

A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well informed Radiola 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 or 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 RCA Loudspeakers and Radiolas, occupy a favorable position to contract for this work.

To assist in promoting this phase of the Dealers' 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 R. C. A. 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 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.

RCA LOUDSPEAKER 104

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

These "Service Notes" cover problems encountered when using RCA Loudspeaker Model 104 as a Power Speaker and B-Battery Eliminator. For information concerning combination with Radiola 25 and 28 A. C. operated consult Service Notes entitled "A. C. Operation of Radiolas 25 and 28."

RCA Loudspeaker, Model 104, consists essentially of two main parts, the Reproducer unit and the Rectifier-Power-Amplifier unit. It is designed to operate from an alternating current supply of 105 to 125 volts, 40 to 45 cycles (using Ballast tube, Radiotron UV-886) and 50 to 75 cycles (using Ballast tube, Radiotron UV-876), such as is available for lighting and general household uses in the majority of American homes. Should there be any doubt in the mind of a dealer concerning the rating of the local electric power supply of a prospective purchaser, the company supplying electric lighting service in the customer's locality will furnish the correct information.

The Reproducer is a power unit operating on the electro-dynamic principle of sound reproduction. A movable coil, rigidly fastened to the cone moves in the strong magnetic field of the pot magnet in accordance with the modulation of the received signal. This in turn actuates the cone, which results in sound production. The output of the RCA Loudspeaker, Model 104, is a truly faithful recreation or reproduction of the original sound production as transmitted.

A Rectifier Power Amplifier containing suitable rectifying and amplifying devices provides for amplification beyond the first audio stage of any receiver. It can also be used to supply the necessary plate voltage for most receivers. If used with Radiola 25 or 28 and the proper AC package, complete AC operation may be secured—thus eliminating all batteries. Figure 1 illustrates the socket layout of the R.P.A. unit.

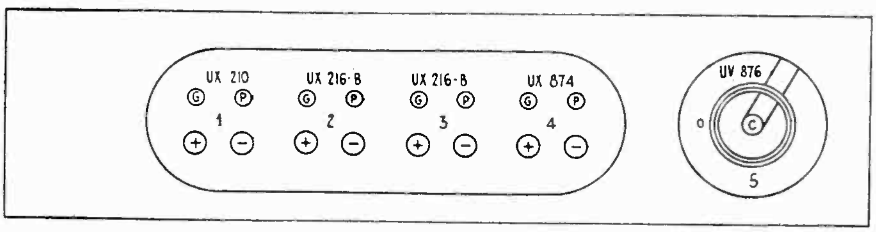


Figure 1—R.P.A. socket layout

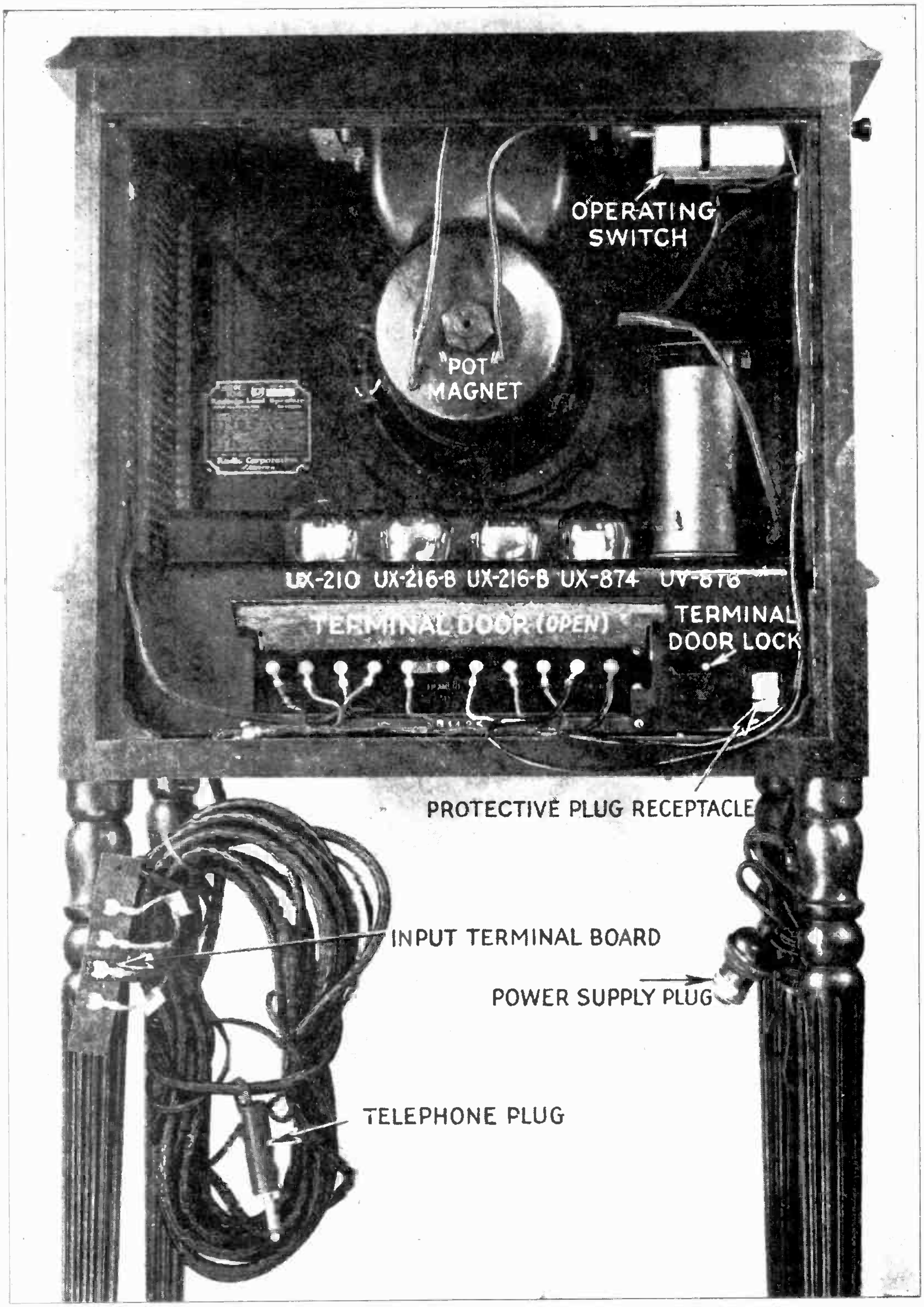


Figure 2—Rear view R.C.A. Loudspeaker, Model 104, showing location of Radiotrons, Rectrons, and parts

SERVICE DATA

The R.P.A. unit makes use of one Radiotron UV-876 (or UV-886), two Rectrons UX-216B, one Radiotron UX-874 and one Radiotron UX-210. It is imperative that these various Radiotrons and Rectrons be in perfect operating condition, otherwise the various test indications will be misleading. The purpose of these Radiotrons and Rectrons are as follows:

The Radiotron UX-210 is a super-power amplifier capable of handling great volume without distortion.

The two Rectrons UX-216B are rectifying tubes used to convert the alternating current into pulsating direct current, which is smoothed out by the filter system to continuous direct current. (Note—The Rectrons UX-216B are interchangeable with the new Radiotron half-wave rectifiers UX-281. The UX-281 gives the same operation with improved life.)

Radiotron UX-874 is a Voltage Regulator tube and functions to keep a constant voltage on the plates of the receiving Radiotrons at all times. When Radiola Loudspeaker Model 104 is used in conjunction with Radiola 25 or 28 for complete A.C. operation Radiotron UX-874 is replaced by resistor unit UP-591.

Radiotron UV-876 (or UV-886) is a Current Regulator tube known as the "Ballast Tube." It is connected in the primary circuit of the power transformer. The resistance of its filament rises and falls rapidly with an increase or decrease of current flowing through it, thus maintaining a substantially constant input current. Radiotron UV-876 is used when the frequency of the house lighting current is between 50 and 75 cycles, and Radiotron UV-886 on 40 to 45 cycles. A ventilating stack is provided to enclose this Radiotron, as it is very hot during normal operation. The R.P.A. unit should not be operated unless the ventilating stack is in place.

Figure 2 illustrates the internal mechanism and the placing of the different parts of Loudspeaker Model 104.

(1) FILAMENT ACTION OF RADIOTRONS AND RECTRONS

Should RCA Loudspeaker Model 104 suddenly cease to operate satisfactorily, look through the cane side of the cabinet and note whether or not the filaments of the first three tubes—counting from the left when facing the back of the cabinet—are burning. Replace the tubes that do not light.

The Voltage Regulator tube, Radiotron UX-874 (fourth from the left) should show a pink or violet glow. Should this Radiotron fail to show any glow when the three tubes to its left light, replace it with a new one. If this one also fails to glow the house lighting line voltage may be below 105 volts or the Ballast tube, Radiotron UV-876 (or UV-886) may be defective or a 2 Mfd. condenser (next to resistance units) shorted. Test R.P.A. unit as indicated in Section 14 (see Figure 3). Check line voltage with an A.C. voltmeter. If it reads between 105 and 125 volts replace Radiotron UV-876 (or UV-886) and, as a last resort, test condensers as outlined in Section 14.

If Radiotron UX-874 flashes intermittently while the branch telephone cord is disconnected from the receiver, it should be replaced. Loud signals or strong static discharges will, however, cause it to flicker somewhat when the telephone cord is connected to the receiver. A prolonged loud signal will decrease the brilliancy of the glow.

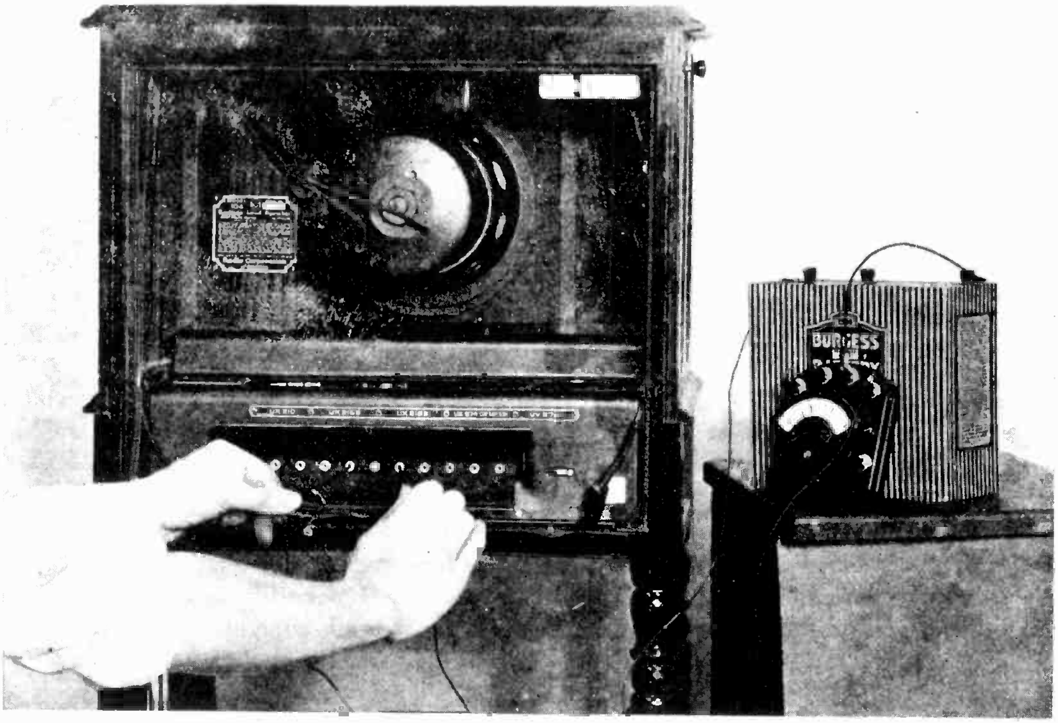


Figure 3—Tests Conducted at the Terminal Board of the R.P.A. Unit

There is little or no visual filament indication when Radiotron UV-876 or UV-886, the Ballast Tube (large one enclosed in ventilating stack) is functioning properly. This Radiotron, however, dissipates a considerable amount of heat in operation.

Should all Radiotrons and Rectrons fail to light or operate as described in the preceding paragraphs, look for:

(a) House lighting current switched off or loose connection at convenience outlet.
(b) Operating switch in Loudspeaker 104 not functioning properly.
(c) Blown fuse in house lighting circuit.
(d) Loose protective plug.
(e) Burned out filament in Radiotron UV-876 (or UV-886).
(f) Poor contact in Radiotron UV-876 (or UV-886) socket.
(g) Defective Voltage Regulator tube or poor socket contact.
(h) House lighting current not A.C. This condition is manifested by the filament of the Radiotron UV-876 (or UV-886) lighting a bright red.

(2) NO SIGNALS WHEN RADIOTRONS AND RECTRONS ARE O. K.

If all the Radiotrons and Rectrons appear to be functioning properly with no signals heard from the Loudspeaker, test the radio receiver for operation by using a pair of headphones. If the receiver is O. K. and the Loudspeaker plug is in place check the following:

(a) Loose connections in telephone plug.

(b) Loose connections at "Input" on R.P.A. terminal board.

(c) Defective 30-foot cable.

(d) Filament to grid short in Radiotron UX-210.

(e) Dirty grid or plate contacts in any socket.

(f) Open movable coil on cone.

(g) Defective R.P.A. unit. (Check all circuits by means of continuity test.)

(3) OPEN FIELD IN REPRODUCER UNIT

An open field of the Pot Magnet in the Reproducer Unit will be indicated by Radiotron UX-210 and Rectrons UX-216B lighting up very brightly and Radiotron UX-874 not lighting. The connections of the field to the terminal board of the R.P.A. unit should be checked. They may be loose, thus giving the effect of an open field. However, if the connections are tight and the field coil tests defective it should be replaced. Before making these tests short the two field connections on the terminal strip after turning the Loudspeaker "off." This will discharge the filter condenser and prevent any high voltage contacts.

(4) EXCESSIVE HUM

Excessive hum in the reproducer unit may be due to any of the following causes:

(a) Low emission UX-216B, or UX-281 if used.

(b) Input plug from A.C. line reversed.

(c) 2 Mfd. condenser shorted (Located next to 7 Mfd. condenser).

(d) Loose laminations in transformer or loose screws.

(e) Power line interference. This can be checked by removing loop or antenna from receiver and noticing if hum disappears.

(f) Potentiometer not properly adjusted. Some models of Loudspeaker 104 have a potentiometer for the suppression of hum. This potentiometer must be adjusted for the position of minimum hum.

The remedies for (a), (b) and (c) are obvious. In cases of power line interference notify the power company.

(5) RADIOTRON UX-210 PLATE EXCESSIVELY HOT

Should the plate of Radiotron UX-210 become excessively hot, disconnect the power supply immediately and check the following units:

(a) Open Resistance Unit R-4 (Plate will be white hot).

(b) Shorted 2 Mfd. condenser (Located between the two 2 mfd. condensers).

If any unit is found defective replace it.

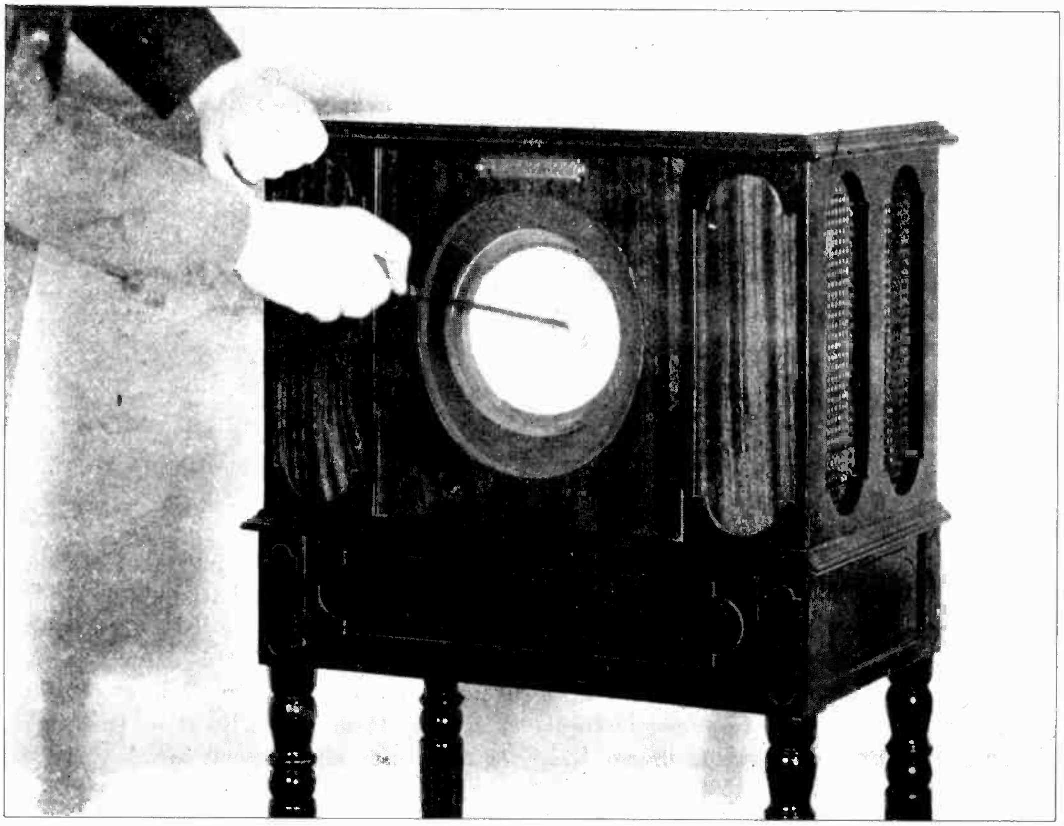


Figure 4—Readjusting cone

(6) RECTRONS UX-216B PLATES EXCESSIVELY HOT

Should the plates of the Rectrons UX-216B (or Radiotrons UX-281 if used) heat excessively, disconnect the power supply immediately and check the following:

(a) Shorted 7 Mfd. (or 4 Mfd.) condenser. (Located low side or next to 2 Mfd. condenser.)

(b) Shorted 7 Mfd. (or 4 Mfd.) condenser. (Located high side or next to power transformer.)

(c) Internal short in power transformer.

Replace any part found defective.

(7) ONE RECTRON UX-216B RED HOT AND ONE APPARENTLY NORMAL—(No reproduction from Loudspeaker)

One Rectron UX-216B excessively hot and one apparently normal will indicate a defective Rectron. The one that is apparently normal has lost its emission and will throw the entire load on the other, thereby causing it to heat excessively. Replace the Rectron that is not excessively hot. If Radiotrons UX-281 are used it is doubtful if the O. K. tube will show color. The one dissipating the least amount of heat should be replaced.

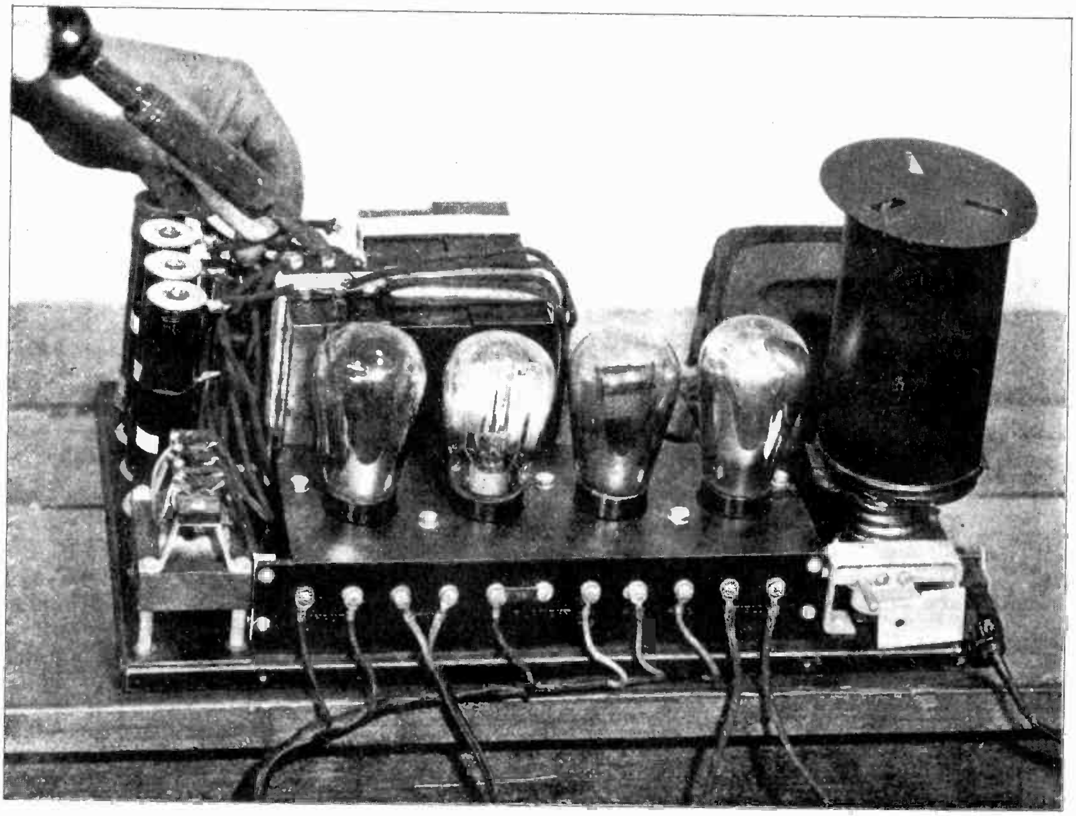


Figure 5—Testing 2 Mfd. condensers for leakage

(8) DISTORTION IN REPRODUCER UNIT

Distortion in the Reproducer unit may be caused by any of the following:

(a) Poor input from Receiver. (Examine receiver.)

(b) Shorted 2 Mfd. condenser. (Located next to 7 Mfd. condenser.) (Replace condenser.)

(c) Shorting of movable coil to pole piece of pot magnet. (Replace cone.)

(d) Defective Radiotron UX-210. (Replace Radiotron.)

(e) Leads from movable coil broken away from cone. (Make these fast with a little shellac.)

(f) Misalignment of reproducer cone.

The reproducer cone may be readily realigned by removing the front grille and very carefully adjusting the small round head screw in the center of the cone (see Figure 4). In making this adjustment care should be used to see that the cone is not damaged by the screwdriver being pulled out of control due to the strong magnetic field about the pole piece of the pot magnet behind the cone.

A leakage in any one of the small 2 Mfd. condensers may cause distortion in the cone. To locate the defective condenser it will be necessary to remove the metal case of the

R.P.A. unit and reconnect it. Disconnect one of the 2 Mfd. condensers (Figure 5), operate loudspeaker and note the result. If the distortion is not eliminated, turn off input current, replace the connection and try the next one, repeating this process until all the 2 Mfd. condensers have been tested. If the distortion ceases after a certain condenser has been disconnected, that condenser must be replaced.

This condenser test should only be employed as a last resort, after all other methods have been tried to eliminate distortion.

(9) NO GLOW FROM RADIOTRON UX-874

No glow from Radiotron UX-874 with the power supply "on" indicates the tube is not receiving the proper voltage supply, which may be caused by:

(a) Shorted 2 Mfd. Condenser. (Located next to resistance unit.)

(b) Open Pot Magnet or Connection. (*Short circuit terminals before testing.*)

(c) Open or shorted 90-volt connections.

(d) Defective Rectron UX-216B.

(e) Defective Radiotron UX-874.

Replace unit found defective in (a), (b), (d), (e) and in (c) repair connections.

(10) NO "B" VOLTAGE

A no-voltage reading obtained at the 45 or 90-volt terminals will indicate one of the following defects:

(a) Shorted 2 Mfd. Condenser (Located next to resistance units.)

(b) Defective Radiotron UX-874.

(c) Defective Radiotron UX-874 socket.

(d) Defective Rectron UX-216B.

(e) Open or shorted "B" voltage connections.

(11) FADING OF SIGNALS

Fading of signals beyond the normal slight drop after the speaker has been placed in operation may be due to any of the following causes:

(a) Defective Radiotron UX-210. This will be accompanied by rough and unnatural reproduction.

(b) Defective Radiotron UV-876 (or UV-886).

(c) Defective Resistance in R.P.A. unit or poor joint in connection to resistance unit. Replace if defective.

(12) BLASTING

Blasting may occur in the Loudspeaker when operating with any type of receiver. Increasing the distance between the receiver and loudspeaker or changing their relative position will usually stop blasting. In some cases interchanging the Radiotrons in the receiver will eliminate the trouble.

Figure 6—Removal of R.P.A. connections, Radiotrons and Rectrons preparatory running continuity tests

(13) FLUTTERING

When RCA Loudspeaker Model 104 is used with Radiola 28 for complete A.C. operation fluttering sometimes occurs. Look for the trouble in Radiola 28—not in Loudspeaker 104. The following remedies are suggested, any of which may eliminate the flutter.

(a) Change A.C. Package.

(b) Interchange Radiotrons UX-199 of catacomb.

(c) Connect 30-50 henry choke across terminals 10 and 15 of catacomb terminal strip. (Count from the left when facing front of Radiola.)

(d) Connect 2 Mfd. condenser in series with 30-henry choke and then place combination across terminals 15 and 22 in the Radiola 28. The choke goes to terminal No. 15 and condenser to terminal No. 22.

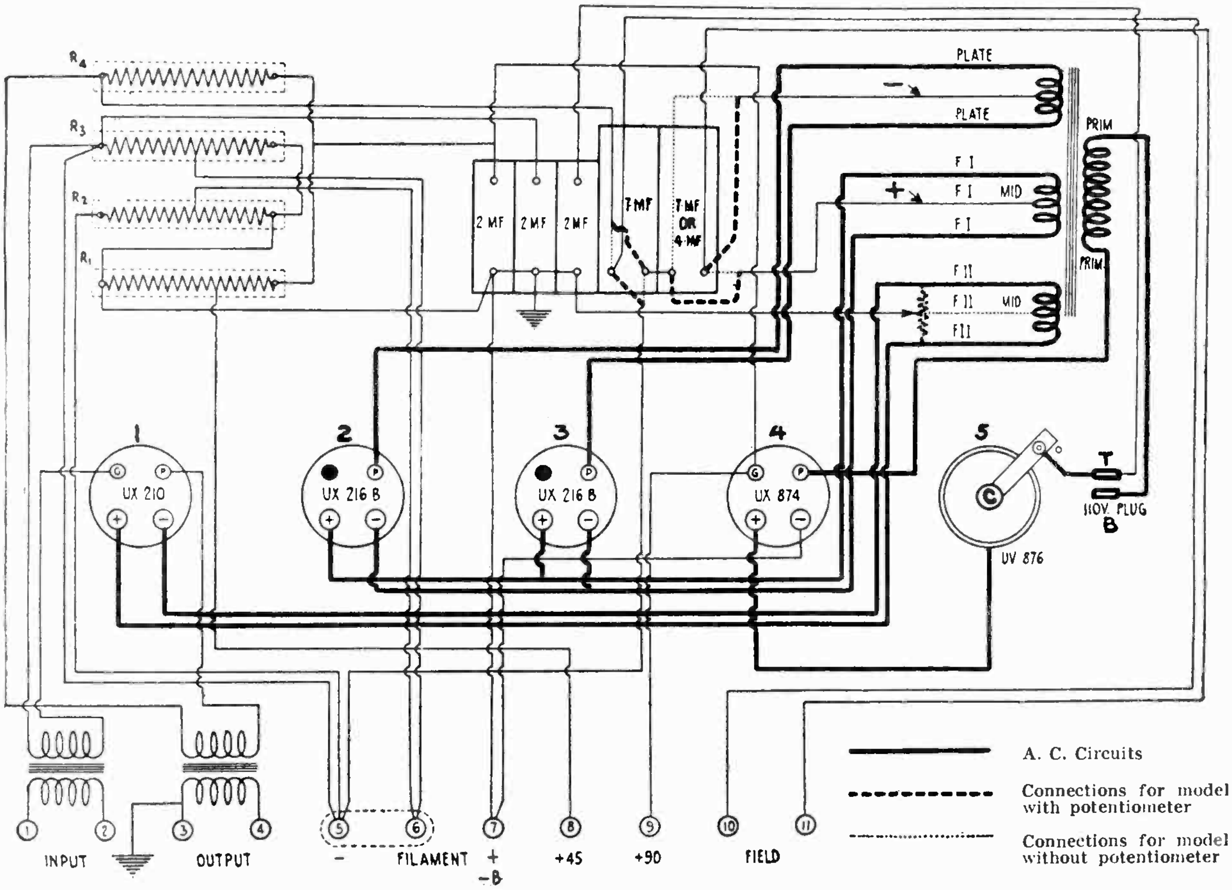
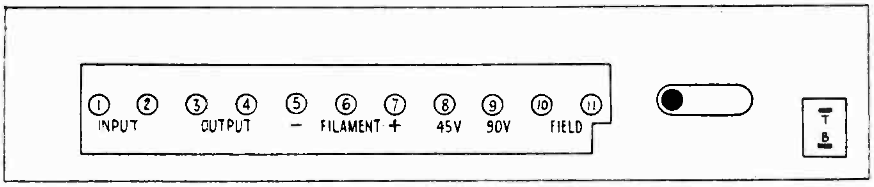


Figure 7—Continuity circuit of R.P.A. Unit

(14) COMPLETE R.P.A. CONTINUITY TEST

The tabulated continuity tests given in the text cover all circuits of the RCA Loudspeaker Model 104 R.P.A. unit. Before running these tests remove all connections from the terminal board at the rear of the R.P.A. unit, also the Radiotrons and Rectrons. (See Figure 6.) The reference letters and numbers used in the table will be found in Figure 7.

The testing equipment consists of a high resistance voltmeter with battery voltage sufficient to give approximately full scale deflection when connected directly across battery terminals—for example, a 45-volt "B" battery connected in series with a voltmeter having a 0-50 volt scale. (See Figure 3, page 6.) The contact points of the testing equipment should not touch any metallic part of the unit except the terminals specified. Discharge the 4 or 7 Mfd. filter condensers by short-circuiting their terminals with a screwdriver before starting test.



R.P.A. terminal board

R.P.A. CONTINUITY TEST
(For Loudspeaker 104 Without Potentiometer)

Terminals	*Correct Effect*	*Incorrect Effect Caused By:*
1 to 2	Closed	Open primary of input transformer
3 to 4	Closed	Open secondary of output transformer
3 to metal frame	Closed	Open ground connection
5 to G1	Closed	Open secondary input transformer
5 to P2	Closed	Open ½ plate winding of power transformer
5 to P3	Closed	Open ½ plate winding of power transformer
5 to 6 Link open	Closed	R2 and R3 open
5 to 7	Closed	R2 and R3 open
7 to +F1	Closed	Open ½ UX-210 filament winding of power transformer
7 to —F1	Closed	Open ½ UX-210 filament winding of power transformer
7 to 8	Closed	R1 open
7 to —F4	Closed	Open connection
8 to 9	Closed	R1 open
9 to G4	Closed	Open connection
9 to 10	Closed	R4 open
10 to P1	Closed	Open primary output transformer
11 to +F2	Closed	Open ½ UX-216B filament winding of power transformer
11 to —F2	Closed	Open ½ UX-216B filament winding of power transformer
B to P4	Closed	Open primary of power transformer
Metal shell of fifth socket to +F4	Closed	Open connection
C to T	Closed	Open connection

R.P.A. CONTINUITY TEST

(For Loudspeakers Employing Potentiometers)

Terminals	*Correct Effect*	*Incorrect Effect Caused By:*
1 to 2	Closed	Open primary of input transformer
3 to 4	Closed	Open secondary of output transformer
3 to metal frame	Closed	Open ground connection
5 to G1	Closed	Open secondary input transformer
11 to P2	Closed	Open ½ plate winding of power transformer
11 to P3	Closed	Open ½ plate winding of power transformer
5 to 6 Link open	Closed	R2 and R3 open
5 to 7	Closed	R2 and R3 open
7 to +F1	Closed	Open ½ UX-210 filament winding of power transformer and potentiometer
7 to —F1	Closed	Open ½ UX-210 filament winding of power transformer and potentiometer
7 to 8	Closed	R1 open
7 to —F4	Closed	Open connection
8 to 9	Closed	R1 open
9 to G4	Closed	Open connection
9 to + or—F2 or F3	Closed	R4 open
P1 to + or—F2 or F3	Closed	Open primary of output transformer
+F2 to —F2	Closed	Open UX-216B filament winding of power transformer or connections
+F3 to —F3	Closed	Open UX-216B filament winding of power transformer or connections
B to P4	Closed	Open primary of power transformer
Metal shell of fifth socket to +F4	Closed	Open connection
C to T	Closed	Open connection

(15) FILTER CONDENSER TESTS

Excessive heating of the rectifier tubes is usually an indication of a shorted filter condenser.

If the condenser on the high side (located next to the power transformer) is shorted the plates of both rectifiers will become white hot, provided the tubes are in good condition. Should the condenser on the low side of the pot magnet become shorted the loudspeaker will become inoperative and the plates of Rectrons UX-216B will become a dull red. If Radiotrons UX-281 are used it is doubtful if their plates will show color, but they will dissipate considerably more than normal heat.

A further test of the condition of the filter condensers may be made by means of a high voltage charge. Since a high D.C. voltage is rarely obtainable either in the dealer's shop or the customer's home, it will be necessary to use the high voltage source incorporated in the R.P.A. unit.

The following procedure is used:

(a) Remove the R.P.A. assembly from the cabinet and remove the metal cover. Short circuit terminals No. 10 and 11 (connections to the reproducer unit), and remove all other connections to the terminal strip.

(b) Release the connection at the top of the No. 4 resistor—leading to the 4 or 7 Mfd. condenser, located next to the 2 Mfd. condensers.

(c) With all tubes in place and the ventilating stack over Radiotron UV-876 connect the A.C. power supply line to the input plug. Switch "on" the current for a moment in order to charge the filter condensers and then switch "off" the current.

(d) Now, standing clear and using a small stick or insulated screwdriver, push the lead, released, back to its original position. A flash should occur at the point of contact. *Do not come in contact with either of the leads as a severe shock may result.* The flash obtained will be an indication that both filter condensers hold the charge and are in good operating condition.

(e) If no flash is obtained it will be an indication that one or both condensers are inoperative. Disconnect each alternately from the circuit and apply the test to the other to determine their condition. This test subjects these condensers to a voltage in excess of the maximum operating voltage normally received and a defective condenser that might pass a click or low voltage test will be identified immediately.

Printed in U.S.A., 1928

RCA
Loudspeaker 105

SERVICE NOTES

RCA Loudspeaker 105

First Edition—20M

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SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT
233 BROADWAY, NEW YORK CITY

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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 RCA Loudspeaker or 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 RCA Loudspeakers and Radiolas occupy a favorable position to contract for this work.

To assist in promoting this phase of the Dealers' 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 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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PART I—OPERATION

PART II—INOPERATION

PART III—MAKING REPLACEMENTS

ILLUSTRATIONS

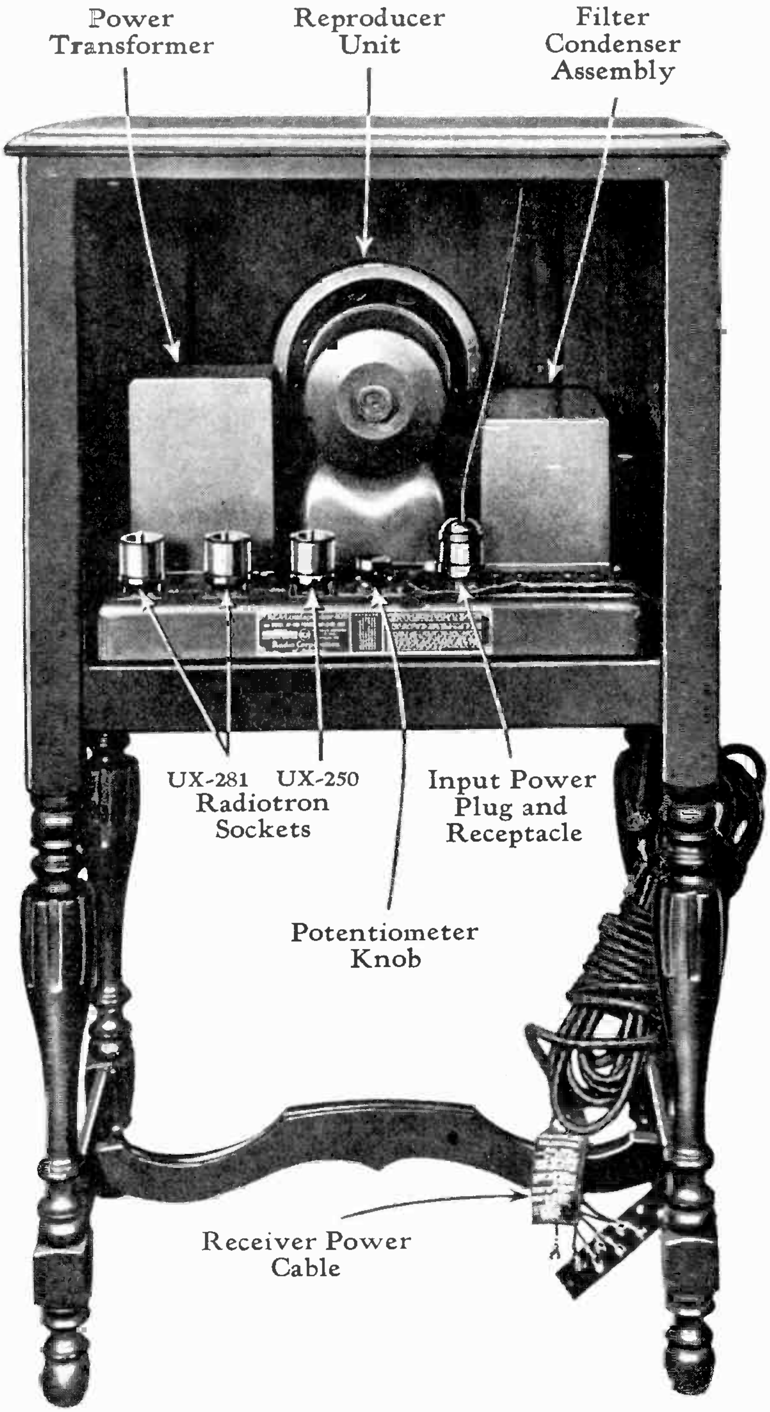

Figure 1—Rear inside view of cabinet, showing various parts.

RCA LOUDSPEAKER 105

105-125 Volts—50-60 Cycle A.C. Operation

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

RCA Loudspeaker 105 is a new power reproducer operating on the electro-dynamic principle of sound reproduction (see Figure 1). It gives faithful reproduction of voice or music throughout the audible frequency range. Combined with the loudspeaker is a socket power unit containing a stage of power amplification for the reproducer. "B" and "C" voltage supply is also provided for the receiver used to drive the loudspeaker. One UX-250 Radiotron in the power amplifying stage, and two UX-281 Radiotrons, connected in a full wave rectifying circuit, are used.

An RCA Radiola, or a receiver of good quality, used in conjunction with RCA Loudspeaker 105 will give best results. Under such conditions the quality of the output from the broadcasting station is the deciding factor in the exactness of the reproduction.

RCA Loudspeaker 105 is designed for operation on alternating current supply of 50-60 cycles, 105-125 volts. Connection to D.C. lines or power supply of different rating will damage the instrument. The quality of construction used in this loudspeaker ensures unfailing operation under normal conditions and the simplicity of design makes adjustment or replacement of damaged parts an easy and quick procedure. The present text, divided into three parts, offers information to those called upon to locate and remedy any trouble that may occur. Part I deals with proper operation; Part II—Inoperation, and Part III details the procedure used in replacing the main units of the instrument.

Figure 2—Top view of chassis assembly.

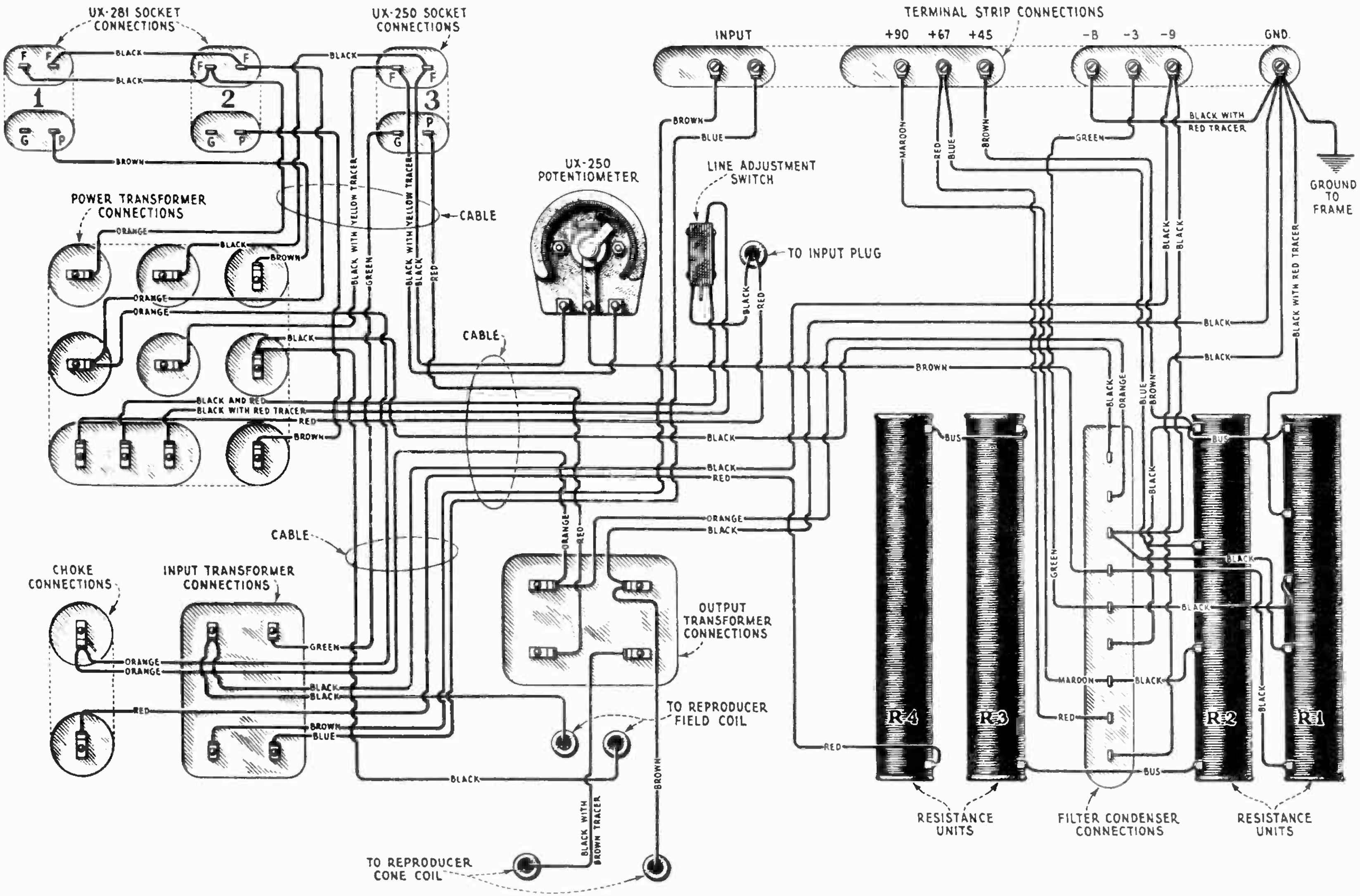

Figure 3—Sub-chassis assembly and continuity wiring diagram.

PART I—OPERATION

[1] LINE SWITCH

A two-way switch is provided for adjustment to power line voltages ranging from 105 to 125 volts. See Figure 2. If it is definitely known that the line voltage is always 115 volts or less the switch may be set at the 110-volt position. If the line voltage is over 115 volts the switch should be set at the 120-volt position.

When making an installation it is advisable to measure the power supply with a 0-150 A.C. voltmeter in order to determine the correct setting of the line switch. Disregard of this precaution may result in damaged Radiotrons or other units, caused by excess voltage.

[2] POTENTIOMETER

A potentiometer is provided for the suppression of A.C. hum. This potentiometer should be adjusted to the correct electrical center of the filament of Radiotron UX-250 when installing the speaker. After the receiver is connected put the loudspeaker and receiver into operation and without tuning in a signal adjust the potentiometer to the position producing minimum hum. If the loudspeaker is changed from one electrical outlet to another, or the Radiotron UX-250 is replaced, a slight readjustment may be necessary.

[3] OUTPUT VOLTAGES

RCA Loudspeaker 105 provides plate and grid voltages for practically all receivers employed to drive it. See Figure 3. A 30-foot cable (see Figure 1) connected to the terminal strip of the loudspeaker conducts this voltage supply to the receiver and conducts the output of the receiver to the loudspeaker. The voltages obtained at the loudspeaker terminal strip are as follows:

— 3 "C" (to be connected to receivers using 3 to 4½ volts grid bias)
— 9 "C" (to be connected to receivers using 9 volts grid bias)
+45 "B" (for detector plate supply)
+67 "B" (for R.F. plate supply)
+90 "B" (for R.F. or A.F. plate supply)

A link is provided between +67 and +90, which provides voltage regulation for various types and number of tubes.

The following voltages at different current loads are obtained at the 90-volt tap depending on the position of the link.

Link closed: +90 volts at 10 milliamperes.

Link open: +90 volts at 20 milliamperes or 135 volts at 3 milliamperes.

At the place of connection to the receiver the color scheme of the cable must be used to identify the voltage of the particular lead. The color scheme is printed on a tag attached to the cable and is as follows:

Input ((Plate) Brown
(B+) Black with brown tracer)
(B+) Amp. (90-volt) Red
(B+) Amp. (67-volt) Maroon and Red
(B+) Detector (45-volt) Maroon
(B—) Black with red tracer
(C—) Amp. (3-volt) Black and green
(C—) Amp. (9-volt) Black with green tracer

Correct plate and grid connections must be made to the receiver to secure proper loudspeaker reproduction.

[4] RADIOTRONS

Radiotron UX-250 is used in a stage of transformer coupled amplification and provides a reserve of power that makes for realistic reproduction at low as well as high volume up to the maximum requirements of the loudspeaker. The operating condition of this Radiotron should be compared periodically with one of known quality to ensure proper loudspeaker reproduction.

Radiotrons UX-281 are connected in a full wave rectifying circuit. The rectified or pulsating direct current from these tubes is smoothed out by means of the filtering system into approximately pure D.C. which is used for the plate and grid supply to Radiotron UX-250 and the Radiotrons used in the receiver. (See Figure 4.)

The loudspeaker Radiotrons are operated well below their maximum output which ensures stable operation and long life.

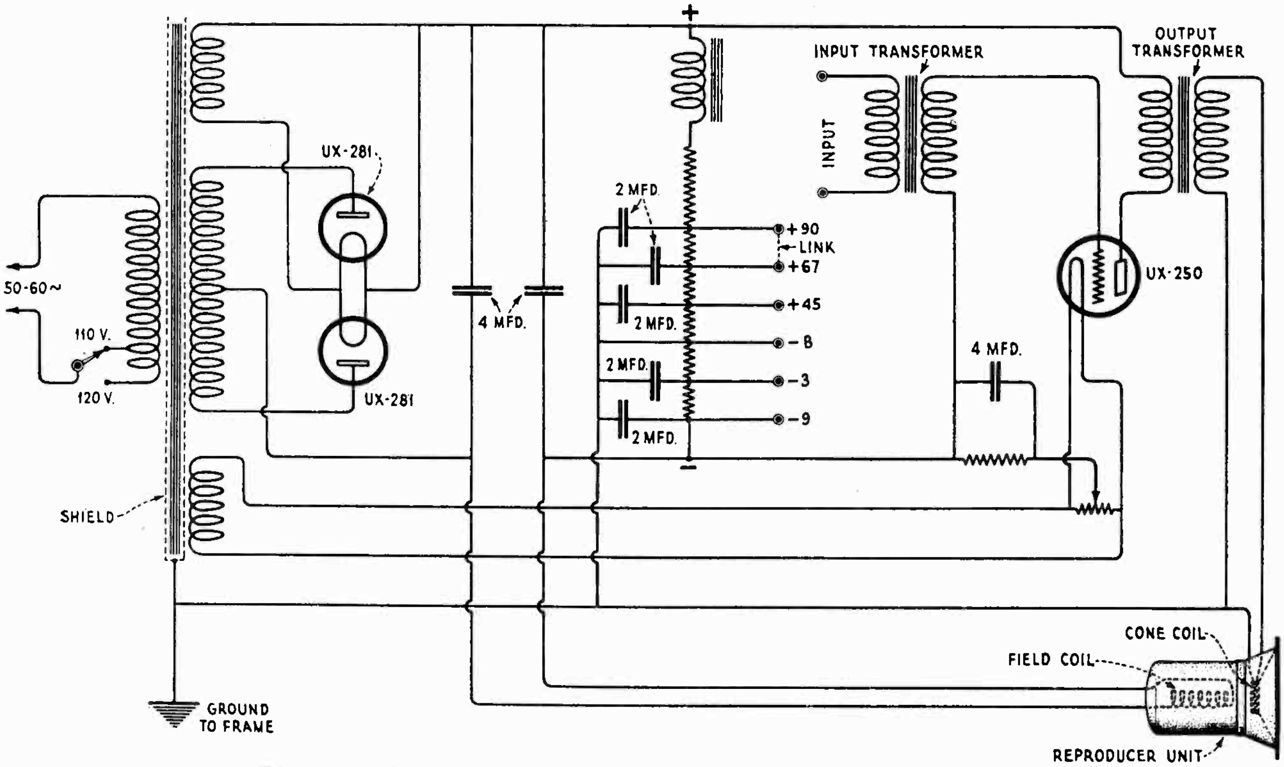

Figure 4—Schematic circuit diagram of RCA Loudspeaker 105.

[5] CONNECTING LOUDSPEAKER 105 TO RADIOLAS OR OTHER RECEIVERS

In order to obtain satisfactory operation from Loudspeaker 105 it is important that the receiver used in connection with it be correctly connected. (See Figure 5.) The correct placing of the link on the terminal board of the loudspeaker will be determined by the number of Radiotrons and the plate voltage used in the receiver. It is assumed that either UX-199, UX-201A, WD-11 or WX-12 Radiotrons are used in the R.F., detector and A.F. stages. For sets of four tubes or less using only 45 and 90 volts plate supplies, the link should be closed. For sets using a greater number of tubes or those requiring 67 volts, the link must be left open.

After correctly placing the link the small terminal strip at the end of the 30-foot cable is attached to a convenient place either in or on the receiver. Two holes are provided for two small wood screws to properly hold the strip in place.

If the set is equipped with a first stage jack the input plug at the end of the 30-foot cord should be inserted. If no jack or stage change switch is provided an internal connection is made to the first audio stage in the receiver. The following procedure should be used in making this connection.

(a) Disconnect all connections to the plate contact of the first audio Radiotron socket and to this contact solder a wire lead long enough to reach the input cord. Remove the plug from the input cord and connect the brown lead to the plate lead just made. This connection should be soldered and carefully taped.

(b) Connect the other side of the input cord (black with brown tracer) to the +B supply for this stage. If the plate supply is taken from the loudspeaker, the connection is made at the terminal strip on the 30-foot cable by connecting the +B supply and the input cord under one screw on the receiver terminal strip. The leads are sufficiently long for this purpose.

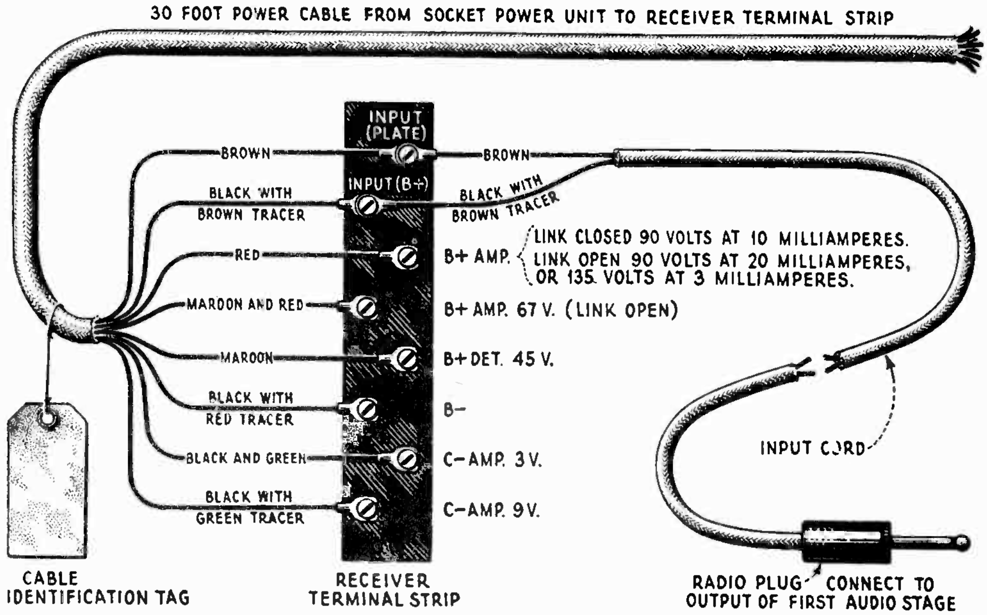

Figure 5—Thirty-foot power cable and receiver terminal strip.

Some receivers (such as Radiola 16) use 135 volts on the plate of the first audio stage. However, 90 volts with the correct "C" voltage will give sufficient amplification for use with Loudspeaker 105.

After connecting the input correctly the other connections should be made to the receiver terminal strip according to the tag attached to the 30-foot cable. If in doubt about any voltage, or should the tag be lost, identification may always be made by noting the color of the lead at the loudspeaker terminal strip. The voltages are engraved on the terminal strip and the color scheme of connection can be traced through the cable to the receiver terminal strip.

As the second audio stage in the receiver is not used the tube in this stage is removed, and the receiver operated with less filament current, which in turn extends the operating life of the "A" batteries.

After making all connections they should be checked. To put the set in operation turn on the receiver filament supply first and then pull out the operating switch of the loudspeaker. Figure 5 shows the receiver terminal strip and the correct connections to be made to it.

PART II—INOPERATION

[1] RADIOTRONS FAIL TO LIGHT WHEN OPERATING SWITCH IS "ON"

Should all Radiotrons fail to light when the operating switch is "ON", look for:—

(a) House current switched off, or loose connection at convenience outlet.
(b) Operating switch in loudspeaker not functioning properly.
(c) Line switch not functioning properly.
(d) Damaged power transformer in S.P.U.
(e) Burned-out filaments in Radiotrons.

The remedy for (a) (b) and (c) is apparent. Any external cause (such as D.C. supply etc.) of (d) and (e) should be located and eliminated before making any replacements.

[2] PLATES OF RADIOTRONS EXCESSIVELY HOT

Should the plates of Radiotrons UX-281 become excessively hot, check the following:

(a) Shorted 4 mfd. filter condenser on high side.

(b) Internal short in power transformer. Test for grounds to shield or to core, or short from one winding to another.

Should one Radiotron UX-281 become slightly overheated, but not show color and the other remain apparently normal, replace the one that appears normal. This tube is defective causing the other one to heat from overload.

[3] NO SIGNAL—RADIOTRONS O.K.

If the Radiotrons appear to be functioning properly and no signals are heard from the loudspeaker test the radio receiver for operation by using a pair of headphones. If the receiver is delivering a normal output of good quality, and the loudspeaker is properly connected, check the following:

(a) Inoperative Radiotrons in loudspeaker. Defects other than filament failures are not apparent until the tubes are tested. Inoperative Radiotrons UX-281 may cause low voltages at the terminal strip. Low voltage supply to the receiver will affect its operation and the input to the loudspeaker will not be normal.
(b) Loose connections in output plug of receiver if used.
(c) Loose connections at output of receiver if plug is not used.
(d) Defective 30-foot cable.
(e) Open movable coil on cone.
(f) Defective S.P.U. Check by means of continuity test.
(g) Open field coil in reproducer unit. This is indicated by the filaments of the Radiotrons burning at excess brilliancy.

[4] EXCESSIVE HUM

Excessive hum in the reproducer may be due to any of the following causes:

(a) Potentiometer not properly adjusted. The potentiometer at the back of the S.P.U. should be adjusted for the point of minimum hum when an installation is made, or when the loudspeaker is changed from one electrical outlet to another. Further reduction of hum may sometimes be obtained by reversing the plug contacts at the socket outlet.

(b) Loose laminations in transformer or loose screws in S.P.U. Loose laminations in the power transformer may be remedied by removing it from the S.P.U. frame as described in Part III, Section 1, and heating it in a slow oven to soften the sealing compound sufficiently to seal all laminations in the transformer. The transformer should be allowed to cool about 24 hours before returning it to the loudspeaker. Loose screws in the S.P.U. may cause a hum. It is a good plan, whenever trouble of this kind is encountered, to tighten all bolts and screws in the S.P.U.

(c) Power line interference. This can be checked by removing the antenna or loop and first R.F. Radiotron from the receiver used to drive the loudspeaker. If the hum disappears it is an indication that the trouble is external to the receiver and loudspeaker. In this case locate the cause of the trouble and have it corrected according to local conditions.

(d) Shorted 4 mfd. condenser across bias resistance. This causes distorted reproduction and loud hum.

(e) Decreasing emission in Radiotron UX-281 causes a gradual increase of hum.

(f) In some localities an external ground will be found effective in reducing hum. A ground terminal is provided on the terminal strip of the S.P.U. for this purpose.

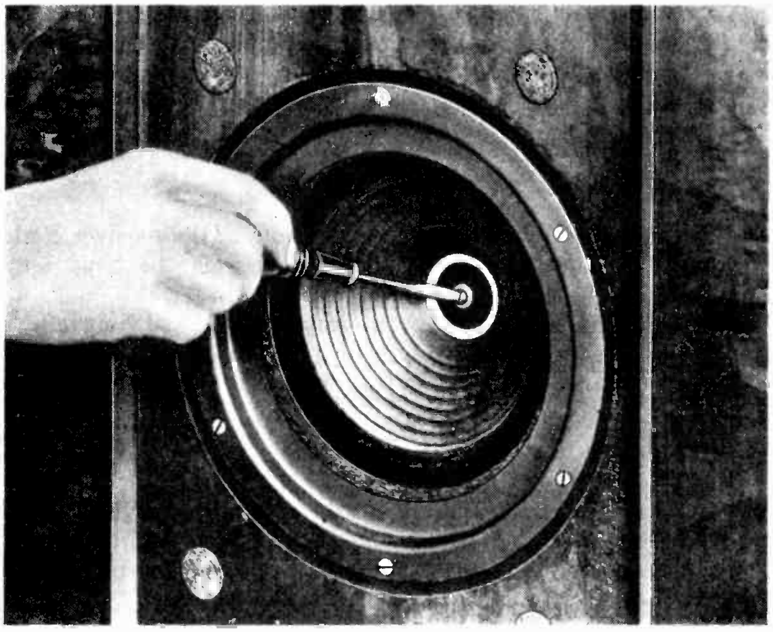

Figure 6—Centering cone.

[5] DISTORTION IN REPRODUCER UNIT

Distortion in the reproducer unit may be due to any of the following causes:

(a) Poor input to loudspeaker from receiver. Examine the receiver for quality of output. If output is poor and receiver is using "B" and "C" supply from the loudspeaker, check for correct voltages. Wrong voltage supply may cause receiver distortion.

(b) Damaged Radiotron UX-250. Try one known to be in good operating condition.

(c) Cone out of alignment. Remove grille as explained in Part III, Section 5. and relocate cone coil by loosening center adjusting screw and shifting position of cone (Figure 6). The correct position must be found by experiment.

(d) Leads from cone coil broken away from side of cone. Make these fast with a little shellac.

(e) Defective S.P.U. Test by means of continuity test, Part II. Section 11.

(f) Loose grille, name plate or baffle board. Any loose part in the cabinet will cause a rattle. Tighten all loose parts.

[6] NO "B" OR "C" VOLTAGE AT TERMINAL STRIP

A zero voltage reading obtained at any of the "B" and "C" supply terminals will indicate one of the following conditions:

(a) Damaged tapped resistance unit. Determine by continuity test and replace.

(b) Damaged condenser. Across all output voltages there are connected 2 mfd. condensers. Should one of these be shorted the particular terminals across which it is connected will give a zero voltage reading. In this case replace the entire condenser bank as described in Part III, Section 2.

(c) Open or shorted connections. Determine by continuity test.

(d) A low output voltage reading may be caused by low emission Radiotrons UX-281.

[7] FADING SIGNALS

Fading signals not caused by transmission variations may be caused by:

(a) Damaged Radiotrons—either in the receiver or in the loudspeaker.

(b) Damaged resistance unit. Determine by continuity test and replace. If the resistance eventually opens normal operation of the receiver and loudspeaker will be interrupted.

[8] ACOUSTIC HOWL

Acoustic howl is caused by vibration of the elements in the receiver Radiotrons. This is amplified in the loudspeaker. Conditions being favorable the howl may increase in intensity and drown out the broadcast signal.

Howling may usually be eliminated by interchanging the Radiotrons (especially the detector) in the receiver or changing the angle of position of the loudspeaker to the receiver. In extreme cases it may be necessary to increase the distance from the receiver to the loudspeaker.

[9] FILTER CONDENSER TESTS

The filter condensers in Loudspeaker 105 can be tested by placing a high D.C. voltage charge on them and noting the retention of the charge. As a high D.C. voltage is rarely obtainable either in the dealer's shop or in the customer's home the high voltage source incorporated in the S.P.U. can be used to make the test as follows:

(a) Remove Radiotron UX-250; disconnect receiver power cable and then remove S.P.U. from cabinet. Up-end the unit to make the sub-base accessible.

(b) With a hot soldering iron release the black wire from the second lug of resistance unit R1.

(c) Standing so as not to be in contact with any part of the S.P.U., connect an A.C. line to the input plug and switch "ON" the current long enough to charge the condenser. Then turn the current "OFF". Using a well insulated screwdriver or one having a wooden handle move the black wire lead into contact with the resistance lug from which it was removed. At the point of contact there will be a flash. To guard against shock do not come in contact with any of the condenser leads when making this test. The flash obtained will be an indication that all the filter condensers are in good condition, because a defective condenser prevents charging of any condenser.

(d) If no spark is obtained one of the two 4 mfd. condensers should be released separately from the circuit (see Figure 7) and the test applied to the one remaining. When the damaged condenser is released a good discharge will be obtained from the remaining condenser.

This test subjects the condenser to a voltage in excess of the maximum operating voltage normally received and a damaged condenser that might pass a click or low voltage test will be immediately identified.

The 2 mfd. condensers can be tested by measuring the voltage across the resistance sections across which the condensers are connected with the Radiola in operation. A zero voltage reading will generally indicate a defective condenser.

[10] CHECKING VALUES OF DIFFERENT RESISTANCE UNITS

The following values are correct for the different resistance units used in Loudspeaker 105.

R1—2,976 ohms (Taps at 1,325, 67, 134 and 1,450)
R2—3,675 ohms (Taps at 1,260, 1,415 and 1,000)
R3—4,000 ohms
R4—4,000 ohms

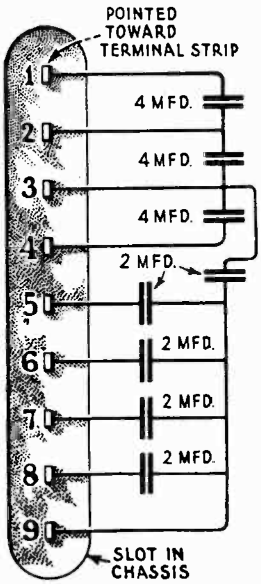

Figure 7—Filter condenser connections.

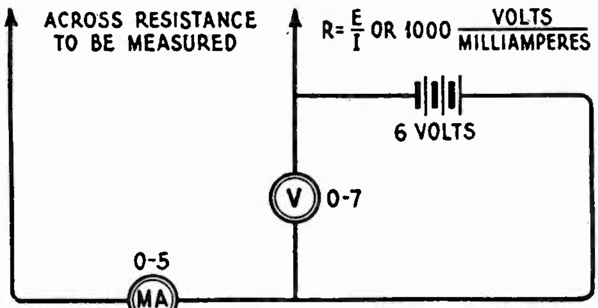

Figure 8—Schematic circuit for resistance measurement.

These resistances should be close to their rated values in order to supply correct plate and grid voltages to Radiotron UX-250 for best operation.

The following method can be used to check the resistance units in case a resistance bridge is not available. A milliammeter with a scale of 0-5 and a voltmeter of 0-7 is used with an applied voltage of approximately 6 volts. Figure 8 shows the hookup. The readings obtained are sufficiently accurate for checking purposes.

The resistance is calculated by Ohms law.

$$R = \frac{E}{I} \left(\begin{array}{l} \text{Where R equals ohms, E equals volts} \\ \text{and I equals amperes} \end{array} \right) \text{ or } 1{,}000 \frac{\text{Volts}}{\text{Milliamperes}}$$

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.

This arrangement with a 0-5 milliammeter must be used for measuring the total resistance of the various units and not for the individual sections. In the latter case some of the readings would be beyond the range of the milliammeter. If it is desired to measure the resistance of the sections between taps a 0-100 milliammeter must be used.

[11] CONTINUITY TESTS

The following tabulated tests cover the wiring continuity of the Socket Power Unit (see Figure 3). Disconnect the cable from the current supply outlet and all connections at the terminal strip of the S.P.U. Remove all Radiotrons.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient voltage to give full scale deflection when connected directly across the battery terminals should be used in making these tests.

LOUDSPEAKER 105 CONTINUITY TEST

Remove all Radiotrons and connections to terminal strip. Radiotron socket reference numbers used are counted from left to right facing rear of loudspeaker. Reference letter P refers to plate and G to grid. See Figure 9.

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Power transformer	P 1 to P 2	Closed	Open high voltage winding of power transformer or connections
	Across filament socket No. 1	Closed	Open UX-281 filament winding or connections
	Across filament socket No. 2	Closed	Open UX-281 filament winding or connections
	Across filament socket No. 3	Closed	Open UX-250 filament winding
	Across A. C. input plug	Closed	Open primary of power transformer. Try at both positions of power line adjusting switch. If open at either position check transformer without switch in circuit
Input transformer	G3 to −9	Closed	Open secondary of input transformer
	Across input terminals	Closed	Open primary of input transformer
Output transformer	P3 to +90	Closed	Open primary of output transformer; open reactor, or resistance units R2, R3 or R4
	Disconnect cone coil leads and test across terminals	Closed	Open secondary of output transformer
Cone coil	Across cone coil leads	Closed	Open cone coil
	One side of cone coil terminal to ground	Closed	Open ground connection
Resistance units	−9 to +90	Closed	Open resistance units R1 and R2
Miscellaneous	P1 or P2 to −9	Closed	Open ½ high voltage winding of power transformer or pot magnet field winding
	P1 or P2 to either filament socket No. 3	Closed	Open ½ high voltage winding of power transformer, open pot magnet field winding or open resistance unit R1
	G3 to either filament socket No. 3	Closed	Open secondary of input transformer, tapped resistance unit or potentiometer

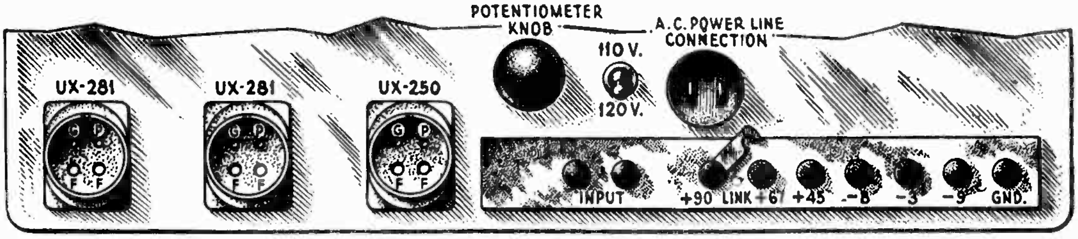

Figure 9—Location of Radiotron socket contacts and socket power unit binding posts.

PART III—MAKING REPLACEMENTS

The work involved in replacing any unit in RCA Loudspeaker 105 is rather simple because all parts are fastened by screws and nuts. When replacing any of the units fastened to the chassis it is first necessary to remove the chassis assembly from the cabinet (see Figure 10). As a precaution against possible shock by contact with leads from the high voltage condensers in case a charge has been stored up due to an open resistance unit, filter reactor or reproducer field coil, it is advisable to make certain that the condensers are discharged by connecting a short lead of insulated wire from terminal —9 (on the S.P.U. terminal strip) successively to the plate contacts of all three Radiotrons, first removing all tubes. The chassis is quite heavy and care must be exercised in handling it. Provide a bench or table in advance to hold the unit when removed from cabinet.

[1] REPLACING POWER TRANSFORMER, INPUT TRANSFORMER AND FILTER REACTOR

The power transformer, input transformer and filter reactor are each held in place by four machine screws, lock washers and nuts. Replacements are made in the following manner:

(a) Remove the bolts underneath cabinet that hold the loudspeaker assembly and disconnect cable at S.P.U. terminal strip.

(b) Carefully remove assembly to a place convenient for working.

(c) Unsolder the wires in the sub-chassis assembly connecting the unit it is desired to replace.

(d) Remove the four screws and nuts that hold the unit to the metal base. Loosen the nuts first, with a pair of pliers or socket wrench. It may now be removed and the new one placed in the position occupied by the old one. Fasten the new unit to the metal base with the old screws and nuts.

(e) Solder the proper wire connections to the new unit. The color scheme is shown in Figure 3.

(f) Replace loudspeaker assembly in cabinet in reverse order of that used to remove it.

[2] REPLACING FILTER CONDENSER ASSEMBLY

The filter condenser assembly consists of a number of condensers all contained in a metal case. A defect in any of the condensers will necessitate a replacement of the entire condenser assembly. When making a replacement proceed as follows:

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

(b) Unsolder and remove all connections to the condenser lugs. These are located between the resistance units on the sub-chassis.

(c) Remove the six machine screws, nuts and lock washers which hold the condenser assembly to the metal base. The condenser unit may now be removed and the new one placed in the position occupied by the old one. The correct position of the unit is easily determined by pointing terminal No. 1 toward the S.P.U. terminal strip. The condenser terminals are numbered from 1 to 9.

(d) Fasten the new unit to the base with the screws, nuts and lock washers removed from the old unit.

(e) Resolder the wire connections to the lugs on the new bank. The diagram shown in Figure 3 illustrates the correct color scheme of these connections.

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

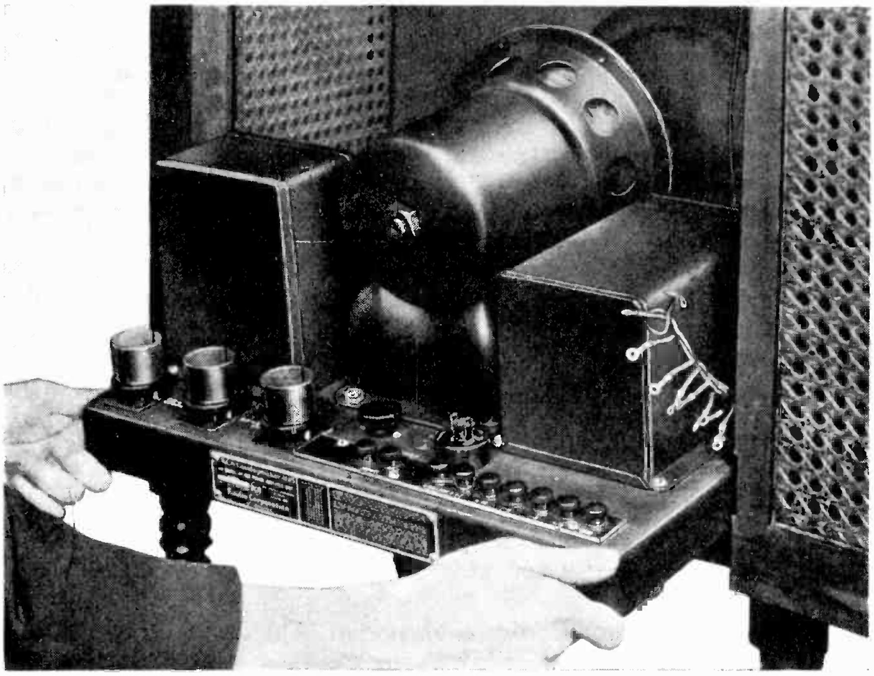

Figure 10—Removing chassis assembly from cabinet.

[3] REPLACING OUTPUT TRANSFORMER

The output transformer is located directly under the reproducer unit. If replacement becomes necessary proceed as follows:

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

(b) Turn chassis up on end and unsolder the two field coil leads of the reproducer unit. Tag the connections so that later they may be returned to their correct position.

(c) Disconnect the two leads to the cone coil terminals.

(d) Now remove the four hex head machine screws that hold the reproducer unit in place. The reproducer may now be lifted clear and the output transformer exposed to view. (See Figure 11.)

(e) Unsolder the four wires connected to the output transformer terminals in the subchassis. Tag these wires correctly for re-connection.

(f) Remove the four screws, nuts and lock washers that hold the output transformer to the chassis (see Figure 11). The transformer may now be removed and the new one placed in the position occupied by the old one.

(g) Replace parts in the reverse order of that used to remove them. The terminals and leads should be connected and soldered as indicated on the tags, or as shown in the continuity wiring diagram Figure 3.

(h) Return the entire loudspeaker assembly to the cabinet and fasten securely.

[4] REPLACING CONE

To replace a cone on the reproducer unit proceed as follows:

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

(b) Release the two cone coil connections from their terminals so that they hang free.

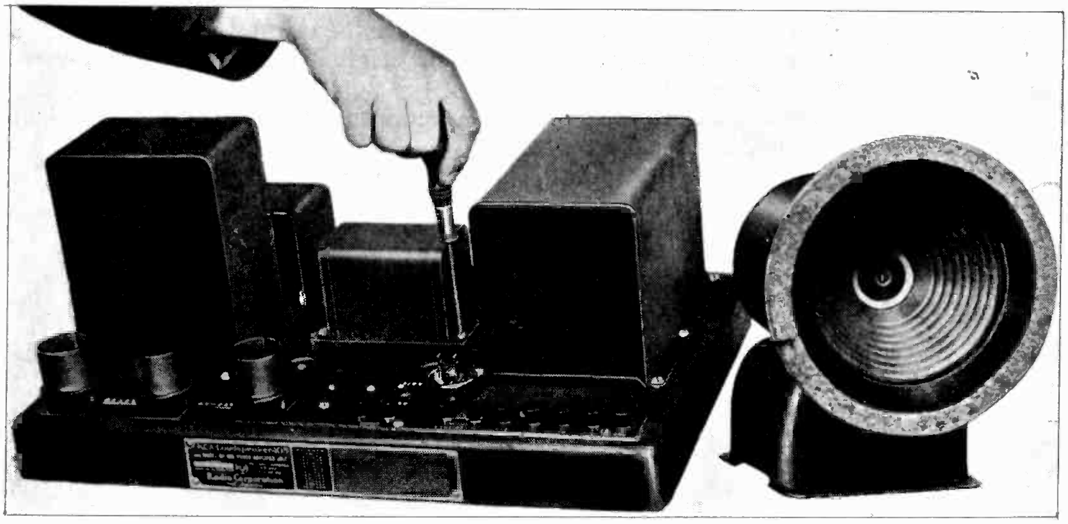

Figure 11—Removing output transformer.

(c) Remove the felt ring glued to the metal clamping ring holding the cone. This must be done carefully to prevent tearing the felt.

(d) Remove the screw used to center the cone on the pole piece.

(e) Remove the six machine screws holding the clamping ring. On release of this ring the cone may be removed. The new cone should be placed in the position occupied by the old one and the cone coil centered in the air gap of the pot magnet. The ring holding the edge of the cone in place should be returned to its original position and the six machine screws replaced. Glue the felt ring on the metal ring and return chassis to cabinet.

(f) Remove grille (see Part III, Section 5), loosen center cone screw and adjust the position of the cone coil until there is no rattle or distortion with the loudspeaker operating at maximum volume. After this adjustment the center cone screw is tightened and the grille replaced.

[5] REPLACING GRILLE

To replace a grille proceed as follows:

(a) Open rear door and remove the two wood screws that hold the front grille. These screws are located in the top section of the baffle board inside the cabinet.

(b) Remove the grille by pulling it from the top and then lifting it clear of the cabinet.

(c) The new grille is placed in the position occupied by the old one and the two wood screws replaced.

[6] REPLACING RESISTANCE UNIT

Should it be necessary to replace a resistance unit proceed as follows:

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

(b) Turn chassis on end and unsolder the connections to the resistance unit it is desired to replace.

(c) Remove the nuts that hold the brackets at each end of the resistance unit and remove the resistance unit with brackets attached.

(d) With a pair of pliers, hold the flat end of the rod running through the center of the resistance unit, and with another pair of pliers remove the nut at the other end of the rod.

(e) Remove the rod from the resistance unit. Replace the old resistance unit with a new one and return the rod and brackets to their original positions in the reverse order of that used to remove them.

(f) Tighten all screws and solder the wire connections to the resistance unit in their correct positions as indicated in Figure 3.

(g) Return the chassis assembly to the cabinet in the 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 damaged tubes. If imperfect operation is not due to damaged tubes the "Service Data Chart" should be consulted for further detailed causes.

Indication	*Cause*	*Remedy*	SEE SERVICE NOTES *Part*	SEE SERVICE NOTES *Section*
No signals	House current not "On"	Turn house current "On"	II	1
	Defective operating switch	Repair or replace operating switch	II	1
	Defective cord to S. P. U.	Repair or replace cord	—	—
	Defective receiver	Check and repair if necessary	II	3
	Defective S. P. U.	Check by continuity and repair or replace	II	11
	Defective pot magnet or open cone coil	Check for continuity and repair or replace	II	3
	Defective cable to receiver	Check and repair or replace defective cable	II	3
Weak signals	Receiver in shielded locality	Use outdoor antenna	—	—
	Defective S. P. U. assembly	Check S. P. U. continuity and repair or replace defect	II	11
	Defective receiver	Check receiver and repair or replace defect	—	—
Poor Quality	Poor input from receiver	Check receiver	II	5
	Cone of Reproducer unit not centered properly	Center cone of Reproducer or replace cone	II	5
	Wires loose on side of cone	Fasten wires with shellac	II	5
Noisy or Intermittent Reception	Dirty Radiotron prongs	Clean Radiotron prongs	—	—
	Loose connections in receiver	Check receiver	—	—
	Sprung socket contacts	Bend socket contacts correctly	—	—
Howling	Microphonic Radiotrons (especially detector) in receiver	Interchange Radiotrons	II	8
	Receiver too close to loudspeaker	Increase distance from receiver to loudspeaker	II	8
Hum	Potentiometer not properly adjusted	Adjust potentiometer for minimum hum	II	4
	Loose laminations in power transformer or loose screws	Heat transformer in slow oven or tighten any loose screws	II	4
	Power line interference	Check receiver with antenna disconnected and if outside interference remedy trouble at source	II	4
	Shorted 4 mfd. condenser across bias resistor	Check and replace	II	4
	Low emission Radiotrons UX-281	Test and replace	II	4
	Ground connection not made on loudspeaker	Connect ground terminal of loudspeaker to cold water pipe or other good ground	II	4

Printed in U. S. A. 1928

RCA
Loudspeaker 106

SERVICE NOTES

RCA LOUDSPEAKER 106

Regular Edition—30M

Radio Corporation of America

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PREFACE

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 RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

To assist in promoting this phase of the Dealer and Distributor's business the RCA Service Division 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 and Distributors' 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.

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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PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

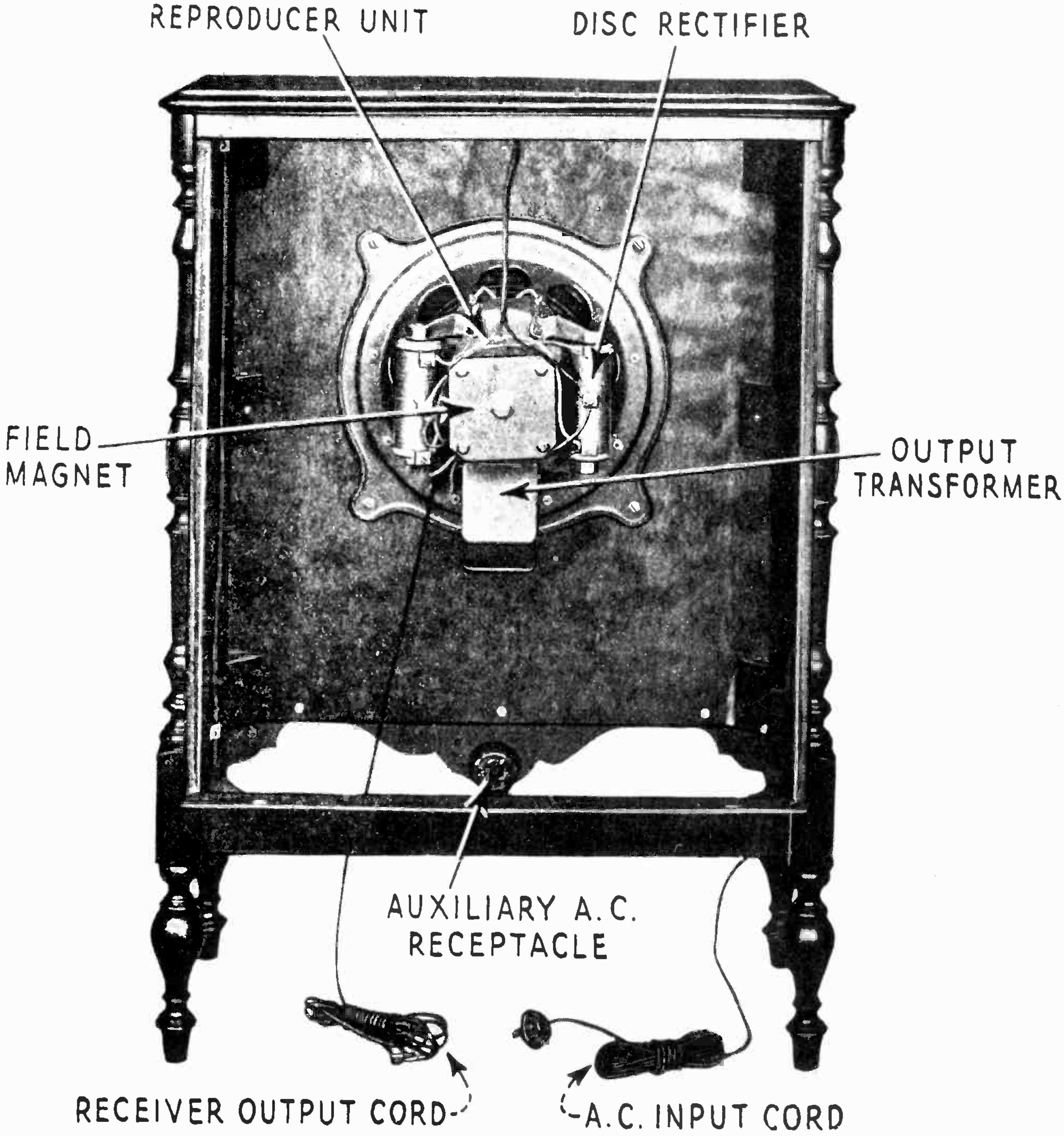

Figure 1—Rear interior view of Loudspeaker 106

RCA LOUDSPEAKER 106

(105-125 Volts. 25-60 Cycle A. C.)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Loudspeaker 106 is a reproducing device operating on the electro-dynamic principle and is designed for use with any radio receiver having a power output tube or using an external power amplifier. The entire mechanism is mounted in an artistic cabinet having a large baffle area and an open back. Both of these features contribute materially to the quality of reproduction that is an inherent characteristic of Loudspeaker 106.

The dynamic speaker mechanism consists of an eight-inch corrugated cone, similar to that used in Radiolas 62 and 64, a new type field magnet, a full wave disc rectifier, an output transformer, and two .1 mfd. line condensers. A receptacle is also provided at the rear of the cabinet for connecting the A. C. input current to the receiver used with the Loudspeaker, or any accessories requiring A. C. current for their operation in conjunction with the Loudspeaker. Thus the Loudspeaker operating switch provides complete control over the entire radio installation—a very useful and convenient feature.

Loudspeaker 106 is also made in a model adapted to D. C. operation. This model is similar to the A. C. model except that a higher resistance field is used and no rectifiers nor .1 mfd. line condensers are used. Because of this slight difference the present Service Notes apply equally well to the D. C. models.

PART I—INSTALLATION

The following instructions should be observed when installing Loudspeaker 106. Damage to the speaker will result if improperly installed when operation is attempted.

[1] ASSEMBLY

(a) Remove the cabinet from the shipping container and place it front down on a rug or other soft material. Remove the two screws that hold the back cover in place and remove the back cover.

(b) Place the mechanism assembly in position on the front baffle board as indicated in Figure 1 (output transformer toward the legs). Place the four mounting screws in place and screw down tightly.

(c) Connect the receiver output leads, the cord that has phone tips, to the two terminals located on the lower side of the reproducer unit. See Figure 1.

(d) Connect the leads from the top of the cabinet (A.C. input leads) to the two center connections of the disc rectifiers taking care not to allow the wires already connected to these terminals to become disconnected. *Do not connect these leads to the two terminals at the top of the frame because it will cause immediate burn-out of the cone coil and output transformer and may possibly cause other damage when the current is switched "on."*

(e) Return the back to the cabinet, allowing the input leads and power cord to fall through the opening in the bottom of the cabinet.

(f) Connect the A. C. input cord of the receiver, or other device, to be operated simultaneously with the Loudspeaker to the auxiliary receptacle at the back of the Loudspeaker cabinet. If more than one outlet is necessary a two-way plug may be used.

(g) Connect the two phone tips of the speaker cord to the output from the receiver. Never put the phone tips into the auxiliary receptacle openings.

The operating switches on the receiver and power devices in the installation are left permanently "on" and the installation is controlled by the operating switch in the Loudspeaker.

Should the receiver use a battery for filament supply the receiver filament switch will also have to be operated in addition to the Loudspeaker operating switch.

A trickle charger and storage battery should *not* be connected to the auxiliary receptacle, but should be connected to a separate supply outlet and operated according to instructions accompanying the device.

If the receiver is entirely battery operated the auxiliary receptacle is not used.

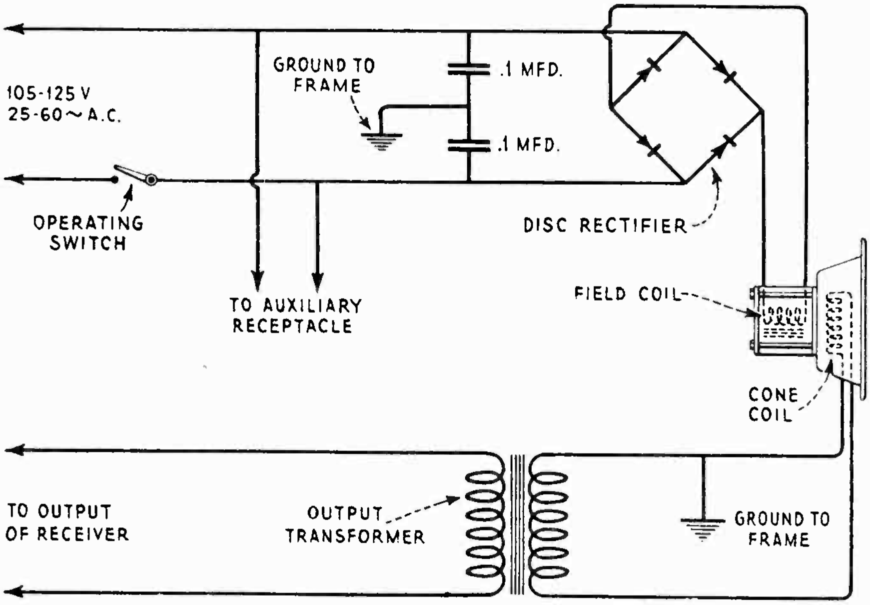

Figure 2—Schematic wiring diagram of Loudspeaker 106

PART II—SERVICE DATA

The service problems of Loudspeaker 106 deal with conditions evidenced by no reproduction, weak reproduction and distorted or noisy reproduction. These conditions and their attending causes, while not common to Loudspeaker 106, are explained and remedies noted so that service men may be provided with helpful information in any service work that may be required. Figure 2 illustrates the schematic circuit diagram which will be found useful in connection with service work.

[1] RECEIVER OUTPUT

Before inspecting the Loudspeaker for the cause of any imperfect operation first check the receiver output with a pair of head phones or another loudspeaker known to be in good operating condition. Any distortion in the receiver will be faithfully reproduced in the loudspeaker and corrective remedies must be applied to the receiver. However, if a signal of good quality and volume is being delivered by the receiver, the Loudspeaker must be examined for the trouble experienced.

[2] NO OUTPUT

If the receiver output is O.K. and no reproduction is delivered by the Loudspeaker look for:

(a) Open winding of output transformer.
(b) Shorted connections to output transformer.
(c) Open cone coil.
(d) Shorted or grounded cone coil.
(e) Defective input cord or faulty connections, either at receiver or loudspeaker.

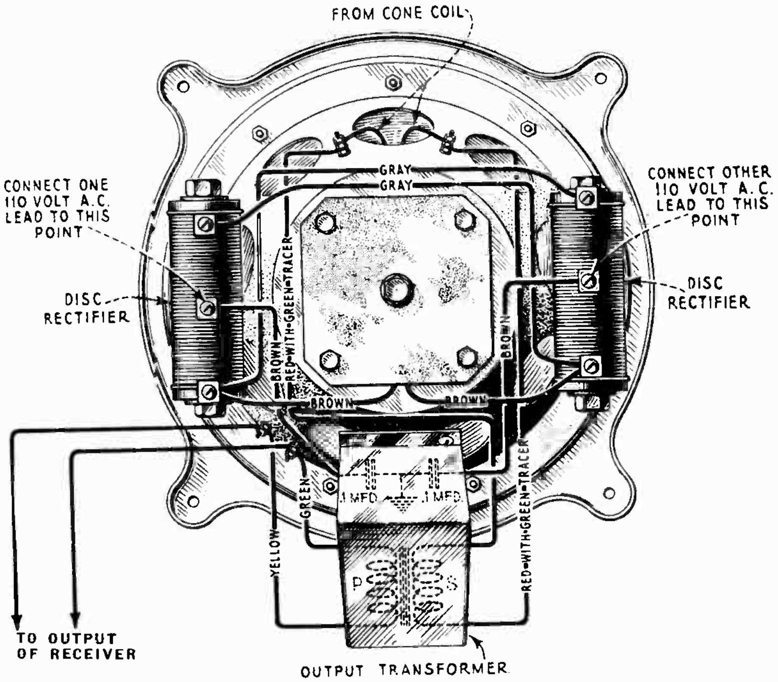

Figure 3—Wiring diagram of reproducer unit

[3] WEAK SIGNALS

Should weak signals be experienced check the following:

(a) Open or shorted field coil. A short my be experienced at the point where the leads enter the field magnet housing.

(b) Defective disc rectifier. A defective rectifier—not supplying field current—will cause weak reproduction. This will generally be accompanied by a loud hum. Sometimes the fuses in the A. C. line will blow.

(c) Defective connections to rectifier or to field, or a defective operating switch. Check all connections carefully against the wiring diagram Figure 3.

[4] DISTORTED OR NOISY REPRODUCTION

Distortion or noise may be caused by any of the following conditions:

(a) Cone out of alignment. Remove reproducer unit as explained in Part IV, Section 1. Then center the cone as described in Part II, Section 6.

(b) Leads from cone coil broken away from side of cone. Remove reproducer assembly as described in Part IV, Section 1, and fasten the leads to the side of the cone with a little shellac.

(c) Loose name plate, rear panel or any cabinet parts will cause a rattle at certain frequencies. Tighten all loose parts.

(d) Open or shorted line condensers. Defective line condensers may allow the receiver to be affected by R. F. noise originating in the disc rectifiers. If both line condensers should become shorted, the fuses in the A. C. line will probably blow.

[5] HUM

Excess hum and faulty operation may be caused by defective disc rectifiers. This may be checked by measuring the voltage across the terminals of the field leads. With the field connected it should be about 80 volts and with the field disconnected about 95

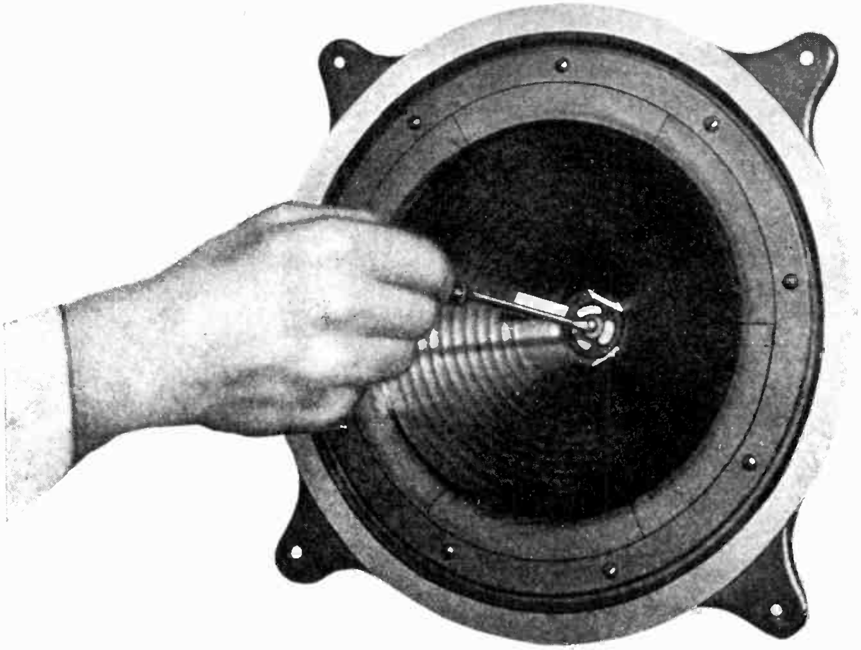

Figure 4—Centering cone

volts. The receiver should also be checked for excessive hum. A receiver that will operate satisfactorily with a magnetic type of Loudspeaker may have an excessive amount of hum when operated with a dynamic speaker. This is due to the greater low frequency response of the dynamic speaker compared with the magnetic. When this condition exists the remedy must be applied to the receiver, *not* the Loudspeaker.

[6] CENTERING REPRODUCER CONE

To properly center a new cone or one out of center use the following procedure:

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

(b) Loosen center screw of cone, but do not remove it.

(c) Insert three cardboard strips, about the thickness of a visiting card, 1½ inches by ¼ inch in size, through the center spider of the cone into the space between the pole piece and cone coil. This will give the cone coil the same clearance on all sides of the pole piece.

(d) Tighten the center screw (Figure 4) holding the spider of the cone and remove the three strips. The cone is now properly centered. Replace the reproducer assembly in the cabinet in the reverse manner of that used to remove it.

PART III—ELECTRICAL TESTS

The following tests give complete check on the circuits of Loudspeaker 106 and should be referred to whenever the functioning of the speaker is faulty in order to locate the cause.

[1] TESTING THE DISC RECTIFIER

The disc rectifier may be checked by measuring the output voltage that is delivered to the field of the reproducer unit. This should be approximately 80 volts with the field connected; with the field disconnected it should rise slightly to about 95 volts.

Figure 5—Removing baffle plate

Precaution—The operation of the disc rectifier depends on the pressure with which the discs are held. *Do not* loosen the bolts that hold them together as it is highly improbable they can be returned to normal operation without special instruments. Should replacement become necessary, remove the bracket and the unit together. The replacement part is supplied with brackets so that replacement is comparatively easy.

[2] TESTING OUTPUT TRANSFORMER

The primary of the output transformer should be tested for continuity by click testing from the phone tips that connect to the receiver output terminals. While testing shake the cord so that any intermittent opens may be disclosed. If this tests O.K. remove the cord from the two terminals and then test the cord for a short by shaking. After testing the cord test from terminal to terminal at the cord connections on the reproducer frame. This should test closed. Then test from each terminal to ground. The primary should *not* be grounded. The secondary winding of the transformer should then be tested by removing the two leads from the cone coil and testing from terminal to terminal. This should test closed. Then test from each terminal to ground. One side of the secondary is grounded so a click will be obtained when either of the terminals are tested to ground.

Disconnect the transformer leads from their terminals and check to determine that only one terminal is grounded. If both are grounded to frame one should be re-insulated with new insulating washers.

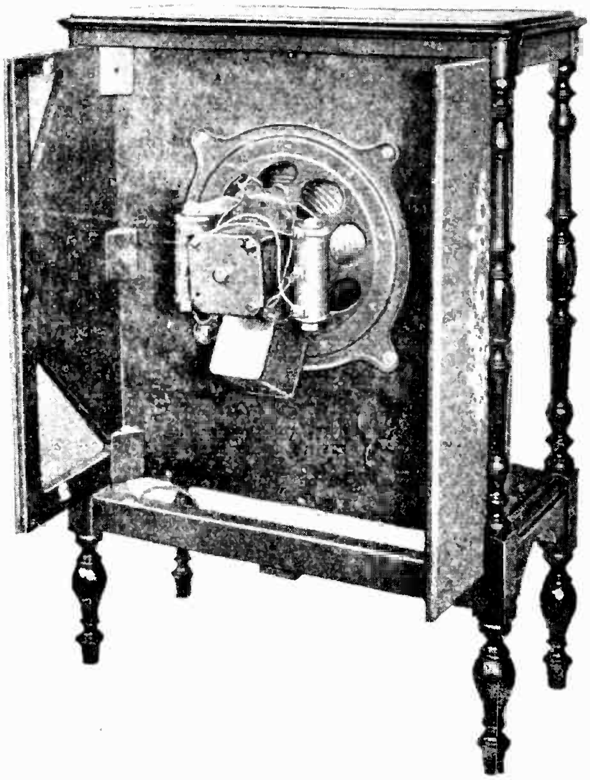

Figure 6—Baffle plate partly removed

[3] TESTING CONE AND FIELD COIL

Disconnect the two cone coil leads from their terminals on the reproducer frame and test from terminal to terminal. It should test closed. Then test to ground. It should not be grounded.

The two field coil leads should be disconnected from the rectifier and a test made from lead to lead. It should test closed. The field coil is not grounded.

[4] TESTING LINE CONDENSERS

The two line condensers may be tested by releasing their two outside leads (Figure 3) and testing from each lead to frame. They should test open. A shorted condenser will necessitate a replacement of the whole unit including the output transformer.

After all testing is completed and the necessary repairs are made, all wiring should be returned to its proper place as indicated in Figure 3.

PART IV—MAKING REPLACEMENTS

The reproducer assembly and cabinet parts in Loudspeaker 106 are easily accessible and replacements can be made readily. The following procedure outlines the methods to be used when making replacements.

[1] REPLACING PARTS IN REPRODUCER ASSEMBLY

To replace a part in the reproducer assembly proceed as follows:

(a) Remove rear panel by unscrewing the two wood screws that hold it in place and lift the panel clear.

(b) Disconnect the A. C. input connections to the disc rectifier, having previously removed the A. C. input plug from the supply outlet.

(c) Disconnect the receiver output leads at their terminals on the reproducer frame.

(d) Remove the four bolts that hold the reproducer assembly to the baffle board. It may now be lifted clear and placed in a position convenient for work. After the necessary repairs or replacements are made, it should be returned in the reverse manner of that used to remove it.

[2] REPLACING GRILLE CLOTH

The grille cloth used in Loudspeaker 106 is supplied in one piece consisting of the front and two sides stitched together. Should replacement become necessary proceed as follows:

(a) Remove rear cover by removing two wood screws and lifting clear.

(b) Remove all connections to reproducer assembly and release the A. C. input cable from the sides of the cabinet. Then release the operating switch and the auxiliary receptacle and pull cable, switch and receptacle through opening in bottom of cabinet.

(c) Remove the eighteen wood screws (Figure 5) that hold the baffle and side pieces to the cabinet frame. The frame may now be pulled through the rear opening (Figure 6). The grille cloth is held in place by means of tacks. Remove the tacks and grille cloth and stretch the new cloth in place. Replace the tacks.

(d) The cabinet is then reassembled in the reverse manner of that used to disassemble it and the Loudspeaker is returned to normal operation.

[3] RCA LOUDSPEAKER 106 REPLACEMENT PARTS

No.	*Description*
5895	Tapestry—Grille Cloth—Comprising front and side pieces stitched together.
2361	Output Cable—From receiver to loudspeaker.
5896	Power Cable—From socket outlet to operating switch, power receptacle and disc rectifier.
2015	Switch—Line operating switch.
5898	Rectifier Stack.
5899	Transformer — Comprising output transformer and two capacitors mounted in metal container.
8375	Cone—8" Corrugated paper cone.
8376	Ring—Metal clamping ring for holding cone.
8390	Ring—Cardboard seal ring—Package of 10.
8391	Coil—Field Coil.
9248	Magnet complete—Comprising field coil, core, coil case, two end plates, cone support, paper washers, four machine bolts with nuts and one cap screw.
5980	Field Coil (D. C. Model).
5981	Transformer—Output Transformer (D. C. Model).
5982	Terminal Strip Assembly — Comprising metal bracket with insulating bushings inserted, dilecto strips top and bottom, terminal screws with nuts and washers—completely assembled (D. C. Model).
9276	Magnet complete with Cone Support—Comprising two end plates, coil casing, core, field coil, damping washer, cone support, paper washers, four machine bolts with lock washers and nuts and one cap screw for holding core—completely assembled (D. C. Model).

SERVICE DATA CHART

The following table of information provides a handy reference when servicing Loudspeaker 106 and a working knowledge of it will enable service men to handle service problems readily and efficiently. Reference to Part No. and Section No. in the "Service Notes" is noted for detailed information.

Indication	*Cause*	*Remedy*
No Reproduction	No output from receiver	Examine receiver, Part II, Sec. 1
	Defective cone coil	Replace cone
	Defective output transformer	Replace output transformer
	Defective cord	Repair or replace cord, Part III, Sec. 2
	Loose or broken connections	Repair connections, Part III, Sec. 2
Weak Reproduction	Weak receiver output	Examine receiver, Part II, Sec. 1
	Improperly centered cone	Center cone correctly, Part II, Sec. 6
	Open field coil	Replace field coil, Part III, Sec. 3
	Defective rectifier	Replace rectifier, Part III, Sec. 1
	Faulty connections	Repair connections, Part II, Sec. 3
Distorted or noisy Reproduction (Rattle)	Distorted output from receiver	Examine receiver, Part II, Sec. 1
	Improperly centered cone	Adjust cone correctly, Part II, Sec. 6
	Cone leads broken from side of cone	Fasten loose leads with shellac, Part II, Sec. 4
	Open or shorted line condensers	Replace defective condensers, Part II, Sec. 4
	Loose parts in cabinet assembly	Tighten all loose parts or nuts, Part II, Sec. 4
Hum	Faulty receiver output	Check receiver output for hum and make repairs necessary, Part II, Sec. 5
	Defective disc rectifier	Replace defective rectifier, Part III, Sec. 1

Printed in U. S. A.

RCA

Power Amplifier

(UNI-RECTRON—MODEL AP-935)

SERVICE NOTES

Third Edition—5M—June, 1928

RCA Uni-Rectron—Model AP-935

Radio Corporation of America

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

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A WORD OR TWO ABOUT SERVICE

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RCA POWER AMPLIFIER

(UNI-RECTRON—MODEL AP-935)

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

RCA Uni-Rectron, Model AP-935, is a power amplifier unit containing suitable rectifying devices for operation from an alternating current house lighting circuit rated at 110-120 volts, 50 to 60 cycles. No attempt should be made to operate it from a direct current circuit or from an alternating current source of voltage or frequency other than specified. Such misuse may result in serious damage to the Uni-Rectron.

There is one Radiotron UX-210 and one Rectron UX-216B employed in the Uni-Rectron. The Rectron UX-216B converts or rectifies the alternating current supply to pulsating direct current which is smoothed out by the filter system and used as plate current by the power amplifier, Radiotron UX-210. The new RCA Radiotron UX-281 is interchangeable with Rectron UX-216B in the RCA Power Amplifier, and has the advantage of increased operating life.

PROTECTIVE SEALS AND THEIR USE

The lead seals placed on Uni-Rectrons by the RCA are for the protection of the dealer. Broken seals indicate tampering.

A service man may find it necessary to break the seals in order to make repairs. In such instances he should replace those broken by suitable substitute seals when the repair work is finished. Thus he is aided in determining whether any trouble that may develop later is due to tampering or ordinary wear and tear of assembled parts. The unit that has been tampered with will be indicated by a broken seal. This information places the dealer in a preferred position when it is found necessary to render a bill for service.

SERVICE DATA

Place Rectron UX-216B and Radiotron UX-210 in their respective sockets and see that they are firmly seated. Having ascertained that the lighting circuit is of alternating current of the proper voltage and frequency, insert plug in socket and pull Uni-Rectron switch to "on" position. Both tubes should light.

(1) IF NEITHER TUBE LIGHTS

Look for:

(a) Blown fuse in lighting circuit (check voltage of outlet socket used with a test lamp).

(b) Loose plug in lighting socket.

(c) Operating switch on Uni-Rectron not making proper contact.

(d) Open in power supply cord.

(e) Defective Radiotron or Rectron.

(f) Open in transformer. (Run continuity test.)

The remedies for the above conditions are obvious, but in the event that trouble still exists check the voltage and frequency of the house lighting current. If these are correct run the complete continuity test shown on pages 7 and 8 to isolate the trouble.

(2) IF ONE TUBE LIGHTS AND OTHER DOES NOT

Look for:

(a) Open in filament winding of power transformer.
(b) Open in connections at filament contacts of socket.
(c) Defective Rectron or Radiotron.

(3) EXCESSIVE HUM IN OPERATION

May be due to:

(a) Defective Rectron UX-216B.
(b) Ground terminal not connected.
(c) Ground connections in Uni-Rectron open. (Check diagram and continuity for grounds.)
(d) Connections in plug to A.C. line reversed. (Try reversing plug.)
(e) Loose laminations in power transformer or choke. (This is generally accompanied by a physical vibration.)

Any loose items such as clamps, nuts, screws, bolts and transformer laminations may cause a serious hum in operation. These should all be gone over carefully and tightened where necessary, paying particular attention to the nuts, bolts and clamps holding the transformer and choke coils.

(4) DECREASED LOUDSPEAKER VOLUME

May be caused by:

(a) Defective loudspeaker. Check speaker on radio receiver known to be operating satisfactorily.

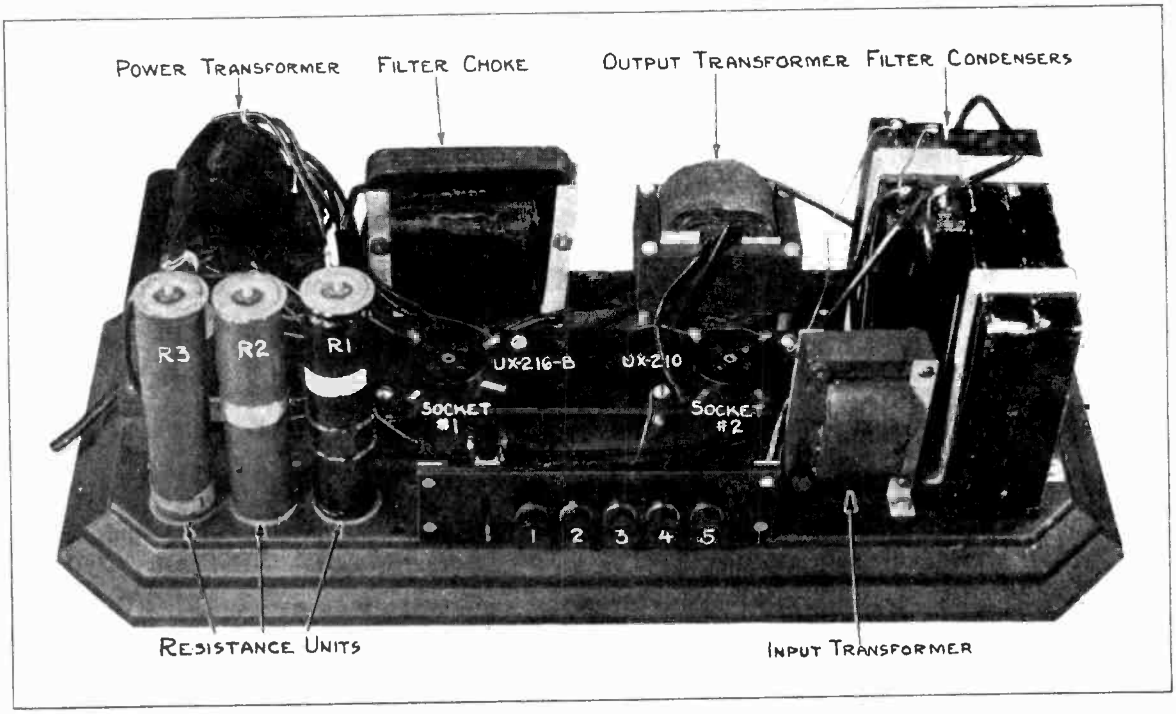

Figure 1

Rear view of Uni-Rectron with cover removed showing location of various parts

(b) Weak signals from radio receiver. Check output with pair of phones.

(c) Defective Radiotron UX-210 or Rectron UX-216B. (Defective Rectron UX-216B may cause low plate voltage which in turn would cause decrease of loudspeaker output.)

(d) Defective input or output transformer. (Check continuity, including grounds to core.)

(e) Low plate voltage. Measure with high resistance type of voltmeter.

(f) Defective transformer windings. High voltage secondary having shorted turns.

(5) MAGNETIC PULL TESTS FOR ISOLATING TROUBLE

These tests are made by holding a steel screw driver in proximity to the iron core of the choke coil and noting the degree of magnetic pull together with the condition of the plate of the Rectron UX-216B. (See Figure 3.)

Magnetic Pull	*Color of Plate*	*Defect*
(a) Excessive	Dull red	3½ Mfd. condenser No. 2 shorted.
(b) None	White hot	3½ Mfd. condenser No. 1 shorted.
(c) None	Normal	Defective power transformer or open choke.
(d) Excessive	Normal	Shorted elements in Radiotron UX-210.

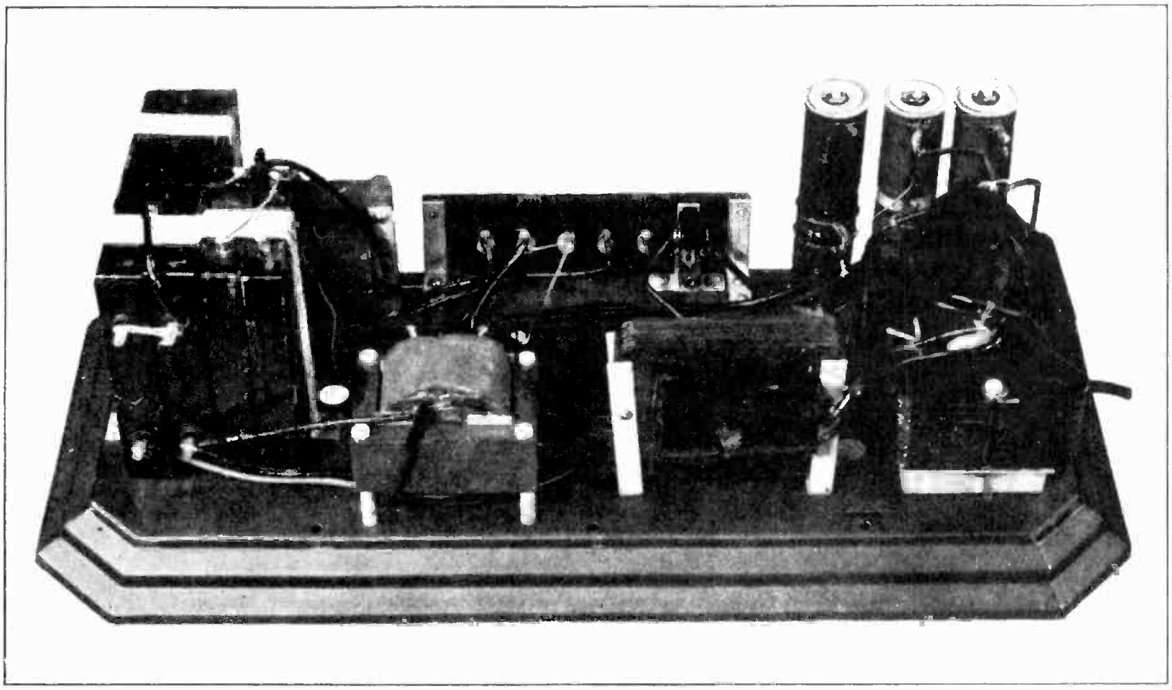

Figure 2

Uni-Rectron—Front view with cover removed

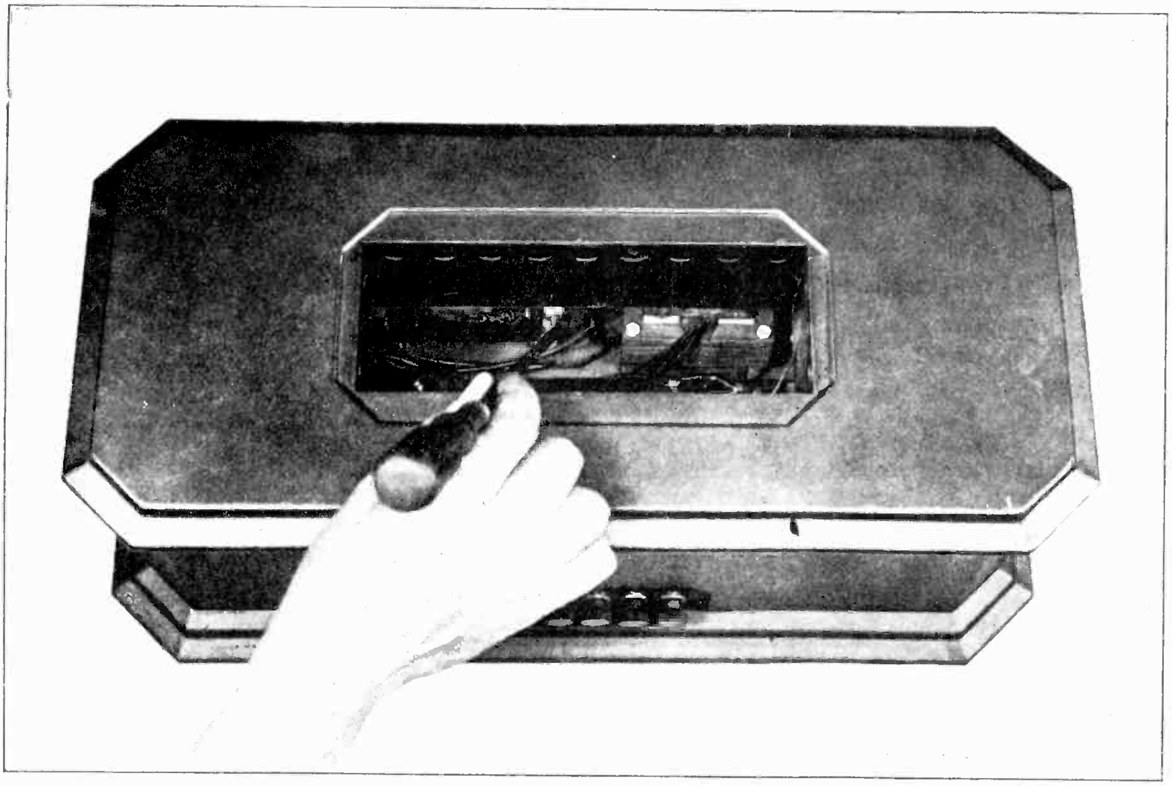

Figure 3
Location of screw driver for Magnetic Pull Test

(6) IF FILAMENTS OF RECTRON UX-216B AND RADIOTRON UX-210 LIGHT EXCESSIVELY BRIGHT

Look for:

(a) Shorted turns in primary of power transformer.

(b) Alternating current supply of excessive voltage.

(c) Open plate winding of power transformer.

(7) PLATE OF RECTRON UX-216B TURNS RED

Look for:

(a) Shorted 3½ Mfd. condenser. This condition would be indicated by an excessive pull on the choke. To further isolate this trouble, run Magnetic Pull Test given in Section 5.

(b) Short in power transformer secondary windings.

(c) Shorted Radiotron UX-210. Tube will become hot, but will not necessarily show color.

(8) COMPLETE CONTINUITY TEST

(Use Phones in series with a 4½ volt "C" battery.)

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
1 to 2	Click through primary of input transformer	Open primary input transformer
4 to 5	Click through secondary of output transformer	Open secondary output transformer
4 to 3	Click through connections	Open lead
4 to ground	Click through connections	Open lead

Use Voltmeter with Battery voltage sufficient to give full scale deflection when connected directly across battery terminals.

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
P1 to P2	Small scale deflection	Open high voltage winding of transformer. Open resistance unit or primary of output transformer

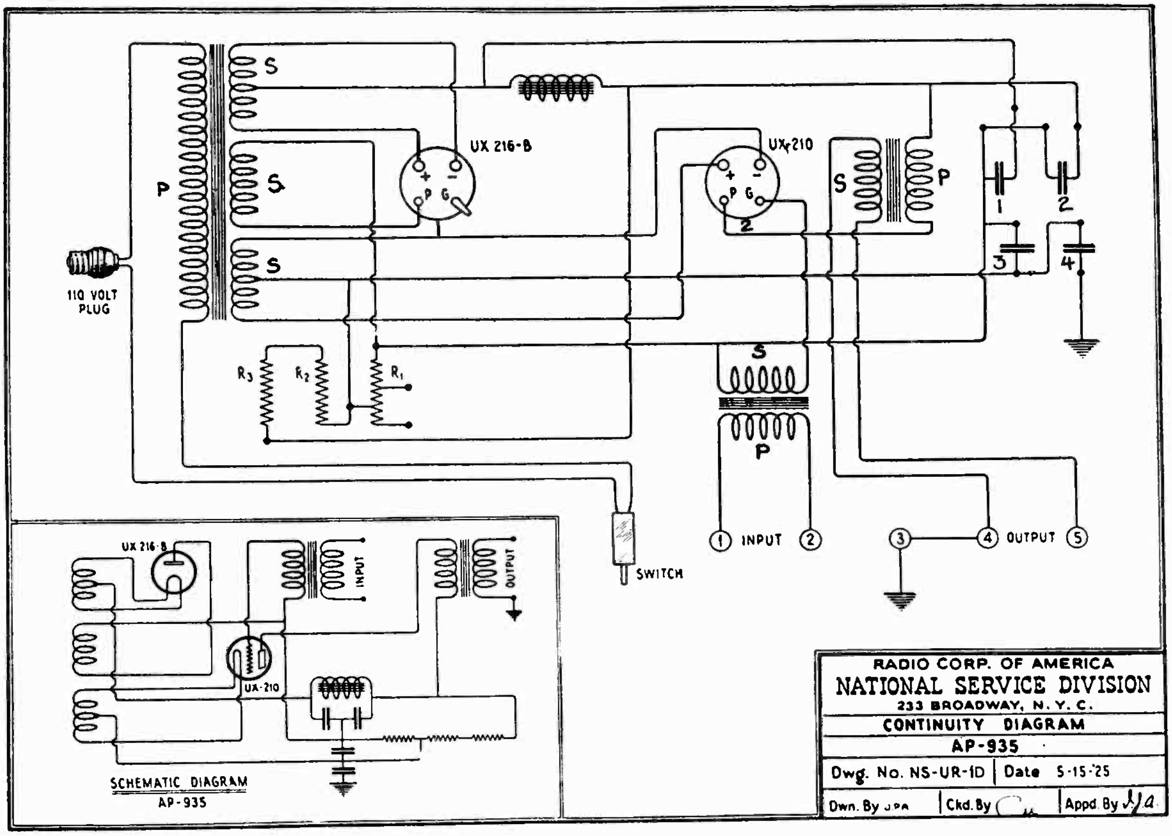

Figure 4
Continuity diagram RCA Uni-Rectron

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
—F1 to +F1	Full scale deflection	Open filament winding of power transformer
P1 to G2	Small deflection	Open (high voltage winding of transformer) (secondary of input transformer)
P2 to —F2 or +F2	Half deflection	Open (primary output transformer) (resistance unit) (filament winding)
P1 to —F1 or +F1	Small deflection	Open (choke) (filament winding) (resistance unit) (plate winding)
Ground to —F2	No deflection	Shorted condenser No. 4

The test points referred to are shown in the Continuity Diagram, Figure 4. The designations "P" and "G" refer to the plate and grid socket contacts. The number immediately following refers to the first or second socket. For example G2 indicates the grid contact of the second socket. P1 indicates the plate contact of the first socket. In the same manner the letter "F" denotes the filament contact of the tube socket indicated by the number.

(9) RESISTANCE UNIT TESTS

The tests given in Sections 5 and 8 cover every circuit and winding of the Uni-Rectron and will, in practically all cases, isolate trouble to a certain unit or condenser without removing cover or breaking seals. However, it will be necessary to remove the cover in order to replace a defective part. With the cover removed the following tests may also be made:

After the Uni-Rectron has been in operation for some time the normal temperature of the resistance units should be as follows:

No. 1—Warm.
No. 2—Warm.
No. 3—Quite hot.

If No. 1 or No. 2 run excessively hot it is a positive indication of trouble, likewise a lack of heat will indicate an open in the adjacent circuits. The continuity tests should be made to isolate the trouble provided it is not apparent at sight. If trouble has previously been isolated to these resistances they may be clicked for opens at their respective terminal lugs. It will be noted in the case of No. 3 that only a small part of the resistance is in use.

The condensers may also be individually tested for shorts by using the voltmeter and battery. A full scale deflection in any case will be an indication of a shorted condenser. A partial deflection will be an indication of normal operation of condenser No. 1 and No. 2 as these are shunted by resistances. Condenser No. 2 will cause a greater deflection than No. 1. Before testing the condensers discharge any voltage by short circuiting them with a steel screw driver.

Printed in U.S.A.—1928.

RCA

"B" Battery Eliminator

(DUO-RECTRON—MODEL AP-937)

SERVICE NOTES

Third Edition—5M—June, 1928

RCA Duo-Rectron—Model AP-937

Radio Corporation of America

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

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A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well informed Radiola 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 Dealers' 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 Radiola 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.

RCA "B" BATTERY ELIMINATOR

(DUO-RECTRON—MODEL AP-937)

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

The RCA Duo-Rectron or "B" Battery Eliminator is a rectifier unit which will operate from an alternating current house lighting circuit rated at 110-125 volts, 50 to 60 cycles. No attempt should be made to operate it from a direct current circuit or from an alternating current source of a voltage or frequency different from that specified above. Such misuse may result in serious damage to the Duo-Rectron.

RCA Duo-Rectron is furnished with one Rectron UX-213 and one Radiotron UX-874. Rectron UX-213 is a full wave rectifier having two parallel filaments and two plates, thus utilizing both halves of the alternating current wave. The RCA Radiotron UX-280 is interchangeable with Rectron UX-213 and has the advantage of increased operating life. Radiotron UX-874, the "glow tube," is connected across from the —B to the +90 terminal and serves to maintain a constant voltage across these two points under varying load conditions. It has in its base a strap, connecting two of its contacts, which closes the primary circuit of the power transformer. There is, therefore, no voltage impressed on the power transformer until the "glow-tube" is in place.

The Duo-Rectron will supply "B" plate voltages of 22½, 45, 90 and 135 volts to a Radiola or other radio receiver. Under normal conditions, it is rated to furnish 2 milliamperes (0.002 ampere) at the 45-volt post, 20 milliamperes (0.020 ampere) at the 90-volt post, and 10 milliamperes (0.010 ampere) at the 135-volt post. If the radio receiver in use does not require 135 volts on the plate of any Radiotron, a larger plate current output may be obtained by connecting the +90-volt post to the +135-volt post by a short jumper. Under these conditions the Duo-Rectron will furnish its maximum output of 50 milliamperes (0.050 ampere) at 90 volts.

If the Duo-Rectron is over-loaded beyond its rated capacity, the operation of the "glow-tube" and of the rectifier unit is likely to be erratic. Also, if the current drain of the radio receiver is heavy the "glow-tube" may fail to function if the Duo-Rectron is started with the load on. It is, therefore, desirable not to light the filaments of the radio receiver until the Duo-Rectron is in operation.

PROTECTIVE SEALS AND THEIR USE

The lead seals placed on Duo-Rectrons by the RCA are for the protection of the dealer. Broken seals indicate tampering.

A service man may find it necessary to break the seals in order to make repairs. In such instances he should replace those broken by suitable substitute seals when the tear of assembled parts. This information by the condition of the seal in determining repair work is finished. Thus he is aided is due to tampering or ordinary wear and whether any trouble that may develop later places the dealer in a preferred position when it is found necessary to render a bill for service.

PART I—SERVICE DATA

Place Rectron UX-213 and Radiotron UX-874 in their proper sockets and see that they are firmly seated. Having made certain that the power supply is alternating current of the proper voltage and frequency, plug in the unit and turn "on" the switch. Pull up Duo-Rectron operating switch to the "on" position.

Both tubes should light up, Radiotron UX-874 showing a purple or pink glow.

(1) IF NEITHER TUBE LIGHTS

Trouble may be due to:

(a) Blown fuse in lighting circuit (may be checked by means of a test lamp).
(b) Loose plug in lighting socket.
(c) Operating switch on Duo-Rectron not making proper contact.
(d) Open in power supply cord.
(e) Radiotron UX-874 not making proper contact.
(f) Strap in base of Radiotron UX-874 open. (Try another "glow tube".)
(g) Open in transformer. (Run continuity test.)

(2) UX-213 LIGHTS, BUT UX-874 DOES NOT

(a) Low line voltage. (Check with A.C. voltmeter.)
(b) Duo-Rectron started under load.
(c) Short in B battery leads in radio receiver. ("Click" radio receiver with leads disconnected from Duo-Rectron.)
(d) Rectron has low emission. (Try another Rectron UX-213.)
(e) Radiotron UX-874 defective. (Try another Radiotron UX-874.)
(f) Open resistor. (Run continuity test.)
(g) Open in chokes or connections. (Run continuity test.)
(h) Shorted condenser.
(i) Open plate coil in transformer secondary. (Run continuity test.)

(3) "DUO"-TUBES LIGHT, BUT "GLOW TUBE" DIES WHEN RECEIVER RADIOTRONS ARE LIGHTED

(a) Excessive load on Duo-Rectron.
(b) Possible short in radio receiver.
(c) Defective Radiotron UX-874.
(d) Low emission Rectron UX-213.

(4) EXCESSIVE HUM IN OPERATION

(a) Open or defective filter condenser.
(b) Rectron UX-213 not properly seated on base.
(c) Defective Rectron UX-213.
(d) Loose transformer laminations or poorly soldered joints.
(e) Low emission rectifying tube.

(5) "GLOW TUBE" HOWL

This is usually a high-pitched intermittent or continuous howl heard in the Loudspeaker, which sets in after the Duo-Rectron has been in operation for some time. The howl may sometimes be temporarily stopped by jarring the "glow-tube." The trouble is due to a defective "glow-tube" and may be eliminated by replacing it with a new one.

PART II—SERVICE PROCEDURE

(1) TEST INDICATIONS

The following indications, in conjunction with the "click" tests given on page 6, will isolate any trouble that may appear. (See Table 1, page 7).

(A) *Condition of the plate of Rectron* UX-213:

When overloaded, as in the case of a short across the tube, the plates will become a dull red in color when the Duo-Rectron is in operation.

(B) *Magnetic pull of choke A.*

This pull, which may be tested by means of a steel screw driver placed in the space between the two chokes as shown in Figure 1, will show whether there is any current flowing through the coil of the choke. The arrows in Figure 2 indicate where the magnetic pull may be tested.

(C) *Magnetic pull of choke B*

This pull, tested as in the case of choke A, will indicate whether there is any current flowing through the coil of choke B.

(D) *Voltage reading from —B to* +45

(E) *Voltage reading from —B to* +90

(F) *Voltage reading from —B to* +135

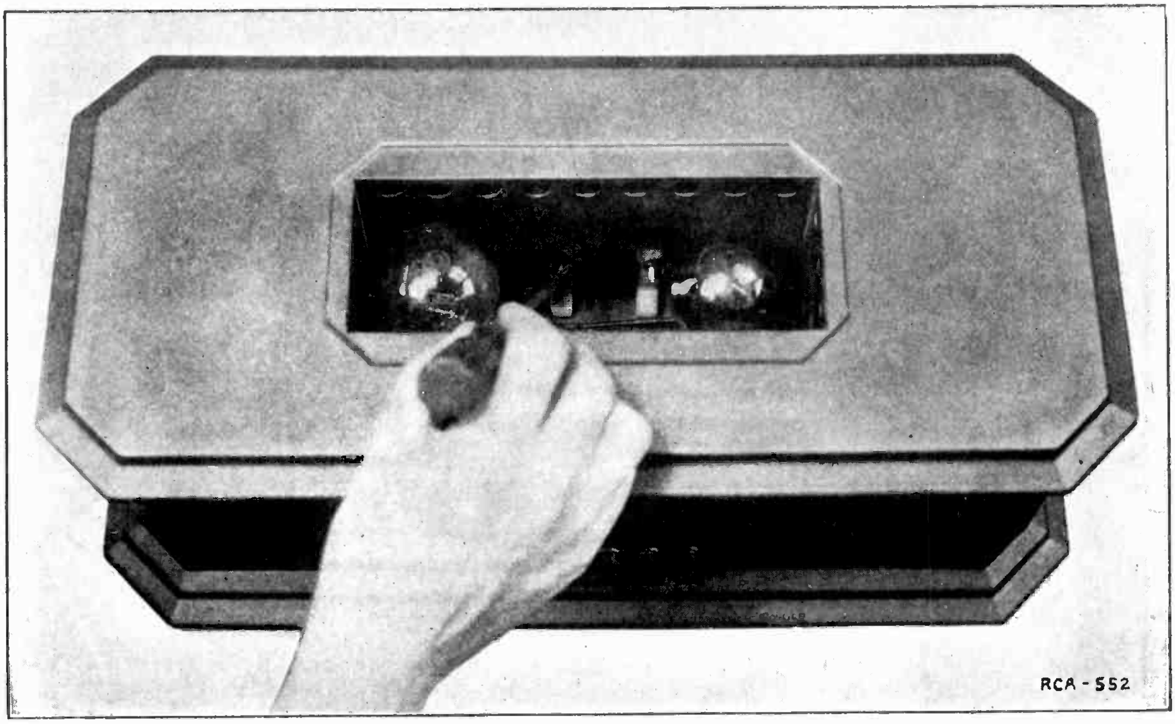


Figure 1—Screw driver used to test magnetic pull of chokes A and B.

In testing for the magnetic pull of chokes A and B, care should be taken not to allow the screw driver to touch any other part of the Duo-Rectron except the cores of the two chokes under test. The resistor element, located on the other side of the tube sockets, is wound with very fine resistance wire and may easily be damaged.

(2) ISOLATING TROUBLE

With the radio receiver cable or wires entirely disconnected from the Duo-Rectron, turn "on" the operating switch. If Rectron UX-213 lights with normal brilliancy, but Radiotron UX-874 fails to function.

(a) Try another Radiotron UX-874.

(b) Try another Rectron UX-213.

If these changes do not eliminate the trouble, shut "off" operating switch, remove AC plug, take out tubes and make the following continuity tests with a 4½ volt C battery in series with a pair of phones.

Terminals	Correct Effect	Incorrect Effect Caused by
—F1 and +F1 to +135	Click closed thru chokes and filament coil of transformer.	Open choke or open transformer mid-tap.
+135 to —B	Click, closed thru resistor.	Open resistor.
—B to G1 and P1	Click, closed thru plate coil of transformer.	Open transformer or mid-tap.

If all the above circuits "click" as indicated replace the tubes in the proper position, replace AC plug and turn "on" the Duo-Rectron. Take the six test indications outlined in Sec. 1, Part II (page 5) and refer to Table I (page 7), to isolate the trouble.

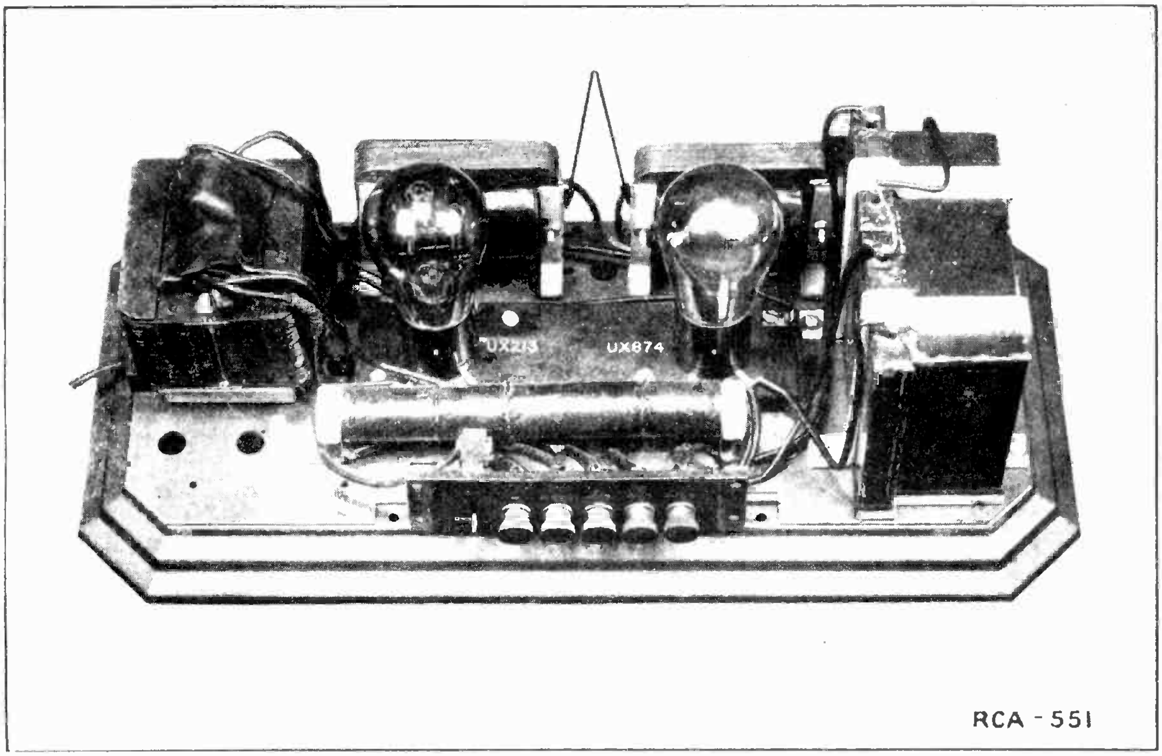


Figure 2—Top view of "B" Battery Eliminator with cover removed and showing arrows where magnetic pull of chokes may be tested.

TABLE I
Trouble Indicating Table

Conditions under which this chart is applicable:
(1) Rectron UX-213 lights, but Radiotron UX-874 does not function.
(2) Closed circuit from —F1 and +F1 to +135 to —B to G1 and P1.

PLATES OF UX-213	PULL ON CHOKE A	PULL ON CHOKE B	VOLTAGE			TROUBLE
			—B TO +45	—B TO +90	—B TO +135	
Dull Red	No	No	No	No	No	Condenser C shorted
Apparently normal	Strong	No	No	No	No	Condenser D shorted
Normal	Normal	Normal	No	No	No	Condenser E shorted
Normal	Normal	Normal	No	No	About 70	Condenser F shorted
Normal	Normal	Normal	No	Nearly normal, glow tube may light	Normal	Condenser G shorted

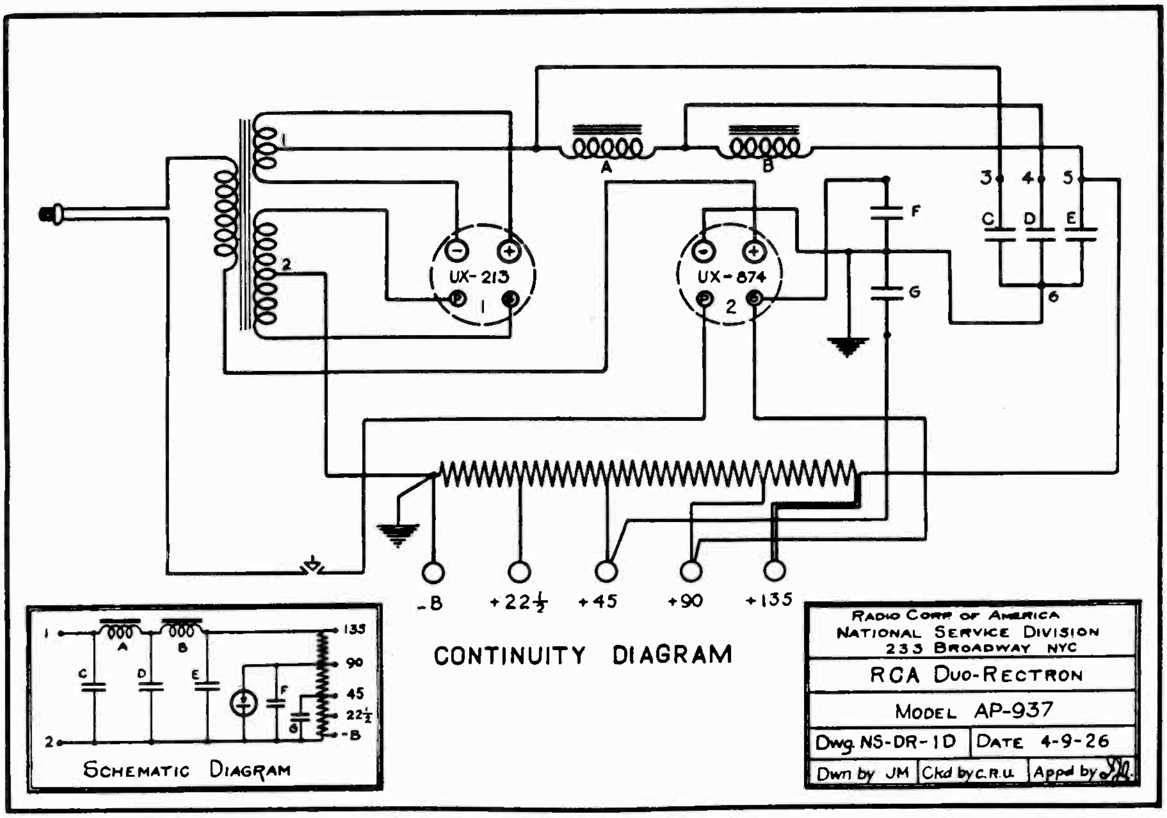


Figure 3—Continuity wiring diagram of RCA "B" Battery Eliminator.

A COMPLETE DUO-RECTRON CONTINUITY TEST

Terminals	Correct Effect	Incorrect Effect Caused by
(At plug) one side of AC line to +F2	Closed thru transformer	Open transformer primary
(At plug) other side of AC line to P2 (with switch "on").	Closed thru AC switch	Open in switch or leads
G1 to P1	Closed thru transformer plate coil	Open secondary coil
G1 or P1 to —B	Closed thru mid-tap and transformer secondary	Open mid-tap
+F1 to —F1	Closed thru transformer filament coil	Open secondary coil
+F1 or —F1 to +135	Closed thru mid-tap, transformer secondary coil and two chokes	Open mid-tap or open choke
—B to +22½	Closed thru resistor	Open resistor
+ 22½ to +45	Closed thru resistor	Open resistor
+45 to +90	Closed thru resistor	Open resistor
+90 to +135	Closed thru resistor	Open resistor
—F2 to G2	Closed thru resistor from —B to +90	Open in section of resistor or leads to glow tube

Above tests may be made without breaking seals or removing cover. If cover is removed further tests may be made to isolate trouble.

3 to 4	Closed thru choke A	Open in choke A
4 to 5	Closed thru choke B	Open in choke B

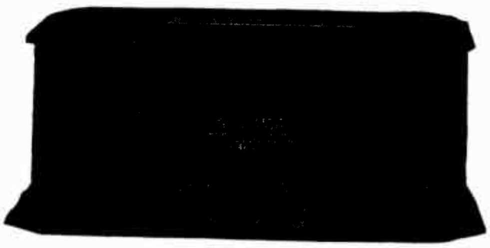
The test points referred to are shown in the Continuity Diagram, Figure 3 (page 7). The designations "P" and "G" refer to what would normally be the plate and grid socket contacts if three-element tubes were used. The number immediately following refers to the first or second socket. For example G2 would indicate the grid contact of the second socket. P1 would indicate the plate contact of the first socket. In the same manner the indication "F" denotes the filament contact of the tube socket indicated by the number.

Printed in U.S.A.—1928

Use *of* RCA "B" Battery Eliminator *with* Radiolas Super-Heterodyne *and* Super VIII

DUO-RECTRON SERVICE NOTES

Third Edition—5M—June, 1928



RCA Duo-Rectron—Model AP-937

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Use of RCA "B" Battery Eliminator with Radiolas Super-Heterodyne and Super VIII

(DUO-RECTRON—MODEL AP-937)

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

These instructions cover the operation of RCA "B" Battery Eliminator (Duo-Rectron Model AP-937) in use with Radiolas Super-Heterodyne and Super VIII employing Radiotron UX-120 in the second stage of audio frequency amplification.

There are two ways in which the Duo-Rectron may be used to supply plate voltages to the Radiotrons of these two Radiolas. One method involves the use of an external "B" battery to supply the additional 45 volts required to make up the necessary 135 volts for the plate of Radiotron UX-120. This method is the most convenient one as it requires no changes in the panel wiring. A second method takes advantage of the 135-volt tap of the Duo-Rectron by making certain alterations in the panel wiring of the Radiolas, thus eliminating all "B" batteries.

As the first method is fully described in the Instruction Book supplied with the Duo-Rectron, the following instructions will be confined to the second method.

PART 1

RADIOLA SUPER-HETERODYNE—SECOND HARMONIC (Semi-Portable Model)

Figure 1 shows the alterations necessary in the Radiola Super-Heterodyne panel to take advantage of the 135-volt tap of the Duo-Rectron to supply the required plate voltage for Radiotron UX-120. A step by step procedure to effect the necessary changes is suggested as follows:

(1) Tilt panel forward and release catch at right hand side permitting panel to be removed from cabinet.

(2) Loosen screws on battery terminal strip allowing the latter to be removed.

(3) Connect a short piece of wire between the +45 terminal and the —45 terminal of the UR-556 adapter.

(4) Connect a 22½-volt "B" battery to the +22½ and —22½ "C" battery terminals of the UR-556 adapter. (This battery may be placed in one of the battery compartments.)

(5) Remove switch plug. To do this, the small retaining split washer will first have to be removed with a small pair of pliers. The plug may then be readily pulled out.

(6) Make the one wiring change shown by dotted line in Figure 1.

(7) Solder an insulated wire to the switch frame (as indicated in Figure 1) and connect free end to the +135 terminal of Duo-Rectron.

(8) Make other connections to the —B, +45 and +90 terminals of the Duo-Rectron in the usual manner as indicated in the Duo-Rectron Instruction Book No. 86996, Edition "C".

WHEN THE ABOVE ALTERATIONS HAVE BEEN MADE, THE STAGE CHANGE SWITCH WILL BECOME THE SECOND STAGE JACK AND THE PHONE JACK WILL BECOME THE FIRST STAGE JACK.

These changes apply to Radiola Super-Heterodyne *only*.

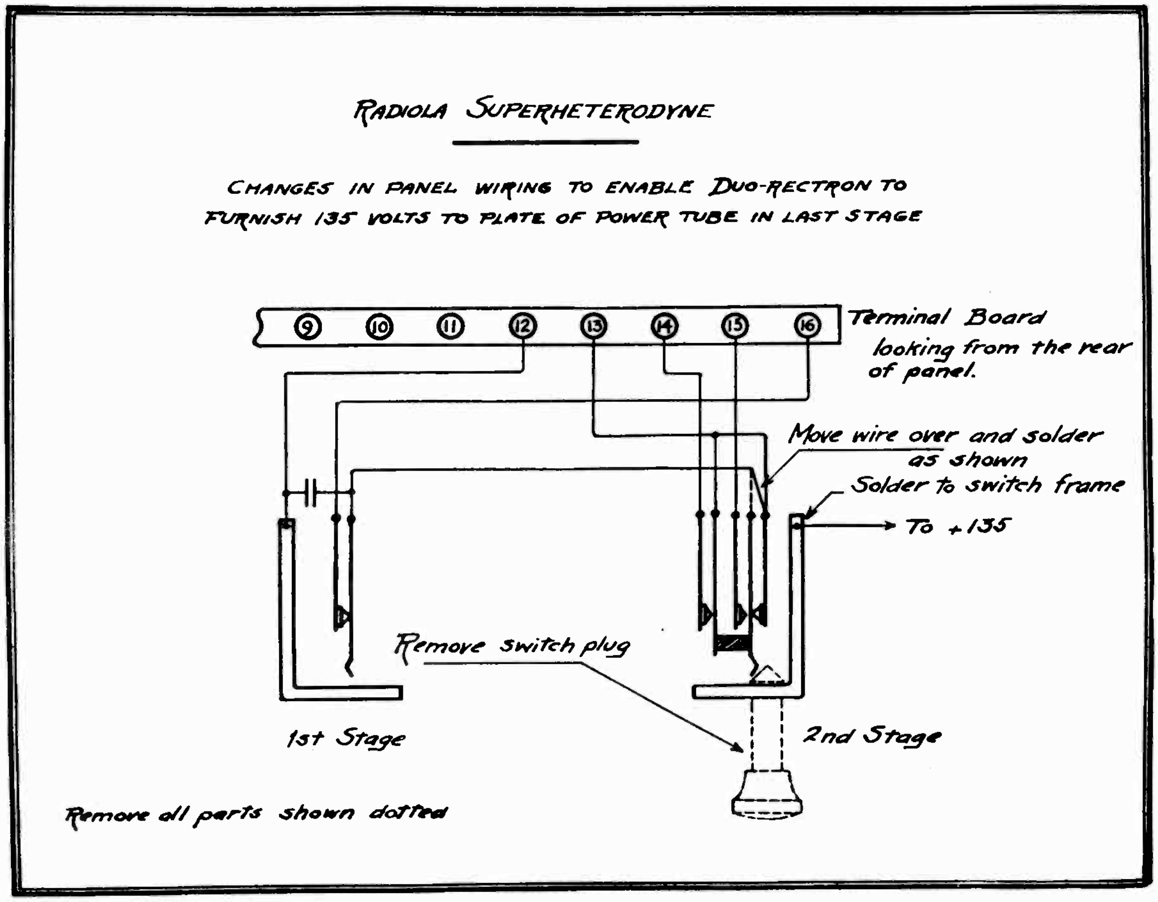


Figure 1

PART 2
RADIOLA SUPER-VIII

Figure 2 shows the normal wiring connections from the terminal board to the jacks in Radiola Super-VIII. This diagram is included for purposes of comparison with, and to facilitate making the new connections shown in Figure 3.

Figure 3 clearly shows the revised panel wiring necessary to take advantage of the

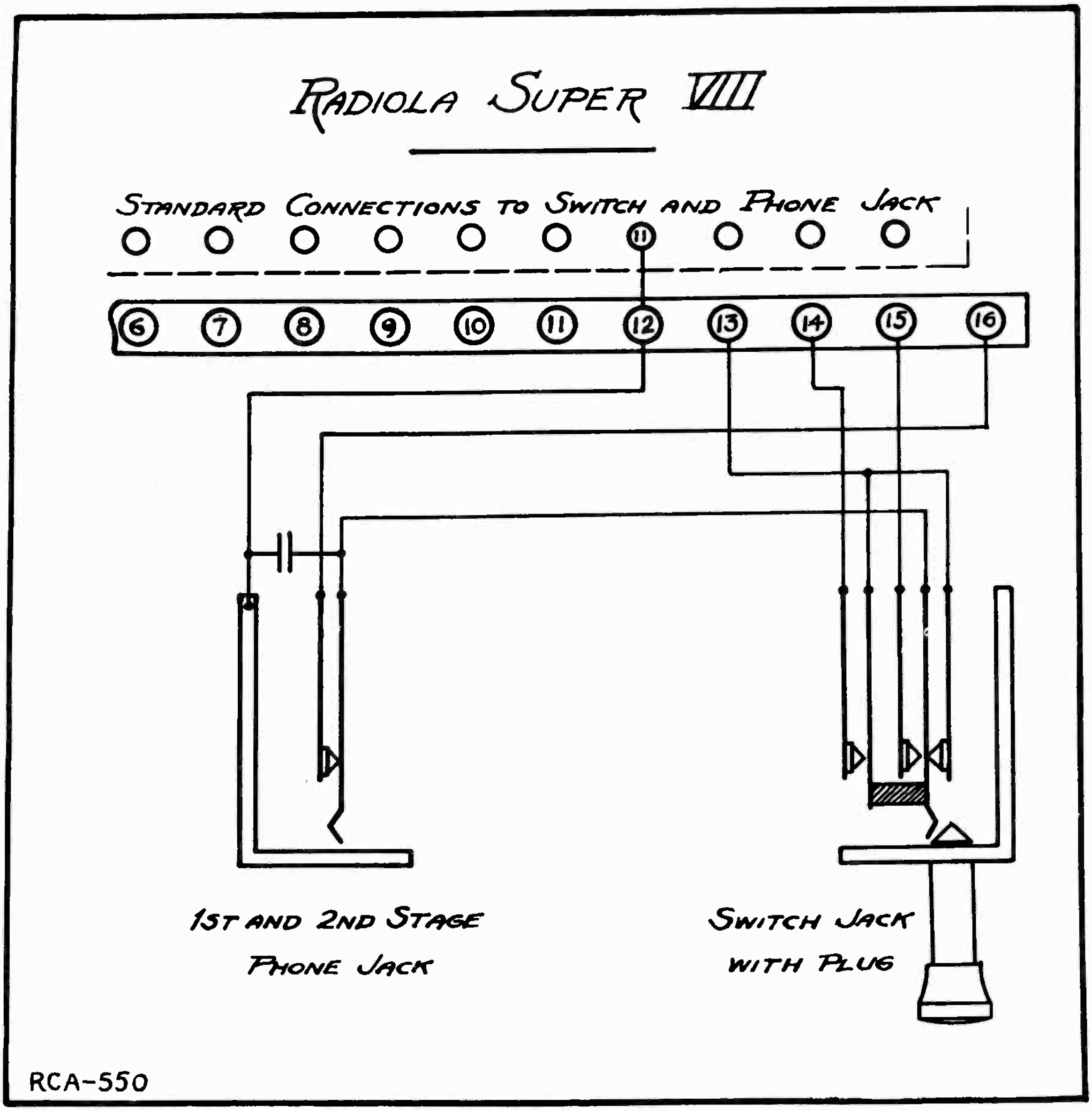


Figure 2

135-volt terminal of the Duo-Rectron to supply the proper plate voltage for Radiotron UX-120, used in connection with the UR-556 adapter.

The catacomb terminal board and catacomb "whiskers" (short, flexible leads from catacomb) are indicated just as they would appear looking at the panel from the rear. From this position the whiskers and terminals are numbered from left to right. (The second whisker hole on catacomb is blank, but counted.)

A step by step procedure for effecting the necessary changes is outlined as follows:

(1) Remove panel and detach battery terminal strip as outlined in Part 1 of these instructions.

(2) Connect a short piece of wire between the +45 and —45 terminals of UR-556 adapter.

(3) Connect a 22½-volt "B" battery to the +22½ "C" and —22½ "C" terminals of the adapter. This battery supplies the proper negative bias for the grid of Radiotron UX-120. It may be conveniently placed in the location vacated by the old "B" batteries.

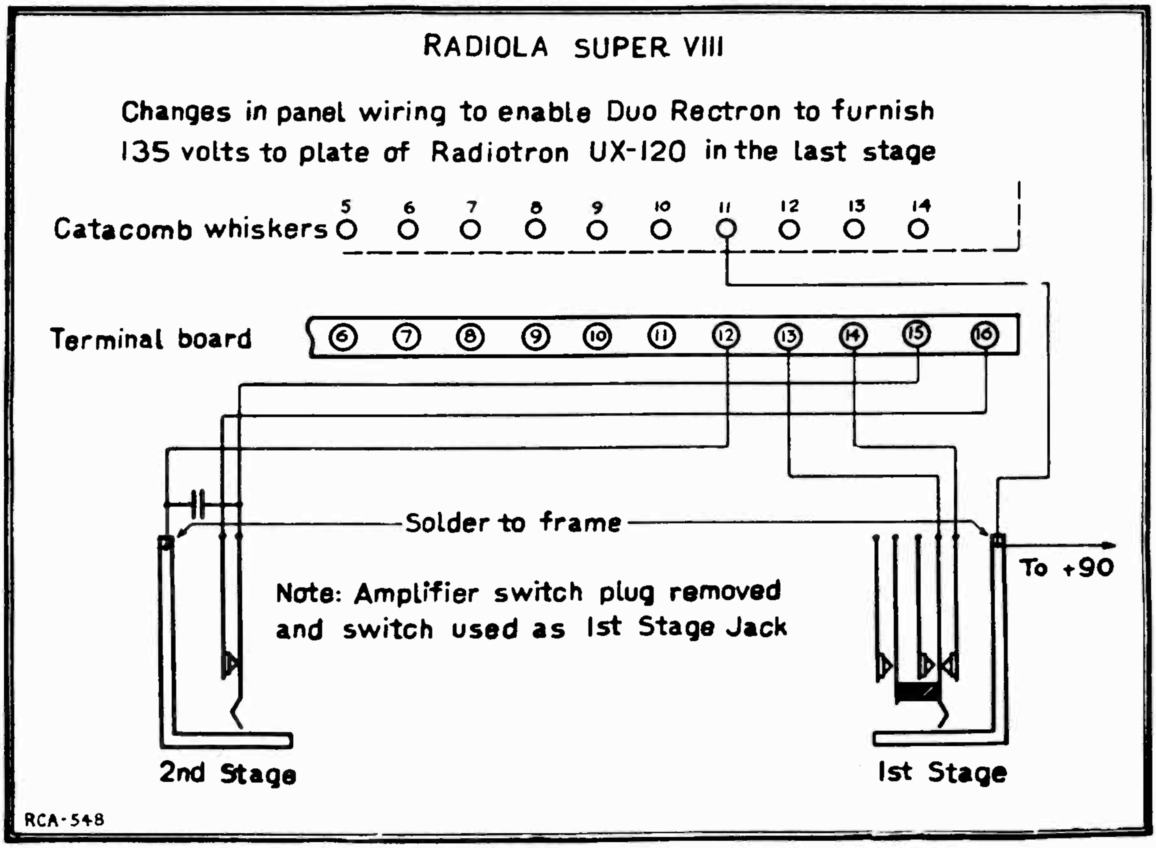


Figure 3

(4) Remove amplifier switch plug as instructed in Part 1.

(5) Referring to Figure 2, unsolder and remove wire running from terminal 15 to switch jack. Referring to Figure 3, make all other changes indicated in this diagram. Special attention is called to catacomb whisker number 11 (fourth from the right) which should be unsoldered from catacomb terminal number 12 and resoldered to the frame of the amplifier switch jack (1st stage). An extra length of insulated wire will be necessary to make this connection, soldering same to the whisker lead and carefully taping to avoid the possibility of it short-circuiting to any other terminal.

(6) Solder an insulated wire to the frame of the amplifier switch jack (1st stage) and connect other end to the +90 terminal of Duo-Rectron.

(7) Connect:

—B lead in Super-VIII (lower battery tier) to —B of Duo-Rectron.

+B (lower battery tier) to +45 of Duo-Rectron.

—B (upper battery tier) to be taped up (not used).

+B (upper battery tier) to +135 of Duo-Rectron.

Thus connected Duo-Rectron will supply the proper plate voltages for all the Radiotrons, including Radiotron UX-120. The **PHONE JACK** (Figure 2) becomes the **SECOND STAGE JACK** (Figure 3) and the **AMPLIFIER SWITCH JACK** (Figure 2) the **FIRST STAGE JACK** (Figure 3).

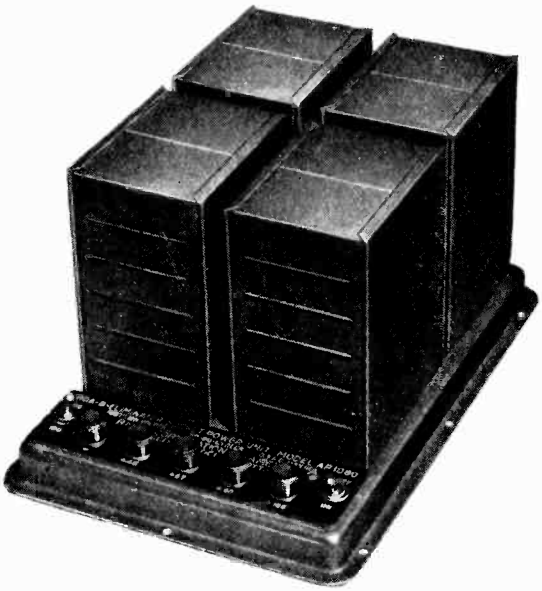
The output of Radiotron UX-120 goes through the built-in loudspeaker of Radiola Super-VIII and is also connected to the second stage jack so that an external loudspeaker can be employed if desired.

If RCA Loudspeaker Model 102 is installed at a later date, it will not be necessary to replace the original connections. Merely remove Radiotron UX-120 and adapter from the catacomb and insert the loudspeaker plug in the first stage jack (Figure 3).

Printed in U.S.A.—1928

RCA
B-Eliminator

SERVICE NOTES



First Edition—1M
April, 1928

Radio Corporation of America

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT
233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

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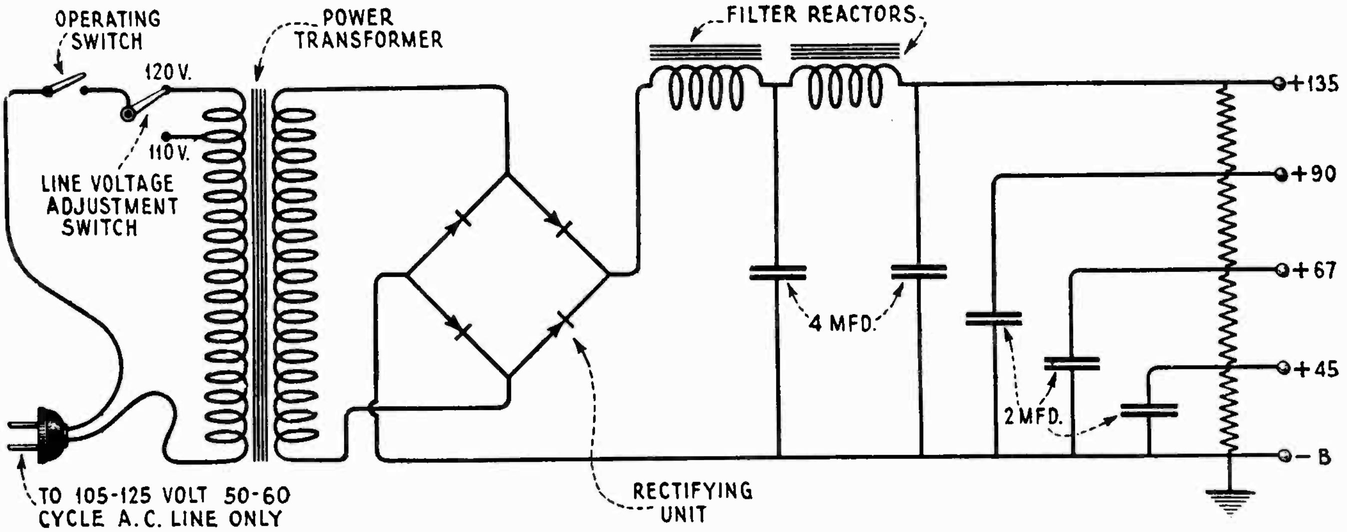


Figure 1—Schematic circuit diagram of RCA B-Eliminator

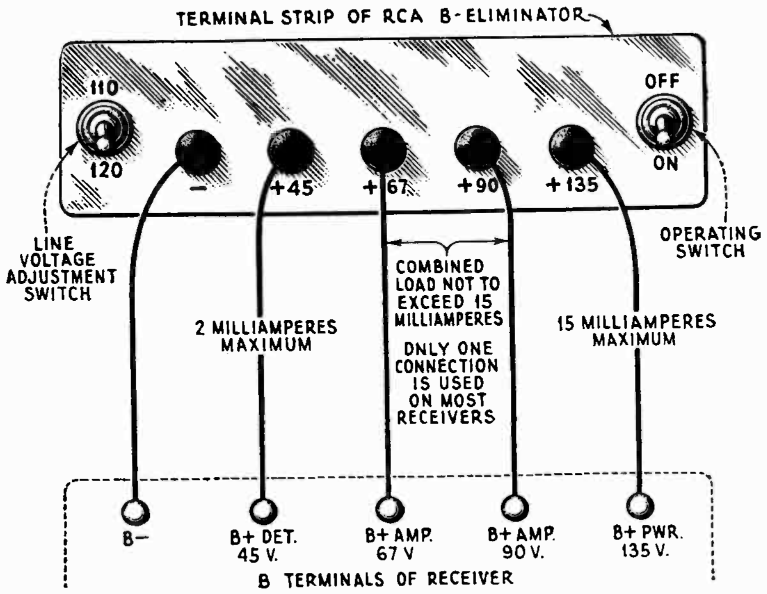


Figure 2—Connections from RCA B-Eliminator to a receiver

RCA B-ELIMINATOR (MODEL AP-1080)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

The RCA B-Eliminator is a device for converting alternating current into direct current, suitable for use as plate supply to radio receiving sets. It is compact and operates consistently without any particular attention. The dry disc type of rectifier employed, makes unnecessary the use of tubes or liquid containing devices. The output is of sufficient capacity to operate any radio receiver using up to eight tubes or requiring a plate voltage up to 135 volts. Figure 1 illustrates the schematic circuit diagram. The following notes are presented for the information of those called upon to install or service the set.

The text is divided into two parts: Part I - Installation; and Part II - Service Data.

PART I - INSTALLATION

(1) LOCATION

The RCA B-Eliminator should be located in a place that is accessible for ready operation; has a free circulation of air; and is convenient for making connections to the receiver.

(2) CONNECTIONS TO RECEIVER

The leads from the receiver that ordinarily go to the "B" batteries are connected to the B-Eliminator. Figure 2 shows the correct connections to be made for practically any receiver. The maximum milliampere load of the B-Eliminator is 2 milliamperes for the detector or 45-volt tap; 15 milliamperes for the combined drain of the 67 and 90-volt tap; and 15 milliamperes for the 135-volt tap. These ratings are ample for practically all receivers and should never be exceeded.

The 135-volt plate supply for receivers using Radiotron UX-171A in the last audio stage is ample for good reproduction in conjunction with a 27-volt grid bias is used. Under such conditions the output will be of ample volume for all practical requirements and the tube life will be increased over that obtained when using the maximum of 180 volts.

(3) LINE VOLTAGE ADJUSTMENT SWITCH

A two-way switch is provided for adjustment to power line voltages ranging from 105 to 125 volts, 50 to 60 cycles. The switch should be kept at the 120-volt position unless it is definitely known that the line is always below 115 volts, in which case it may be set at the 110-volt position. It is a good plan to leave the switch at the 120-volt position provided the output voltages are high enough to give satisfactory operation of the receiver.

(4) POWER SUPPLY

After connecting the RCA B-Eliminator to a receiver, and adjusting the line switch to its correct position, the input plug should be connected to a lamp socket of 105-125 volt 50-60 cycle alternating current. Connection to D.C. supply or A.C. supply of different rating will result in damage to the B-Eliminator.

PART II - SERVICE DATA

(1) PRECAUTIONS

At the time of installing an RCA B-Eliminator the customer should be made fully aware of its operation and the procedure to take in case of inoperation. He should be advised to turn the power supply "off" immediately any trouble develops and not to operate the device until the cause of the failure is corrected. The failure of one unit may damage the other units if operation of the device is maintained. As an example of possible developments in case this precaution is not observed, consider the effects of operating the B-Eliminator with a shorted filter condenser. Such a short would increase the load on the rectifier and damage it. The damaged rectifier in turn would increase the load on the transformer and possibly cause a burn-out.

(2) VOLTAGE READINGS

Under normal load, the voltages obtained at the terminal strip should be those indicated at the binding posts. If the voltages are slightly high the load is probably light or the line switch is at the wrong position for the particular line voltage used. Various types of failure and the corresponding indication are listed below:-

High voltages at terminals-

(a) High voltages at all terminals may be caused by open resistance section -B to 45V.
(b) High voltages at one or more terminals and no voltages at the remaining terminals may be caused by open section between terminals where high and no readings are obtained.

No voltage at any terminal may be caused by-

(a) Open winding in transformer.
(b) Defective rectifier unit.
(c) Shorted 4 mfd. filter condenser.
(d) Open winding in filter reactor.

No voltage between some terminals and low at other terminals may be caused by-

(a) Shorted 2 mfd. filter condenser.
(b) Loose connections to binding posts.

(3) FILTER CONDENSERS (2 MFD.)

A defective filter condenser will cut out the section of the resistance strip across which it is connected and no voltage readings will be obtained across the output terminals at that point. To locate a defective condenser connect a voltmeter across the output binding posts and disconnect the condensers one at a time with the current turned "on". The release of the defective condenser will restore the normal output voltage readings across the terminals. If the ground or common connection is disconnected all the condensers will be released sufficiently to make this test across the 135-volt terminals. This will indicate whether or not any of the filter condensers are causing the trouble that may exist. If the trouble is in the condensers they should be tested individually, as already described, to locate the defective one.

(4) FILTER REACTOR

The filter reactor may be tested by releasing the connections to its terminals and making a "click test" from point to point. An open will give a "no click" indication.

(5) RECTIFIER UNIT

The rectifier unit may be tested by disconnecting all circuits from it, except the power transformer, and measuring the D.C. voltage of its output. This should be approximately 230 volts.

(6) POWER TRANSFORMER

A "click test" across each winding with all other connections removed will indicate the condition of the power transformer. An open of either winding will give a "no click" indication.

(7) MAKING REPLACEMENTS

Should it be necessary to replace any unit, except the terminal strip and resistance unit, use the following procedure:-

(a) Drill out the six rivets that hold the bottom metal sheet of the B-Eliminator in place. Turn the unit upside down and remove this bottom piece. The connections and fastenings of all the units are now accessible.
(b) Bend the tabs, holding the particular unit to be replaced, so they will slip out of their respective slots. Unsolder and release the connections to the defective unit. The unit may now be pulled clear of the base and the new unit placed in the position occupied by the old one.
(c) Bend the tabs to secure the new unit to the base.
(d) Resolder the connections that were removed. These are shown in Figure 3.
(e) Replace the bottom metal sheet with small machine screws and nuts. Make sure the ground connection is connected under one of the screws.

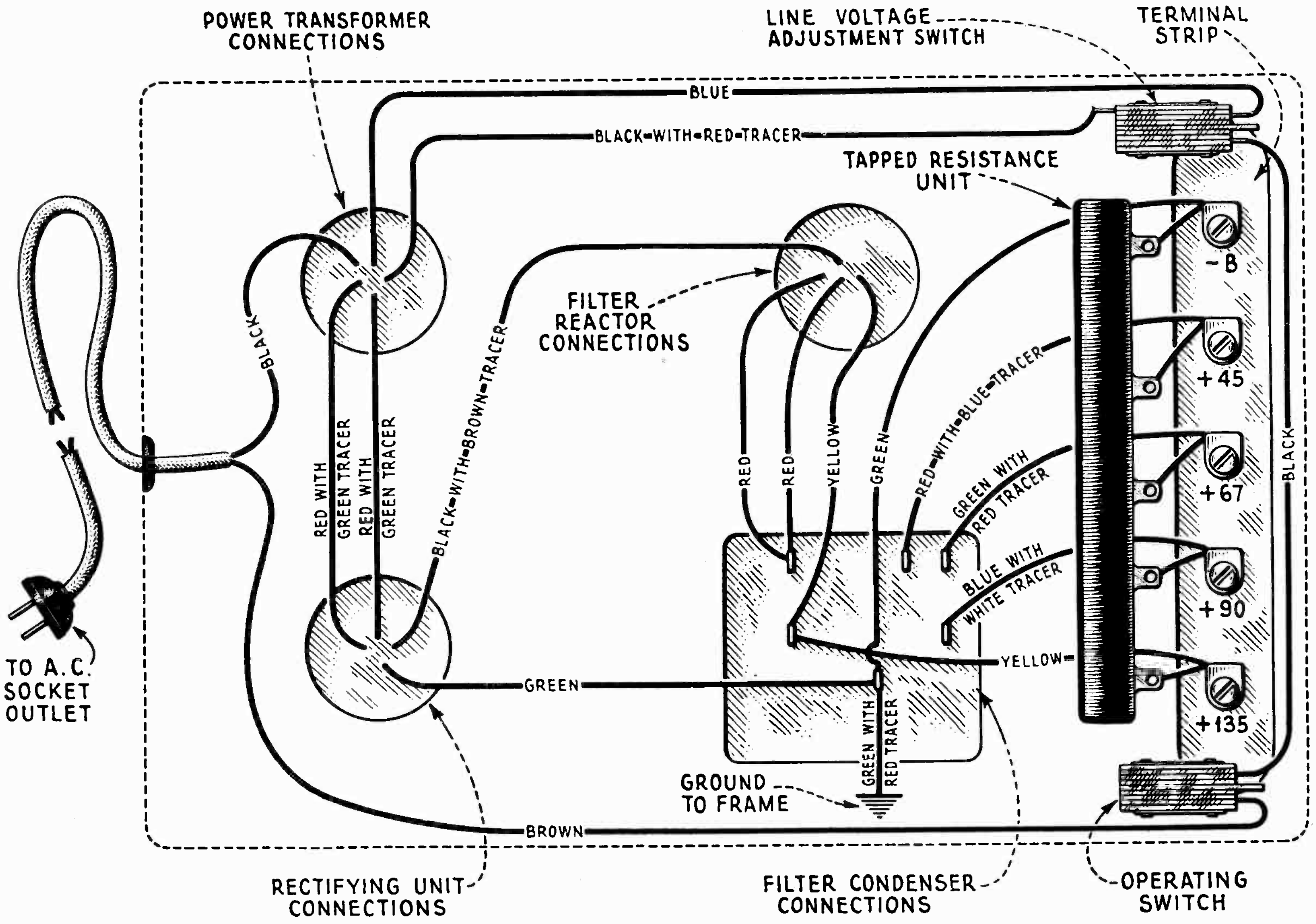


Figure 3—Sub-chassis view of the RCA B-Eliminator showing color scheme of wiring and connections

RCA

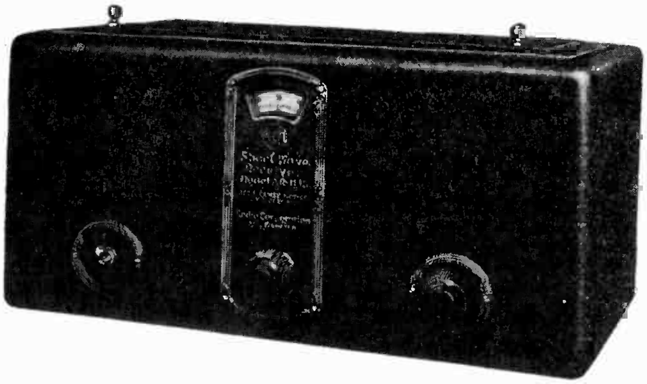
Printed in U. S. A. 1928

RCA

Short Wave Receiver

(Model AR-1145)

SERVICE NOTES



RCA Short Wave Receiver
(Model AR-1145)

First Edition—1M

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PREFACE

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 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 RCA Distributors, and RCA Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

To assist in promoting this phase of the Dealer and Distributor's business the RCA Service Division 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 and Distributors' 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.

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PART I—INSTALLATION

PART II—SERVICE DATA

PART III—ELECTRICAL TESTS

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

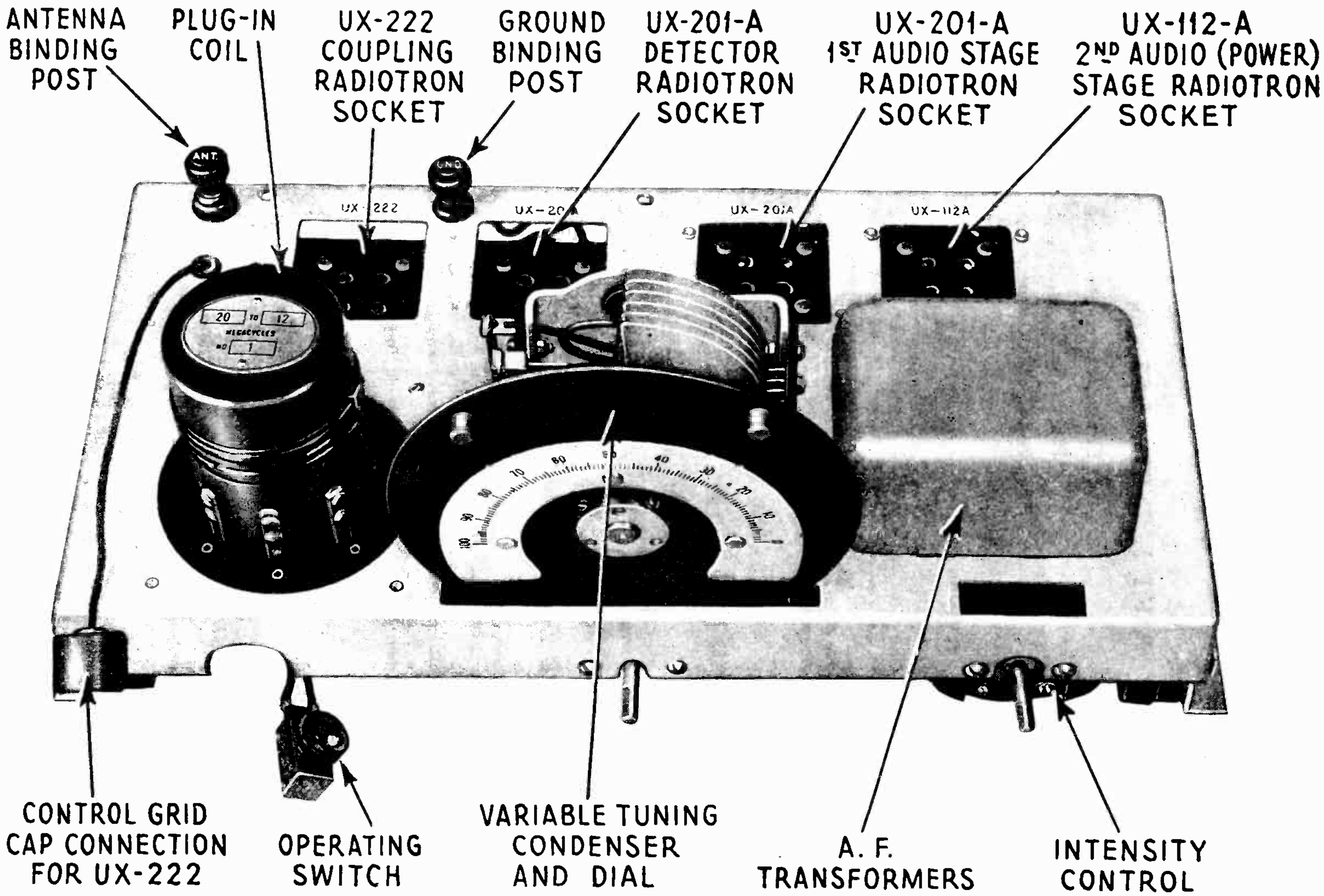


Figure 1—Top view of receiver chassis showing principal parts

RCA SHORT WAVE RECEIVER

(Model AR-1145)

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

RCA Short Wave Receiver, Model AR-1145 is a regenerative battery type short wave radio receiver employing one Radiotron UX-222, two Radiotrons UX-201A and power amplifier Radiotron UX-112A. Figure 1 illustrates a top view of the receiver chassis, Figure 2 the Radiotron sequence and Figure 3 the schematic circuit diagram. Figure 4 is a sub-chassis view showing the principal parts. Connected to an efficient antenna good sensitivity and tone quality are obtained with this receiver.

A single station selector with a high ratio frictional vernier control and three interchangeable coils provide efficient and easy tuning over the range of 20 to 4 megacycles or 15 to 75 meters. Two additional coils may be procured as optional equipment which cover the broadcast range of frequencies, *i. e.,* 1500 to 550 Kilocycles.

Filament current for this receiver is obtained from a 6-volt storage battery. Plate and grid voltages may be obtained from dry cell batteries, or from suitable socket power devices having correct rating and electrical characteristics.

PART I—INSTALLATION

[1] ANTENNA

The first requirement of a good installation is an efficient antenna system. The antenna should be enameled or bare copper wire, single strand, B. & S. No. 14, from 25 to 100 feet in length, erected as high as possible and removed from all obstructions. Enameled wire resists corrosion, and offers no hindrance to radio reception when properly used. The lead-in should preferably be a continuation of the antenna itself. However, before entering the receiver it should be spliced to an insulating wire, as the antenna wire will short circuit to the metal receiver housing if it is led directly into the receiver. All splices should be carefully soldered to insure a good electrical connection and increase the mechanical strength of the joint. Use a good hot iron and plenty of solder making sure to remove the enamel if enameled wire is used, and see that the ends of the wires are scraped clean, and that a good mechanical joint is made. Clean off all excess flux on completion of the soldering and tape the connection.

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 through a porcelain tube insulator to the inside of the house for connection to the receiver.

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.

[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 to 100 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.

[3] 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 short and 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.

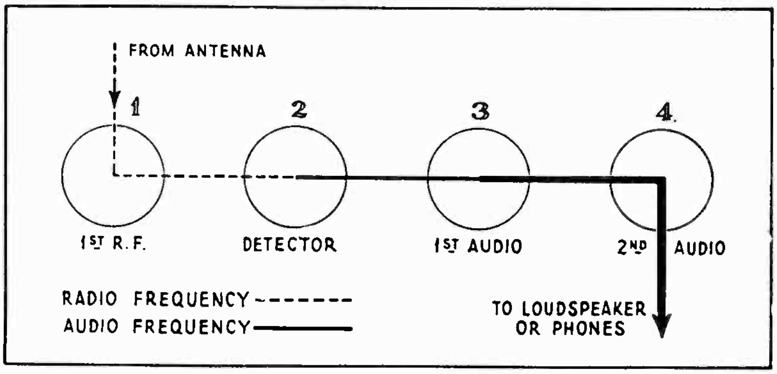


Figure 2—Radiotron sequence

[4] BATTERY CONNECTIONS

After the antenna and ground system has been properly installed the receiver should be unpacked and placed in the location it is to occupy, which must be in range of the antenna and ground connections. The battery cord should be pulled through the hole in the rear of the cabinet and connections made as shown in Figure 10. A fuse block equipped with a 5 or 10-ampere fuse should be placed in series with the positive "A" battery lead. This may be done by cutting the yellow lead and connecting the block to each of the ends made by the cut. All other connections should be accurately made, as otherwise correct operation will not be secured and damage in some cases will result.

The color scheme of the leads is shown on the tag tied to the battery cable and in Figure 10.

[5] LOUDSPEAKER OR HEADPHONE CONNECTIONS

A loudspeaker such as RCA Loudspeaker 100A, 100B, 103 or 106 should be provided with a standard plug on the end of the input cord for insertion in the bottom jack of the receiver when it is used. On many occasions sufficient signal strength will not be obtained for loudspeaker operation and a pair of headphones is necessary. These should be equipped with a similar plug and inserted in either the upper or lower jack, depending on the strength of the signal.

[6] PLUG-IN COILS

Three coils are provided with the RCA Short Wave Receiver which cover the range of 15 to 75 meters, illustrated in Figure 5. Two additional coils may be obtained as optional equipment which cover the broadcast range of 200 to 545 meters, illustrated in Figure 6. Bottom plug connections to windings are shown in Figure 7.

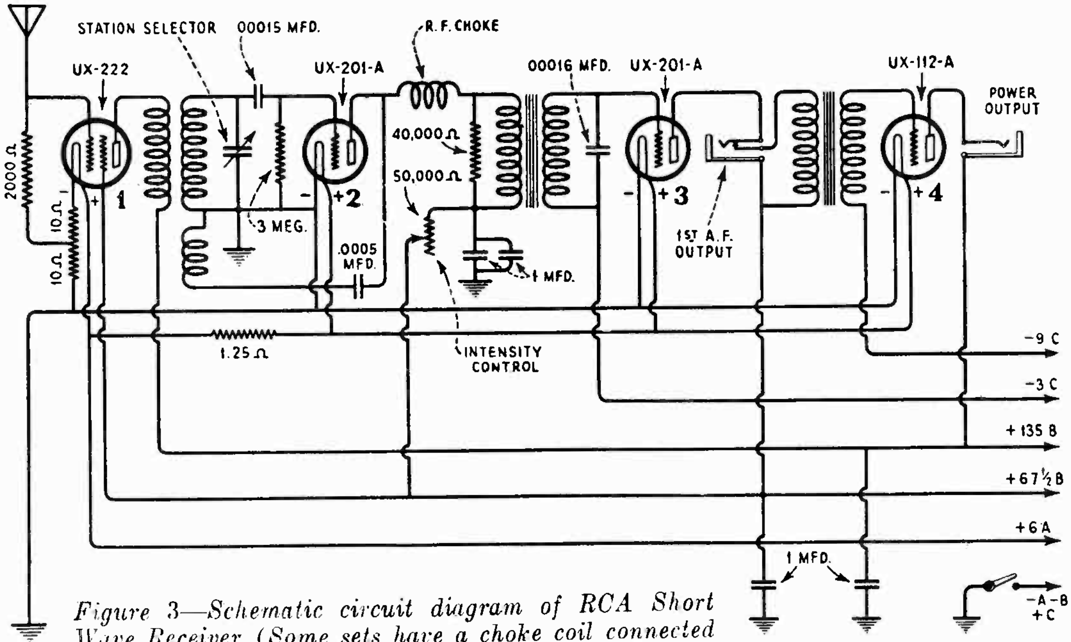


Figure 3—Schematic circuit diagram of RCA Short Wave Receiver (Some sets have a choke coil connected in the antenna circuit instead of the 2000-ohm resistor shown)

The ratings of the different coils are as follows:

Coil No.	*Frequency Range*		*Wavelength Range Meters*
	Megacycles	*Kilocycles*	
1	20—12	20,000—12,000	15— 25
2	12—7.2	12,000— 7,200	25— 42
3	7.2—4	7,200— 4,000	42— 75
6	......	1,500— 940	200—320
7	......	940— 550	320—545

The correct coil for the band of frequencies to be covered must be inserted in the coil socket on the left side of the receiver chassis.

[7] USE OF COILS COVERING BROADCAST BAND

The use of coils Nos. 6 and 7 gives the receiver a tuning range that covers the broadcast band of frequencies. Operation at these frequencies is somewhat different from that encountered at the lower wavelengths to be noted as follows:

Station Interference—In districts where stations are operating on frequencies close to each other, interference or cross talk from one station to the other may be experienced.

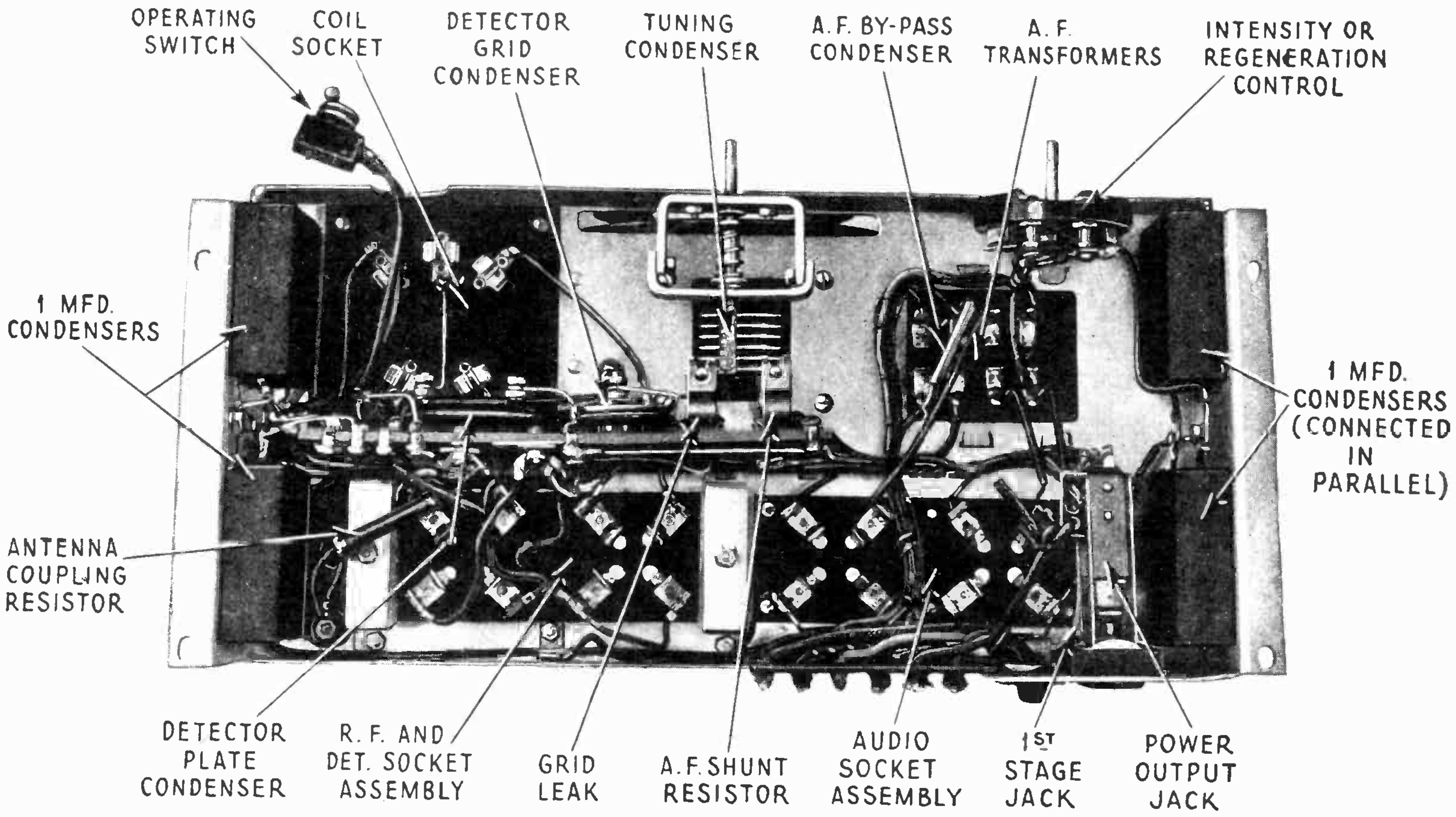


Figure 4—Sub-chassis assembly showing principal parts

Shortening the antenna to 25 feet or less may remedy this condition. If this size antenna does not provide sufficient signal strength at other frequencies, two antennas may be desirable. A double-throw single-pole switch may be used for changing from one antenna to the other.

If only one station is causing interference a wave trap may be used to reduce its signal input to the receiver and thereby prevent interference. The constants and correct connections are shown in Figure 8. The trap is tuned by the condenser until the signal strength of the interfering signal is reduced. If this cannot easily be determined the receiver should be slightly detuned and the trap adjusted until a reduction of signal is noticed.

Volume Control—When receiving stations of considerable strength sufficient reduction of volume may not be obtainable by use of the intensity control. In such cases detuning the receiver by means of the station selector may give the desired signal reduction without affecting the tone quality. If detuning causes interference with other stations in addition to reducing the volume, an external variable resistor may be inserted in series with the antenna lead to the receiver and the volume reduced by increasing the resistance in the antenna circuit. This variable resistor should be approximately of 2000 ohms in value, such as is used in Radiola 18, RCA Part No. 5901.

Figure 5—Short wave coils—15 to 75 meters

PART II—SERVICE DATA

[1] 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 battery connection, 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 from the receiver and noting whether or not the grating noise 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.

[2] RADIOTRONS

RCA Short Wave Receiver uses the screen grid Radiotron UX-222 as an R.F. coupling tube, two Radiotrons UX-201A as a regenerative detector and first audio frequency stage and one UX-112A as the power amplifier. The Radiotron sequence is shown in Figure 2. Care should be taken to place each Radiotron in its correct socket as designated at the rear of the individual sockets. While putting the UX-201A or UX-112A tubes in wrong sockets will only cause poor operation, placing the UX-222 in any socket other than the correct one will result in filament damage.

Sometimes dirty Radiotron prongs will cause noisy operation. At frequent intervals they should therefore be cleaned with fine sand-paper. The use of emery cloth or steel wool is not recommended. Before reinserting the Radiotrons in the sockets, wipe the prongs and base carefully to make certain that all particles of sand are removed.

In placing Radiotrons in the gang sockets care should be exercised to make certain that the two large pins and two small pins of the Radiotrons match the socket holes. If a Radiotron will not fit into a socket without considerable pressure being applied, the trouble is probably due to excessive solder on one or more of the prongs. This may be removed with

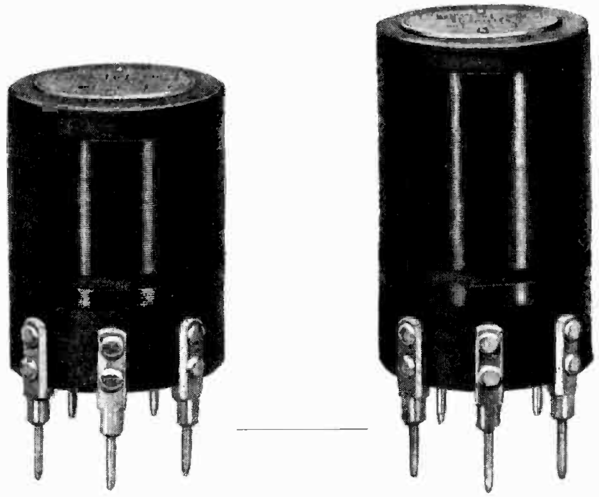


Figure 6—Broadcast frequency band coils—200 to 545 meters

a file or knife. Never try to force one in. These sockets are so designed that the prongs of the Radiotrons will fit in snugly without force being applied. If sufficient force is applied it might be possible to insert the prongs in the wrong holes, resulting in a filament burnout.

Caution—Do not remove or replace Radiotrons without first turning off the operating switch.

[3] RADIOTRON SOCKETS

The Radiotron sockets in the RCA Short Wave Receiver are of the standard UX two-gang type. The cushioned sockets are for the UX-222 coupling tube and the UX-201A detector. The solidly mounted sockets are for the first and power audio stages. Care must be exercised when inserting Radiotrons in their sockets. A socket contact may not be in its correct position and the forced insertion of a tube will bend or break it. If care is exercised and the Radiotrons 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. The Radiotron socket layout, with socket contact designations for use in the continuity tests outlined in Part III, Sec. 3 along with battery cable markings are shown in Figure 10.

[4] LOOSE OR DIRTY INTENSITY CONTROL ARM

Should a grating noise be obtained when the intensity control is moved it may be due to the arm being loose, or dirt or corrosion lodged between the contact wire and the arm.

Should the latter cause be the trouble, turning the knob back and forth several times to each extreme will probably rectify the trouble. If this procedure does not clean the resistor the bottom should be removed from the cabinet as described in Part IV, Section 1, and the resistance section cleaned with alcohol applied with a pipe cleaner.

If the arm is loose, removal of the chassis from the cabinet as described in Part IV, Section 1, is necessary to gain access to the intensity control so that the arm can be tightened.

[5] LOOSE STATION SELECTOR OR INTENSITY CONTROL KNOBS

If the station selector or intensity control knob becomes loose on its shaft, tighten the small set screw that holds it in place. If the threads are defective the knob must be replaced.

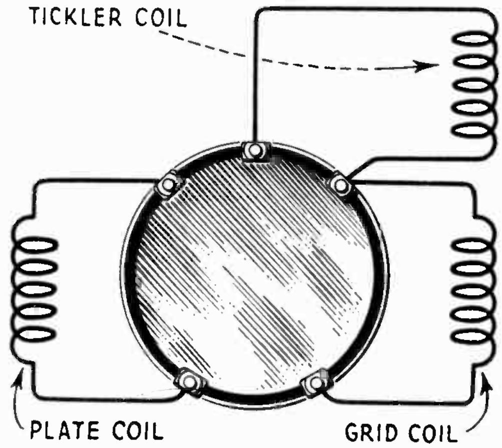


Figure 7—Schematic diagram of coil connections

[6] NOISY OR LOOSE JACKS

Noisy or intermittent operation may originate at either jack. This may be caused by loose connections, jacks having lost their tension, or by dirty contacts.

To remedy this trouble remove the bottom from the cabinet as described in Part IV, Section 1. The jacks can then be examined and necessary adjustments made. A loss of tension may be remedied by applying pressure to the spring leaf and pushing it toward the frame of the jack. The correct tension may be determined by inserting the loudspeaker or phone plug and noticing if the leaf is making proper contact. If the soldered connections appear faulty, a hot iron applied to them will generally remedy the trouble. Dirty contacts should be cleaned by the use of a small piece of fine sand-paper properly applied between the contacts of the jack spring leaves.

[7] "FRINGE" HOWL AND AUDIO HOWL

A howl occurring just as the intensity control reaches the point where oscillation occurs is sometimes called "fringe" howl. If it occurs one of the following conditions may be its cause:

(a) Poor detector tube, or microphonic detector tube (see Part II, Sec. 10).

(b) Wrong type of detector tube. Use of a UX-112A instead of a UX-201A will cause a howl.

(c) Resistance across primary of 1st A.F. transformer open.

(d) Condenser across secondary of 1st A.F. transformer open.

(e) Open grid connection or grid of any Radiotron.

(f) Defective wiring in audio system. Figure 9 illustrates the internal connections of the audio transformers.

[8] FAILURE TO REGENERATE

Advancing the intensity control clockwise to its maximum position without the receiver going into oscillation by regeneration to secure continuous wave signal reception at any point in the tuning range may be lue to:

(a) Shorted R.F. choke in detector plate circuit. This will cause oscillations to be obtainable only at portions of the tuning range and not through the entire range.

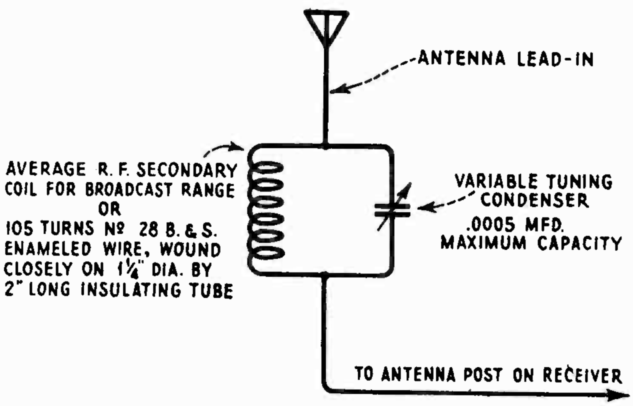


Figure 8—Schematic diagram of wave trap

(b) Defective Radiotron in detector stage. A Radiotron that may be suitable for other stages may not be suitable for use as a regenerative detector. Try interchanging the detector Radiotron with the 1st A.F. stage Radiotron.

(c) Open detector plate condenser. If this condenser is open, sufficient coupling from the plate through the tickler coil to the grid of the detector will not be obtained to cause oscillation.

(d) Low "B" batteries. If the 67½-volt connection drops below 50 volts at the battery terminals the battery should be replaced. The low voltage keeps the detector from oscillating due to low plate voltage.

[9] DISTORTED REPRODUCTION

Distorted reproduction may be due to any of the following causes:

(a) Defective Radiotrons. Check Radiotrons and replace any found defective.

(b) Defective batteries. Replace run down batteries.

(c) Wrong battery connections causing wrong plate and grid voltages. Check battery connections according to Figure 10.

(d) Defective audio transformer. A defective audio transformer will cause distortion.

(e) Defective grid condenser or grid leak.

[10] ACOUSTIC HOWL

This is caused by a microphonic Radiotron, or the loudspeaker being too close to the receiver. The sound waves from the loudspeaker striking a Radiotron may cause the Radiotron elements to vibrate, which in turn, produces an amplified howl in the output of the loudspeaker.

The remedy lies in interchanging the Radiotrons. Counting from left to right the second Radiotron UX-201A (see Figure 10) is the most susceptible to this microphonic condition. Interchanging it, with the UX-201A of the A.F. amplifier or placing the loudspeaker at a greater distance from the receiver will generally remedy this condition. In some cases both remedies may be necessary.

[11] LOUDSPEAKERS

Instead of head telephones connection can be made to magnetic or dynamic loudspeakers for reproduction. Among the various types of magnetic speakers RCA Loudspeaker Models 100A, 100B and 103 may be used with excellent results. Of the dynamic speakers RCA Models 104, 105 and 106 will give high class performance when used with the RCA Short Wave Receiver. The various RCA Service Notes issued on these speakers should be referred to when any service information is desired.

The polarity on these speakers is not an important factor when connection is made to a receiver. They should accordingly be connected in the manner that gives the most pleasing reproduction.

PART III—ELECTRICAL TESTS

[1] CHECKING RESISTANCE VALUES

The values of the various resistance units of RCA Short Wave Receiver, Type AR-1145, are shown in the schematic diagram, Figure 3. When testing a receiver for defects the various values of resistance should be checked. This may be done by a resistance bridge; the voltmeter-ammeter method shown in previous RCA Service Notes; or by the following method, the results depending upon the care exercised in using the prescribed method.

For resistances of low value, 5000 ohms or less, use a voltmeter not greater than 100 ohms per volt. The rating of 100 ohms per volt means that a meter with 50 volts maximum scale reading, has a total resistance of 50 times 100, or 5000 ohms, when the 50-volt scale is used. For high values of resistance use a meter of 1000 ohms or more per volt. The Weston Meters, Type 301 or 280, each have a resistance of 62 ohms per volt and are satisfactory for low values. For very low resistances below 100 ohms, it is best to use one dry cell—1½ volts—with the 3-volt scale of a Weston, Model 280. For higher resistances up to 5000 and above use sufficient battery to give a good deflection on the meter, for example, a 45-volt "B" for a 0-50 voltmeter. Then take two readings, one of the battery alone, and one of the battery with the unknown resistance in series.

Then apply the following formula:

$$\left(\frac{\text{Reading obtained of battery alone}}{\text{Reading obtained with resistance in series}} - 1\right) \text{Resistance of meter in ohms} = \text{Unknown resistance in ohms}$$

Example—Using a Weston, Type 301, 30-volt scale, 22½-volt "B" battery. Resistance of meter equals 30x62 or 1860 ohms.

$$\left(\frac{22.5}{8.45} - 1\right) 1860 = 3091 \text{ or unknown resistance in ohms approx.}$$

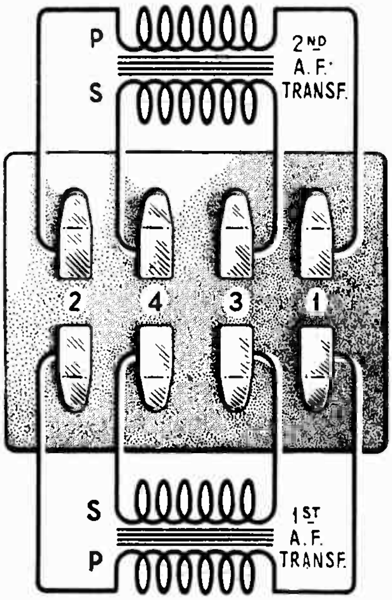


Figure 9—Internal connections of audio transformers

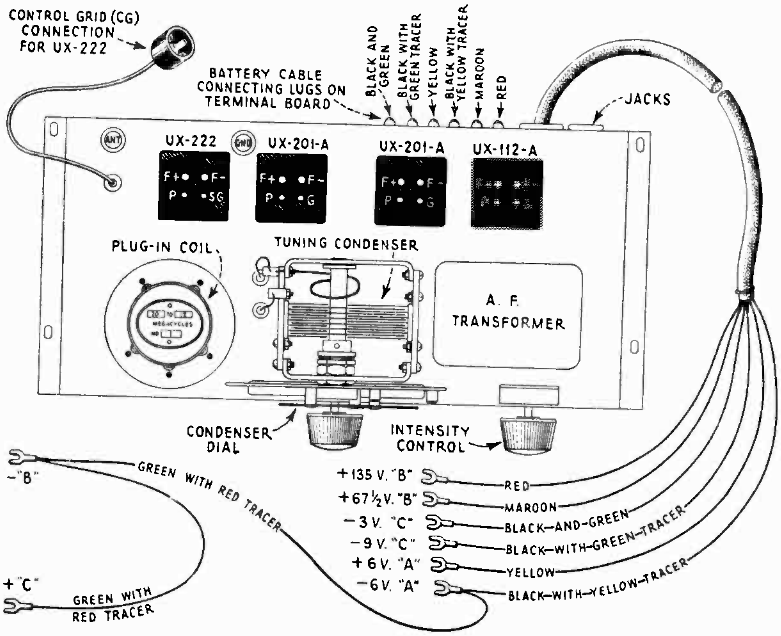


Figure 10—Socket layout and battery cable connections

[2] AUDIO TRANSFORMER CONTINUITY TESTS AND TESTING OF LARGE BY-PASS CONDENSERS

The audio transformers may be tested for continuity when not connected in circuit by using the method described in Part III, Sec. 3, and by referring to Figure 9, which illustrates the internal connections of the audio transformers.

Proper testing of the 1 mfd. by-pass condenser is accomplished by charging them with a handy D.C. voltage, as from "B" batteries connected to give 90 to 157½ volts. If sparking occurs as the charge is applied the condenser is shorted. After a few seconds wait a strong spark should appear when the condenser is discharged by shorting the terminals with a screw driver. If no spark appears the condenser is probably open. If a slight spark occurs the condenser is probably leaky.

All the 1 mfd. condensers have one side grounded (see Figure 3). In the tests given, with the condensers wired in the chassis, if the opposite terminal is defectively grounded a short will be indicated. It is therefore advisable when checking for grounds in the component parts of the receiver to remove all indicated ground connections, so that a defective ground will be truly indicated by a closed continuity test between the frame (ground) and a terminal of the suspected unit.

[3] VOLTAGE READINGS AT RADIOTRON SOCKETS

The following voltages taken at each Radiotron Socket with the receiver in operating condition should prove of value when checking is done with test sets such as the Weston, Model 537, Type 2, or others giving similar readings. The plate currents shown are not necessarily accurate for each tube, as the cable in the test set will cause some circuits to oscillate, due to its added capacity. Small variations of voltages will be caused by different tubes and battery voltages. Therefore the following values must be taken as approximately those that will be found under varying conditions. Radiotron positions are shown in Figure 10.

VOLTAGE READINGS AT RADIOTRON SOCKETS

Intensity Control Near Zero. Operating Switch "On." All Batteries Connected. (See Figure 10.) Radiotrons in Sockets, or Test Set. Loudspeaker Plugged in Second Audio Stage Jack.

Radiotron	*Fil. Volt.*	*Grid Volt.*	*Plate Volt.*	*Plate Current*
Coupling UX-222	3.2	*Control grid 1.5 *Screen grid 67.5	130.0	Plate 3.5 mil. amp. *Screen 0.5 mil. amp.
Detector UX-201A	5.0	....	30-60 (Depending on position of intensity control)	0.65 to 1.5 mil. amp.
1st Audio Amp. UX-201A	5.0	3.0	65	1.1 mil. amp.
2d Audio Amp. (Power) UX-112A	5.0	9.0	130.0	4.0 mil. amp.

* These readings cannot be measured by ordinary methods as with the Weston Model 537 test set.

[4] RCA SHORT WAVE RECEIVER CONTINUITY TESTS

The following tests will check the continuity of all circuits in the RCA Short Wave Receiver.

All Radiotrons should be removed and batteries disconnected. A plug-in coil should be inserted in the coil socket. The Radiotron socket numbers and designation of socket contacts are shown in Figure 10.

A pair of headphones with at least 4½ volts in series or preferably a voltmeter with sufficient voltage to give a full scale deflection when connected directly across battery terminals should be used in making these tests. Flexible insulated leads with partially insulated testing tips should be used to prevent false tests due to the hands.

The contacts of the test equipment should be placed across the terminals or leads indicated in the following test table under the column marked "Terminals." If the results are negative the cause of such negative effect will be found in the last column under the heading, "Incorrect Effect Caused By." The second column indicates the correct effect.

The designation P, CG, SG and G refer to the plate, control grid, screen grid and grid contacts of the various sockets. For example, G2 would indicate the grid contact of the second socket (see Figure 10).

The filament contacts are preceded by their polarity. For example, + F1 would indicate the positive filament contact of the first socket.

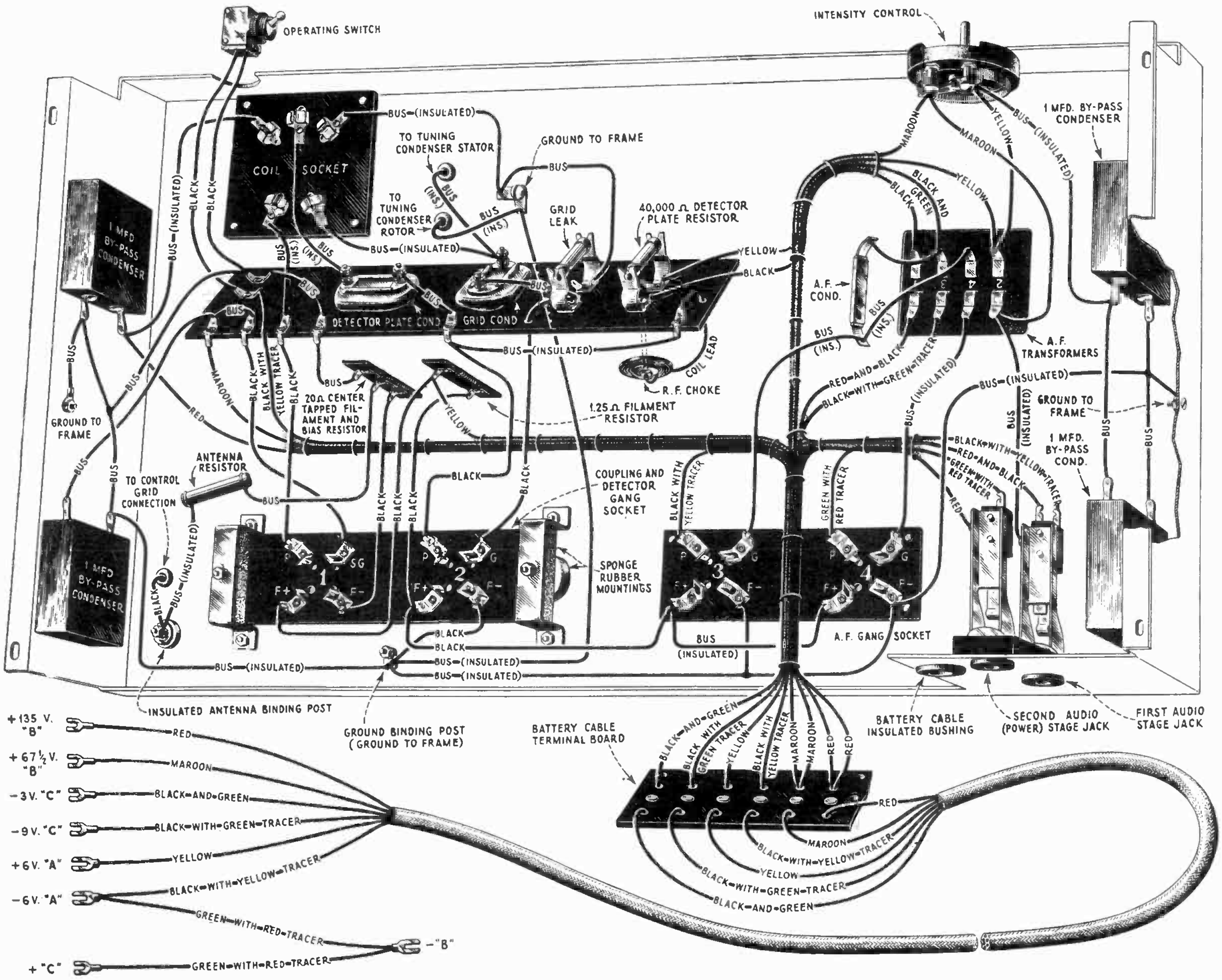


Figure 11—Sub-chassis wiring diagram of receiver

RCA SHORT WAVE RECEIVER CONTINUITY TESTS

Remove all Radiotrons and disconnect batteries. Insert a plug-in coil in coil socket. Refer to Figure 10 for Radiotron socket numbers and designation of socket contacts. Intensity control near zero. Keep hands free from chassis frame.

Circuits	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna to ground	Closed	Open 2000-ohm resistor or UX-222 filament resistor
	Antenna to CG1	Closed	Open connection
	SG1 to +67½ battery lead	Closed	Open connection
	G2 to —F2	Closed (Weak)	Open grid leak
	Stator of tuning condenser to —F2 (Remove grid leak)	Closed	Open grid coil of plug-in coil
	G3 to —3 battery lead	Closed	Open secondary of 1st A.F. transformer
		Closed (Strong)	Shorted secondary condenser
	G4 to —9 battery lead	Closed	Open secondary of 2nd A.F. transformer
	G2 to stator of tuning condenser (Remove grid leak)	Open	Shorted grid condenser
Plate	P1 to +135 battery lead	Closed	Open primary coil of plug-in coil
	P2 to +67½ battery lead	Closed	Open R.F. choke coil, primary of 1st A.F. transformer and 40,000-ohm resistor, or intensity control
	Across plate winding of plug-in coil (see Fig. 8)	Closed	Plate winding open
	P2 to ground	Open	Shorted detector-plate condenser or shorted 1 mfd. condenser
	P3 to +67½ battery lead (no plug-in jack)	Closed	Open primary of 2nd A.F. transformer or defective jack
	P4 to +135 battery lead	Open	Shorted jack
Filament	—F1 to ground	Closed	Open 20-ohm UX-222 filament resistor
	+F1 to +A battery lead	Closed	Open connection
	—F1 to —A battery lead (operating switch closed)	Closed	Open connection
	—F2 to ground	Closed	Open connection
	+F2 to +A battery lead	Closed	Open 1.25-ohm filament resistor or connection
	—F3 to ground	Closed	Open connection
	+F3 to +A battery lead	Closed	Open 1.25-ohm filament resistor or connection
	—F4 to ground	Closed	Open connection
	+F4 to +A battery lead	Closed	Open 1.25-ohm resistor or connection
Misc.	+67½ battery lead to ground	Open	Shorted 1 mfd. condenser } Steady condition
	+135 battery lead to ground	Open	Shorted 1 mfd. condenser } Steady condition
	—A to ground (switch closed)	Closed	Open wiring or defective switch
	—A to ground (switch open)	Open	Shorted switch or wiring

PART IV—MAKING REPLACEMENTS

[1] REMOVING CHASSIS FROM CABINET

Should replacement of any parts become necessary in the RCA Short Wave Receiver the following procedure may be used in gaining access to the different parts:

(a) Disconnect antenna and ground leads and all battery connections.

(b) Place the receiver in an upside down position on a blanket or cloth to protect the cabinet finish and to make the mechanism accessible.

(c) Remove the four machine screws that are in the center of the felt feet and then remove the bottom from the cabinet. Some parts such as grid leaks, fixed condensers, etc., may be replaced without further dismantling (see Figure 12).

(d) To remove the mechanism entirely from the cabinet the battery cable must be pulled through the hole in the cabinet, the station selector and intensity control knobs removed, the operating switch released, and the chassis lifted clear of the cabinet. It may be removed to a place convenient for work.

(e) After all work is completed the receiver should be reassembled in the reverse manner of that used to dismantle it.

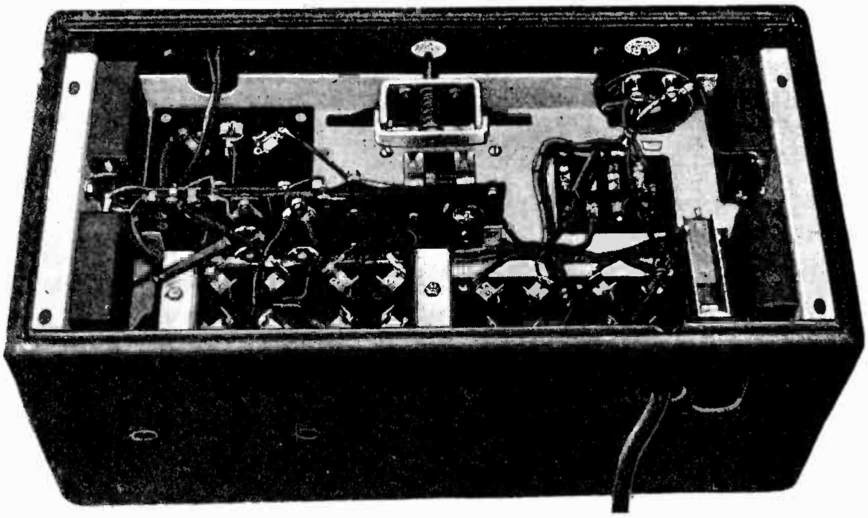


Figure 12—Bottom interior view with bottom removed and cable in place

[2] REPLACING AUDIO TRANSFORMER ASSEMBLY AND BY-PASS CONDENSERS

Should it be necessary to remove the audio transformers or the large by-pass condensers, the chassis should be removed from the cabinet as outlined in Section 1 above. When only one audio transformer is found defective it will be necessary, of course, to remove the complete assembly or container (see Figure 4). This container as well as the by-pass condenser container can be removed in the following manner:

(a) Unsolder connections to defective unit. Never cut them off.

(b) By carefully unbending the tabs holding the container in place, the part may be removed. In removing the 1 mfd. by-pass condenser adjacent to the output jacks, it will be found necessary to remove at least the second audio stage jack (Part IV, Sec. 5) before the condenser can be freed from the chassis.

(c) Replacements should carefully be made in the reverse order. It will be necessary to support the part replaced by holding it, or temporarily clamping it tightly to the chassis in order to bend the tabs to hold securely. Refer to Figure 11 for correct wiring.

[3] REPLACING THE DETECTOR-PLATE CONDENSER

To remove the detector plate condenser it will be necessary to remove the chassis from the cabinet as outlined in Part IV, Section 1.

Then proceed in the following manner after locating the detector-plate condenser (see Figures 4 and 11).

(a) Unsolder and remove the 1.25-ohm filament resistor by simply unscrewing the two end machine screws from their nuts.

(b) Unsolder the detector-plate condenser connections and remove the condenser by unscrewing the machine screws holding it in place.

(c) Replacement is made in the reverse order. Refer to Figure 11 for correct wiring.

[4] REPLACING COIL SOCKET, AUDIO SOCKET GANG ASSEMBLY, OR BATTERY TERMINAL BOARD

Remove chassis from cabinet as outlined in Part IV, Section 1.

(a) Unsolder connections from the part to be removed.

(b) Carefully drill out the rivets holding the part to the frame (see Figures 1 and 4) using a suitable size drill.

(c) Replace the part removed and secure in place by use of small machine screws with nuts and lock washers. Refer to Figure 11 for correct wiring.

[5] REPLACING AUDIO STAGE JACKS

Removal of jacks may be necessary for replacement or cleaning of contacts. For location see Figure 4.

Remove chassis from cabinet as outlined in Part IV, Section 1.

(a) Unsolder connections to the jack to be removed.

(b) By means of a key to fit the hexagonal hole, or careful use of a screw driver to fit, the insulating bushing used to support the jack may be unscrewed and removed.

(c) Replacement is made in reverse order. Refer to Figure 11 for correct wiring.

[6] REPLACING TUNING CONDENSER, INTENSITY CONTROL, ETC.

Remove chassis from cabinet as outlined in Part IV, Section 1.

(a) By unsoldering connections carefully, and simple removal of supporting machine screws when necessary, it will be evident how all remaining parts, such as the tuning condenser, intensity control, etc., can be easily removed without further explanation. See Figures 4 and 11 for location and connection of parts.

(b) Replace and connect properly by referring to Figure 11.

[7] REPLACING BATTERY CABLE

Remove chassis from cabinet as outlined in Part IV, Section 1.

(a) Unsolder the old battery cable from the terminal board.

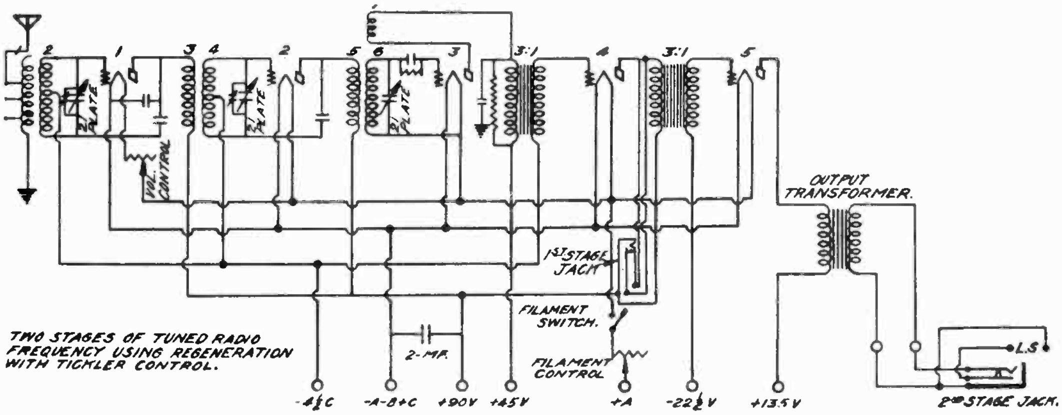
(b) Replace and resolder new battery cable by referring to Figure 10 for correct color code of connections.

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, Defective Batteries, Wrong Battery Connections, a Poor Antenna System* and *Defective Loudspeaker* or *Phones.* If imperfect operation is not due to the above causes the "Service Data Chart" should be consulted for further detailed causes.

Indication	Possible Cause	Remedy	Service Notes
No Signals	Defective operating switch	Check and replace switch	Part IV, Sec. 6
	Open antenna resistor	Check and replace antenna resistor	Part IV, Sec. 6
	Defective battery cable	Check and replace battery cable	Part IV, Sec. 7
	Defective plug-in coil	Check and replace coil	Part I, Sec. 6
	Defective tuning condenser	Check and replace condenser	Part IV, Sec. 6
	Defective A.F. transformer	Check and replace A.F. transformer	Part III, Sec. 2 Part IV, Sec. 2
	Defective by-pass condenser	Check and replace by-pass condensers	Part III, Sec. 2 Part IV, Sec. 2
	Defective grid condenser	Replace grid condenser	Part IV, Sec. 6
	Open R.F. choke	Check and replace choke	Part IV, Sec. 6
Weak Signals	Failure to regenerate	Check continuity of coils, etc.	Part II, Sec. 8 Part III, Sec. 3
	Defective battery cable	Check and replace cable	Part IV, Sec. 7
	Defective antenna resistor	Check and replace antenna resistor	Part IV, Sec. 6
	Defective plug-in coil	Check and replace plug-in coil	Part I, Sec. 6
	Defective A.F. transformer	Check and replace A.F. transformer	Part III, Sec. 2 Part IV, Sec. 2
	Dirty prongs of Radiotrons	Clean Radiotron prongs	Part II, Sec. 2
	Defective by-pass condenser	Check and replace by-pass condenser	Part III, Sec. 2 Part IV, Sec. 2
	Loose intensity control arm	Tighten intensity control arm	Part II, Sec. 4
	Incorrect grid and plate voltages on Radiotrons	Check voltage supply at battery terminals or Radiotron sockets	Part I, Sec. 4 Part III, Sec. 4
Poor Quality	Incorrect plate and grid voltage on Radiotrons	Check voltage supply at battery terminals or Radiotron sockets	Part I, Sec. 4 Part III, Sec. 4
	Defective A.F. transformer	Check and replace A.F. transformer	Part III, Sec. 2 Part IV, Sec. 2
	Defective by-pass condenser	Check and replace by-pass condenser	Part III, Sec. 2 Part IV, Sec. 2
	Defective grid leak	Check and replace grid leak	Part III, Sec. 1 Part IV, Sec. 6
Noisy or intermittent reception	Dirty Radiotron prongs	Clean Radiotron prongs	Part II, Sec. 2
	Loose intensity control arm	Tighten intensity control	Part II, Sec. 9 Part III, Sec. 6
	Dirty jack contacts	Clean jack contacts	Part II, Sec. 5 Part IV, Sec. 5
	Socket contacts bent or broken	Readjust socket contact or replace gang socket if broken	Part II, Sec. 3 Part IV, Sec. 4
	Loose connection in receiver	Check continuity for steady condition. Examine all connections	Part III, Sec. 3
Howling	High plate voltage on Radiotrons	Check voltage supply at battery terminals or Radiotron sockets	Part I, Sec. 4 Part III, Sec. 4
	Open grid connections	Check continuity	Part III, Sec. 3
	Defect in audio system	Check A.F. transformers, etc.	Part III, Sec. 2 Part III, Sec. 3
	Acoustic howl caused by microphonic Radiotrons or loudspeaker too close to Radiola	Interchange Radiotrons or increase distance of loudspeaker from Radiola	Part II, Sec. 10
	Defective detector by-pass condenser	Replace by-pass condenser	Part IV, Sec. 6
Radiotrons fail to light	Operating switch not 'ON"	Turn switch "ON"	....
	Defective operating switch	Check and replace operating switch	Part III, Sec. 3 Part IV, Sec. 6
	Defective cable	Check and replace cable	Part III, Sec. 3 Part IV, Sec. 7
	No filament voltage at Radiotron sockets	Check for open connections by continuity tests	Part III, Sec. 3
Play in station selector	Loose knob	Tighten or replace knob	Part II, Sec. 5
	Loose dial	Tighten set screws	....

Victor Model 7-1 (Alhambra I)



Wiring Diagram Alhambra I (7-1)

If there is evidence of the radio receiver being improperly neutralized, steps should be taken to make the necessary adjustments to bring the equipment to its normal operating efficiency.

1. Prepare the following material:

a. A "modulated oscillator," the circuit and requirements of which are shown in Fig. 1.

(A 4-megohm grid leak is recommended: do NOT use a variable grid leak in the construction of the oscillator.)

PART 18460

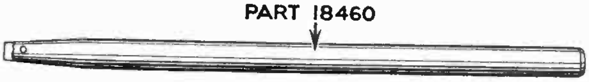


Fig. 2

b. A screw driver, of bakelite construction (with metallic blade) similar to that shown in Fig. 2.

c. A UX-199 Radiotron, from which one of the filament (LARGE) prongs has been sawed close to the base.

Note:—DO NOT use a tube with burnt out, broken, or shorted filament.

d. A pair of headphones.

2. Proceed as follows; being sure that the (black or red enameled) shipping strip has been removed.

a. Place oscillator in operation, near the antenna lead in wire at a point approximately 15 to 20 feet from the receiver. Adjust the oscillator to a frequency of approximately 1100 kilocycles, so that its note is picked up by the radio receiver when the Station Selector is set at 60.

b. Set the panel voltmeter at 3 volts and place the amplification dial at "0." Tune in the oscillator to full volume on the receiver, adjusting the vernier condensers for maximum volume.

c. Plug head phones in first stage jack on panel.

d. Remove Radiotron No. 1 (Fig. 2 in Service Bulletin 5-A) and substitute the special tube.

If this change causes signal to disappear, it is an indication that the first radio frequency stage is properly neutralized.

3. If signal is heard, even though weakly—proceed as follows:

a. With insulated screwdriver, shown in Fig. 2, adjust the neutralizing condenser located directly behind first tube (Fig. 3) until signal disappears—or is reduced to a minimum.

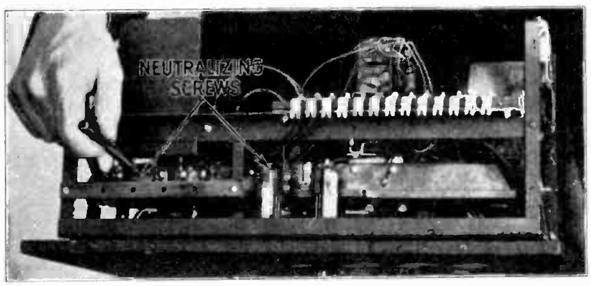
b. Remove the special tube and re-insert the original Radiotron.

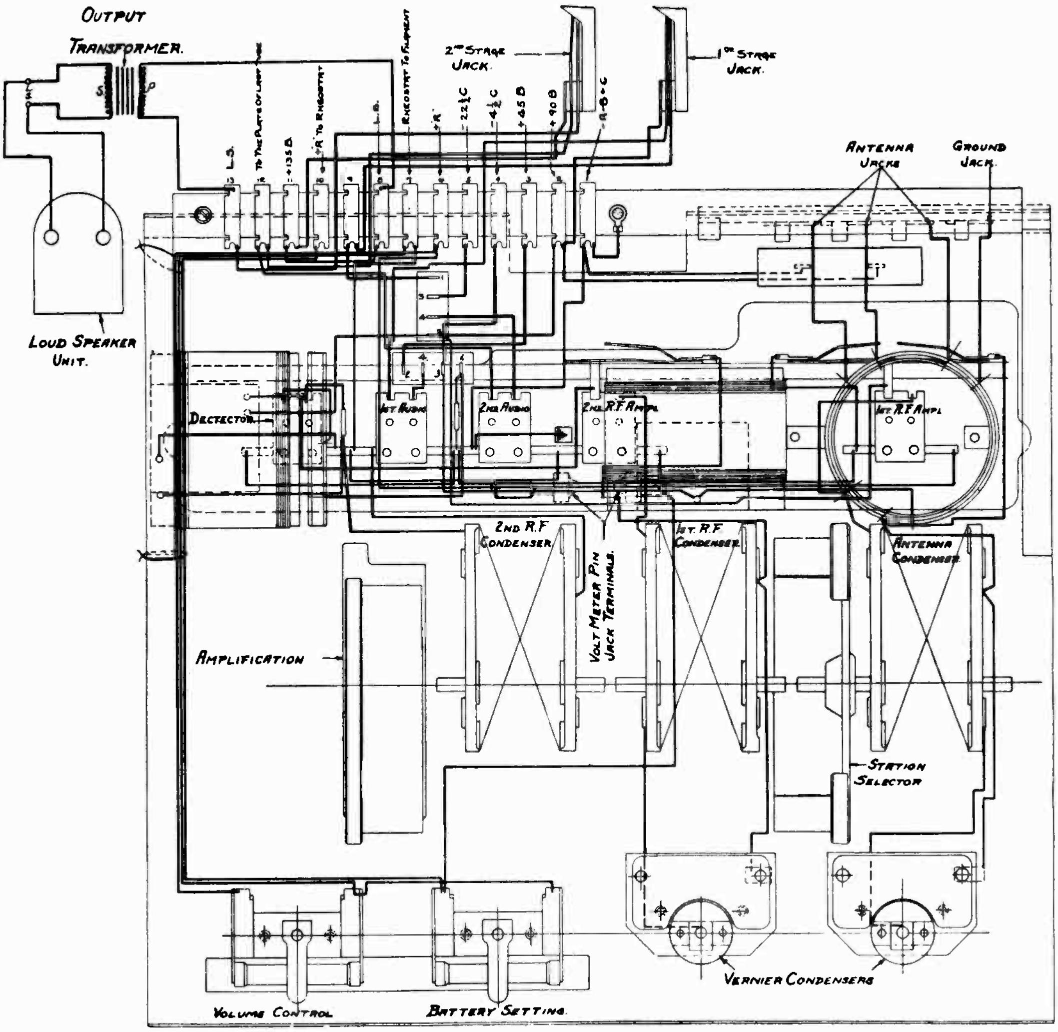
4. Repeat the procedure as outlined above, on next radio frequency stage (second tube in Fig. 2 of Service Bulletin 5-A) adjusting the other neutralizing condenser (Fig. 3).

a. Remove the special tube from the second socket and re-insert the original.

If now properly adjusted, the receiver should NOT oscillate at any position of the Tuning Control, with "Amplification" at zero. It should oscillate only after amplification dial has been turned to approximately 6 or 7. The setting of the amplification dial necessary to produce oscillation in the detector circuit will depend upon

a. The setting of the Station Selector.
b. The condition of the detector tube.
c. The detector B voltage.





Panel Assembly Diagram for Alhambra 1 (7-1)

IF THE TROUBLE HAS NOT BEEN FOUND TO LIE IN THE BATTERIES OR TUBES, THE FOLLOWING TESTS TO LOCALIZE THE TROUBLE IN THE SET ITSELF SHOULD BE MADE WITH TUBES REMOVED AND BATTERIES CONNECTED.

1. Using a low scale of meter with positive lead inserted in any — socket contact, insert negative lead in each "G" contact as shown in Fig. 2. The following table illustrates the results that should be obtained.

Normal	Faulty	Fault
G-1—4½	0	Open coil or broken wire.
G-2—4½	0	Open coil or broken wire.
G-3—1½	0	Open AF transformer or broken wire.
G-4— .3	0	Open AF transformer or broken wire.
G-5—0	Reversed	Short circuited grid condenser.

2. Using a high scale meter with negative lead inserted in any socket contact, insert positive lead in each P contact as shown in Fig. 2. The following are results that should be obtained:

Normal	Faulty	Fault
P-1—90	0	Open Coil or broken wire.
P-2—90	0	Open Coil or broken wire.
P-3—110	0	Open output transformer or broken wire.
P-4—85	0	Open audio transformer or broken wire.
*P-5—35 to 40	0	Open audio transformer or open tickler coil, or open tickler lead or broken wire.
		Short circuited by-pass condenser.

Victor Model 7-2 (Alhambra II)

Victor Model 9-1 (Florenza)

RADIO PANEL TEST FOR ALHAMBRA II (7-2) and FLORENZA (9-1)

The six tube Radiola used in these instruments utilizes the well known superheterodyne principle.

In case of failure to operate or poor operation:

1. Eliminate the possibility of defective tubes by replacing each tube with a tested Radiotron. When the defective tube is located the set will resume normal operation.

2. Check the batteries (or battery eliminator if one is used) to determine that proper voltages are being delivered. Note:—A noisy B battery can be located by a constant fluctuation of the pointer on the meter.

3. Insert a pair of ear phones in the first stage jack. If reception comes through, there is no trouble at this point.

4. Insert phones in output jack. If there is no reception:

(a) UX-120 may be defective.
(b) Output transformer may be open.

5. If reception is obtained at this point but there is no sound through the speaker unit:

(a) The speaker unit may be defective.
(b) The phone jack may not be making proper contact.

6. Check Radio-Victrola valve to see that it is opening and closing the full amount. This can be determined by a sharp click at both ends of the arc.

7. If there is no reception when phones are plugged in first stage jack, remove all tubes and make the following tests:

Using preferably a double scale voltmeter 0-7.5 0-150 volts (a Weston Type 301 meter was used in these tests and the readings will vary if any other type meter is used).

(a) Place battery switch in radio position.
(b) Turn battery setting rheostat to 5.
(c) Turn volume control rheostat to 10.
(d) With the test leads attached to the lower scale, the reading between the large holes of each socket should be 4½ volts with new A batteries.

8. If there is no reading:

(a) Check between contacts —A+C and +A—B) on the terminal strip. If there is a 4½ volt reading at this point:—
(b) Check contacts in filament switch.
(c) Check contacts on battery setting rheostat.
(d) Remove two bolts securing catacomb to spring cushions.
(e) Drop catacomb out of place and tighten all screw connections.
(f) Test all soldered connections.
(g) Replace catacomb.
(h) Reading should now be 4½ volts at the large contacts in the tube sockets.

NOTE—If filament polarity of No. 4 socket is reversed from that shown in Fig .1, the A battery leads should be reversed at the terminal comb. Poor tone quality will otherwise result if A supply is incorrectly connected. The positive side of the voltmeter pin jacks should be on the right looking down on the top of the panel.

9. If reading is obtained only in large contacts of No. 3 socket.

(a) Check external wiring of connection between battery setting control and volume control.

10. If reading is obtained in all sockets except No. 3.

(a) Check external wiring of volume control rheostat.

11. Failure to obtain filament reading in any of the other sockets would indicate an open circuit in the catacomb. If all external connections have been checked, the catacomb should be replaced.

12. Next test grid circuit (indicated as G in Fig. 1) still using low scale of meter.

(a) Insert positive meter test lead in any negative (—) filament contact.
(b) Insert negative meter test lead in all contacts marked "G" in Fig. 1. The readings will indicate as follows:

	O. K.	*Defective*	
G 1	4	0	
G 2	4.5	0	Difficulty may be due to an open oscillator coil external to the catacomb.
G 3	3.3	0	
G 4	0		Any deflection of meter, the catacomb is defective.
G 5	.3	0	
G 6	1.7	0	

If the readings show up a defect, the catacomb should be replaced.

13. Test plate circuits (indicated as P Fig. 1) now using the high scale of the meter.

(a) Insert the negative meter test lead in any (+) filament contact.
(b) Insert the positive meter test lead in all contacts marked "P" in Fig. 1. The readings will indicate as follows:

	O. K.	*Defective*	
P 1	90	0	
P 2	90	0	Before assuming that the catacomb is defective on a 0 reading in this socket, check the external wiring through the oscillator coil.
P 3	90	0	
P 4	10 to 20	0	
P 5	82	0	Check external wiring connections of first stage jack before assuming that open circuit is in the catacomb.
P 6	130	0	A 0 reading might indicate an open circuit in the wiring to the output transformer or in the transformer itself. This transformer is the one to which the loud speaker leads are connected.

14. If all the above tests check O. K and the difficulty still remains:

(a) Remove outside loop lead when testing a Florenza or the outside antenna coil lead when testing an Alhambra II. Connect the meter for lower scale reading. Place the meter in series with this lead and A+ connection on terminal strip. The reading should be 4½. If 0, either the coil or loop is open, depending on which instrument is being tested. If O. K. continue the test.
(b) Disconnect the terminal strip.
(c) Remove set from cabinet.
(d) Connect a 4½ volt "C" battery in series with one of the meter test leads.

(e) Test between rotor and stationary plates of left hand condenser when facing under side of panel. If no meter deflection, look for a broken wire or loose connection between condenser and oscillator coil terminals.

(f) Test from stationary plates of right hand condenser and No. 1 contact of the terminal strip. If no reading, check for a broken wire or loose connections between these points.

(g) Test from rotor plates of right hand condenser and No. 7 contact of the terminal strip. If no reading, check for a broken wire or loose connections between these points.

**(h) Test between connections 1 and 7. If a reading is obtained, the plates of the right hand condenser are short circuited. This may be caused by foreign material between the plates or from mechanical alignment. If the difficulty is not overcome after these exhaustive tests, it becomes a problem for your Distributor.

**Note—Terminals No. 1 and No. 7 referred to can be located counting on the terminal strip closest to the panel from the end opposite the filament switch.

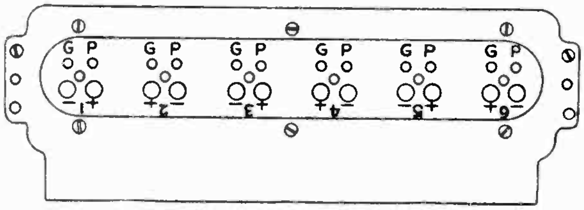


Figure 1

Standing at the front of the instrument looking down in the tube compartment, the top of the catacomb will appear as above.

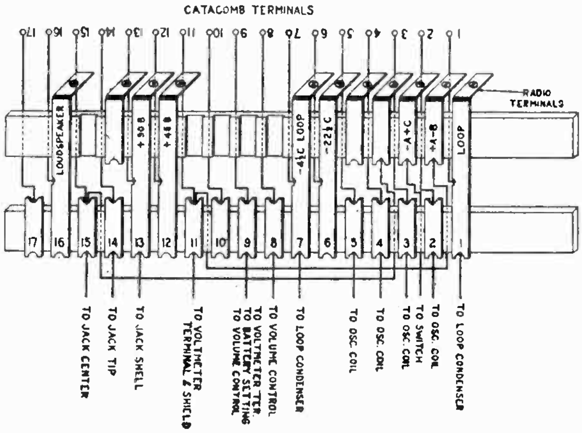
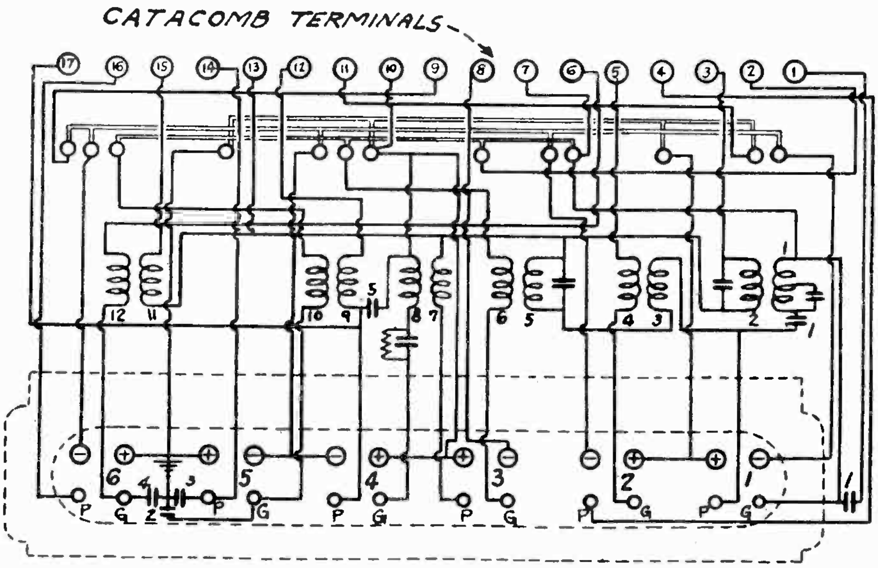
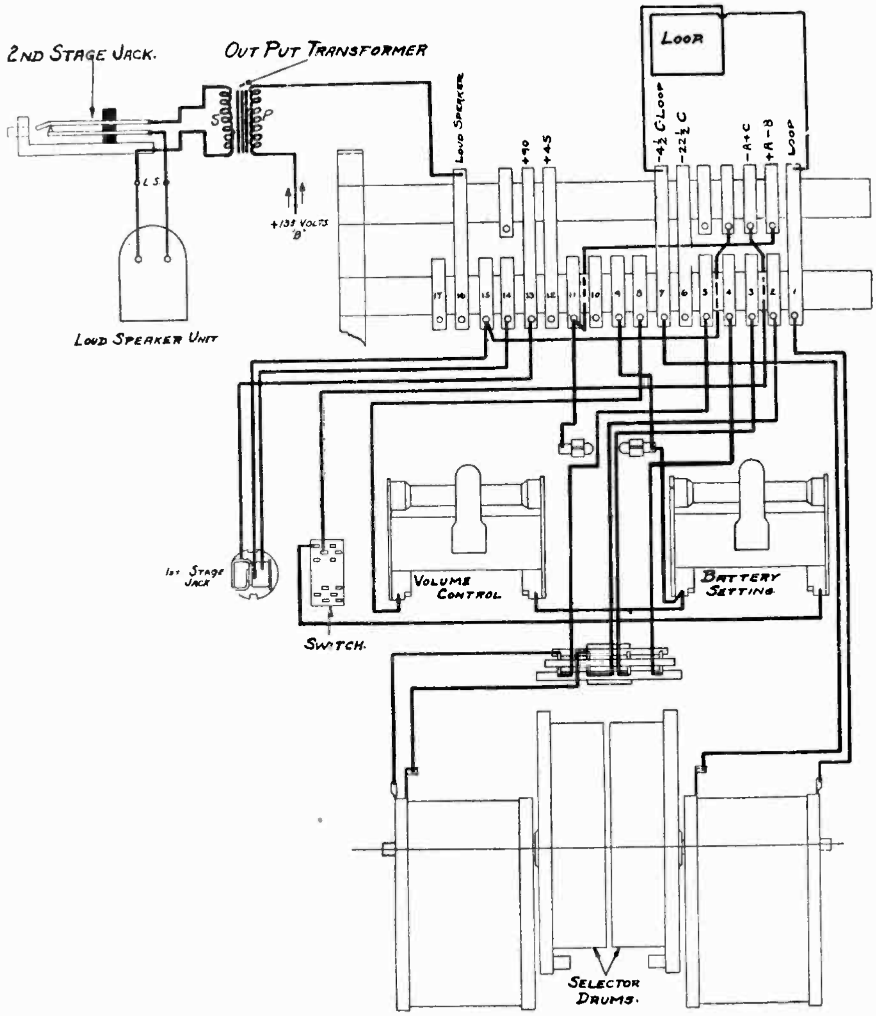


Figure 2



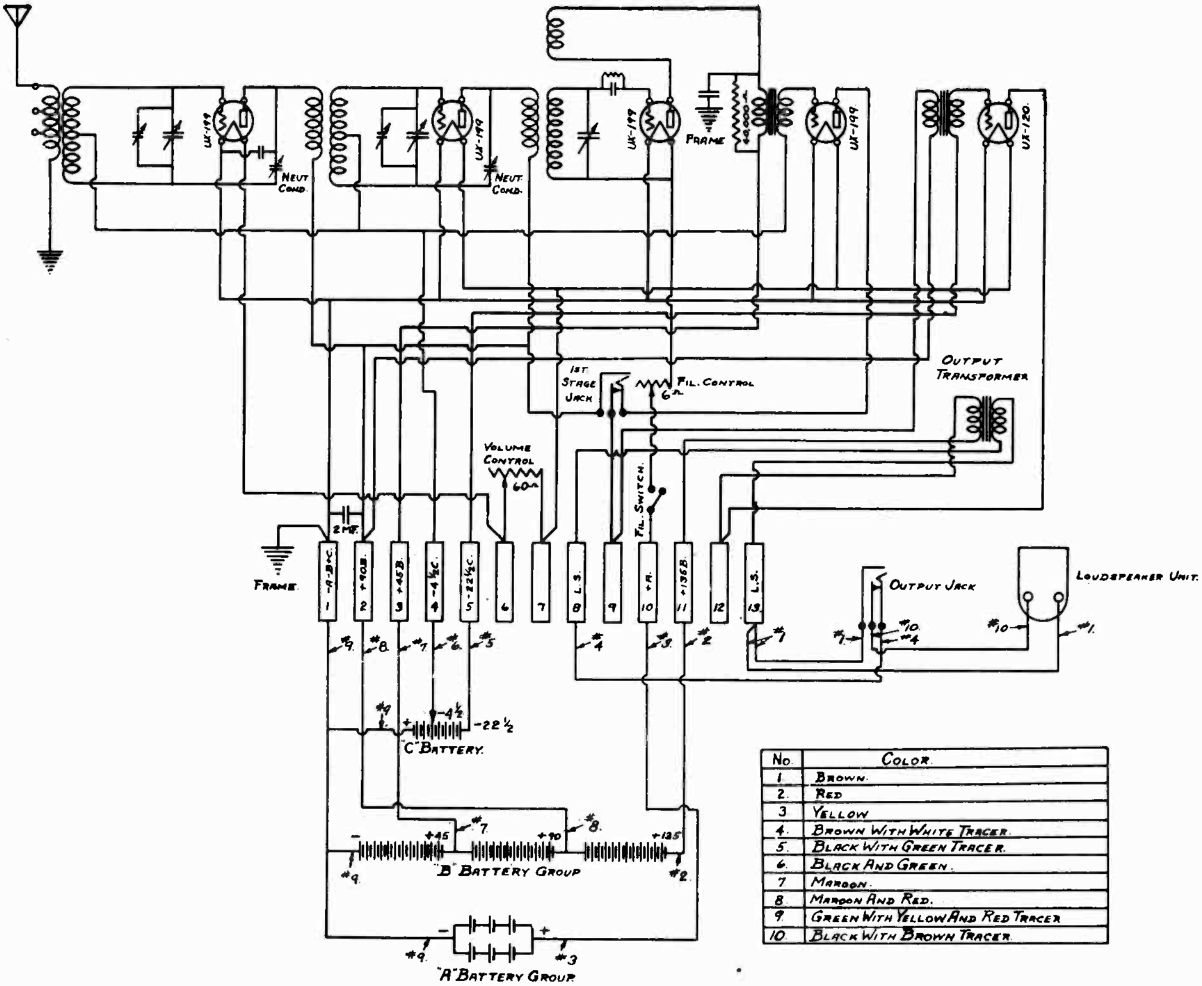
Radiola 25 Catacomb Continuity Diagram for Alhambra II (7-2) and Florenza (9-1) Instruments



Wiring Diagram for Alhambra II and Florenza

Victor Model 7–3

Victor Model 7–30



No.	Color
1	Brown
2	Red
3	Yellow
4	Brown With White Tracer
5	Black With Green Tracer
6	Black And Green
7	Maroon
8	Maroon And Red
9	Green With Yellow And Red Tracer
10	Black With Brown Tracer

Wiring Diagram for Models 7-3, 7-30, and R-20

IF THE TROUBLE HAS NOT BEEN FOUND TO LIE IN THE BATTERIES OR TUBES, THE FOLLOWING TESTS TO LOCALIZE THE TROUBLE IN THE SET ITSELF SHOULD BE MADE WITH TUBES REMOVED AND BATTERIES CONNECTED.

1. Using a low scale of meter with positive lead inserted in any — socket contact, insert negative lead in each "G" contact as shown in Fig. 2. The following table illustrates the results that should be obtained.

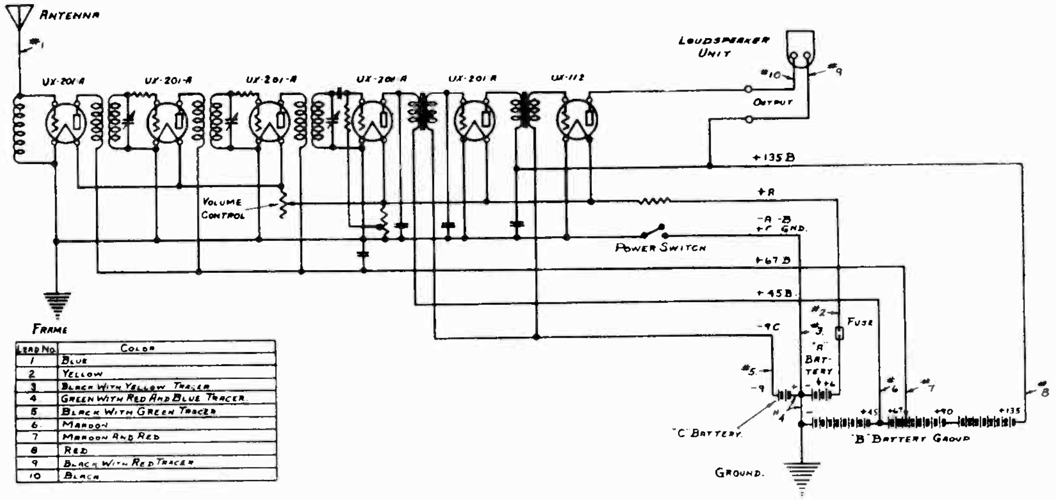
Normal	Faulty	Fault
G-1—4½	0	Open coil or broken wire.
G-2—4½	0	Open coil or broken wire.
G-3—1½	0	Open AF transformer or broken wire.
G-4— .3	0	Open AF transformer or broken wire.
G-5—0	Reversed	Short circuited grid condenser.

2. Using a high scale meter with negative lead inserted in any socket contact, insert positive lead in each P contact as shown in Fig. 2. The following are results that should be obtained:

Normal	Faulty	Fault
P-1—90	0	Open Coil or broken wire.
P-2—90	0	Open Coil or broken wire.
P-3—110	0	Open output transformer or broken wire.
P-4—85	0	Open audio transformer or broken wire.
*P-5—35 to 40	0	Open audio transformer or open tickler coil, or open tickler lead or broken wire.
	45	Short circuited by-pass condenser.

NEUTRALIZING PROCEDURE SAME AS SHOWN UNDER VICTOR MODEL 7—1

Victor Model 7–10



LEAD NO.	COLOR
1	BLUE
2	YELLOW
3	BLACK WITH YELLOW TRACER
4	GREEN WITH RED AND BLUE TRACER.
5	BLACK WITH GREEN TRACER
6	MAROON
7	MAROON AND RED
8	RED
9	BLACK WITH RED TRACER
10	BLACK

Wiring Diagram for Victor Radiola 16
(Used in Model 7-10)

VICTOR RADIOLA 16
(AS USED IN MODEL 7-10)

The Radiola used in combination with the Orthophonic Victrola in the model 7-10 is a six-tube battery operated tuned radio frequency receiver of the inside or outside antenna type, employing three stages of radio frequency amplification, a detector, and two stages of audio amplification. The UX-112-A power tube is used in the last stage of audio amplification. The Radiotrons UX-201-A are used in all the other stages and in the detector.

Most of the common causes of trouble can be located and corrected by the tests given below. In making the tests the use of a Weston Radio Set Tester is recommended. If this is not available, a high resistance voltmeter of reliable manufacture, having two scales (0-7.5 and 0-150 volts), should be used. The meter should be equipped with flexible insulated leads.

1. Test "A," "B" and "C" batteries or battery eliminator if used.

2. Test all cable connections to the batteries.

3. Test loudspeaker unit.

4. Test tubes.

If the Weston Radio Set Tester is used, the tube tests can be made in the regular manner by placing the plug in socket No. 1, Fig. 1. If the set tester is not available, the low scale of the voltmeter can be used, the procedure being as follows:

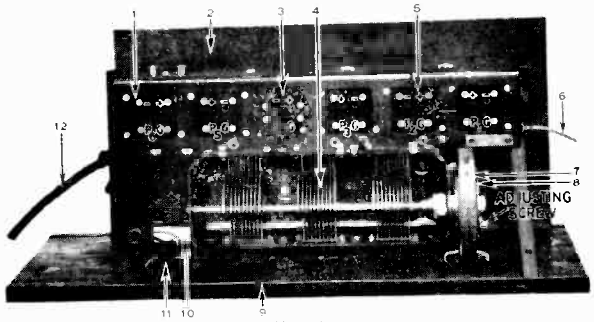


Fig. 1

a. Remove Radiotrons from all sockets except the one to the extreme right. Filament regulation in this socket can be obtained by means of the Volume Control.

b. Place the two leads connected to the low scale of the voltmeter in the two filament socket contacts of Radiotron Socket No. 2 marked "+" and "−" as shown in Fig. 1; regulate the voltage to 5 volts.

c. Remove the +67½B lead from the battery terminal, and connect this lead to the 7.5 terminal of the meter; connect from the + terminal of the meter to the +67½B on the "B" battery.

d. Note the deflection of the meter when the latter is connected as described above, and compare this deflection with that given by a tube which is known to be good. The amount of deflection depends on (1) the meter used, (2) the condition of the "B" batteries, and (3) the condition of the tube under test. (1) and (2) remaining unchanged, a comparative indication of the condition of the various tubes can be obtained; in general a high deflection indicates a good tube, and a low deflection indicates a poor tube.

e. All Radiotrons may be tested in the same manner. The UX-112-A will ordinarily give a higher reading than the UX-201-A.

5. The various Radiotrons, shown in Fig. 1, function as follows:

1. First Radio Frequency Amplifier (UX-201-A).
2. Second Radio Frequency Amplifier (UX-201-A).
3. Third Radio Frequency Amplifier (UX-201-A).
4. Detector (UX-201-A).
5. First Stage Audio Frequency Amplifier (UX-201-A).
6. Second Stage Audio Frequency Amplifier (UX-112-A).

Changing the Radiotrons UX-201-A in the various sockets will often improve reception.

6. If the receiver oscillates:

a. Various Radiotrons should be tried in sockets Nos. 2 and 3, Fig. 1, until two have been found which cause a minimum amount of oscillation.

b If the set still continues to oscillate, the four leads under the center radio frequency transformer should be examined and pushed as far away from this coil as possible. Lengthening the antenna will also help to stop oscillation as the set has a tendency to oscillate more on a short antenna than on a long antenna. In no case, however, should this length exceed 150 feet, including the lead-in.

7. If the trouble has not been located in the batteries or tubes, make the following tests to localize the trouble in the set itself:

a. FILAMENT TESTS—Observe if all the filaments light. Any trouble in the filament circuit may be traced to:

(1) Broken wire in cable.
(2) Broken contact on fixed resistor, 22, Fig. 2, in +A line.
(3) Broken filament leads from resistor to sockets.
(4) Poor socket contacts.
(5) Leads to volume control, 10, Fig. 1, broken or loose.
(6) Contact arm on volume control not making proper contact.
(7) Open fuse (if used) in +A lead.
(8) Poor contact at battery terminals.

These tests can be made with a 4½ volt "C" battery connected in series with the low voltage scale of the voltmeter binding posts of a Weston Radio Set Tester, or with a voltmeter described in the beginning of this bulletin and connected as shown in Service Bulletin No. 5-A. All "B" and "C" batteries should be disconnected when making filament tests.

b. GRID TESTS—Reconnect the batteries; remove all tubes from the sockets; and turn the Switch knob of the Weston Radio Set Tester to the "C" position, or using the low scale of the 0-7.5 and 0-150 voltmeter, test the "C" battery voltage in sockets Nos. 5 and 6. No "C" battery reading will be obtainable from sockets 1, 2, 3 and 4. If the voltmeter is used, place the lead connected to the + terminal of the meter in a "—A" contact, and the lead connected to the 7.5 terminal of the meter in the "G" contact shown in Fig. 1. With the power switch pushed down to the "on" position, the following are the approximate results which should be obtained.

Note—All readings listed below were made with a Weston Radio Set Tester Type 519. Readings will vary slightly, depending upon the meter used and the condition of the batteries.

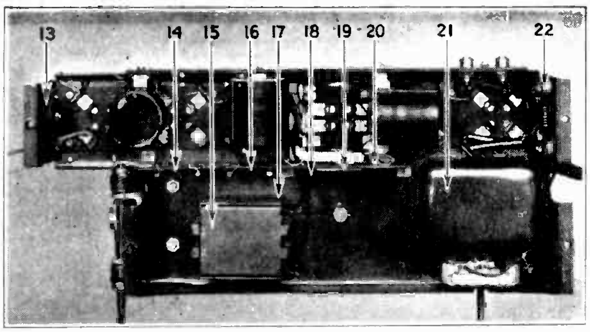


Fig. 2

METER READING

Normal	Faulty	Fault
G_5 6.5	0	Open first A.F. transformer secondary or broken wire.
G_6 6.5	0	Open second A. F. transformer secondary or broken wire.

c. PLATE TESTS—Using the "B" scale of the set tester or the high scale of the voltmeter, test the plate voltages in the various sockets. If the voltmeter is used, the lead from the high voltage terminal should be placed in the —A socket contact and the lead from the + terminal in the plate contact. With the power switch downward to the "on" position, the following are the approximate results which should be obtained.

METER READING

Normal	Faulty	Fault
P_1 63	0	Open R. F. coil or broken lead.
P_2 67	0	Open R. F. coil or broken lead.
P_3 63	0	Open R. F. coil or broken lead.
P_4 36	0	Open A. F. transformer primary or broken wire.
P_5 122	0	Open A. F. transformer primary or broken wire.
P_6 118	0	Poor contact or broken wire on loud-speaker unit.

8. If the trouble has not yet been located, connect a 4½ volt "C" battery and voltmeter as described in (a) above, and proceed as follows:

a. Disconnect all batteries from the cable.

b. Test between the stator (stationary) plates and rotor (rotating) plates of each tuning condenser. No deflection of the meter will indicate that there is a broken or loose connection between the condensers and their respective coils or open circuits in the coils themselves.

c. Check all condensers to see that the rotor plates do not touch the stator plates as the Station Selector is being turned.

d. Reconnect the batteries.

GENERAL

1. Adjustment of condenser drive cable.

Any slack in the condenser drive cable can be taken up by tightening the adjusting screw shown in Fig. 1.

2. Loose volume control contact.

A loose volume control contact is often a cause of noisy reception. If such a condition is found, the contact arm should be bent until it makes a firm contact against the resistance strip.

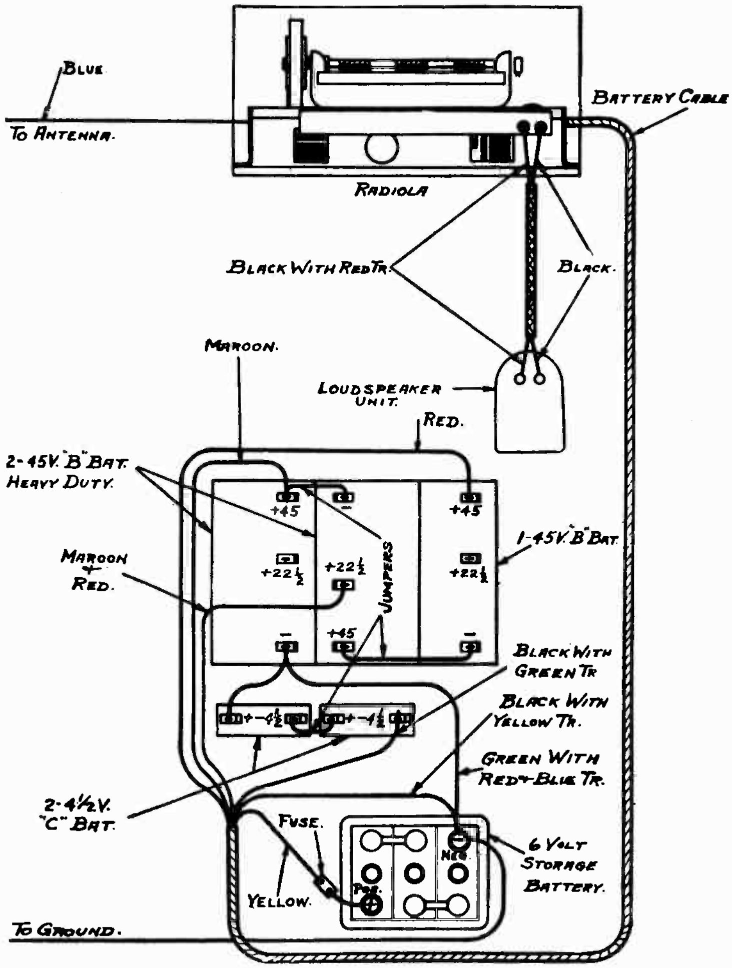
3. Operation with "B" battery eliminator not supplying 67½ volts plate voltage.

The Radiola requires 67½ volts for the radio frequency amplifiers and 45 volts for the detector. A higher amplifier plate voltage may cause the set to oscillate and will seriously affect the tone quality. A lower detector plate voltage will reduce the efficiency of the receiver. On battery eliminators not equipped to supply 67½ volts, the use of a potentiometer in excess of 18,000 ohms resistance is recommended. The General Radio Potentiometer No. 371 (18,000 ohms) is suggested for this purpose. Connection should be made across the +45 and the +90 (+Det. and +Ampl.) taps of the eliminator, with the contact arm connected to the 67½ volt lead of the cable. Using a high resistance voltmeter of the proper scale reading and connected across the —B and the contact arm, adjust the voltage to 67½ volts.

The Philco units AB-6562B (60 cycle) and AB-6522B (25 cycle) are equipped to supply 67½ volts on the +Ampl. tap and 45 volts on the +Det. tap. When using any other Philco unit, the small cartridge resistance should be replaced with a similar cartridge resistance of 50,000 ohms.

Battery cable colors.

A+6V	Yellow.
A—	Black with yellow tracer.
B— C+ Ground	Green with red and blue tracers.
B+Det.	45V Maroon.
B+Amp.	67V Maroon and red.
B+Pwr.	135V Red.
C—Pwr.	9V Black with green tracer.



Battery Cable Diagram

Victor Model 7-11

Victor Model 7-26

VICTOR RADIOLA 18

(Used in Models 7-11 and 7-26)

The Victor Radiola 18, used in combination with the Models 7-11 and 7-26, is a six tube power operated, tuned radio frequency receiver of the antenna type, similar in design to the Radiola 17 used in the Model 7-25. Three stages of radio frequency amplification are used with the Radiotrons UX-226, a detector with the UY-227, and two stages of audio amplification with the UX-226 in the first stage and the UX-171-A in the second. The Radiola is designed for operation on 105 to 125 volts, 50 to 60 cycles, alternating current, and consumes approximately 40 watts. It is also available with a special power unit for operation on 105 to 125 volts, 25 to 40 cycles.

The Radiola used in the 7-26 differs slightly from that of the 7-11 in that it has a terminal strip of three connectors at the left end of the set when facing the front. Two of these are connected to the primary of the first audio frequency transformer, one to the tapped portion and the other to the end. The third terminal is connected to the UY-227 plate resistor.

The socket power unit used in the 7-11 is the SPU 30, and differs from that of the 7-26, which uses the SPU 34, only in its greater length of A. C. power supply cable.

CONTROLS

1. POWER SWITCH—This switch mounted on the radio panel controls the alternating current power input to the socket power unit. Should it be necessary to remove the switch from the Radiola panel or the socket power unit from the base panel, the power plug should first be disconnected from the instrument. Remove the screws in the base of the SPU; remove the switch from the Radiola panel by taking off the knob and escutcheon and unscrewing the nut which holds the switch to the panel.

2. STATION SELECTOR—The three tuning condensers are controlled from the station selector knob which operates the drive mechanism. Any slack in the condenser drive cable can be taken up by tightening the adjusting screw shown in Fig. 2.

3. VOLUME CONTROL—The volume control is connected in the antenna circuit. The control knob operates the volume control contact arm. A loose contact at this point may often be a cause of noisy reception or no reception. If such a condition is found, the control arm should be bent until it makes a firm contact against the resistance strip.

4. VOLTAGE SWITCH—This two position switch s own in Fig. 5 is connected in the primary circuit of the power transformer in the socket power unit, and serves to compensate for high and low voltage in the power supply. *The proper setting of the switch at the time of installation is important and will effect the operation of the Radiola as well as the life of the Radiotrons.*

The switch is locked in position for operation on 120 volts when the instrument leaves the factory. The power line voltage should be measured with an A. C. voltmeter of the proper scale reading. If the voltage is above 115 volts, this position need not be changed. If the voltage is 115 volts or lower, loosen the two screws at each end of the terminal strip shield, and lift the shield clear of the switch. Place the switch in the 110 volt position, and replace the shield.

GENERAL TESTS

In making the Radiotron tests and the radio set tests described below, the use of a Weston Radio Set Tester Type 537 or 519 is recommended. The radio set tests can be made with a high resistance voltmeter of reliable manufacture such as the Weston Model 489, if the Radio Set Tester is not available. All voltage readings listed in this bulletin were made with the Weston Radio Set Tester Type 519, having a 0-8, 0-200 volt scale (high resistance type); with a line voltage of 110 volts; with the voltage switch of the socket power unit in the 110 volt position; and with all tubes in place. Readings will vary according to the meter used, the line voltage, and the condition of the tubes.

In making these tests, a period of approximately 45 seconds must elapse each time the power is turned on. This interval is required for the UY-227 to heat properly.

1. RADIOTRON TESTS—The tests for the Radiotrons should be made in accordance with the instructions furnished with the Radio Set Tester. Do not attempt to make a filament voltage reading unless the Type 537 tester is used. A special adaptor is available from the Weston Electrical Instrument Co. for use in testing the UY-227 Radiotrons. Any Radiotrons which have been found to be defective in these tests should be replaced.

If the Weston Radio Set Tester is not available, each Radiotron should be replaced successively with a new one of the proper type, so that the poor ones can be located and permanently replaced.

2. RADIOLA SOCKET TESTS—Make the grid and plate tests according to the instructions furnished with the radio set tester. Any open circuits or defects in the various voltage supplies can be found by these tests. *Before looking for such defects in the wiring of the radio set, (1) examine the cable terminals at the socket power unit terminal strip and note that all terminals are making proper contact and are properly spaced; and (2) make the socket power unit tests described in subject No. 3.*

The socket power unit must not be operated at any time with the cable disconnected, nor with all the Radiotrons removed from their sockets.

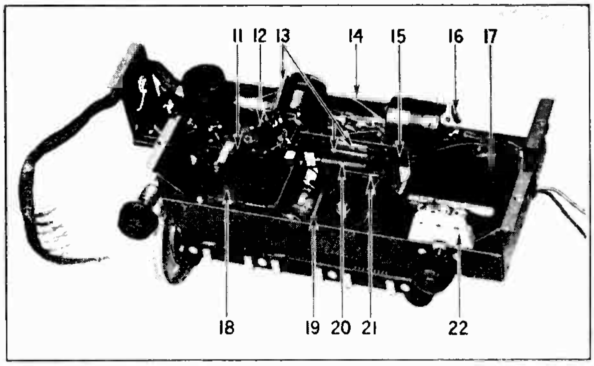


Fig. 3—Bottom View of Radiola

A. FILAMENT TESTS—Trouble in the filament circuit of the radio set can be traced to:

a. Broken wire in cable.
b. Poor or shorted contact on terminal strip.
c. Poor socket contacts.
d. Defective power unit.

B. GRID TESTS—Using the "C" position of the Weston Radio Set Tester, or the high scale of the separate voltmeter, test the "C" voltage in all sockets except the detector.

The "C" voltage readings listed below were made at a line voltage of 110 volts, with the voltage switch of the socket power unit in the 110 volt position and with all tubes in place. These readings will vary with different tubes, different meters, and different line voltages. In addition to the faults listed below, a defective power unit may cause a variation from the normal readings.

Normal	Faulty	Fault
G1 9 volts	0	Open volume control, poor contact, or broken wire.
G2 9 "	0	Open 1st R. F. transformer secondary, or broken wire.
G3 9 "	0	Open 2nd R. F. transformer secondary, or broken wire.
G5 9 "	0	Open 1st audio transformer secondary, or broken wire.
G6 29 "	0	Open 2nd audio transformer secondary, or broken wire.

C. PLATE TESTS—

a. USING WESTON RADIO SET TESTER—Using the "B" scale, test the plate voltages in the various sockets with the tubes in place. These readings will also vary with different tubes, and different line voltages. A defective power unit may cause variations from these readings.

NOTE: In the 7-26 the transfer switch must be placed in the "Radio" position before the readings can be taken.

Normal	Faulty	Fault
P1 136 volts	0	Open primary of first R. F. transformer or broken wire.
P2 136 "	0	Open primary of second R. F. transformer open concentrated coil (mounted inside of R. F. transformer) or broken wire.
P3 135 "	0	Open primary of third R. F. transformer, open concentrated coil or broken wire.
P4 48 "	0	Open primary of first audio transformer, open resistor 19, shorted condenser 18, Fig. 3, or broken wire. In 7-26—break in wiring to transfer switch, poor contact in transfer switch, or poor contact at terminal strip of three connectors.
P5 130 "	0	Open primary of second audio transformer or broken wire.
P6 144 "	0	Broken wire.

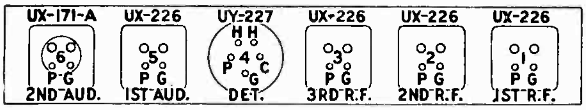


Fig. 1—Top Front View of Radio Tube Sockets

b. USING SEPARATE VOLTMETER—Connect the low voltage scale of the meter in series with a 4½ volt "C" battery and make the continuity tests as outlined below.

(1) Turn the power switch to the left to the off position.
(2) Test between either filament contact of socket No. 1 and the plate "P" contact. (See Fig. 1).
(3) Make the same tests for all the other amplifier sockets.
(4) When testing the detector socket, place the leads in the "C" and the "P" contacts.

An open circuit in the "B" supply of the power unit in addition to the points listed below will be indicated in this test by a zero reading of the meter.

SOCKET	FAULT
1	Open primary first R. F. transformer or broken wire.
2	Open primary second R. F. transformer, open concentrated coil (mounted inside R. F. transformer) or broken wire.
3	Open primary third R. F. transformer, open concentrated coil or broken wire.
4	Open primary first audio transformer, open resistor 19, shorted condenser 18, Fig. 3, or broken wire. In 7-26—break in wiring to transfer switch, poor contact in transfer switch, or poor contact at terminal strip of three connectors.
5	Open primary second audio transformer or broken wire.
6	Broken wire.

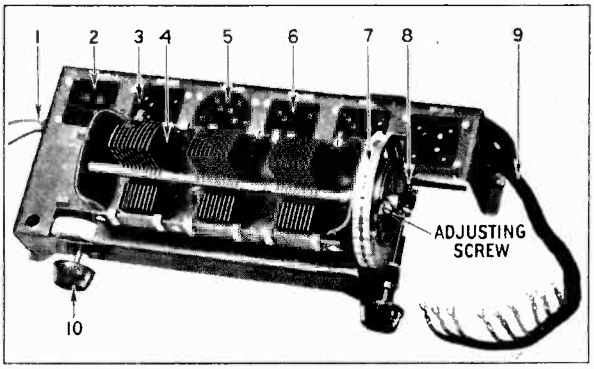


Fig. 2—Top View of Radiola

3. POWER UNIT TESTS—Remove the terminal strip shield from the socket power unit, and make the following voltage tests before looking for trouble in the radio set.

A. FILAMENT SUPPLY—Test the filament voltage across each of the three pairs of filament binding posts shown in Fig. 4, using either the Weston Type 537 Tester or a separate A. C. voltmeter of the proper scale reading. The following are the correct meter readings which should be obtained:

UX-226	1.5 Volts A. C.
UY-227	2.25 Volts A. C
UX-171-A	5.0 Volts A. C

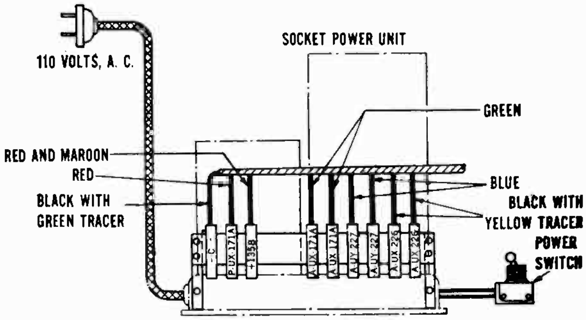


Fig. 4—Socket Power Unit Terminals

A lack of filament voltage at the terminals may be caused by:

a. Poor socket contact at A. C. outlet or in A. C. power supply line.
b. Broken wires or connection in A. C. power supply or in power unit wiring.
c. Defective power transformer No. 24, Fig. 5.

B. PLATE SUPPLY—Using the high range voltmeter binding posts of the set tester or the high range scale of the separate D. C. voltmeter, test between one of the A-UX-226 terminals and the +135B terminal (see Fig. 4), and between one of the A-UX-171-A terminals and the P-UX-171-A. The following are the approximate readings which should be obtained.

+135-B	136 Volts
P-UX-171-A	160 Volts

A lack of voltage at either of these points may be caused by:

a. Burnt out or low emission UX-280.
b. Poor socket contact in power supply line.
c. Broken wires or connections in power supply or in power unit wiring.
d. Open resistor unit No.33, Fig.6, or No.34 for "+135 B" only
e. Shorted condenser unit No. 25, Fig. 5.
f. Open choke No. 23, Fig. 5.

If the trouble has not been located in the cable or in the socket power unit, refer back to the list of possible faults in subject No. 2, and isolate the defect in the wiring or connections of the radio set.

4. SPECIAL TESTS—

A. EXCESSIVE HUM—Excessive hum may be caused by:

a. Reversed polarity of power plug. Remove plug and reverse the position of the prongs.
b. Low emission Radiotron UX-280.
c. Shorted Condenser 18, Fig. 3.
d. Open ground connection to frame of Radiola.
e. Defective resistor unit 33, Fig. 6.

B. AUDIO HOWL—This condition can often be eliminated by:

a. Replacing the detector Radiotron UY-227 with a new one.
b. Interchanging the UX-226 Radiotrons.
c. Adjusting compensating condenser, as shown in Fig. 7, by means of the neutralizing screw driver shown in Fig. 2 of Supplement to Victor Service Bulletin No. 5-A. The following procedure should be used:

(1) Break the paper seal over the opening in the bottom of the tuning condenser assembly.
(2) Tune the Radiola to a broadcasting station on the lower wave lengths.
(3) Turn the volume control all the way to the right.
(4) Turn the condenser screw in a clockwise direction until the receiver goes into oscillation.
(5) Turn the screw slightly in a counter-clockwise direction until the oscillation stops and the howl is eliminated.
(6) Replace the paper seal to prevent tampering with the adjustment.

C. CONDENSER TESTS—If the trouble has not yet been located, connect a 4½ volt "C" battery in series with the low voltage binding posts of the radio set tester or the separate voltmeter, and proceed as follows:

a. Turn the power switch to the left—(off).
b. Test between the stator (stationary) plates and rotor (rotating) plates of each tuning condenser. No deflection of the meter will indicate that there is a broken or loose connection between the condensers and their respective coils, or open circuits in the coils.
c. Turn the station selector knob, observing if any of the plates touch while they are being rotated. A short circuit in these condensers will cause a lack of reception.

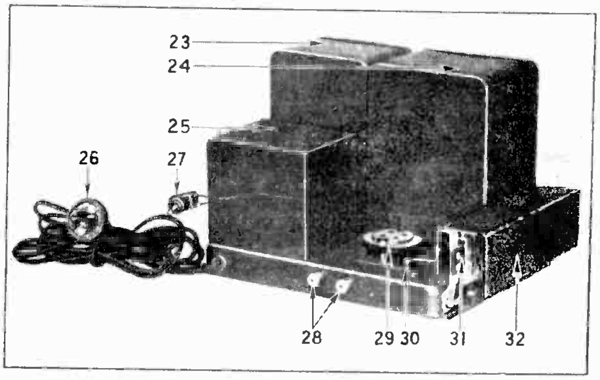


Fig. 5—Top of Socket Power Unit

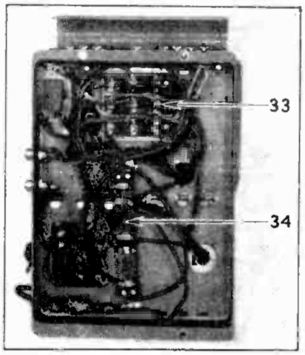


Fig. 6—Bottom of Socket Power Unit

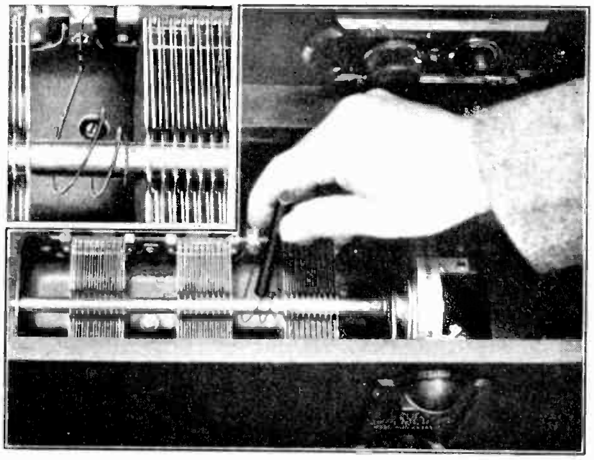


Fig. 7—Method of Adjusting Compensating Condenser

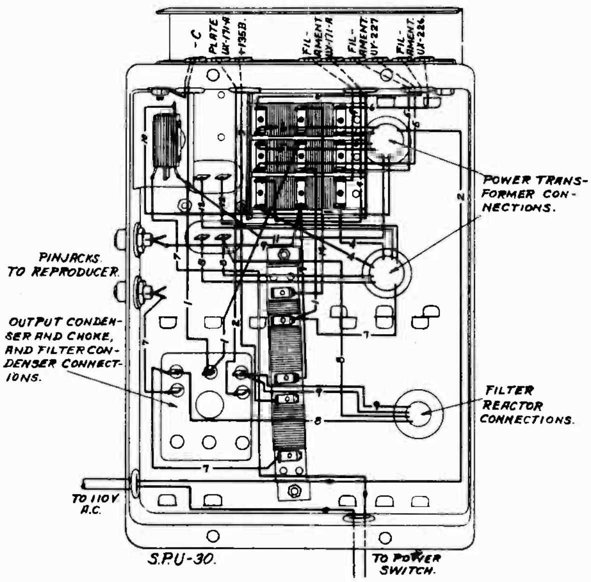
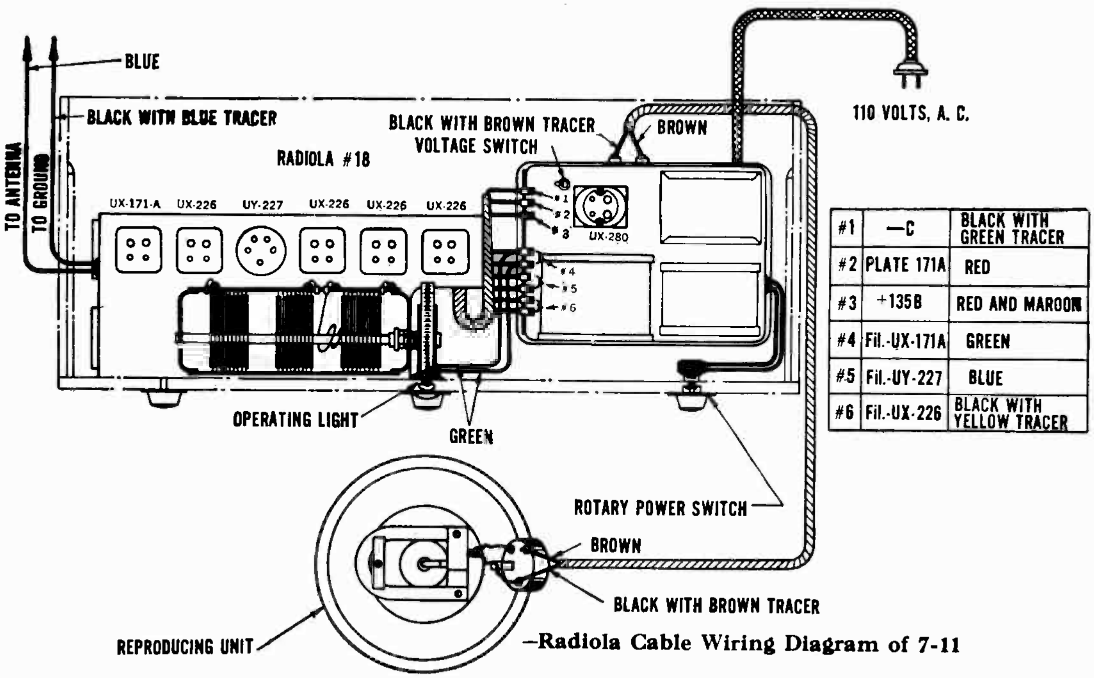


Fig. 8—Bottom of Socket Power Unit Showing Wiring Between Terminals

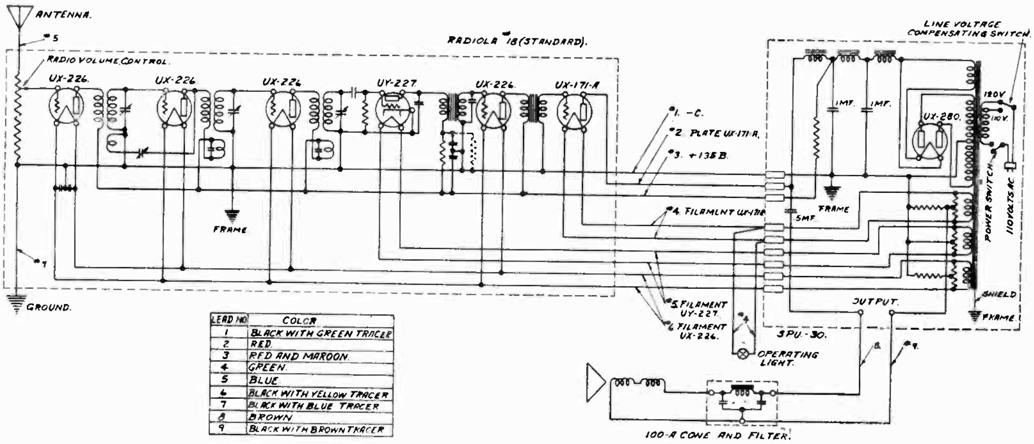
COLOR CODE WIRING OF SPU 30 AND 34

1. Black with green tracer.
2. Red.
3. Red and maroon.
4. Green.
5. Blue.
6. Black with yellow tracer.
7. Black.
8. Yellow.
9. Maroon.
10. Black with red tracer.
11. Red and black.
12. Brown.
13. Red with green tracer.
14. Green with red tracer.



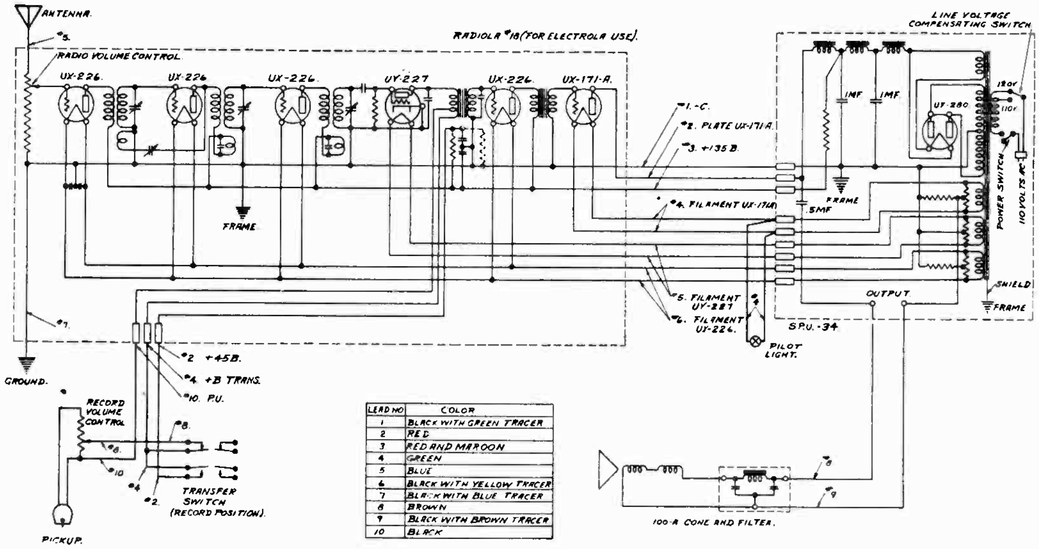
#1	—C	BLACK WITH GREEN TRACER
#2	PLATE 171A	RED
#3	+135B	RED AND MAROON
#4	Fil.-UX-171A	GREEN
#5	Fil.-UY-227	BLUE
#6	Fil.-UX-226	BLACK WITH YELLOW TRACER

–Radiola Cable Wiring Diagram of 7-11



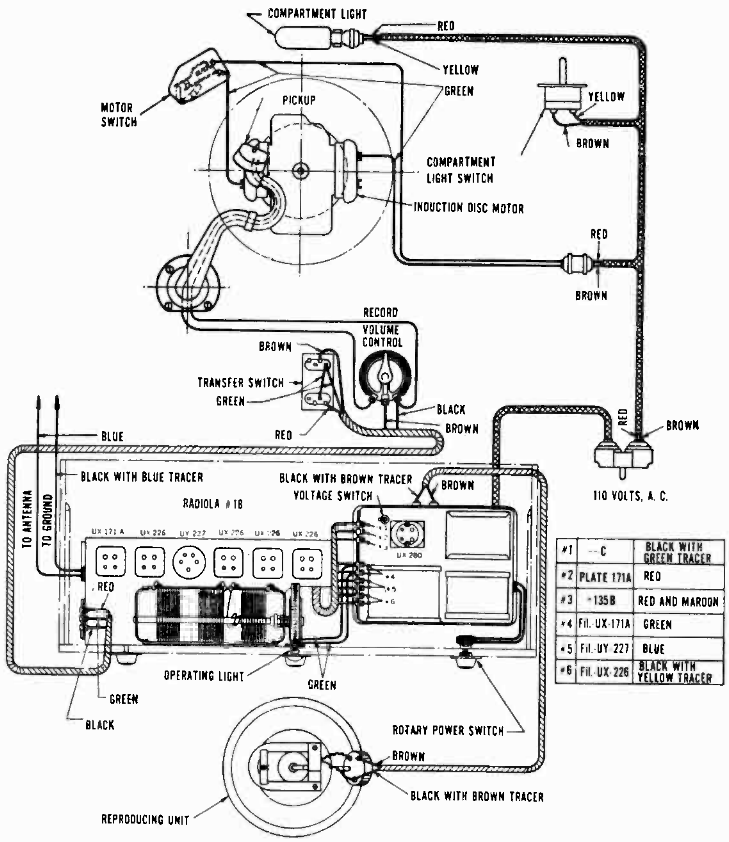
LEAD NO	COLOR
1	BLACK WITH GREEN TRACER
2	RED.
3	RED AND MAROON.
4	GREEN.
5	BLUE
6	BLACK WITH YELLOW TRACER
7	BLACK WITH BLUE TRACER
8	BROWN
9	BLACK WITH BROWN TRACER

Wiring Diagram Victor Radiola 18
(Used in 7-11)

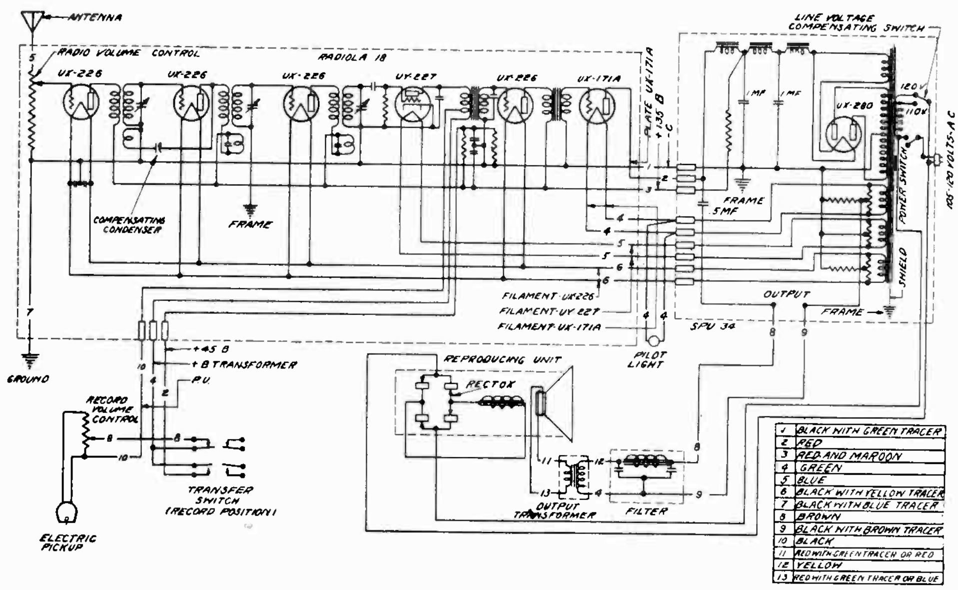


LEAD NO	COLOR
1	BLACK WITH GREEN TRACER
2	RED
3	RED AND MAROON
4	GREEN
5	BLUE
6	BLACK WITH YELLOW TRACER
7	BLACK WITH BLUE TRACER
8	BROWN
9	BLACK WITH BROWN TRACER
10	BLACK

Wiring Diagram Electrola Radiola 7-26



-Cable Wiring Diagram Electrola Radiola No. 7-26



Wiring Diagram Electrola Radiola 7-26 Above Serial No. 12000

Victor Model 7–25

VICTOR RADIOLA 17
(As Used in Model 7-25)

The Radiola used in combination with the Orthophonic Victrola in the Model 7-25 is a six tube tuned radio frequency receiver of the antenna type, employing three stages of radio frequency amplification, a detector, and two stages of audio frequency amplification. The UX-171-A power tube is used in the last stage of audio amplification; the UX-226 tubes in all the other amplifier stages; and the UY-227 in the detector.

A snap switch controlling the 110 volt input power to the socket power unit is mounted on the front of the Radiola panel. When removing the radio set from the cabinet, it is first necessary to remove this switch which is held to the escutcheon with a small ring. The switch can be readily removed by unscrewing the ring.

A two position switch in the primary circuit of the power transformer in the socket power unit serves to compensate for high and low voltage in the power supply. The switch should be placed in the 120 volt position when the power line voltage is above 115 volts and in the 110 volt position when the voltage is 115 or lower.

When servicing the installation, make the preliminary tests described in subjects 1, 2, 3, and 4, below before assuming that the trouble lies in the set. In making these tests a period of approximately 45 seconds must elapse each time the power switch is turned on. This interval is required for the Radiotron UY-227 to heat properly.

1. RADIOTRON TESTS—In making the Radiotron tests, and the radio set tests described later, the

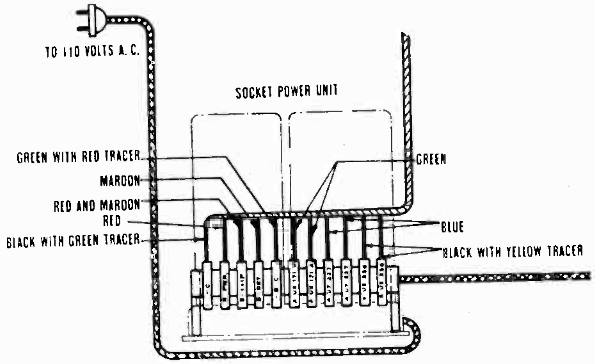


Fig. 1

use of a Weston Radio Set Tester Type 519 is recommended. The radio set tests, however, can be made with a high resistance voltmeter of reliable manufacture such as the Weston Model No. 489. All voltage readings listed in this bulletin were made with a Weston Radio Set Tester, Type 519, having a 0–8, 0–200 volt scale (high resistance type) with a line voltage of 110 volts; with the voltage switch of the socket power unit in the 110 volt position, and with all tubes in place. Readings will vary according to the meter used, the line voltage, and the condition of the tubes. Readings with the 0–150 volt meter will be lower than those listed because of the lower meter resistance.

The tests for the Amplifier Radiotrons should be made in accordance with the instructions furnished with the Radio Set Tester. Do not attempt to make a filament voltage setting. A special adaptor will be made available by the Weston Electrical Instrument Co. for use in connection with the Weston Radio Set Tester for testing the UY-227 Radiotrons.

Any Radiotrons which have been found to be defective in these tests, should be replaced.

If the Weston Radio Set Tester is not available, each Radiotron should be replaced successively with a new one of the proper type, so that the poor ones can be located and permanently replaced.

2. INTERCHANGING RADIOTRONS—Changing the Radiotrons UX-226 in their respective sockets will often improve reception. *Never place the UX-171-A Radiotron in any socket but the one to the extreme left. Never place a UX-226 Radiotron in the UX-171-A socket as the higher filament voltage would burn out the UX-226 Radiotron.*

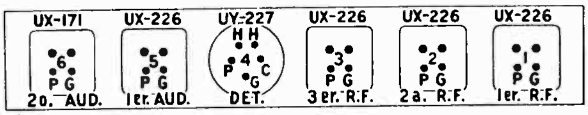


FIG. 2. TOP FRONT VIEW OF RADIO TUBE SOCKETS.

3. CABLE TESTS—Examine the cable terminals at the socket power unit terminal strip and on the radio set. Be sure that all of these terminals are making proper contact and are properly spaced.

4. TESTING SOCKET POWER UNIT—Using the high range voltmeter binding posts of the Set Tester or the high range scale of the separate voltmeter.

a. Test between the −B+C terminal and B+ Det. and B+ Ampl. terminals (See Fig. 1).

b. Test between either of the A UX-171-A terminals and B+ Pwr. for the UX-171-A plate voltage. The following are the approximate readings which should be obtained:

B+ Det.	50 Volts
B+ Ampl.	155 "
B+ Pwr.	160 "

c. A lack of voltage at any of these points may be caused by:
   (1) Broken wires or connections.
   (2) Open resistor unit, No. 34, Fig. 6.
   (3) Shorted condenser unit, No. 26, Fig. 5.
   (4) Open choke, No. 25, Fig. 5..
   (5) Burnt out UX-280 filament.

d. If the readings vary radically from those given above, the Radiotron UX-280 should be replaced.

e. If the filaments in the radio set fail to light, refer to Fig. 1 and check the various filament terminals of the socket power unit in the following manner:
   (1) Remove the pilot lamp from its socket.
   (2) Make temporary connections to the two terminals of the lamp with two wires about one foot long.
   (3) Test the filament power supply by touching the pair of wires across each separate pair of *filament* terminals on the power unit terminal strip; that is, across the two UX-171-A terminals, the two UX-226 terminals, and the two UY-227 terminals.

NOTE:—The UX-226 and UY-227 will not illuminate the lamp as brightly as the UX-171-A.

5. TESTING RADIOLA PANEL—If the trouble has not been located in the socket power unit or in the tubes, make the following tests to localize the trouble in the set itself.

a. FILAMENT TESTS—Assuming that filament voltage is present at the socket power unit terminal strip, trouble in the filament circuit of the radio set can be traced to:

(1) Broken wire in cable.
(2) Poor or shorted contact on radio terminal strip.
(3) Broken filament leads from radio terminal strip to socket contacts.
(4) Poor socket contacts.

b. GRID TESTS—Snap the power switch to the "on" position. Using the "C" position of the Weston Radio Set Tester, or the high scale of the separate voltmeter, test the "C" voltage in all sockets except the detector.

The following "C" voltage readings were made at a line voltage of 110 volts, with the voltage switch of the socket power unit in the 110 volt position and with all tubes in place. These readings will vary with different tubes, different meters, and different line voltages.

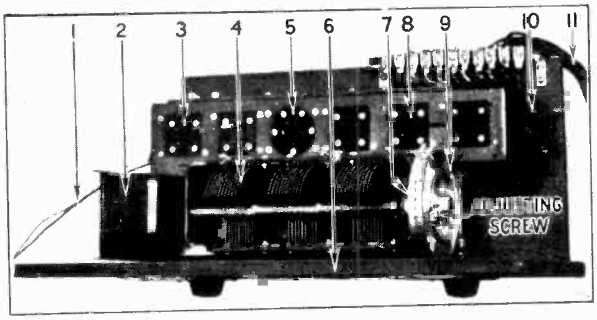


Fig. 3

Normal	Faulty	Fault
G1 10 volts	0	Open volume control, poor contact, or broken wire.
G2 10 "	0	Open grid resistor 12, Fig. 4. Open 1st R. F. transformer secondary, or broken wire.
G3 10 "	0	Open grid resistor 13, Fig. 4. Open 2nd R F. transformer secondary, or broken wire.
G5 10 "	0	Open 1st audio transformer secondary, or broken wire.
G6 28 "	0	Open 2nd audio transformer secondary, or broken wire.

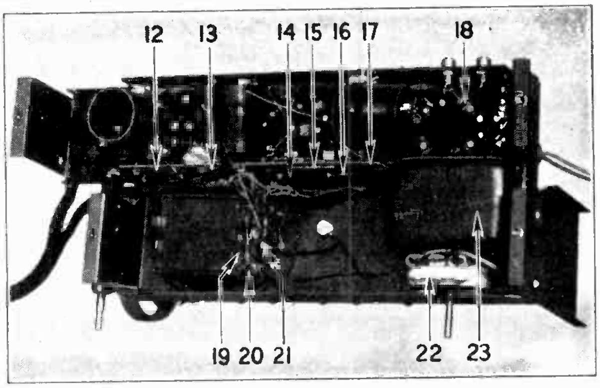


Fig. 4

c. PLATE TESTS WITH WESTON RADIO SET TESTER—Using the "B" scale of the Set Tester, test the plate voltages in the various sockets with the tubes in place. These readings will also vary with different tubes, and different line voltages.

Normal	Faulty	Fault
P1 155 volts	0	Open primary of 1st R. F. transformer or broken wire.
P2 155 "	0	Open primary of 2nd R. F. transformer or broken wire.
P3 155 "	0	Open primary of 3rd R. F. transformer or broken wire.
P4 150 "	0	Open primary of 1st audio transformer or broken wire.
P6 150 "	0	Open primary of 2nd audio transformer or broken wire.
P6 145 "	0	Open primary of output transformer or broken wire.

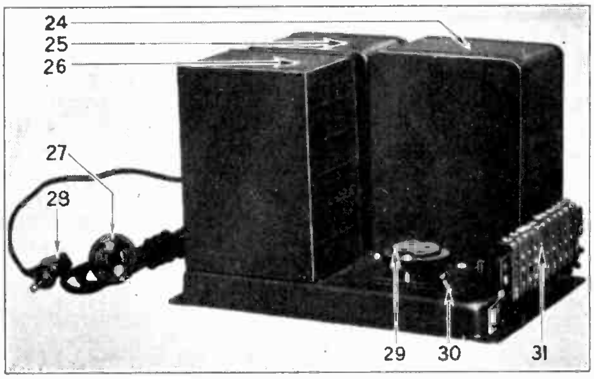


Fig. 5

PLATE TESTS WITH SEPARATE VOLTMETER—When using the separate voltmeter for the plate tests, the low voltage scale of the meter should be connected in series with a 4½ volt "C" battery.

(1) Snap the power switch to the "off" position.
(2) Test between either filament contact of socket No. 1 and the plate "P" contact. (See Fig. 2).
(3) Make the same tests for all the other amplifier sockets.
(4) When testing the detector socket, place the leads in the "C" and the "P" contacts.
(5) Assuming that voltage was present at the radio terminal strip, a lack of voltage in the sockets can be traced to:

Socket	Fault
1	Open primary 1st R. F. transformer or broken wire.
2	Open primary 2nd R. F. transformer or broken wire.
3	Open primary 3rd R. F. transformer or broken wire.
4	Open primary 1st A. F. transformer or broken wire.
5	Open primary 2nd A. F. transformer or broken wire.
6	Open primary output transformer or broken wire.

NOTE:—A shorted condenser, either 19 or 20, Fig. 4, will cause a lack of plate voltage.

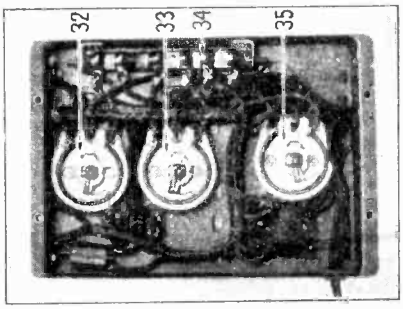


Fig. 6

6. CONDENSER TESTS—If the trouble has not yet been located, connect a 4½ volt "C" battery in series with the low voltage binding posts of the Radio Set Tester or the separate voltmeter, and proceed as follows:

a. Disconnect the cable from the socket power unit terminal strip.

b. Test between the stator (stationary) plates and rotor (rotating) plates of each tuning condenser. No deflection of the meter will indicate that there is a broken or loose connection between the condensers and their respective coils or open circuits in the coils themselves.

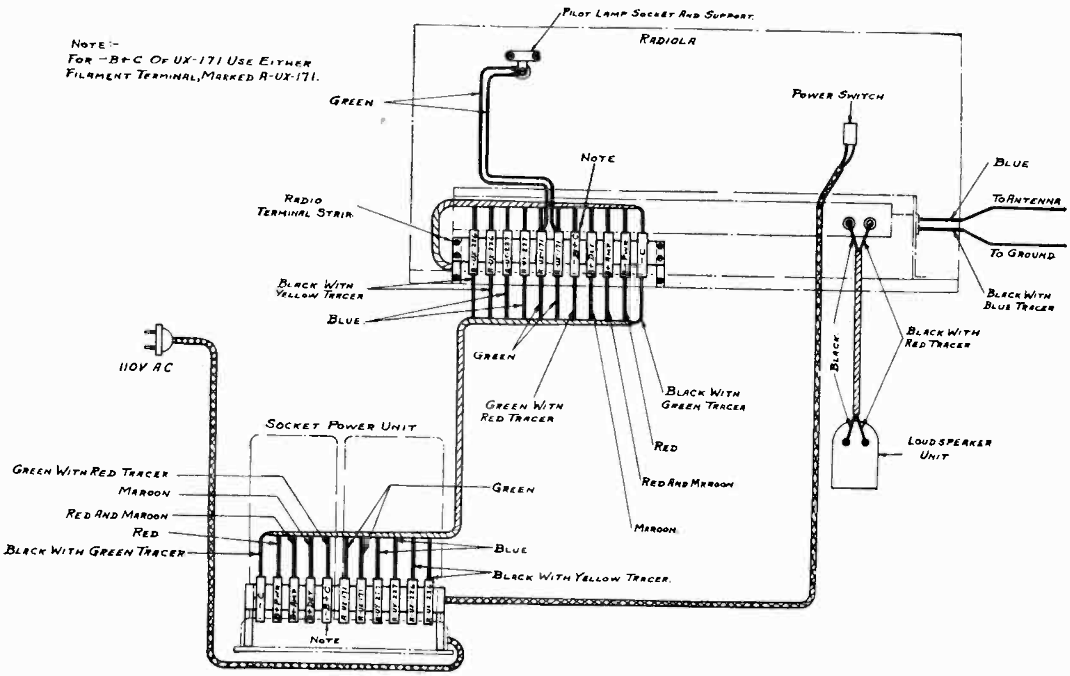
c. Check all condensers to see that the rotor plates do not touch the stator plates as the Station Selector is being turned.

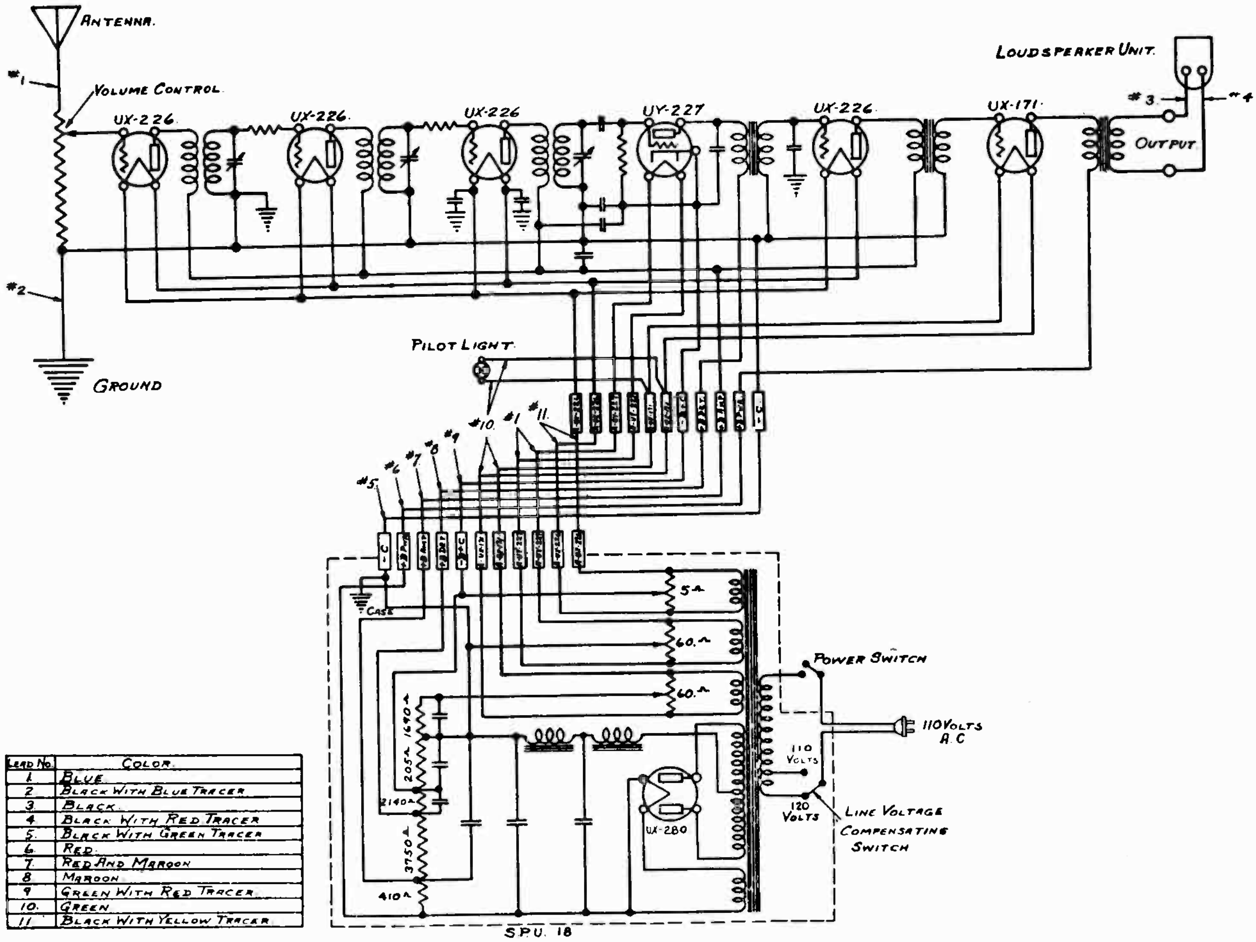
d. Re-connect the cable to the socket power unit.

GENERAL

1. ADJUSTMENT OF CONDENSER DRIVE CABLE—Any slack in the condenser drive cable can be taken up by tightening the adjusting screw shown in Fig. 3.

2. LOOSE VOLUME CONTROL CONTACT—A loose volume control contact may often be a cause of noisy reception or no reception. If such a condition is found, the contact arm should be bent until it makes a firm contact against the resistance strip.

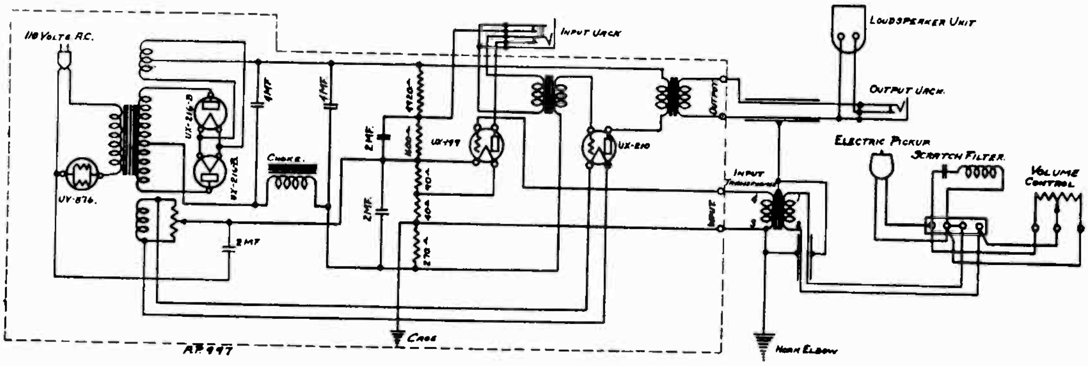




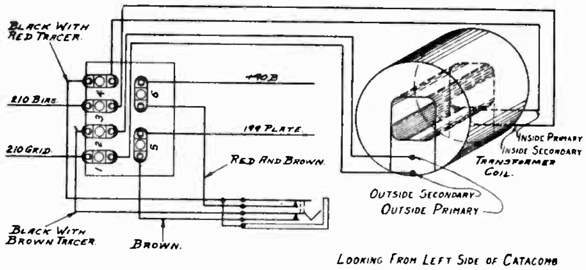
LEAD No.	COLOR
1	BLUE
2	BLACK WITH BLUE TRACER
3	BLACK
4	BLACK WITH RED TRACER
5	BLACK WITH GREEN TRACER
6	RED
7	RED AND MAROON
8	MAROON
9	GREEN WITH RED TRACER
10	GREEN
11	BLACK WITH YELLOW TRACER

Wiring Diagram for Victor Radiola 17
(As Used in Model 7–25)

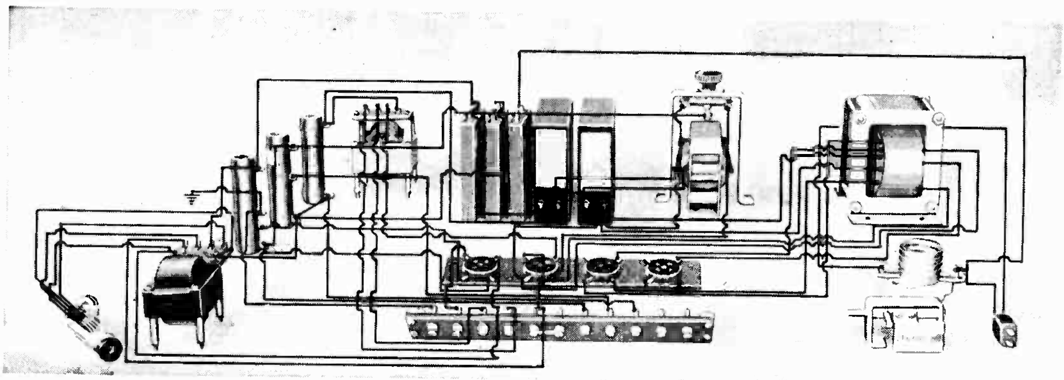
Victor Model VE-8-60



Wiring Diagram for Electrola 8-60



8-60 Input Transformer Wiring



Parts and Wiring of Power-Amplifier Unit AP 997 (RPA 5 Special)
(Used in 8-60)

SERVICING

Below is a summary of the most common points on the Power Unit which will require service from time to time. CAUTION should be observed while working on this Unit to have the alternating current supply cut off.

DO NOT IMMEDIATELY CONCLUDE THAT THE TROUBLE IS IN THE TOMCAT UNTIL BOTH THE TUBES IN THE TOMCAT AND THE RADIO SET HAVE BEEN THOROUGHLY TESTED AS A DEFECTIVE TUBE AT ANY POINT WILL EFFECT ALL VOLTAGE READINGS.

1. Either one of the 216B rectifier tubes may be defective. This will be noticed by low voltage in tube sockets, low volume, failure of Set to operate or a difference in plate temperature of tubes.

2. One of filaments in ballast tube may be burnt out in which case Victrola or Set will not operate. This defect can be very easily detected because the remaining half of the filament burns very bright. The 216B and the UX210 filaments will burn correspondingly low.

3. The UX210 may be burnt out or of low emission in which case the voltage at the tube sockets will be O. K., but the output will be low or no production whatever.

4. It is well in all cases to remove the AC Plug from the Tomcat, open the safety switch and check to see that all connections are tightened properly.

If the above does not correct the trouble, the following is a more comprehensive test and if followed, should permit of locating and correcting any and all faults which may show up in this equipment.

We will assume that none of the tubes light in the Radio Set or Power Unit. To locate this trouble, the steps are:

1. Check monitor lamp in turntable compartment. If monitor lamp does not light also is an indication of an open in the alternating current line. Note:—On the Hyperion, the toggle switch controls this lamp, while on the Borgia II, the toggle switch controls only the supply to the Tomcat, the lamp being controlled automatically by raising and lowering the lid.

2. Next check to see if motor will run.

(a) If motor runs, disconnect alternating current plug from alternating current supply socket.

b) Short circuit toggle control switch on motor board.

(c) Replace AC plug in socket. If this rectifies trouble, replace or repair toggle switch.

(d) If this does not complete the AC supply, remove the short on the switch and proceed.

(e) Check for broken or loose connections or a defective cable between where the AC feed for the Power Unit taps on to the main feed and the female plug at the Tomcat.

If all the previous tests have been made correctly, the trouble will be found in making the last test.

3. If motor does not run nor the tubes light:

(a) Check AC supply socket either with a motor or a test lamp.

(b) If this checks O. K. examine AC plug on end of cord for broken or loose connections.

(c) If this checks O. K., test between motor plug and plug at current supply for broken or loose connections or an open cable.

If previous tests were carried out properly trouble will be ocated at this point.

4. If motor runs and pilot lamp lights in turntable compartment but the Tomcat tubes do not light:

(a) Check voltage in Tomcat female socket.

(b) If no voltage at this point, trouble lies in broken or loose connections or in the cable itself between this point and the toggle switch on the motor board.

(c) If voltage is O. K. at this point and ballast lamp does not light the trouble may be:

Firstly—A defective ballast lamp.

Secondly—A defective UP591 resistor.

Thirdly—If both of the above are O. K. the trouble is in the Tomcat in which case same should be removed and a new one installed in its stead.

Fourthly—The above test will also hold good on the 216B and the UX210, namely, if these tubes do not light, even after spares have been tried in the various sockets, the trouble is in the Tomcat.

5. It might be well to mention here that the UP591 resistor serves a double purpose:

(a) To close the AC circuit through the ballast tube

(b) To shunt a resistance in the direct current circuit to maintain a constant B Battery voltage.

While it is possible or the resistor to be functioning properly in the AC circuit allowing the ballast tube to light, it still may be open or short circuited as far as the DC resistance is concerned, in which case the following will be noted in the results both on Victrola and Radio:

(a) If the resistance is short circuited, there will be no B Battery voltage.

(b) If the resistance is open, the B Battery voltage will be higher than it should be.

6. Assuming that all tubes light in the Tomcat, and Radio Set is equipped with tested tubes and the volume on either record or Radio is low:

(a) Check tube voltage on Set.

(b) If voltages are low, it will be found that one of the 216B rectifying tubes need replacing. If this does not rectify trouble, remove AC plug from Tomcat, open safety lock, lift hinged cover and check all connections to see that they are properly tightened in Tomcat.

It might be well to mention here that if the plates of the rectifying tubes become red hot, one or both of the filter condensers has become short-circuited, in which event it will be necessary to replace the Tomcat. In this case, there will be no output voltage to the pick-up or to the Radio Set.

(c) If the voltages check O. K., the UX210 power amplifying tube should be replaced.

(d) If volume still is low, place set switch on Radio, tune in station and check with earphones or external loud speaker in last stage jack.

e) If volume is greater than received through the horn on the Set, the loud speaking unit is defective and should be replaced with a new one or adjusted.

(f) If volume still is low, repeat the test only using the first stage jack. If the broadcast comes in as strong or stronger than on the second stage jack, the trouble is in the Tomcat.

(g) If the volume is very low at this point, it would be well to check the receiving set. (The test for this will be taken up under separate cover.)

7. Another cause for non-operation of Victrola and Radio. even though all the Tomcat tubes light, will be found in the ballast tube. This tube has two filaments in parallel and will still light even though one of the filaments is burnt out. The one filament will pass enough current to light the tubes, but the capacity will be so low that it will not operate the Set. This condition of the ballast tube is readily discernable as the one remaining filament will light much brighter and the other tubes in the Tomcat will have less brilliancy.

8. If the change-over switch on the front of the Radio panel is in the Radio position and the Set operates properly, but when it is thrown to record or electric pick-up fails to operate, the trouble is in:

(a) The volume control.

(b) Connections leading from the volume control.

(c) The resistance mounted on the frame of the Radio Set which takes care of the filament voltage drop when using the electric pick-up.

(d) The connections leading from this point (1st audio) can be checked: if open, tube will not light, or tube may be shorted or burnt out.

(e) Pick-up may not be making contact.

(f) Pick-up may be defective.

All tests mentioned herein include continuity tests of cables between the various points. The tubes operate in series and are shunted by resistance, so if any tube is removed, it changes not only the voltage in that socket, but the voltage on all remaining tubes and sockets, although no injury can happen to the tubes.

ELECTRIC PICK-UP

The electric pick-up is the introduction of an electrical method of sound reproduction.

The pick-up is mainly composed of three major parts:

1st. The permanent magnet.
2nd. A small generating coil.
3rd. The vibrating armature on the end of which is the needle holder.

The generating coil, both ends of which run to the volume control, is placed in the center of the permanent magnet which causes a constant flow of magnetic lines of force through the coil. In order to generate current in the coil it is necessary to vary the magnetic field, so, in order to accomplish this, the vibrating armature is placed in the center of the coil with a needle inserted in the needle holder. As the needle vibrates back and forth along the grooves in the record the density of the magnetic field is changed correspondingly generating pulsating electric current which corresponds to sound waves of music. The advantage of this method of reproduction is that these electrical pulsations can be amplified many times by means of radio amplifying tubes.

When these pulsations have passed through the amplifying tubes they are then carried to the speaker unit where they set in motion its diaphragm thus generating sound waves in the air.

These sound waves may be generated in large volume by use of a large diaphragm such as the cone or, if a small diaphragm is used, may be amplified by use of a horn.

Another advantage of this method of reproduction is the ease with which volume of sound may be varied by the volume control which varies the amount of amplification of the electrical pulsations before delivery to the amplifying tubes.

The following data covers the servicing of the pick-up unit

1st. Place the pick-up on the tone arm of the machine, turn on the tubes and have the machine in readiness to play a record.

2nd. Tap the needle lightly with your finger, first on one side and then on the other. Each time you touch the needle there should be a loud click through the speaker.

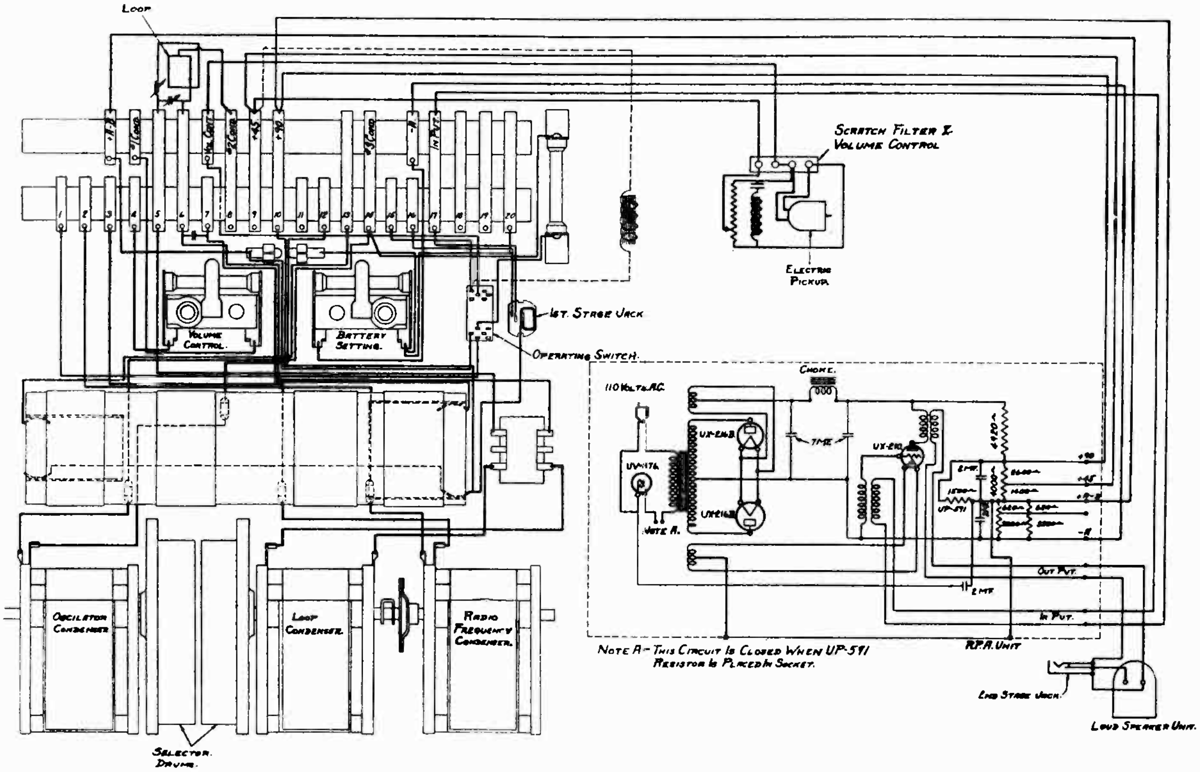
(A) If the click is louder when striking the needle on one side than it is on the other, the electric pick-up is out of adjustment. To determine this, remove the metal case from the pick-up and note whether the vibrating armature which is operated by the needle is directly in the center between the two pole pieces of the magnet. If the vibrating armature is off center remove the holding clamp from the magnet allowing further accessibility to the working parts. You will then see two knurled nuts locked in place by ordinary nuts. By loosening the lock nuts you can adjust the knurled nuts until the vibrating armature is again in the center of the pole pieces.

(B) If there is no click at all in the loud speaker, put a record on the turntable start the motor, put the electric pick-up in place and let the record play.

(a) Take a pair of ear phones, place the tips across the two connections of the volume control to which the leads run from the pick-up. You should hear the record playing with very low volume.

(b) If there isn't sound at this point, remove the pick-up wires from the volume control and check for open circuit from this point through the pick-up. (NOTE:—Occasionally the contacts in the tone arm are not springing into position properly.)

Victor Model 9–2 (Borgia II)



Wiring Diagram for Borgia II

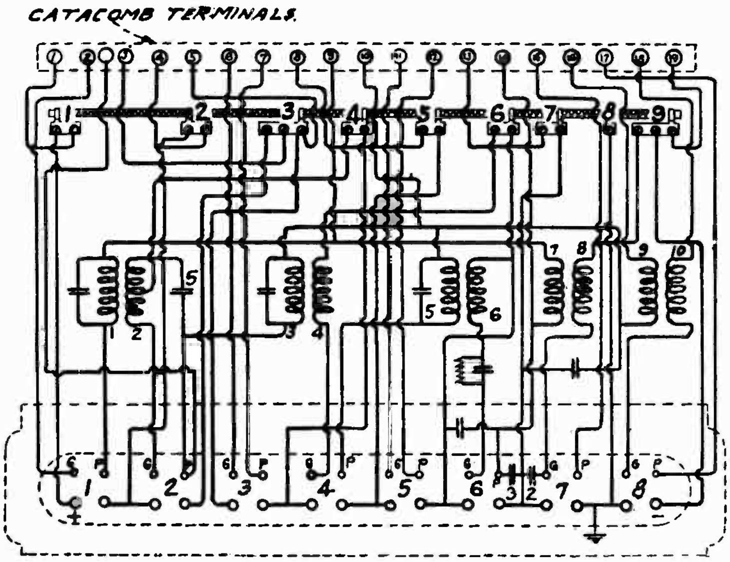


Fig. 6—Internal Wiring Diagram of Catacomb

PICKUP AND AMPLIFIER SAME AS MODEL 8—60

VICTOR RADIOLA 28

(AC Operated)

The Radiola used in combination with the Electrola in models Borgia II (9-2), Hyperion (15-1), 9-40, 9-25 and 9-55, is an eight tube superheterodyne receiver, employing a loop antenna for signal pickup and obtaining its D. C. operating current from an A. C. source through a rectifier-power-amplifier device.

Figure 1 shows in diagramatic form the sequence of tubes in the circuit, and the paths followed by the various currents which are denoted as follows:

.... Incoming Frequency
-------- Oscillator Frequency
.-.-.-.-.- Intermediate Frequency
———— Audio Frequency

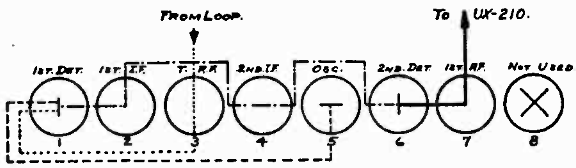


Fig. 1—Radiotron Sequence

(Borgia II reversed end for end)

If the difficulty encountered does not render the radio entirely inoperative the cause of the trouble and its remedy will be found under Sections 24 to 32 of this bulletin. Otherwise the following procedure should serve to isolate the cause of the trouble.

1. Remove back panel and note whether or not the tubes in the power-amplifier unit are lit, and that the ballast tube is operating correctly as indicated by considerable heat dissipation.

2. Should all Radiotrons and Rectrons fail to operate, look for:

a. House lighting current not on or loose connection at outlet.

b. Defective UP-591 resistor.

c. Burnt out filaments of ballast tube or poor contact in socket.

d. Operating switch not making contact.

3. If the ballast tube glows excessively but other Radiotrons and Rectrons light below normal brilliancy, trouble may be due to an open filament in the ballast tube which has two parallel filaments.

4. If the plates of both Rectrons heat excessively, trouble may be caused by a shorted 4 or 7 Mfd. filter condenser in the power-amplifier unit, but if the plate of only one Rectron turns red hot, this Rectron is carrying part of the load of the other Rectron which is defective.

5. Should the plate of the UX-210 turn white hot look for an open resistor or shorted 2 Mfd. condenser in the power-amplifier unit.

6. In making the following tests of circuits, tubes and voltages, a Weston Radio Set Tester, Type 519 or equivalent is essential. It should be noted that when the tester is plugged into any of the catacomb sockets with the transfer switch in the radio position it is necessary to have a tube in each of the other six sockets and one in the tester in order to obtain correct readings. It might be well also to mention here that these tests were made using the

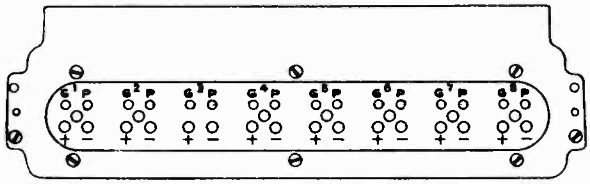


Fig. 2—Top of Catacomb

low resistance type of 519 tester. In the cases of the plate circuit and grid circuit tests, sections 11, 12, 17 and 18, the readings obtained may be slightly higher than those given if the high resistance tester is used.

7. With the transfer switch in the record position, plug the tester in which a good Radiotron has been inserted, into No. 7 socket and check A, B and C voltages, noting the following:

8. "A" voltage less than 2.9 with battery setting at 10 will indicate:

a. Shorted 20 Mfd. condenser unit.

b. Poor contacts in transfer switch.

c. Loose connection at power-amplifier unit terminal board or radio panel terminal strip.

d. Open in section 8 of resistance strip. (See Fig. 3.)

e. Defective Rectron or ballast tube.

f. Resistance strip not properly tightened to catacomb.

g. Open filter choke in power-amplifier unit or broken connections to speaker field if moving coil type speaker or six inch cone are used.

h. Open 220 ohm filament resistor (located on frame of radio panel).

9. "A" voltage in excess of 3.3 with battery setting at 0 will indicate:*

a. Open in section 7 of resistance strip. (See Fig. 3.)

b. If high A voltage is accompanied by no B voltage reading the trouble may be caused by a shorted 2 Mfd. condenser in the power-amplifier unit, shorted unit in condenser bank or a shorted resistor in UP-591.
* Ample time should be allowed for the ballast tube to heat properly before concluding that filament voltage is excessive.

10. No "B" voltage will indicate:

a. Refer to section 9 (b).

b. Loose connection at power-amplifier unit terminal board or radio panel terminal strip.

c. Poor contacts in first stage jack.

d. Open primary of input transformer in the power-amplifier unit.

11. High "B" voltage (normal approximately 85) will indicate:

a. Open resistor in UP-591. Refer to section 23 and Fig. 5.

12. No "C" voltage (normal approximately 2.5) will indicate:*

a. Resistance strip not tightened to catacomb.

b. Open transformer secondary or shorted condenser in catacomb.
* Be sure tube in test box has no grid to filament short.

13. After making the above tests, check all Radiotrons in accordance with instructions accompanying tester, and replace any tubes found defective.

14. Insert plug connected to a pair of phones into first stage jack. If normal operation of Electrola or Radiola is noted at this point refer to section 20. Otherwise proceed as follows:

15. With transfer switch in radio position, and volume control at 10, check A, B and C voltages in all sockets, referring to Sec. 6 and to the following suggestions and tables.

16. If filament voltage is 0 in all sockets the transfer switch will probably be found to be making poor contact. Low filament voltage in one socket accompanied by abnormally high voltage in the others indicates a shorted or partially shorted section of the resistance strip. High filament voltage in one socket accompanied by insufficient voltage in the others indicates an open section in the resistance strip. If the defect is noted in No. 2 socket the trouble may be in the volume control, which should be carefully examined for possible short circuit or open circuit. It may be found that the arm does not travel to the end of the resistor when the pointer is advanced to 10 in which case full voltage cannot be obtained in No. 2 socket.

17. Plate Circuit Tests.

Socket No.	Approx. Value	Fault
1	24	Open transformer primary in catacomb.
2	66	Open transformer primary in catacomb.
3	70	Open in primary of R. F. coil or broken connection.
4	72	Open transformer primary in catacomb.
5	74	Open in Oscillator Coil or broken connection.
6	32	Open transformer primary in catacomb, shorted condenser in catacomb, or shorted condenser in condenser bank.
7		Refer to section 10.

18. Grid Circuit Tests.

The following is a list of faults indicated by 0 readings.

Socket No.	Approx Value	Fault (See note (a)
1	3	Open in secondary of R. F. coil.
2	3	Open transformer secondary in catacomb.
3	3	Open loop or broken connection.
4	3	Open transformer secondary in catacomb.
5	3	Open in grid coil of oscillator coil or broken connection.
6	0	See note (b).
7		Refer to section 12.

Note (a) A zero grid reading may also be caused by the resistance strip not being properly tightened to catacomb, or a shorted section in the A. C. strip.

Note (b) A slight reading will be obtained through the grid leak if the high resistance type of test box is used. A reversed deflection of the meter will indicate a shorted grid condenser.

19. Using the voltmeter of the tester in series with a battery of suitable voltage and a pair of test leads, test across each tuning condenser. If no reading is obtained in thus testing any one tuning circuit, examine condenser pig tails for possible broken connection and all connections between condenser and coil or between condenser and loop, if the loop circuit is the one at fault.

20. If, after making the foregoing tests, the instrument is still inoperative but normal operation is obtained in a pair of phones plugged into the first audio jack, the following tests should be made, with the same equipment as specified in section 19, making certain first that the power supply plug has been disconnected.

Test from plate of UX-210 socket to filament of either Rectron socket. No deflection on the meter will indicate an open primary in the output transformer or in the event that a moving coil speaker or a six inch cone is used—an open choke in the fuzz filter. Test from grid to filament of UX-210 socket. If no deflection is noted the trouble may be caused by an open secondary of the input transformer or a loose contact between the moving arm and the resistor of the hum control potentiometer.

Remove cable comb from the power-amplifier unit and test between the two terminals on the unit marked "output." No reading here will indicate an open secondary in the output transformer. Test between the two terminals on the cable comb which connect to the output terminals. If no reading is obtained look for open winding in loudspeaker unit or poor contacts in output jack.

21. Resistance Strip Values—Fig. 3, illustrates the two types of filament resistance strips mounted on the catacombs of the A. C. operated models. On recent production section No. 2 of this strip has

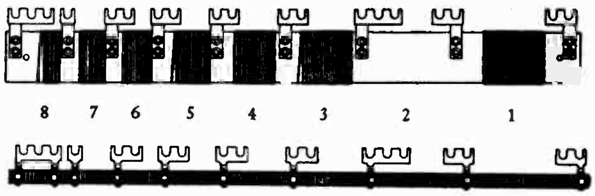


Fig. 3—A. C. Strip

been left open. This has been compensated for by lowering the resistance of the volume control rheostat which is shunted across section No. 2 of the resistance strip. When replacing volume control resistors in models Borgia II and Hyperion it is advisable to use the new type resistors. It is then necessary to cut the No. 2 winding in order to provide correct filament voltage regulation in socket No. 2.

	Borgia II and Hyperion		9-40, 9-25 and 9-55	
Sec.	Lower Limit	Upper Limit	Lower Limit	Upper Limit
1	185	195	260	282
2	360	420	Open (See note)	
3	159	167	230	243
4	151	159	191	203
5	126	134	173	191
6	117	123	143	163
7	112	118	137	154
8	45	55	45	55

Note:—In the early 9-40 model which has the 20,000 ohm volume control this section has a resistance of 240 to 260 ohms.

22. Resistance Strip Test.

If a resistance bridge is not available, the values of the various sections of the resistance strip can be checked by the voltmeter—ammeter method, a circuit diagram of which is shown in Fig. 4. The resistance may be calculated using Ohm's law by dividing the voltage by the current reading. If the current is taken in milliamperes it is necessary to multiply the result by 1,000 to get the resistance value in ohms.

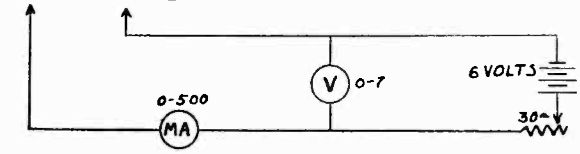


Fig. 4—Wiring Diagram for Resistance Measurement

23. UP-591 Test.

The same method of resistance measurement shown in Fig. 4 can also be used to check the resistance of the UP-591 resistor except that a 45 volt battery and suitable voltmeter will be required. The resistance of the UP-591 resistor should be approximately 1,500 ohms.

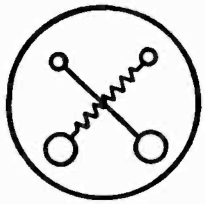


Fig. 5—Bottom View of UP-591 Base Showing Internal Connections

24. Excessive Hum.

In models 9-40, 9-25 and 9-55 provisions have been made to minimize the hum audible from the loud speaker by means of a potentiometer, the knob of which is located on the top of the power-amplifier unit. This knob should be turned in either direction until the hum is at a minimum.

25. Loose Rheostat or Volume Control Contacts.

The resistance cartridges in the Battery Setting and Volume Control rheostats will sometimes become dirty or oxidized, which will cause a grating noise in the loud speaker whenever these controls are turned. The resistance wire on the cartridges should be brightened with a fine grade of sand paper to provide better contact with the contact arm.

In some cases it may be necessary to loosen the set screw holding the contact arm to the shaft and to adjust the arm to obtain greater pressure on the resistor, after which the set screw may be retightened.

26. Acoustic Howl.

This is caused by the microphonic action of the UX-199 Radiotrons in the catacomb. The second detector (No. 6) and the first audio (No. 7) tubes, are the most critical to this condition and should be replaced or interchanged with the other Radiotrons having less microphonic tendencies.

27. Blasting.

Blasting is usually caused by an improperly adjusted speaker or a low emission Radiotron UX-210.

28. Distortion.

A low emission UX-210 may cause distortion. This Radiotron can sometimes be reactivated by operating the power-amplifier unit for a period of ten minutes with the two Rectrons removed

Distortion may originate in a leaky 2 Mfd. condenser which is connected between the primary of the power transformer and the +A —B terminal in the power-amplifier unit. This condenser may be checked by temporarily disconnecting it and operating the Radiola noting if distortion ceases. Under no condition should this condenser be left out permanently.

29. Fluttering.

Fluttering is a loud hum having a 60 cycle base and occurs at the resonant point when manipulating the dial drums. An audio choke which has been added to the circuit to prevent this may have become open or disconnected. To test this choke for continuity it is necessary to first disconnect it from the circuit.

This choke is located inside the radio panel in the Hyperion, beneath the radio panel in the Borgia II either in the power-amplifier unit or in the back of the cabinet in model 9-40.

30. If volume drops after Radiola has been in operation for several minutes.

This condition is usually caused by a defective Radiotron UV-876 or UV-886. This Radiotron after having been in use for considerable time, may develop a tendency to increase its resistance when heated sufficiently to cause a drop in signal strength of the Radiola.

Diminishing of volume of this nature, which will occur on any signals received, should not be confused with "fading" of certain distant stations, which is due to atmospheric conditions, and transmission characteristics.

31. Lack of Sensitivity.

If the Radiola seems to have lost its ability for distant reception, the cause of which could not be ascribed to unfavorable weather conditions, etc., the loop compensating condenser may be out of adjustment. A description of the necessary apparatus and the procedure for checking and correcting this adjustment will be found in Service Bulletin No 18.

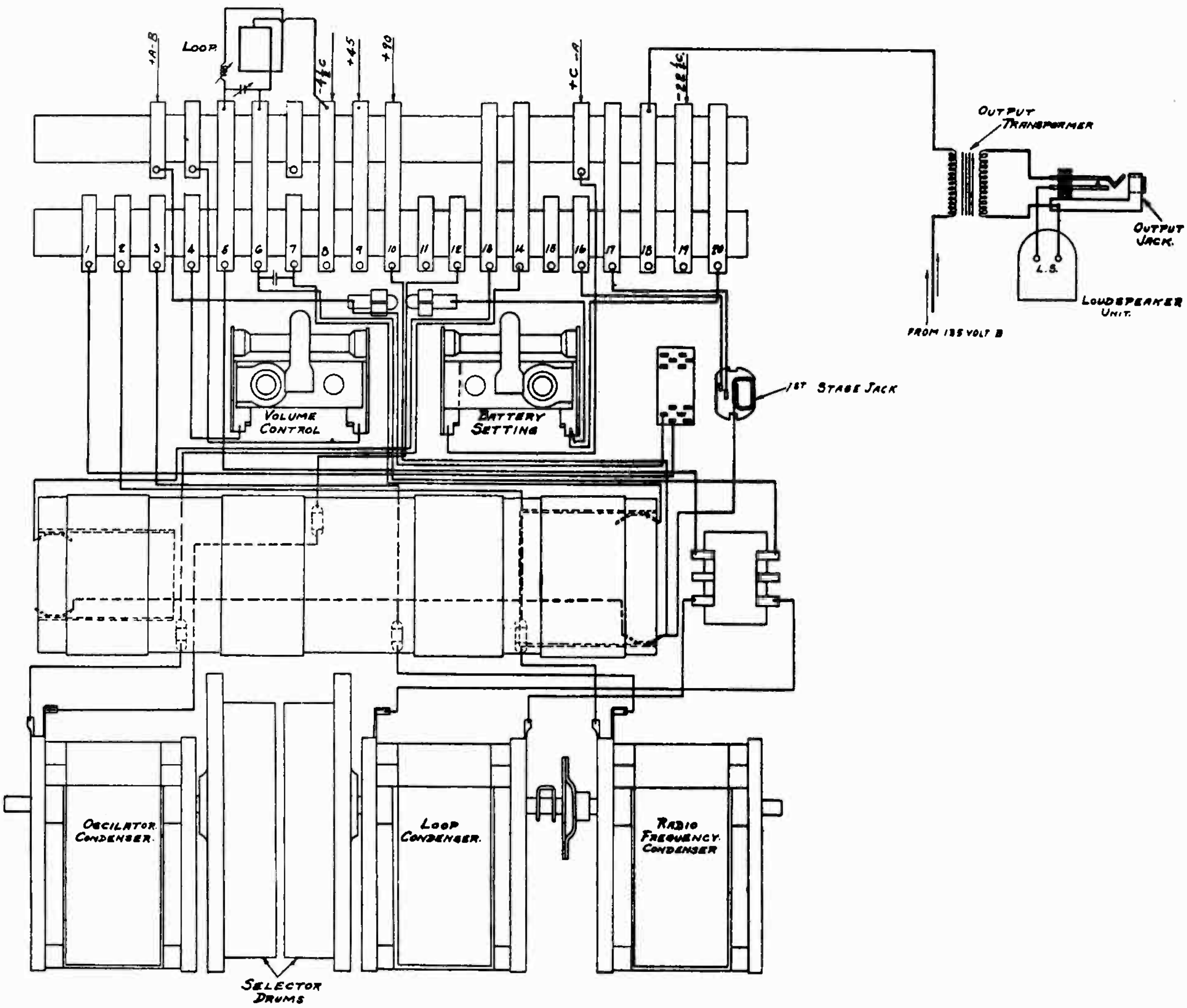
32. Oscillation.

It is important not to confuse with oscillation —"Heterodyning," which occurs only when tuning in certain stations and which sometimes can be eliminated by tuning to the "lower peak" with the right hand dial drum. Oscillation can sometimes be eliminated by interchanging the Radiotron in No. 3 socket with the other Radiotrons in the catacomb. In some cases it may be found that the R. F. neutralizing condenser is disconnected, defective or out of adjustment. In models 9-2 and 15-1 this is a fixed condenser mounted on the terminal strip of the catacomb, and if defective must be replaced. In the later models, however, it is a small condenser mounted beneath the panel and its capacity may be varied by means of an insulated screw driver. In few cases will it be necessary to make any adjustment of this condenser.

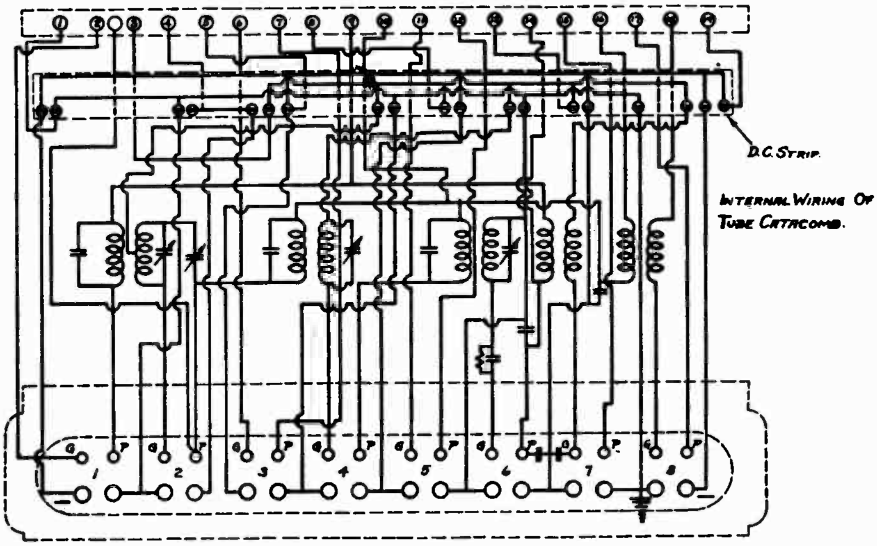
In some cases a type of oscillation commonly called "parasitics" will be present, and cannot be eliminated by adjusting the neutralizing condenser or by replacing the catacomb. It can usually be eliminated, however, by placing a small cartridge type neutralizing condenser or other small capacity across catacomb terminals 7 and 10 (see Fig. 6).

Oscillation may also be due to the neutralizing condenser in the catacomb being out of adjustment, in which case it will be necessary to replace the catacomb.

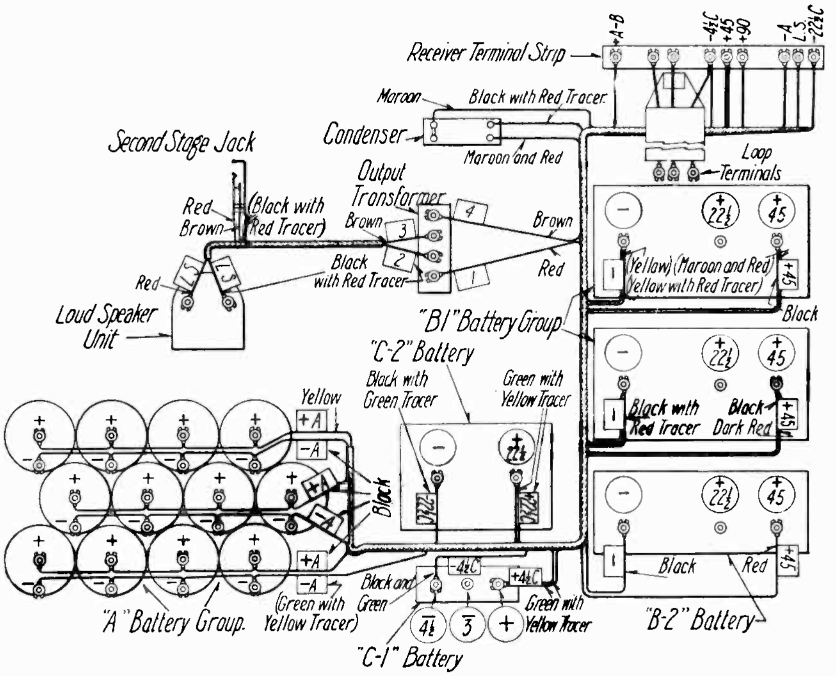
Victor Model 9–3 (Borgia I)



Panel Assembly Diagram for Borgia I

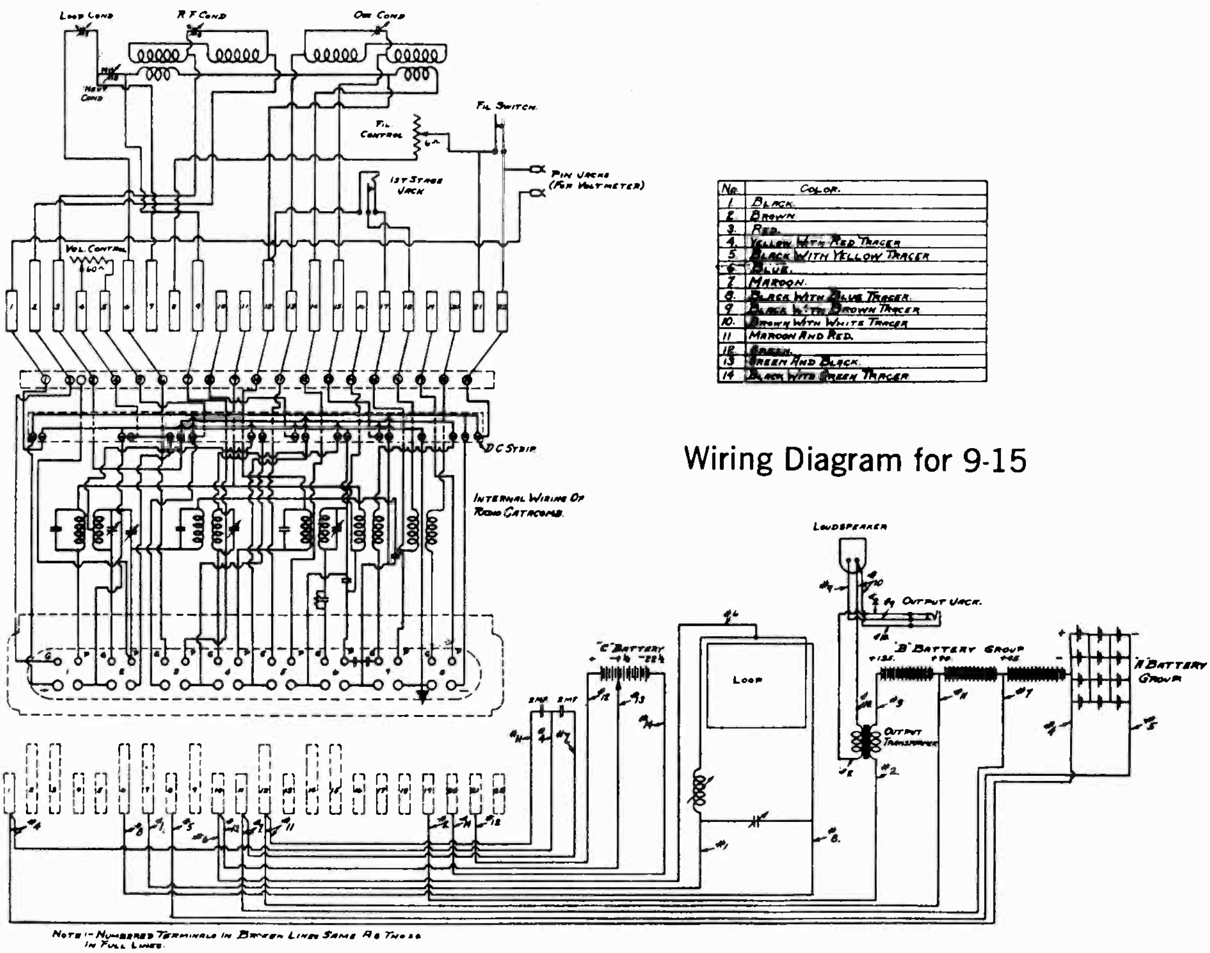


Radiola 28 Catacomb Continuity Diagram for Model 9-3



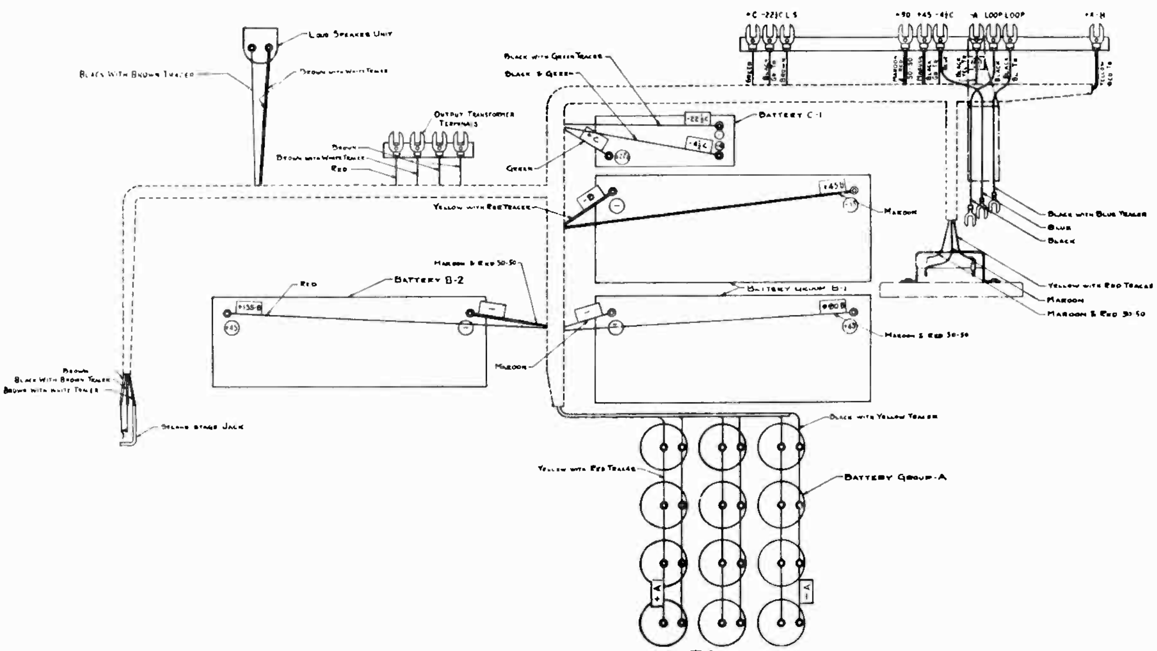
Battery Connection Diagram

Victor Model 9–15



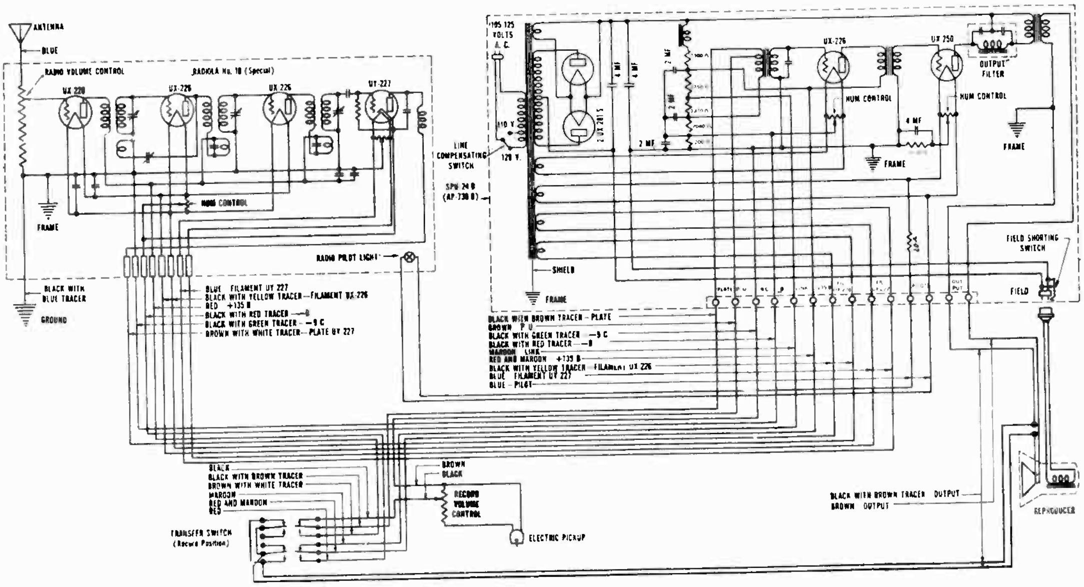
No.	Color.
1.	Black.
2.	Brown
3.	Red.
4.	Yellow With Red Tracer
5	Black With Yellow Tracer
6.	Blue.
7.	Maroon.
8.	Black With Blue Tracer.
9	Black With Brown Tracer
10.	Brown With White Tracer
11	Maroon And Red.
12.	Green.
13	Green And Black.
14	Black With Green Tracer

Wiring Diagram for 9-15

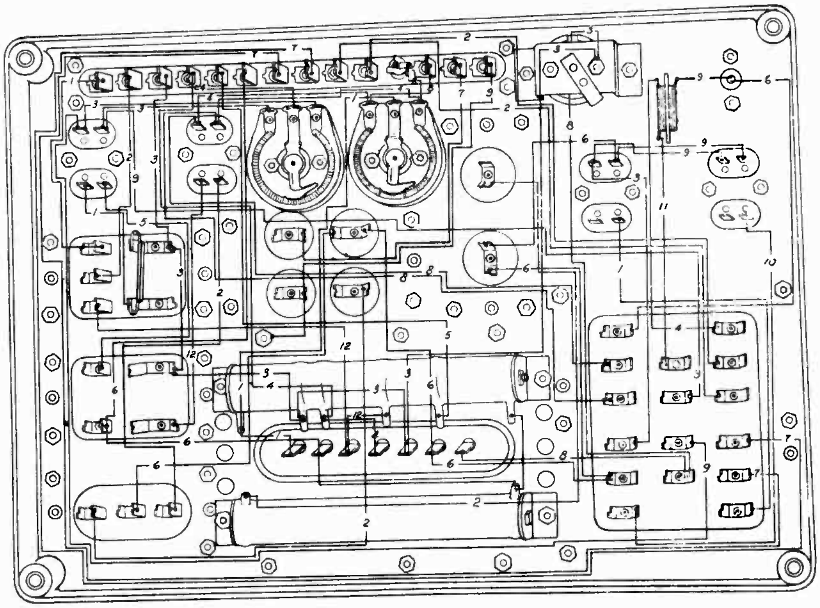


Battery Connection Diagram

Victor Model 9-16



Wiring Diagram Electrola Radiola 9-16



Color Code

1. Brown
2. Blue
3. Yellow
4. Black with Red Tracer
5. Red and Maroon
6. Red
7. Black with Yellow Tracer
8. Green
9. Black
10. Light Brown
11. Red and Black
12. Maroon

-Bottom of Power Amplifier Unit AP-736-B, showing wiring between terminals

VICTOR RADIOLA 18
Used in Model 9-16

The Victor Radiola 18 used in the model 9-16 is similar to that used in the 7-11 and the 7-26, but is modified for power-amplifier operation. Three stages of tuned radio frequency amplification are used with the Radiotrons UX-226, and a detector with the UY-227. The two stages of audio amplification are used in the power-amplifier unit, AP-736-B.

The Radiola is designed for operation on 105 to 125 volts, 50 to 60 cycles alternating current. Special equipment is available for operation on 105 to 125 volts, 25 to 40 cycles.

GENERAL TESTS

In making the Radiotron tests and the radio set tests described below, the use of a Weston Radio Set Tester Type 537 or 519 is recommended. The radio set tests can be made with a high resistance voltmeter of reliable manufacture such as the Weston Model 489, if the Radio Set Tester is not available. All voltage readings listed in this bulletin were made with the Weston Radio Set Tester Type 519, having a 0-8, 0-200 volt scale (high resistance type) with a line voltage of 110 volts; with the voltage switch of the socket power unit in the 110 volt position; and with all tubes in place. Readings will vary according to the meter used, the line voltage, and the condition of the tubes.

1. RADIOTRON TESTS—The tests for the Radiotrons should be made in accordance with the instructions furnished with the Radio Set Tester. Do not attempt to make a filament voltage reading unless the Type 537 Tester is used. A special adaptor is available from the Weston Electrical Instrument Co. for use in testing the UY-227 Radiotrons. Any Radiotrons which have been found to be defective in these tests should be replaced.

If the Weston Radio Set Tester is not available, each Radiotron should be replaced successively with a new one of the proper type, so that the poor ones can be located and permanently replaced.

A period of approximately 45 seconds must elapse each time the power switch is turned on; this interval is required for the UY-227 to heat properly.

2. RADIOLA SOCKET TESTS—Place the transfer switch in the "Radio" position and make the grid and plate tests according to the instructions furnished with the Radio Set Tester. It is important that the tests be made with all Radiotrons in position. Any open circuits or defects in the various voltage supplies can be found by these tests.

IMPORTANT—Before assuming that the trouble lies in the radio set, (1) examine the cable terminals, noting whether they are making proper contact and are properly spaced: and (2) make the terminal strip voltage tests described in Subject No. 3 below to determine whether the power-amplifier unit is delivering the proper voltages.

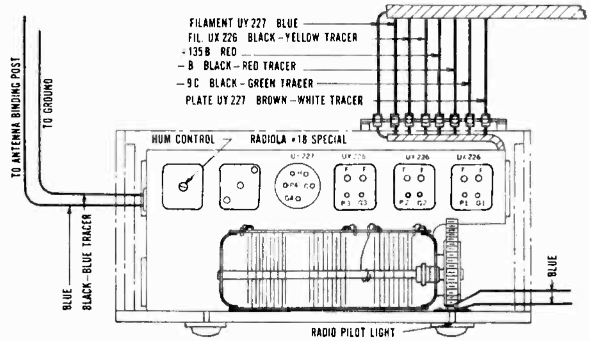


Fig. 1—Radiola Sockets and Terminal Strip

A. FILAMENT TESTS—Trouble in the filament circuit of the radio set can be traced to:

a. Broken wire in cable.
b. Poor or shorted contact on terminal strip.
c. Poor socket contacts.

B. GRID TESTS—Using the "C" position of the Weston Radio Set Tester, or the high scale of the separate voltmeter, test the "C" voltage in all sockets except the detector. When using the separate voltmeter, place the negative lead in the "G" socket contact as shown in Fig. 1, and the positive

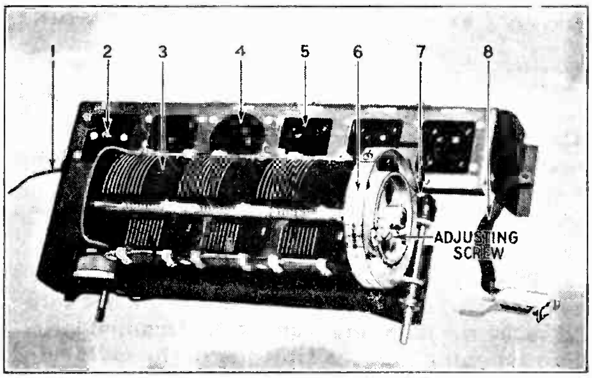


Fig. 2—Top View of Radiola

lead in either filament (F) contact. When testing the UY-227, place the positive lead in the "C" contact.

The "C" voltage readings listed below were made at a line voltage of 110 volts, with the voltage switch of the socket power unit in the 110 volt position and with all tubes in place. These readings will vary with different tubes, different meters, and different line voltages.

	Normal	Faulty	Fault
G1	9 volts	0	Open volume control, poor contact, shorted, or broken wire.
G2	9 volts	0	Open 1st R. F. transformer secondary, shorted, or broken wire.
G3	9 volts	0	Open 2nd R. F. transformer secondary, shorted, or broken wire.

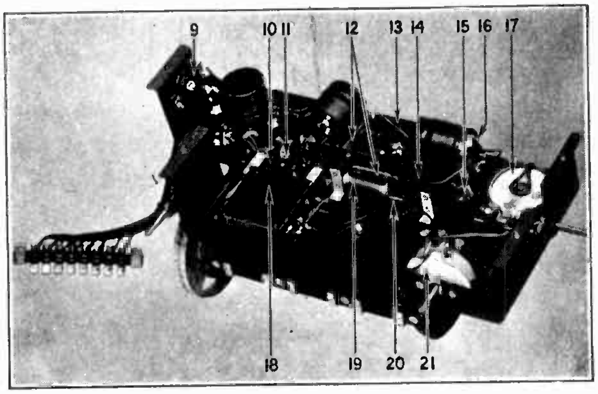


Fig. 3—Bottom View of Radiola

C. PLATE TESTS—Using the "B" scale of the Weston Radio Set Tester or the high voltage scale of the separate voltmeter, test the plate voltages in the various sockets with the tubes in place. When using the separate voltmeter, all tubes should be in place except the one under test. The positive lead of the meter should be placed in the "P" contact and the negative lead in either filament contact.

Normal	Faulty	Fault
P1 123 volts	0	Open primary of first R. F. transformer, broken, or shorted wire.
P2 122 volts	0	Open primary of second R. F. transformer, open concentrated coil (mounted inside of R. F. transformer), broken, or shorted wire.
P3 122 volts	0	Open primary of third R. F. transformer.
P4 45 volts	0	Open, or short circuit in wiring or connections between P terminal of UY-227 socket and Plate UY-227 on terminal strip) open circuit in wiring to transfer switch.

3. TERMINAL STRIP TESTS—If the voltage readings observed in the previous tests are not correct, make the following tests at the terminal strip before assuming that the fault lies in the radio set:

A. FILAMENT TESTS—Test the filament voltage across each of the two pairs of filament terminals shown in Fig. 1, using either the Weston Type 537 Tester or a separate A. C. voltmeter of the proper scale reading. The following are the correct readings which should be obtained:

UX-226	1.5 volts A. C.
UY-227	2.25 volts A. C.

A lack of filament voltage at these terminals may be caused by:

a. Poor socket contact at A. C. outlet or in A. C. power supply line.

b. Broken wires or connection in A. C. power supply or in power-amplifier unit wiring.

c. Defective power transformer in power-amplifier unit.

d. Broken wire in cable.

B. PLATE SUPPLY—Using the high range voltmeter binding posts of the Set Tester or the high range scale of the separate D. C. voltmeter, test between the —B and the +135B terminal (See Fig. 1) and between the — B and Plate UY-227 terminal. The following are the approximate readings which should be obtained:

Between —B and +135B	135 volts
Between —B and P-UY-227	45 volts

A lack of voltage at either of these points may be caused by:

a. Burnt out or low emission UX-281 in power-amplifier.

b. Poor socket contact in A. C. power supply line.

c. Poor contact at power-amplifier terminal strip, or broken wire in cable.

d. Open, or short circuit in wiring or internal parts or power-amplifier unit. (See Supplement to Service Bulletin No. 1, dated July 15, 1928.)

4. SPECIAL TESTS—

A. EXCESSIVE HUM—Excessive hum may be caused by:

a. Reversed polarity of power plug. Remove plug and reverse the position of the prongs.

b. Low emission Radiotron UX-281.

c. Hum control potentiometers out of adjustment. See card, attached to inside of Electrola back panel, or instruction book for proper method of adjustment.

d. Open ground connection to frame of Radiola.

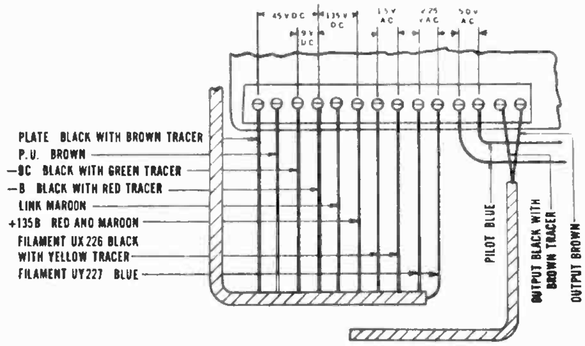
B. AUDIO HOWL—This condition should be eliminated by one or more of the following:

a. Replacing the detector Radiotron UY-227 with a new one.

b. Interchanging the UX-226 Radiotrons.

c. Adjusting compensating condenser, as shown in Fig. 4, by means of the neutralizing screw driver shown in Fig. 2 of Supplement to Service Bulletin No. 5-A. The following procedure should be used:

1. Break the paper seal over the opening in the bottom of the tuning condenser assembly.
2. Tune the Radiola to a broadcasting station on the lower wave lengths.
3. Turn the volume control all the way to the right.
4. Turn the condenser screw in a clockwise direction until the receiver goes into oscillation.



-Terminal Strip of Power Amplifier Unit AP-736-B—showing proper voltages across various terminals.

5 Turn the screw slightly in a counter-clockwise direction until the oscillation stops and the howl is eliminated.

6. Replace the paper seal to prevent tampering with the adjustment.

C. CONDENSER TESTS—If the trouble has not yet been located, connect a 4½ volt "C" battery in series with the low voltage binding posts of the Radio Set Tester or the separate voltmeter, and proceed as follows:

a. Turn the power switch to the off position.

b. Test between the stator (stationary) plates and rotor (rotating) plates of each tuning condenser. No deflection of the meter will indicate that there is a broken or loose connection between the condensers and their respective coils, or open circuits in the coils.

c. Turn the station selector knob, observing if any of the plates touch while they are being rotated. A short circuit in these condensers will cause a lack of reception.

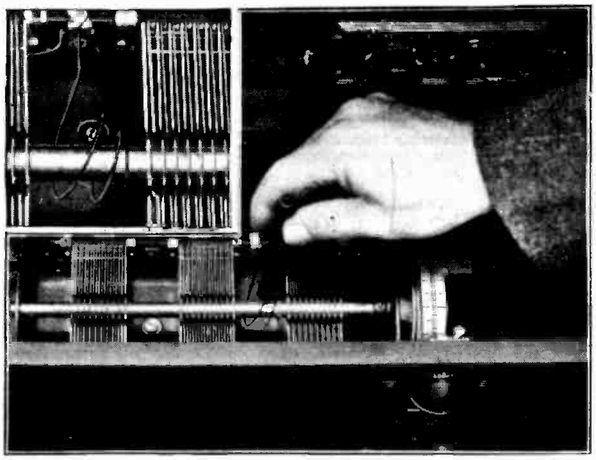
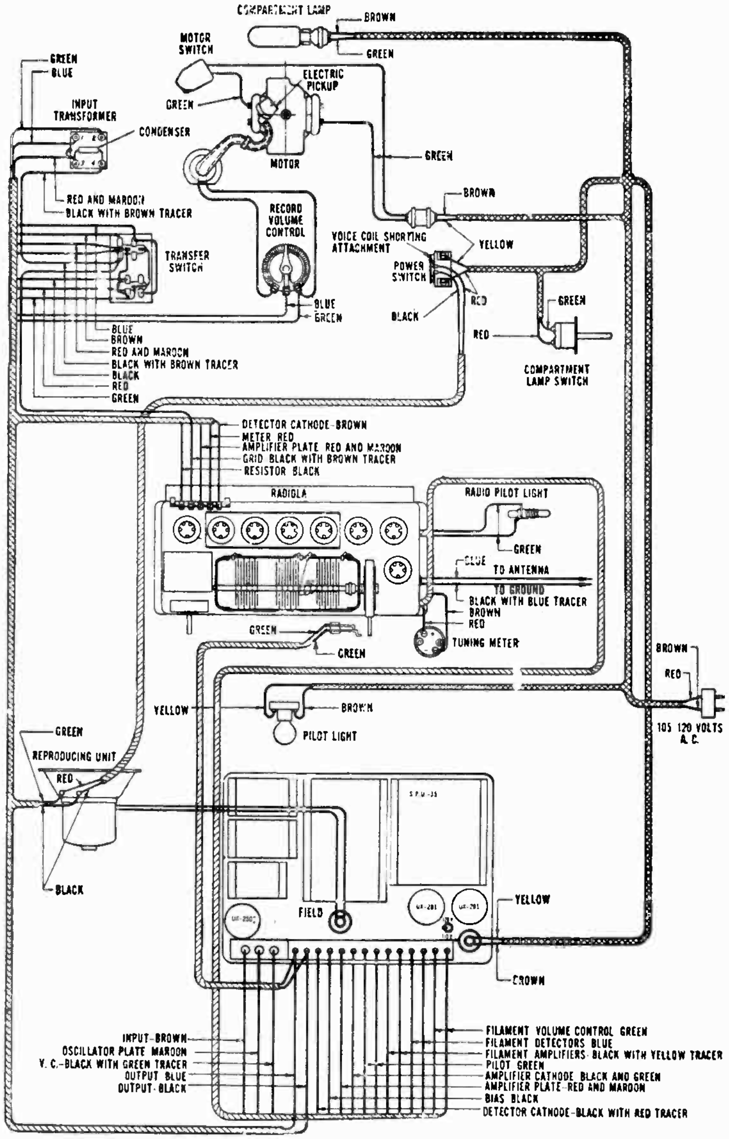
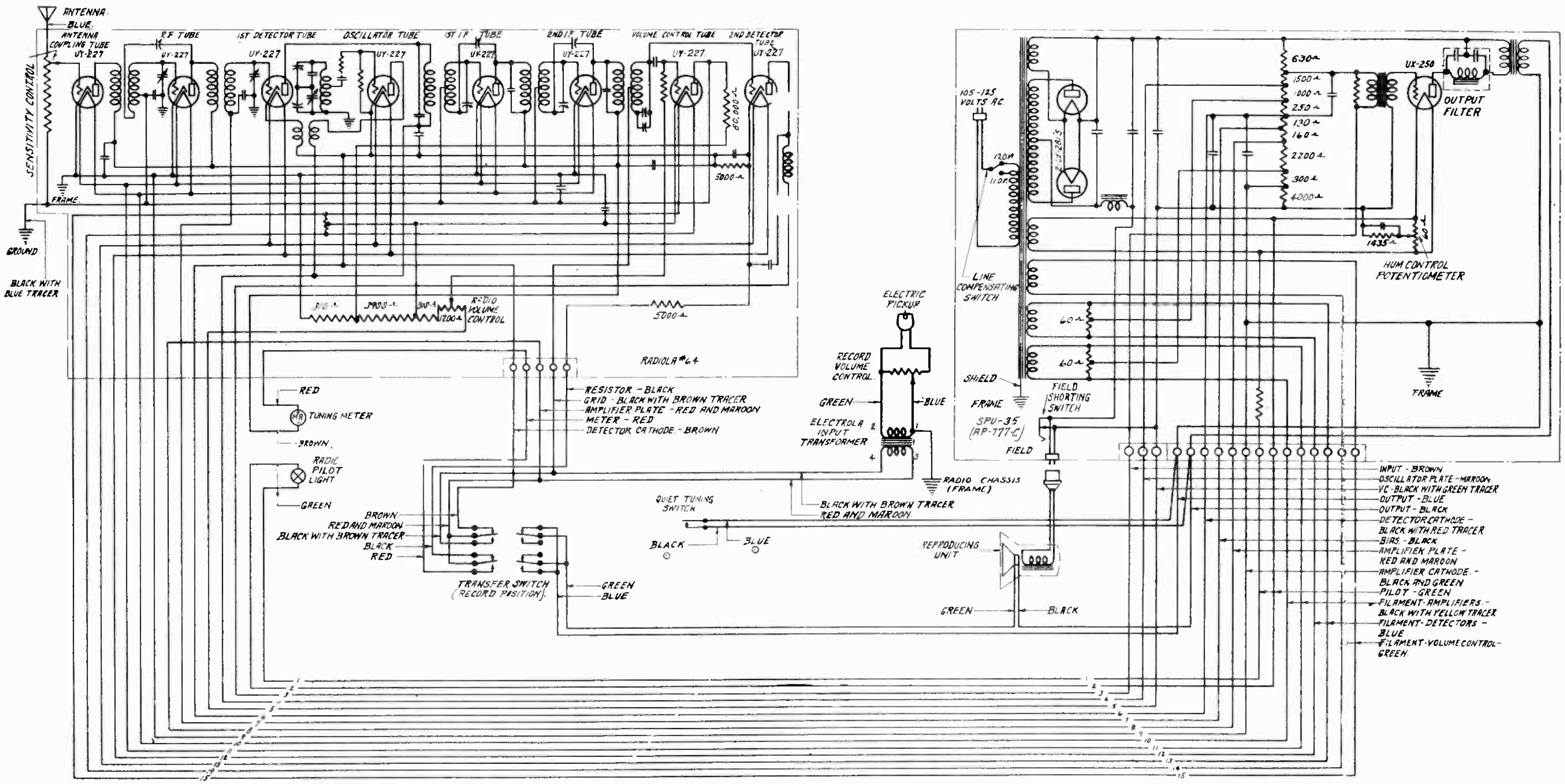


Fig. 4—Method of Adjusting Compensating Condenser

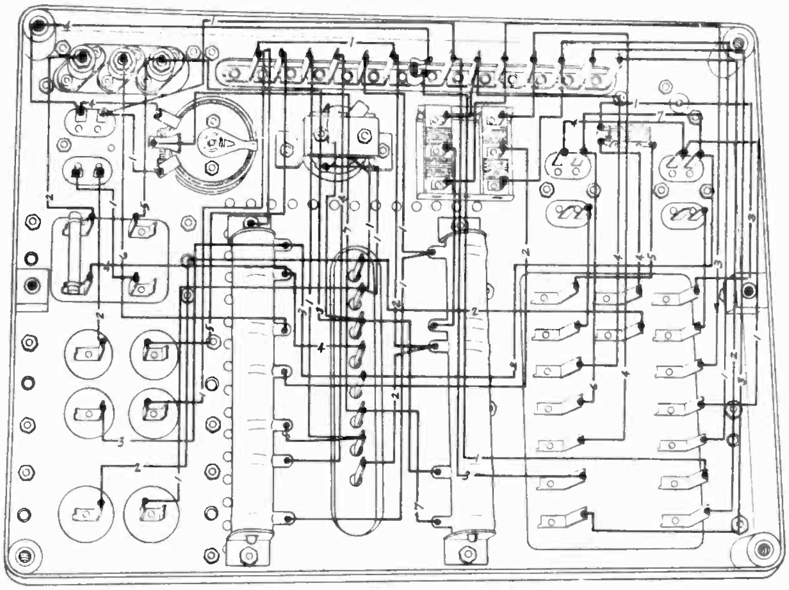
Victor Model 9-18



Cable Wiring Diagram Electrola Radiola No. 9-18



Schematic Wiring Diagram Electrola Radiola Model 9-18



Color Code of Wiring

1. Black
2. Green
3. Blue
4. Red
5. Brown
6. Maroon
7. Yellow

Bottom of Power-Amplifier Unit, showing wiring between terminals

VICTOR RADIOLA 64

(Used in Models 9-18, 9-54 and 9-56)

The Victor Radiola 64 is a power operated superheterodyne receiver, using eight Radiotrons UY-227, and is operated in conjunction with the power amplifier unit AP-777-C, using a power stage of amplification with the UX-250, and two rectifiers UX-281. The circuit utilizes an untuned coupling stage of amplification, one stage of tuned radio frequency, a first detector, an oscillator, two stages of intermediate frequency, a second detector, and an automatic volume control.

Fig. 1—Top Front View of Radiola

The second (power) detector operates at a high plate voltage, producing sufficient power output to operate the UX-250 Radiotron direct, thus eliminating any distortion which might be present if an intermediate audio stage were used.

The Radiola is designed for operation on 105 to 125 volts, 50 to 60 cycles, alternating current. Special equipment is available for operation on 105 to 125 volts, 25 to 40 cycles.

CONTROLS

1. STATION SELECTOR—The three tuning condensers are controlled from the station selector knob which operates the drive mechanism. A switch on the control, operated by pushing the knob, short circuits the voice coil of the reproducing unit while tuning the instrument. Should it become necessary at any time to remove this knob, the set-screw can be loosened by inserting a screw driver up through the hole in the radio panel. Any slack in the condenser drive cable can be taken up by tightening the adjusting screw shown in Fig. 2. The tuning switch mechanism is simple, and should not ordinarily require any adjustment.

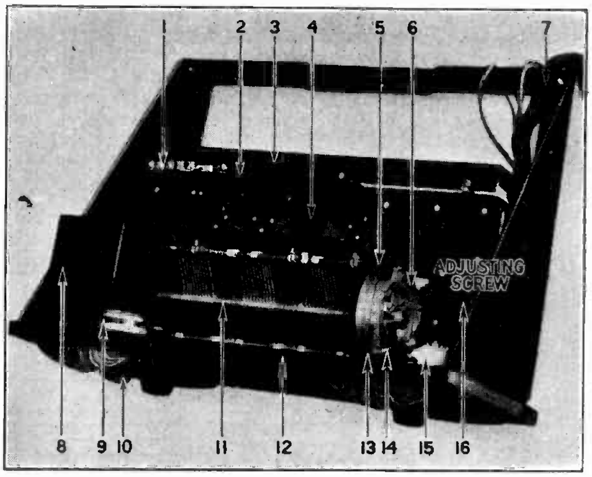


Fig. 2—Top of Radiola

2. TUNING METER—The tuning meter is connected in the plate circuit of the radio frequency and intermediate frequency amplifiers. The meter is so constructed that the needle remains at 10 on the scale while the instrument is turned off.

3. SENSITIVITY CONTROL—The sensitivity control is a potentiometer connected in the antenna circuit. A loose contact between the sensitivity control contact arm and the resistance strip will be a cause of noisy reception or no reception. If such a condition is found, the control arm should be bent until it makes a firm contact against the resistance strip.

4. VOLUME CONTROL—The volume control is a potentiometer controlling the grid bias of the volume control tube, which tube in turn controls the grid bias of the radio frequency and intermediate frequency tubes. The same adjustment for loose contact arm as described in the sensitivity control applies to the volume control.

GENERAL TESTS FOR FAULTY OPERATION

In making the tests described below, the following equipment is suggested:

> Weston Radio Set Tester Model 537, type 1 or 2, equipped with adapter for testing amplifier Radiotrons UY-227
> or
> Weston Radio Set Tester Model 519, high resistance type, with UY-227 adapter especially supplied for this model tester
> or
> High resistance D. C. voltmeter with double range scale of 0-50, 0-250 volts, equipped with well insulated leads and test plugs
> and
> A. C. voltmeter with a 0-4 volt scale (if Model 537 test box is not available).

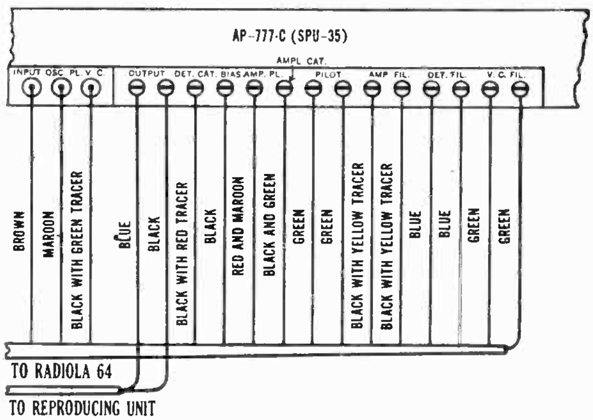


Fig. 4—Power Amplifier Unit Terminals

Readings will vary with different line voltages, different settings of the volume control, and different tubes. It is important that the power switch be turned off each time a tube is removed and the adapter inserted. A period of approximately 45 seconds must elapse each time the power switch is turned on to allow the tubes to heat properly.

1. RADIOTRON TESTS—The tests for the Radiotrons should be made in accordance with the instructions furnished with the Radio Set Tester. A filament voltage reading when using the 519 test box can be made by connecting a pair of wires to an A. C. voltmeter with a 0-4 volt scale, and plugging these leads into the pin jacks on the side of the adapter.

If the Radio Set Tester is not available, each Radiotron should be replaced, successively, with a new one which is known to be in good operating condition.

Any Radiotrons which have been found to be defective in these tests should be replaced.

2 RE-ARRANGING RADIOTRONS—Socket No. 2, Fig. 1, the tuned radio frequency stage, is the most critical for the selection of Radiotrons, and socket No. 7, the second detector, is next in importance. In socket No. 2 place the Radiotron which gives loudest reproduction on distant stations and which does not go into oscillation throughout the entire tuning range of the instrument. Place in socket No. 7 the Radiotron which will best handle large volume without distortion.

3. RADIOLA SOCKET TESTS—If the trouble has not yet been located, make the grid and plate voltage tests according to the instructions furnished with the Radio Set Tester.

If this test box is not available, the high resistance D. C. voltmeter described above can be substituted. Great care should be observed when making the tests with this meter that the terminals do not come into contact with any part of the metal construction of the set, since a high difference of potential exists between certain of the socket terminals and the frame.

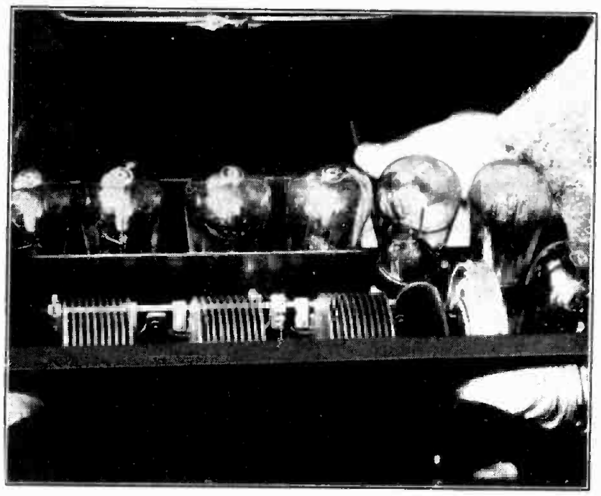


Fig. 5—Adjusting Compensating Condenser

Any open circuits or defects in the various voltage supplies can be detected by these tests. Before looking for such defects in the wiring of the radio set, (1) examine the cable terminals at the power amplifier unit terminal strip, and note that all terminals are making proper contact and are properly spaced; and (2) make the power amplifier terminal tests described in subject No. 4. Should it be desired to remove the radio set from the cabinet for testing, the three center terminals of the terminal strip of five connections can be connected together, thus giving the same effect as placing the transfer switch in the "Radio" position.

A. FILAMENT TESTS—The filament voltages in the various sockets will vary between 2.25 volts and 2.5 volts. Trouble in the filament circuit of the radio set can be traced to:
   a. Poor socket contacts.
   b. Poor or shorted contact on terminal strip.
   c. Broken wire in cable.
   d. Defective power unit.

B. GRID TESTS—Using the "C" position of the Radio Set Tester, or touching the C and G socket contacts with the test leads of the separate voltmeter, test the "C" voltage in all sockets except the oscillator, No. 6, Fig. 1. In addition to the faults listed below a defective power unit will cause variation from the normal readings.

GRID VOLTAGE READINGS

All Readings with Volume Control in Maximum Position

	Normal	Faulty	Fault
G1	3 Volts	0	Open sensitivity control, poor contact, shorted condenser 28, Fig. 3 broken wire.

	Normal	Faulty	Fault
G2	3 Volts	0	Open first R. F. transformer secondary, shorted condenser 28, Fig. 3 broken wire.
G3	10 Volts	0	Open second R. F. transformer secondary, shorted by-pass condenser, or broken wire.
G4	15 Volts	0	Open secondary first I. F. transformer, shorted condenser 28, Fig. 3 or broken wire.
G5	11 Volts	0	Open secondary second I. F. transformer, shorted condenser 28, Fig. 3 or broken wire.
G7	22 Volts	0	Open secondary third I. F. transformer, poor contact in transfer switch, or broken wire.
G8	2 Volts	0	Open volume control, poor contact, open 1 Meg. resistor, shown at 26, Fig. 3, open resistor 29, Fig. 3 poor contact in transfer switch, or broken wire.

C. PLATE TESTS—Using the "B" scale of the Radio Set Tester, or the high scale of the separate voltmeter, test the plate voltages in the various sockets with the tubes in place. A defective power unit may cause a variation from these readings in addition to the possible defects listed below.

PLATE VOLTAGE READINGS

All Readings with Volume Control in Maximum Position

	Normal	Faulty	Fault
P1	125 Volts	0	Transfer switch or tuning meter defective, shorted by-pass condenser 8, Fig. 2, open primary of first radio frequency transformer, or broken wire.
P2	130 Volts	0	Transfer switch or tuning meter defective, shorted by-pass condenser 8, Fig. 2, open primary of second R. F. transformer, or broken wire.
P3	80 Volts	0	Shorted by-pass condenser 8, Fig. 2, open primary of first I. F. transformer, or broken wire.
P4	150 Volts	0	Transfer switch or tuning meter defective, shorted by-pass condenser 8, Fig. 2, open primary of second I. F. transformer, or broken wire.
P5	150 Volts	0	Transfer switch or tuning meter defective, shorted by-pass condenser 8, Fig. 2, open primary of third I. F. transformer, or broken wire.
P6	80 Volts	0	Shorted by-pass condenser 8, Fig. 2, open primary of first I. F. transformer, or broken wire.
P7	185 Volts	0	Shorted by-pass condenser 8, Fig. 2, open 5000 ohm resistor 26, Fig. 3, or broken wire.
P8	75 Volts	0	Open 80000 ohm resistor 26, Fig. 3 open resistor 29, or broken wire.

4. POWER AMPLIFIER TERMINAL TESTS—With the Radiola in operation and with all terminals connected to the terminal strip, make the following voltage tests at the power amplifier terminal strip with the volume control at maximum. The high voltage scale of the voltmeter should be used for these tests.

TERMINAL STRIP VOLTAGE READINGS

Test Between	Voltage
Det. Cath. and Bias	10 Volts D. C.
Ampl. Pl. and Ampl. Cath.	185 Volts D. C.
Ampl. Cath. and Fil. Ampl.	15 Volts D. C.
Det. Cath. and Fil. Det.	16 Volts D. C.

Use 0-4 A. C. Voltmeter

Ampl. Fil.	2.75 Volts A. C.
Vol. Con. Fil.	2.8 Volts A. C.
Det. Fil.	2.8 Volts A. C.

A lack of voltage at any of the above points will be a cause for faulty operation or no operation.

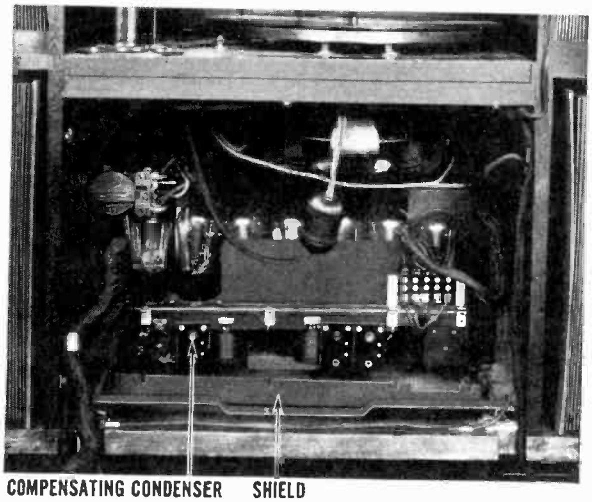


Fig. 6—Back of Cabinet Removed Showing Location of Compensating Condenser.

ELECTROLA TESTS

Trouble in the radio set when operating in the "Record" position can be traced to:

1. Open in either 5000 ohm resistor 26, Fig. 2.
2. Poor contact at terminal strip of five connectors.
3. Broken wire or cable.

SPECIAL TESTS

1. EXCESSIVE HUM—Excessive hum may be caused by:

   A. Reversed polarity of power plug. Remove plug and reverse position of the prongs.
   B. Low emission Radiotron UX-281.
   C. Hum control potentiometer out of adjustment. Adjust with a screw driver until hum is a minimum.
   D. Open ground connection to frame of Radiola.
   E. Lack of voltage across Ampl. Cath. and Amp. Fil. or across Det. Cath. and Det. Fil.
   F. Open center tap resistor 27, Fig. 3.

2. AUDIO HOWL—This condition may be caused by:

A. Incorrect operation of volume and sensitivity control

B. Arrangement of Radiotrons in the detector and amplifier sockets.

C. Open audio by-pass condenser.

D. Open ground connection to frame of Radiola.

E. Compensating condenser out of adjustment. Adjustment can be made as shown in Figs. 5 and 6 by means of the neutralizing screw driver part 18460. The following procedure should be used.

(1) Pull the radio panel forward as far as possible

(2) Loosen the four screws in the shield at the back of the chassis, and lift the shield away from the chassis.

(3) Tune the Radiola to a broadcasting station on the lower wave lengths.

(4) Turn the volume control to the point of maximum intensity and the sensitivity control all the way to the right.

(5) Insert the neutralizing screw driver in the condenser adjustment screw, and turn the screw until the receiver goes into oscillation.

(6) Turn the screw in the opposite direction until the oscillation just stops.

(7) Check this adjustment for a station at approximately the middle of the scale and for one near the top of the scale, making certain that the R. F. stage does not oscillate at any of these points.

(8) Replace the shield.

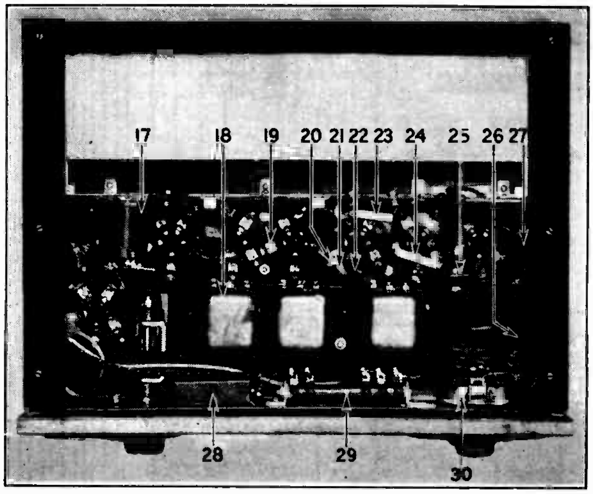


Fig. 3—Bottom of Radiola

3. WEAK RECEPTION—This condition can be caused by one or more of the following:

A. Arrangement of tubes in Radiola. (For correct arrangement of tubes see subject 2 under General Tests for Faulty Operation.)

B. Compensating condenser out of adjustment. (See sub topic E under subject 2 above.)

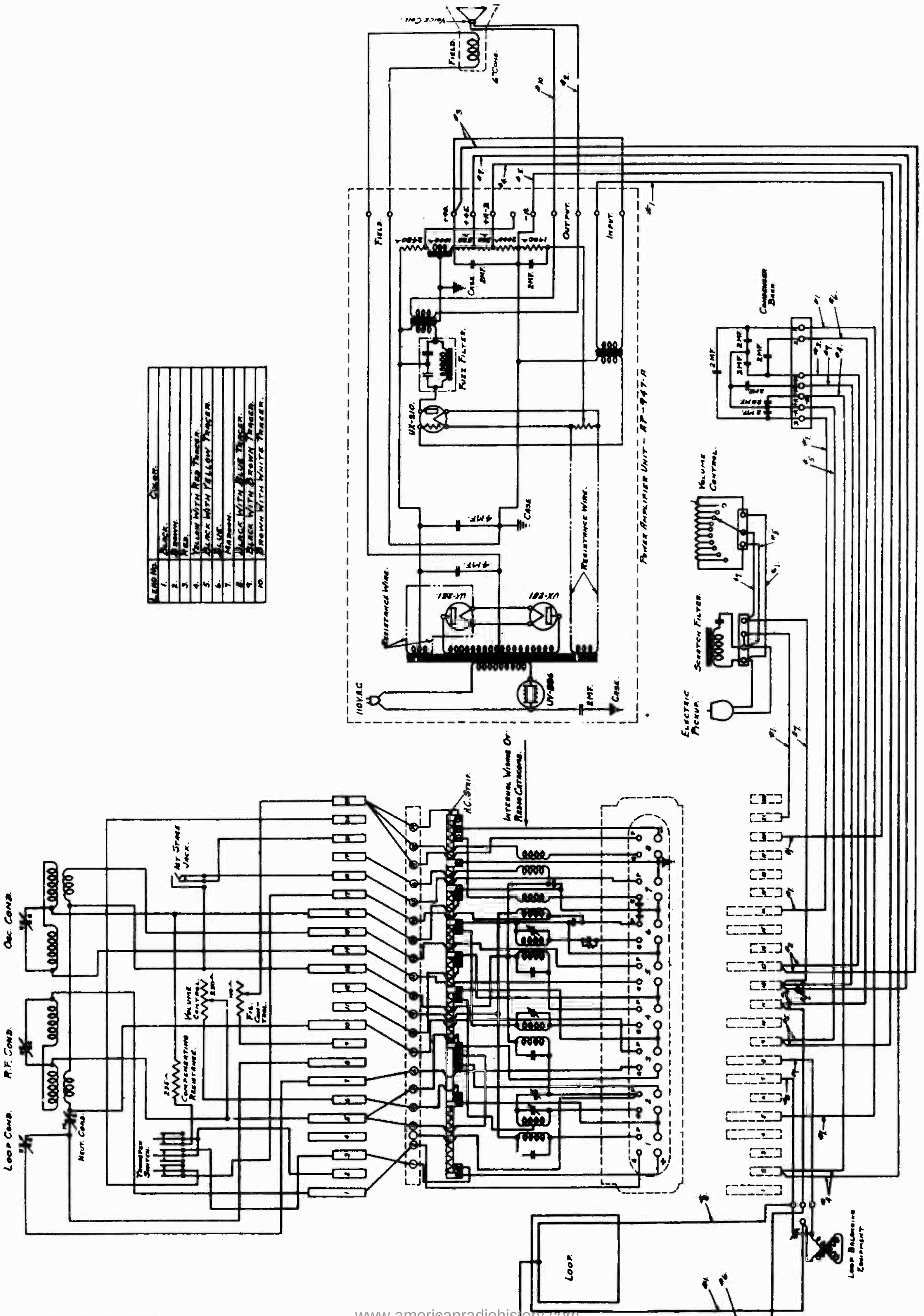
C. Open or shorted resistor in Radiola.

D. Low voltage from power amplifier unit. This point can be checked as described in subject 4 under General Tests for Faulty Operation.

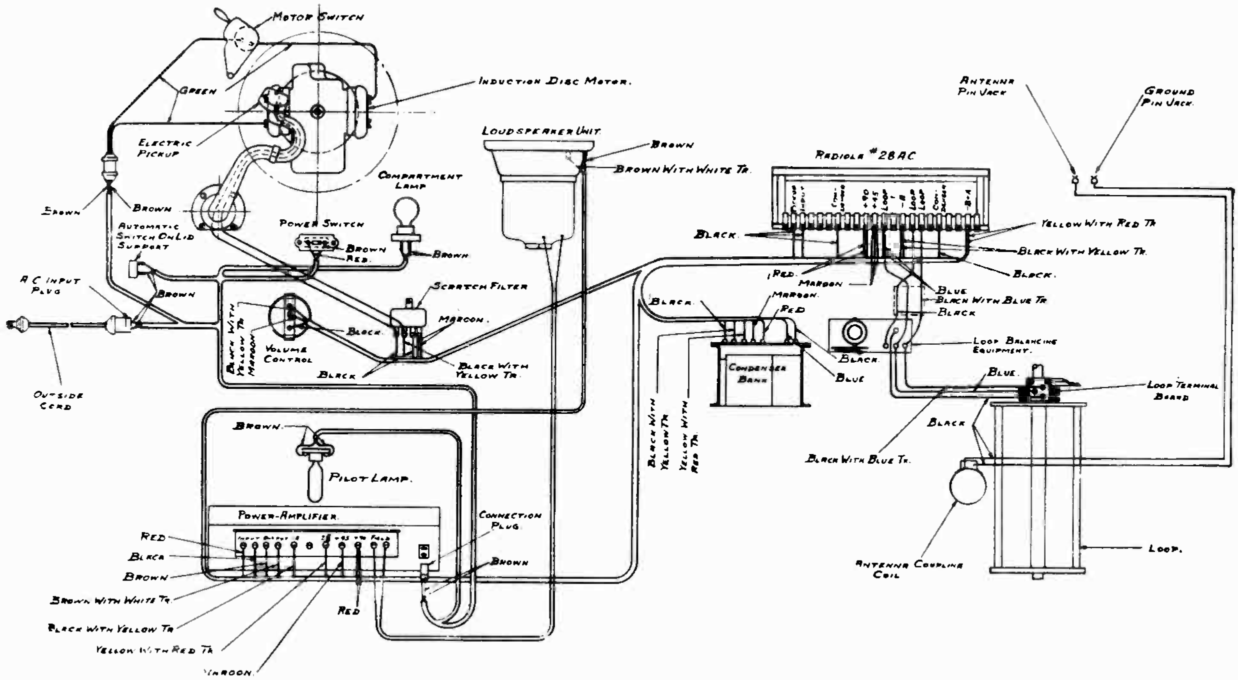
4. DISTORTION FROM POWERFUL STATIONS—Distortion on powerful local stations will be noted if the volume control is advanced too far. The control should be set at the point where local stations will be clearly received without distortion.

Because of the high degree of sensitivity of the Radiola, it may be necessary in some cases,where an outside antenna is used, to obtain a further reduction in volume on powerful local stations than that afforded by a minimum setting of the volume and sensitivity controls. A single pole switch can be connected between the antenna lead-in and the binding post on the back of the cabinet so that the antenna can be conveniently disconnected when desired, and only the metal plate antenna used. The switch should be closed for all other stations except the powerful local.

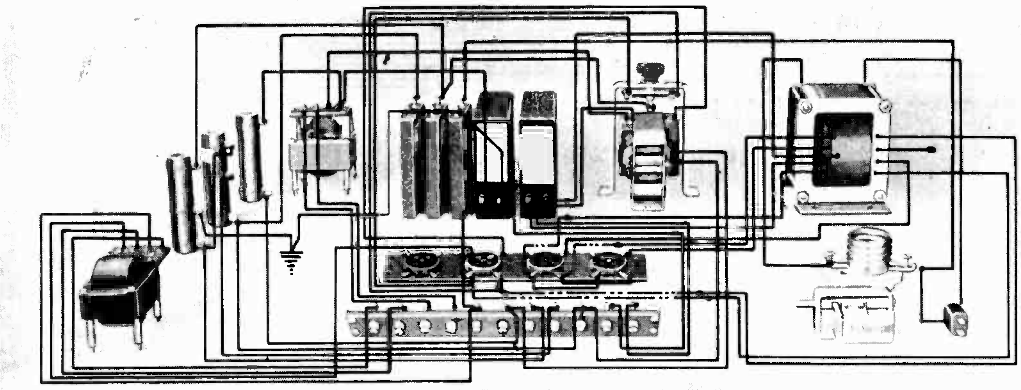
Victor Model 9–25



Wiring Diagram—Electrola 9–25



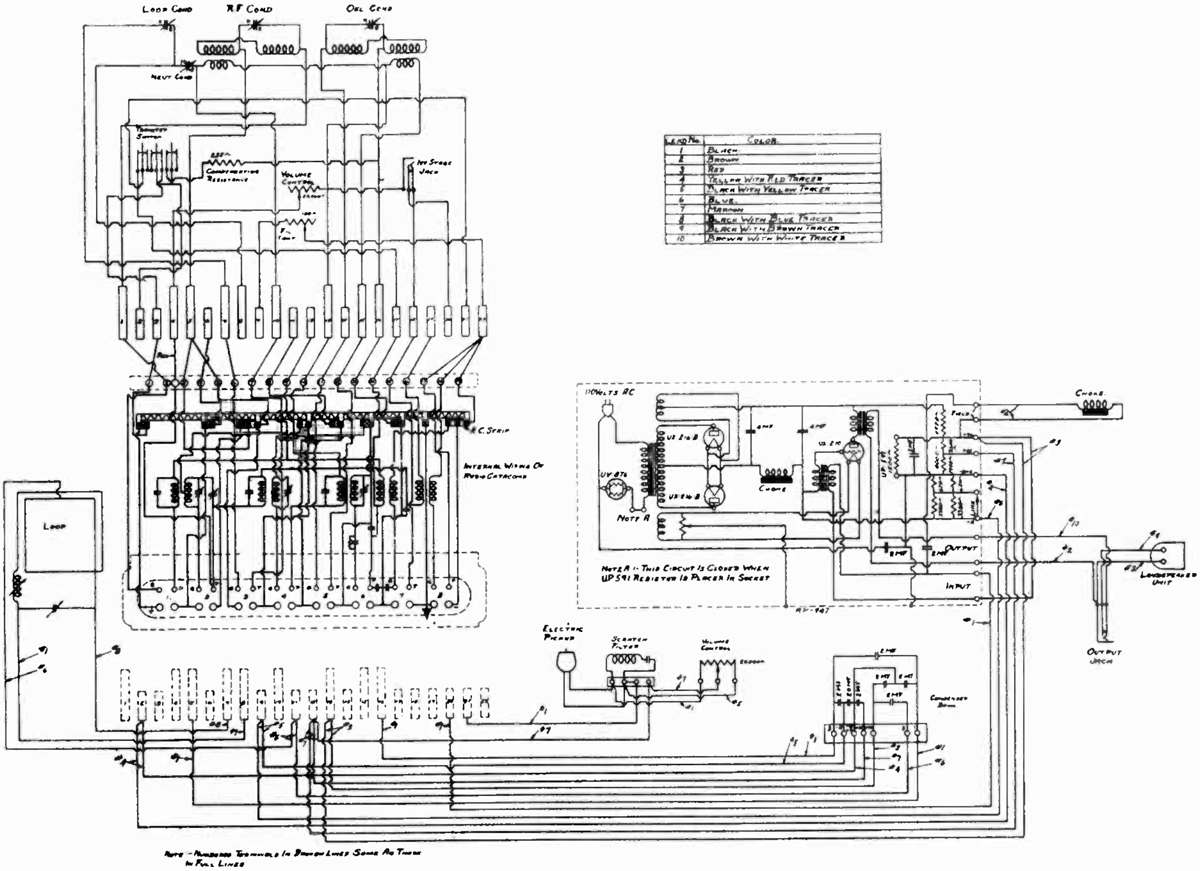
-Wiring Diagram of Electrola Radiola No. 9-25



Parts and Wiring of Power-Amplifier Units

SERVICE DATA ON PICKUP, RADIO RECEIVER AND AMPLIFIER SAME AS 9—2

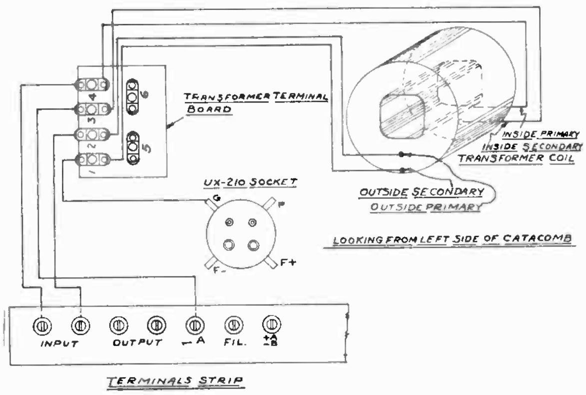
Victor Model 9-40 (Borgia)



Lead No.	Color
1	Black
2	Brown
3	Red
4	Yellow With Red Tracer
5	Black With Yellow Tracer
6	Blue
7	Maroon
8	Black With Blue Tracer
9	Black With Brown Tracer
10	Brown With White Tracer

Wiring Diagram for Electrola 9-40

SERVICE DATA ON PICKUP,
RADIO RECEIVER AND AMPLIFIER
SAME AS MODEL 9—2

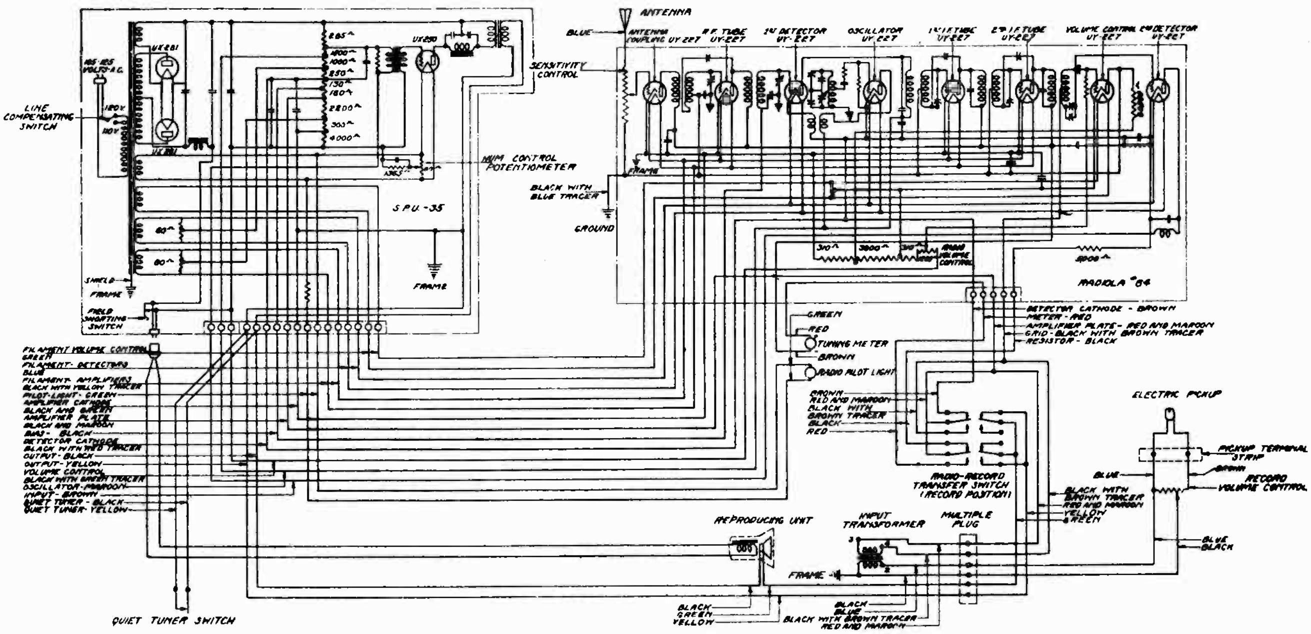


9-40 Input Transformer Wiring

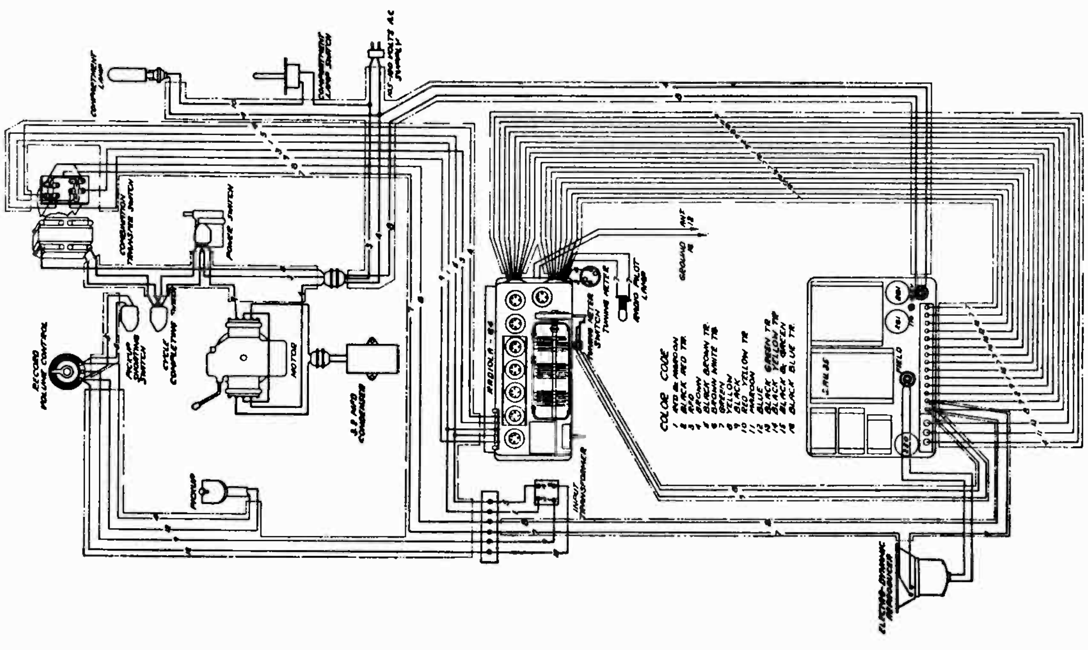
Victor Model 9–54

AND

VICTOR MODEL 9—56



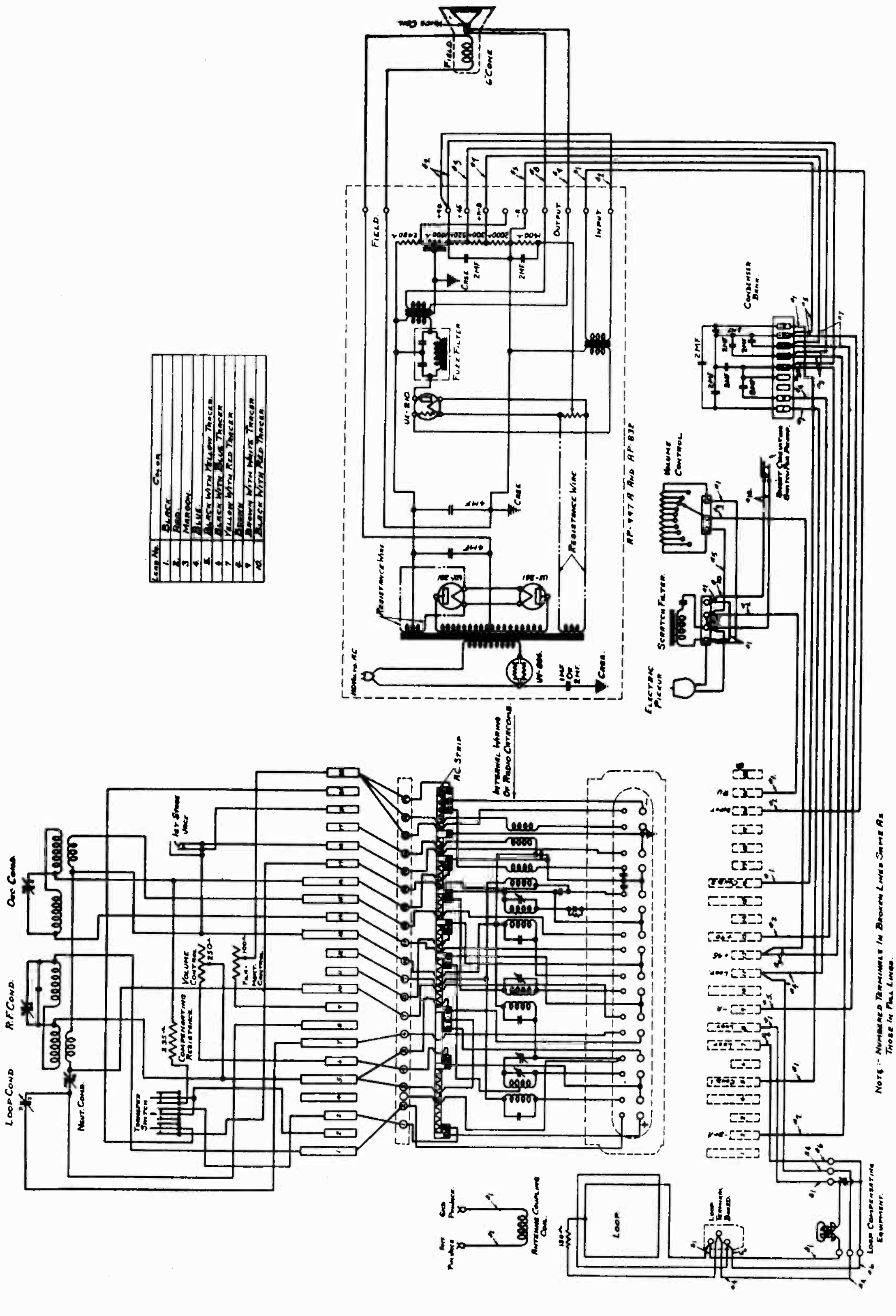
Schematic Wiring Diagram Electrola Radiola 9-54



Cable Wiring Diagram Automatic Electrola Radiola 9-54 above Serial No. 6401

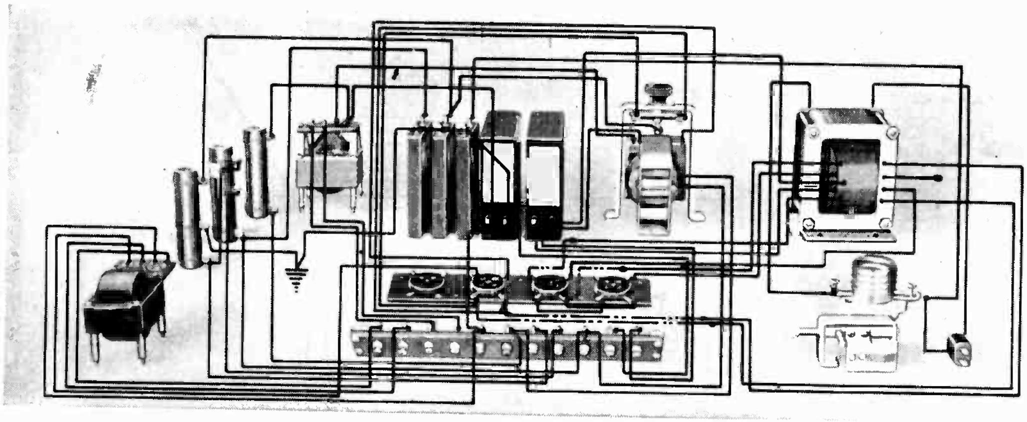
SERVICE DATA SAME AS MODEL 9—18

Victor Model 9-55



Lead No.	Color
1.	Black
2.	Red
3.	Maroon
4.	Blue
5.	Black with Yellow Tracer
6.	Black with Blue Tracer
7.	Yellow with Red Tracer
8.	Brown
9.	Brown with White Tracer
10.	Black with Red Tracer

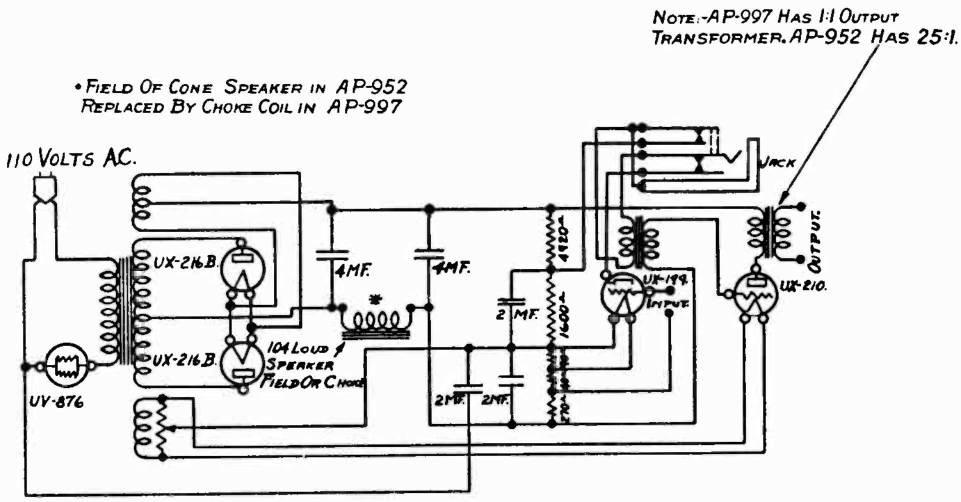
Wiring Diagram for Model 9-55

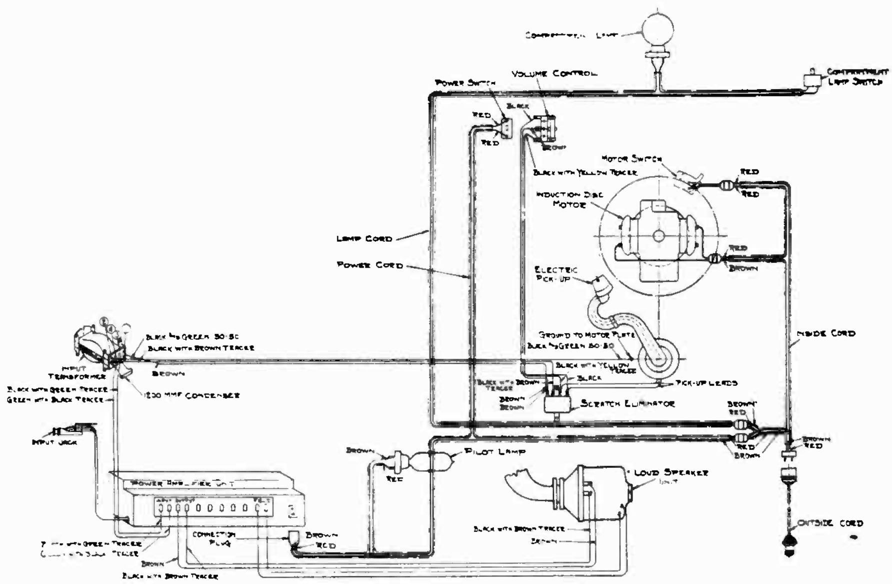


Parts and Wiring of Power-Amplifier Units

SERVICE DATA ON PICKUP, RADIO RECEIVER AND AMPLIFIER SAME AS MODEL 9—2

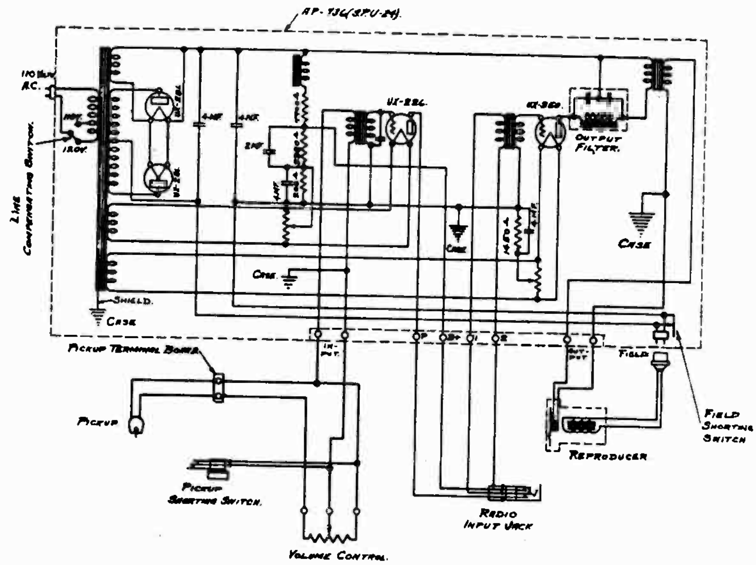
Victor Model 10–51



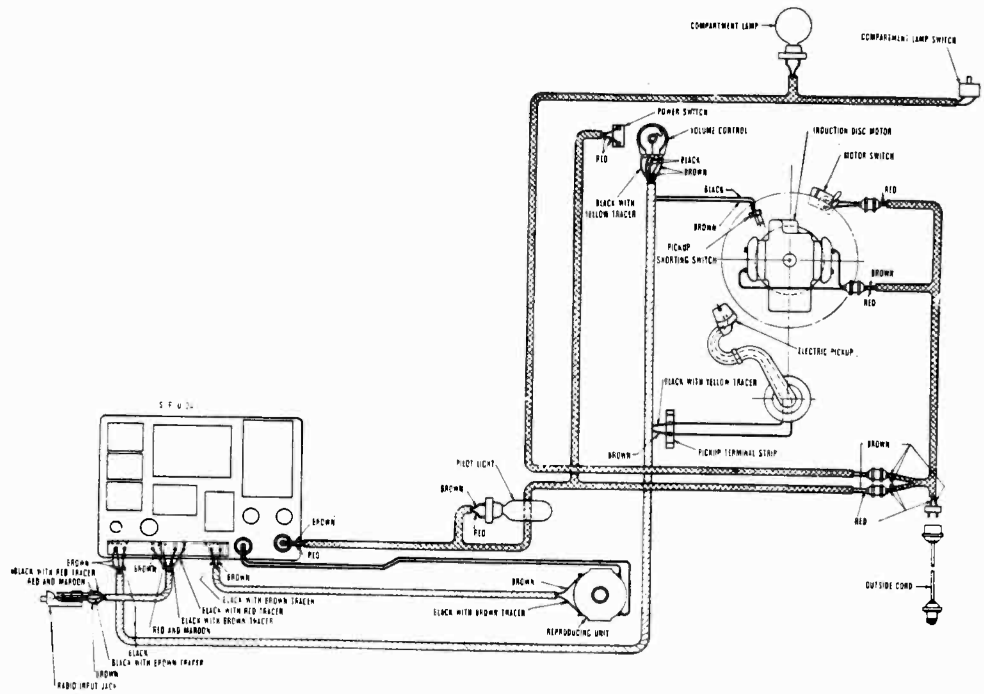


–Wiring Diagram for Automatic Orthophonic Electrola No. 10-51

Showing connections between terminals of the various units. The 110-volt wiring is shown by extra heavy lines.

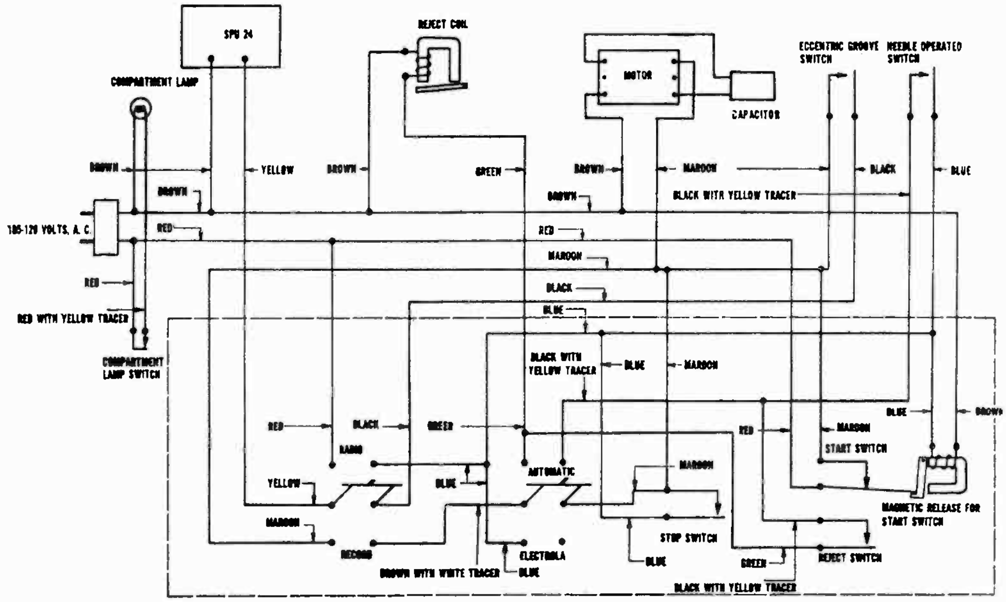


Wiring Diagram 10-51 above serial No. 800

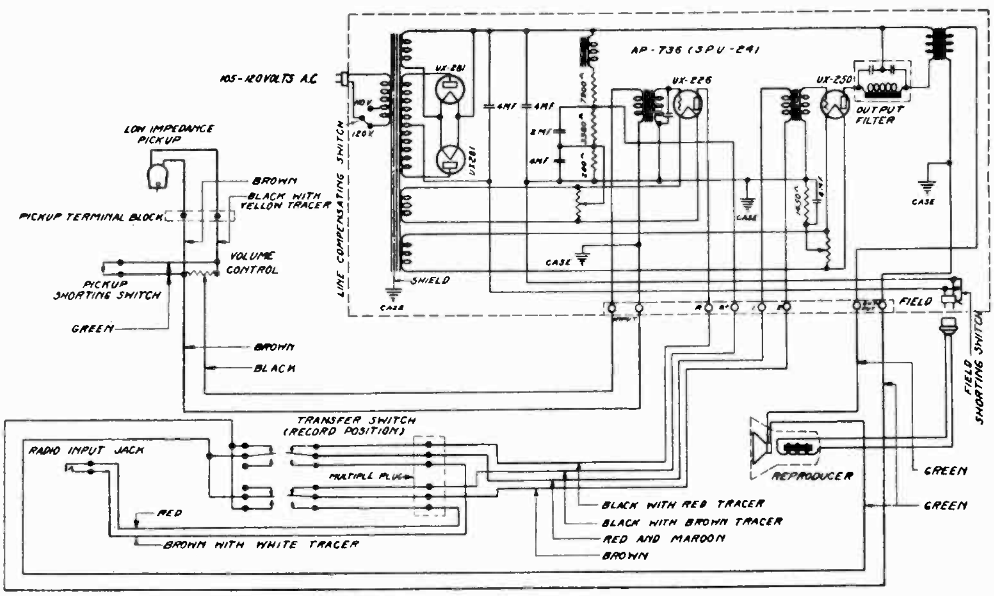


Wiring Diagram for Automatic Orthophonic Electrola
10-51 above serial No. 800,

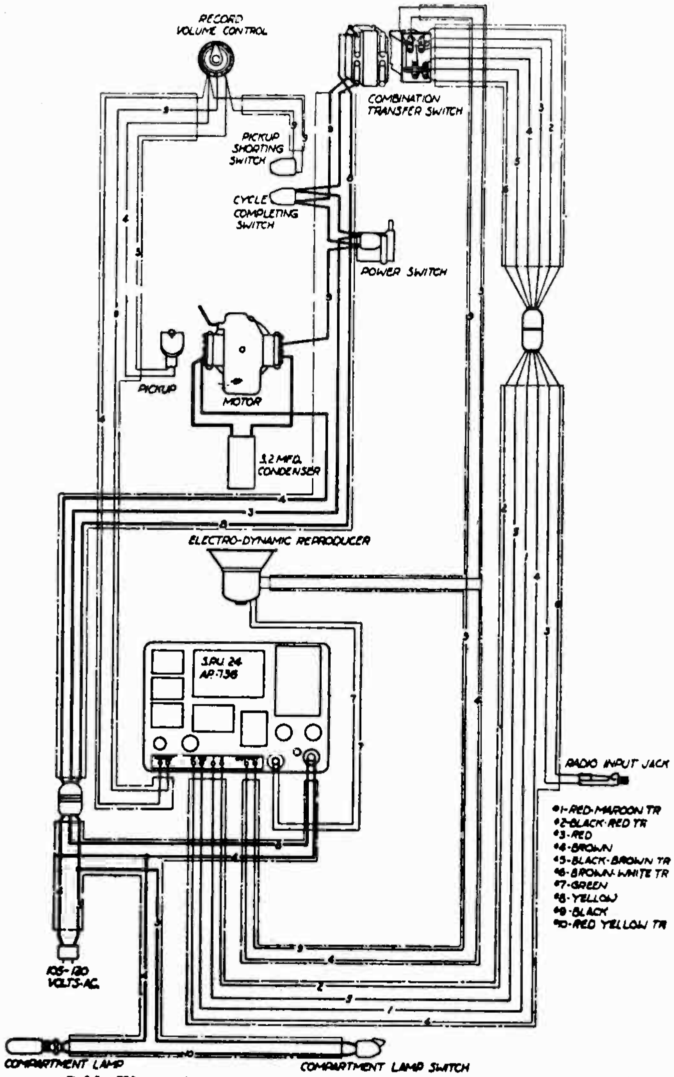
Victor Model 10–69



A. C. Power Wiring Diagram Automatic Electrola No. 10-69 Below Serial No. 3501



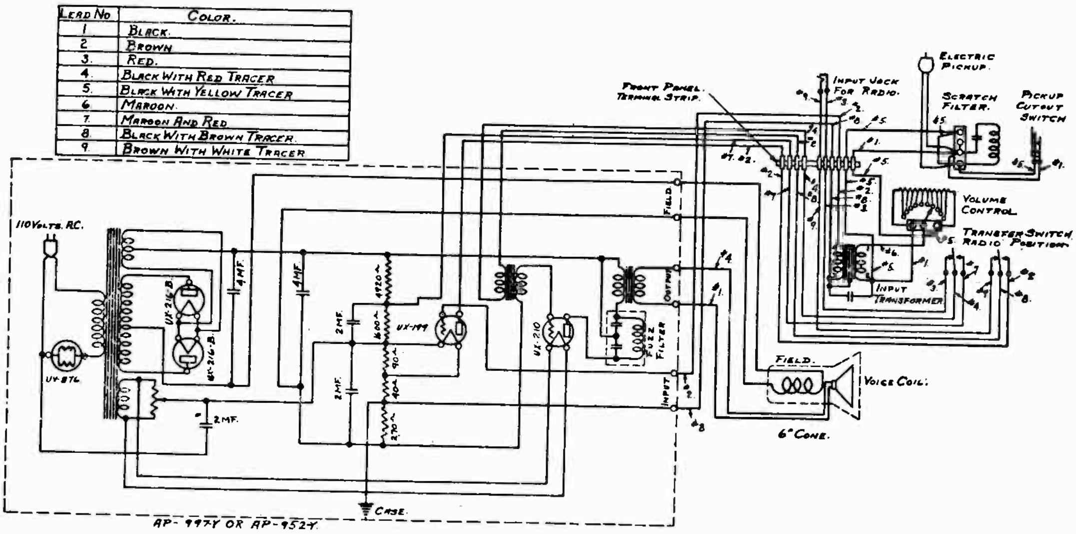
Schematic Wiring Diagram Automatic Electrola 10-69 above serial No. 2600



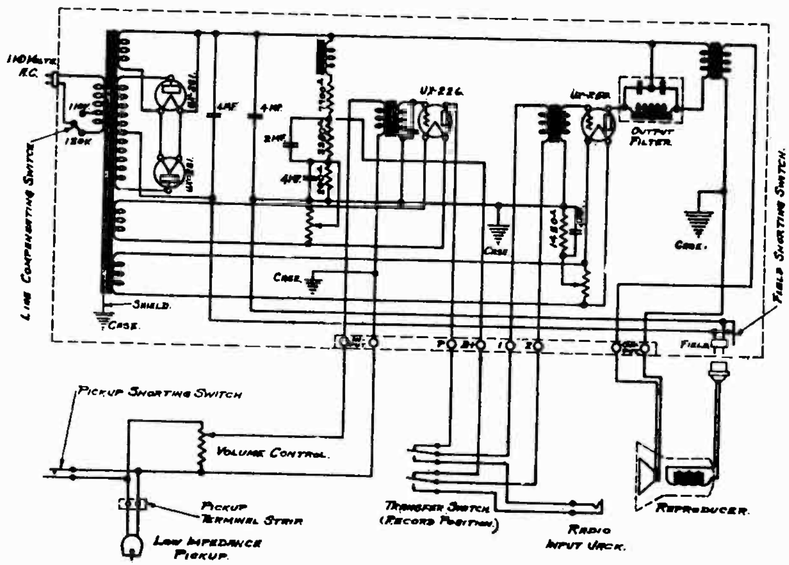
Cable Wiring Diagram Automatic Electrola 10-69, above Serial No. 5001

Victor Model 10-70

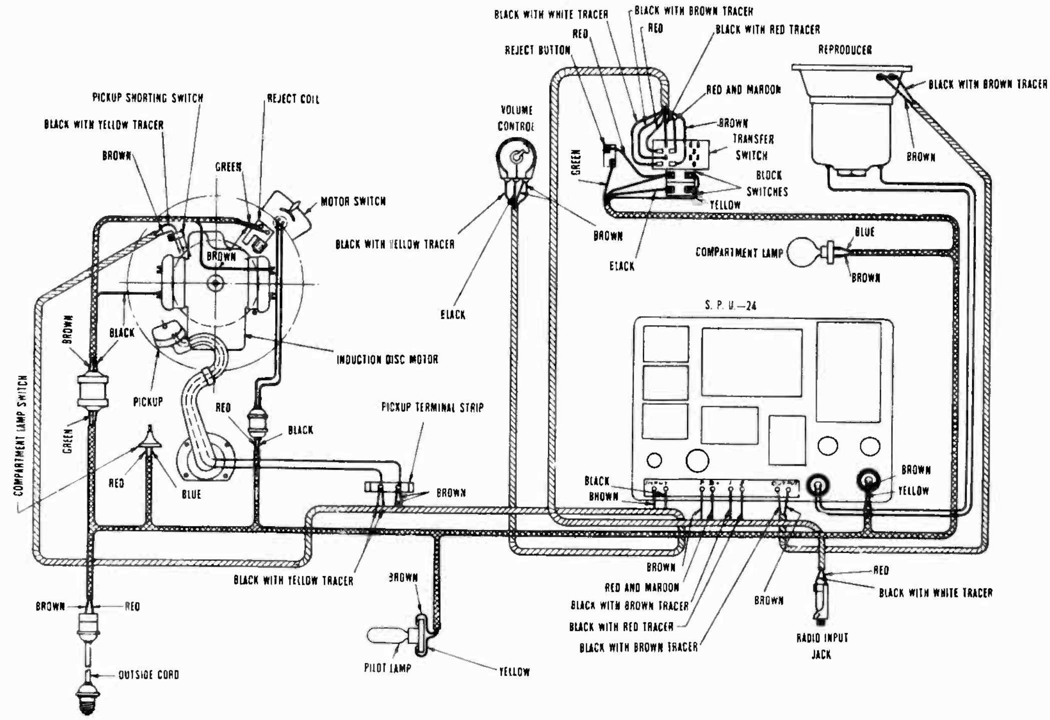
Lead No	Color.
1	Black.
2	Brown
3.	Red.
4.	Black With Red Tracer
5.	Black With Yellow Tracer
6	Maroon.
7.	Maroon And Red
8	Black With Brown Tracer.
9	Brown With White Tracer



Wiring Diagram—Electrola 10-70



Wiring Diagram No. 10-70 above serial No. 2600



–**Wiring Diagram for Automatic Electrola No. 10-70**
Showing connections between terminals of the various units.

Victor Model 12-1 (Cromwell)

CROMWELL ELECTROLA

The Cromwell is an electrical instrument, from the motor which runs the turntable to the electrical pick-up method of sound reproduction which through the rectifier power amplifier unit and the cone type loud speaker produces sound perfect in every detail. The volume of sound supply to the amplifier unit is varied by means of the volume control without sacrifice in quality.

The Cromwell is also a power amplifier and loud speaker for use on any radio receiver. This is accomplished by connecting wires from the 1st stage audio jack of the receiver to the input jack of the Cromwell located in the rear on the base of the machine. It is not recommended that the Cromwell be plugged into the second stage jack of the radio receiver as this will cause overloading of volume with a sacrifice of tone quality and a possibility that a howl will develop in the instrument. When the radio set is plugged into the Cromwell it automatically disconnects the Electrola from the speaker unit.

This instrument, due to its rugged construction and the rigorous tests through which its mechanical parts are put will require very little service.

In the event of damage to the instrument from shipment or other causes, below is the proper method of procedure for servicing:

Assuming that you have placed the tubes in their proper sockets, placed the electric pick-up (reproducer) on the tone arm, turned the toggle switch to the on position, the volume control to number five and that everything lights including the monitor lamp in turntable compartment, ready for operation.

1. Tap the needle lightly with your finger, first on one side and then on the other. Each time you touch the needle there should be a loud click through the speaker.

(A) If the click is louder when striking the needle on one side than it is on the other, the electric pick-up is out of adjustment. To determine this, remove the metal case from the pick-up and note whether the vibrating armature which is operated by the needle is directly in the center between the two pole pieces of the magnet. If the vibrating armature is off center remove the holding clamp from the magnet allowing further accessibility to the working parts. You will then see two knurled nuts locked in place by ordinary nuts. By loosening the lock nuts you can adjust the knurled nuts until the vibrating armature is again in the center of the pole pieces.

(B) If there is no click at all in the loud speaker, put a record on the turntable, start the motor, put the electric pick-up in place and let the record play.

(a) Take a pair of earphones, place the tips across the two connections of the volume control to which the leads run from the pick-up. You should hear the record playing with very low volume.

(b If there isn't sound at this point, remove the pick-up wires from the volume control and check for open circuit from this point through the pick-up. (NOTE: Occasionally the contacts in the tone arm are not springing into position properly.)

(c) If there is sound at this point, repeat the operation on the two output connections of the volume control. If there isn't sound at this point, check the control arm of the volume control to insure proper contact. If this is O. K. and still there is an open circuit, replace the volume control.

(d) If sound comes through the above points, use the same check on the input terminals of the tomcat (metal power unit). If open here, look for broken cable between this point and volume control.

(e) If sound is coming through to the above, check output connections on the tomcat. There should be loud speaker volume at this point. If no sound, check phone plug in back of cabinet for proper contact of all connections. If there is still no sound try:

1. A new 216B.
2. A new UX-199.
3. A new UX210.

If there is still no sound, the trouble is in the tomcat. Same should be removed and returned to your distributor for replacement.

(f) If sound is coming through to output connections but no response from loud speaker, remove loud speaker leads from the tomcat and check for broken or loose connections between this point and the loud speaker.

2. Lack of volume can be traced to:

(A) Defective 216B.
(B) Defective UX199.
(C) Defective UX210.
(D) Defective cone loud speaker. This can be determined by disconnecting the cone loud speaker and making volume comparison with external loud speaker.

(E) Defective electric pick-up. (Out of adjustment. See paragraph I sub. "A.")

(F) If there is a maximum volume on number three contact of volume control with diminishing volume when turned toward number five, the trouble can be traced to a grounded pick-up or grounded electric pick-up leads. If pick-up is grounded usually the case is touching some of the internal live parts. An indication of this grounded condition is that the instrument will squeal when touching the hand to the tone arm or any of the metal parts in the turntable compartment.

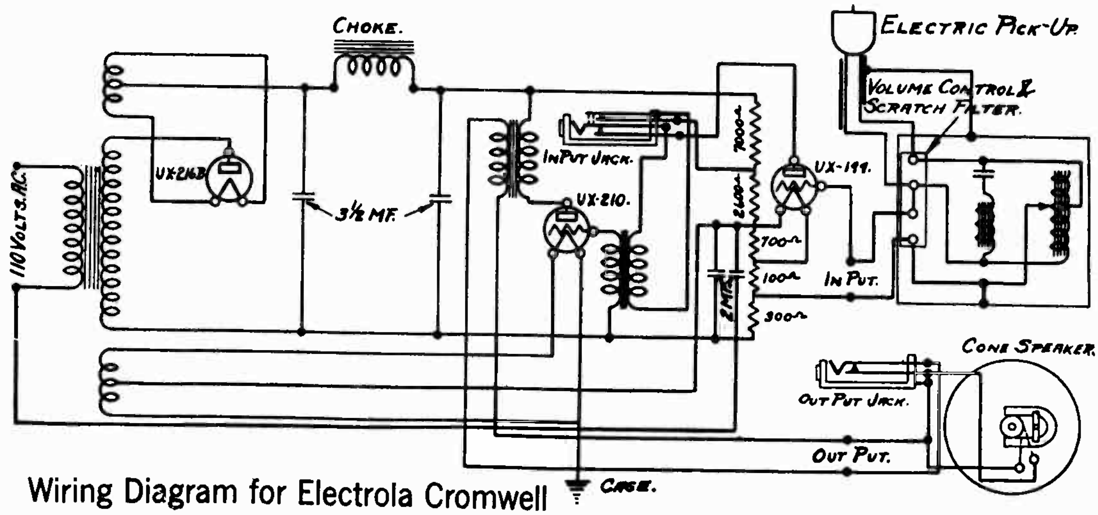
(G) If after trying the above there is still lack of volume, return the tomcat to the distributor for replacement.

3. Failure of monitor lamp to light, motor to run, or tomcat tubes to light.

(A) Check socket in which cable is plugged with either a meter or a test lamp. If there is current at this point check the various alternating current supply cables for an open circuit.

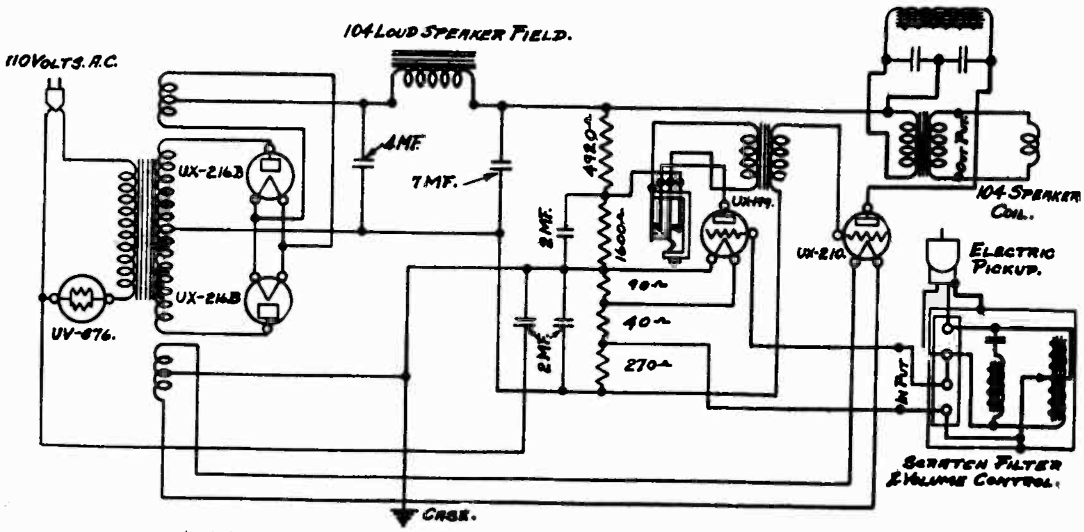
4. Excessive AC hum can often be reduced to a minimum by turning the AC supply plug 180° from the position in which it originally was tried out.

The above points if followed should enable the dealer to intelligently render service on the Cromwell Electrola.

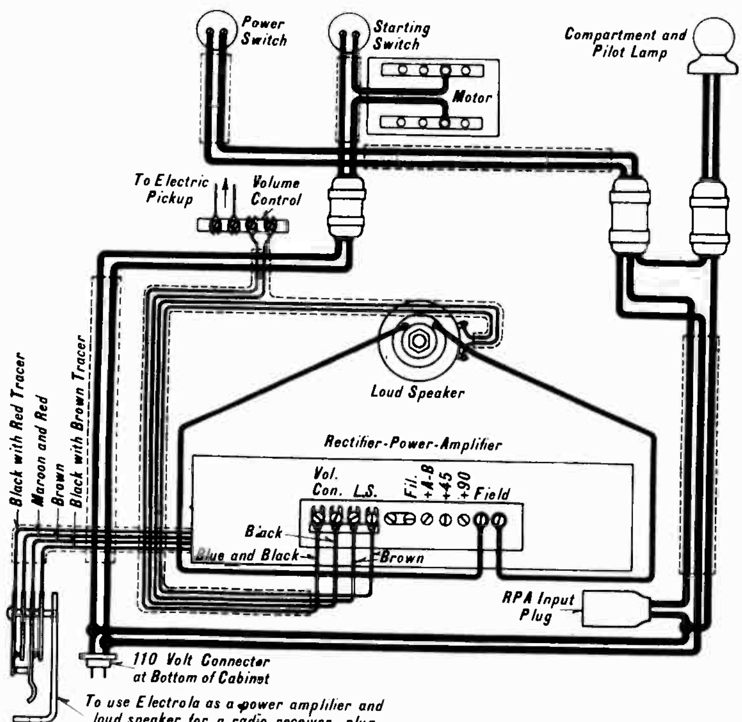


Wiring Diagram for Electrola Cromwell

Victor Model 12-2 (Tuscany)



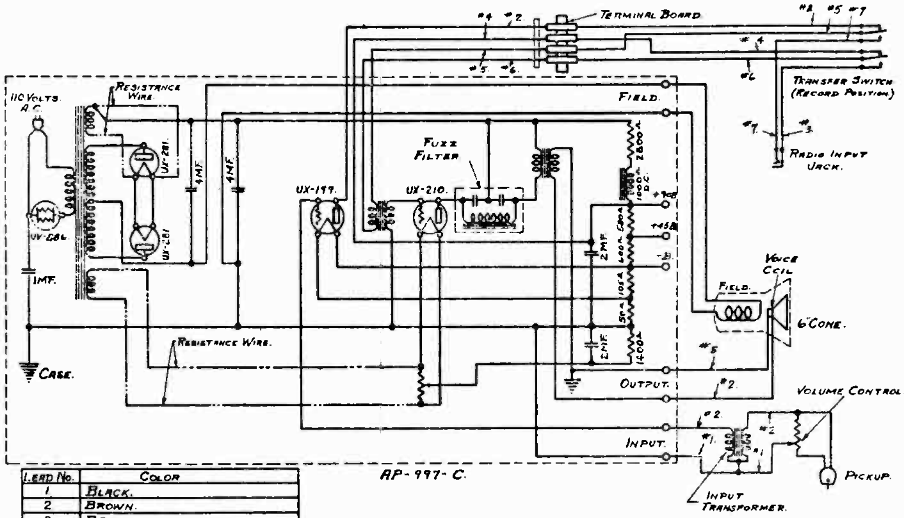
Wiring Diagram for Electrola Tuscany



Schematic Wiring Diagram of Electrola Tuscany

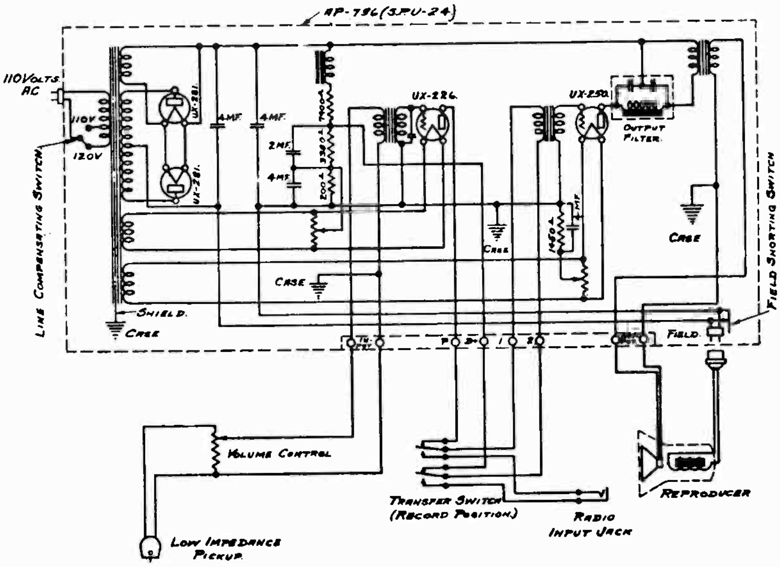
Showing connections between terminals of the various units. The 110-volt wiring is shown by extra heavy lines.

Victor Model 12-15



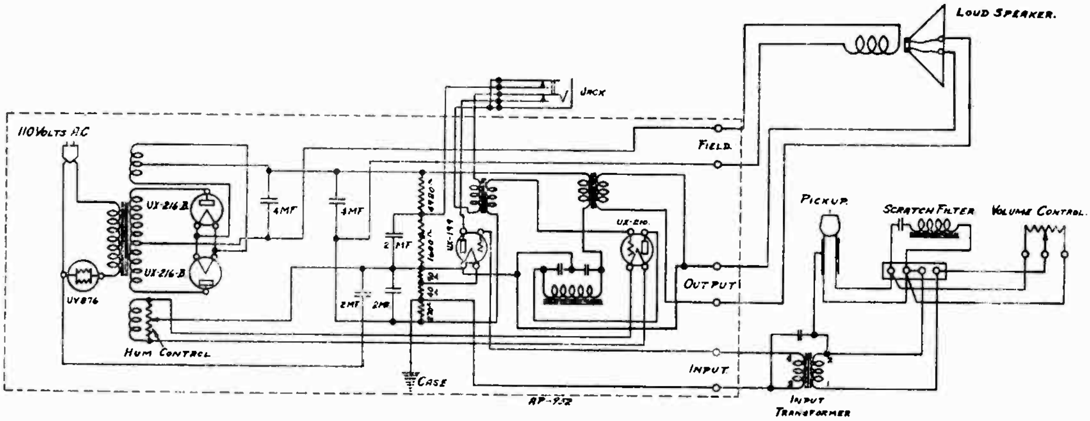
Lead No.	Color
1	Black.
2	Brown.
3	Red.
4	Red And Maroon
5	Black With Brown Tracer.
6	Black With Red Tracer.
7	Brown With White Tracer.

Wiring Diagram Electrola 12-15

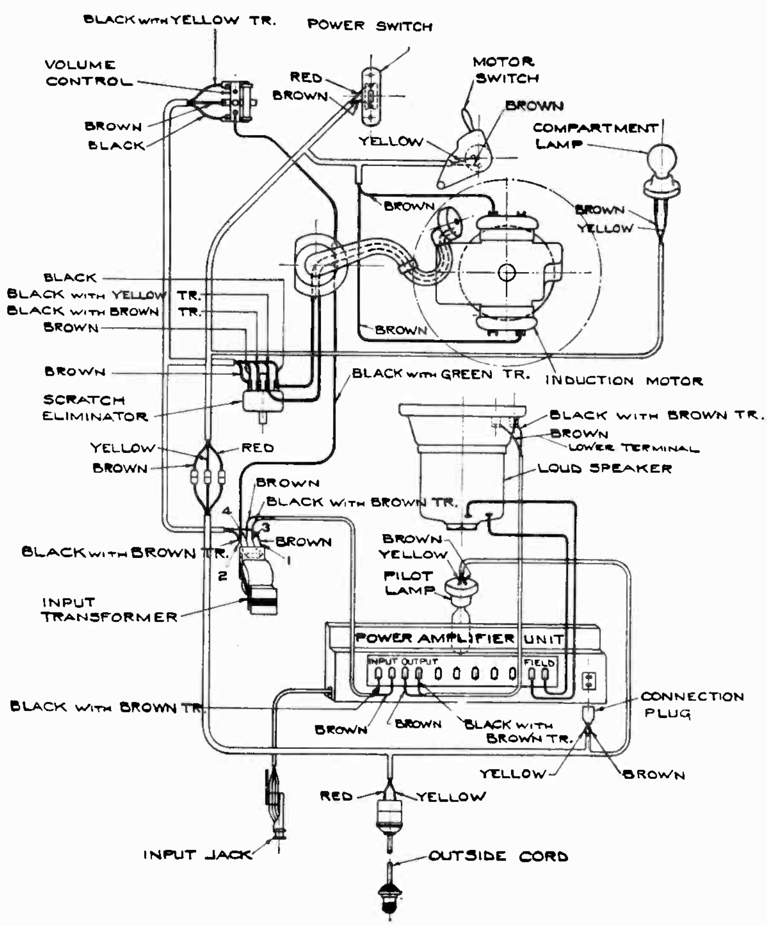


Wiring Diagram 12-15 above serial No. 2600

Victor Model 12–25



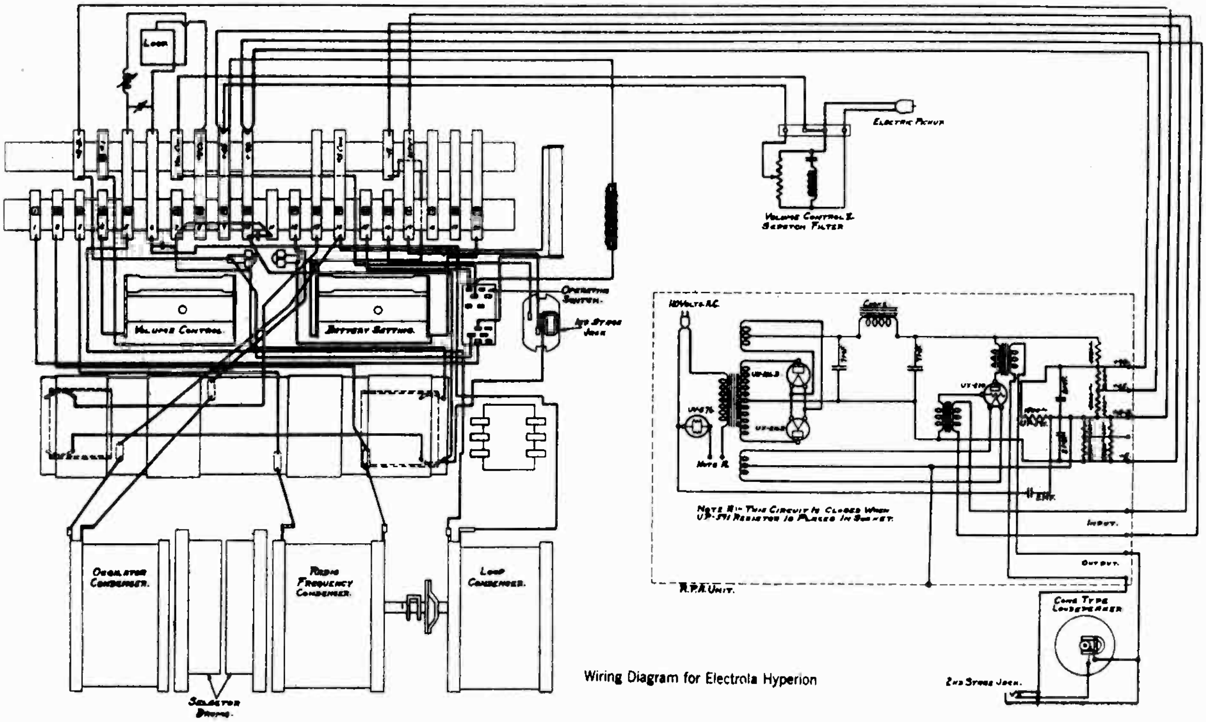
Wiring Diagram for Electrola 12-25



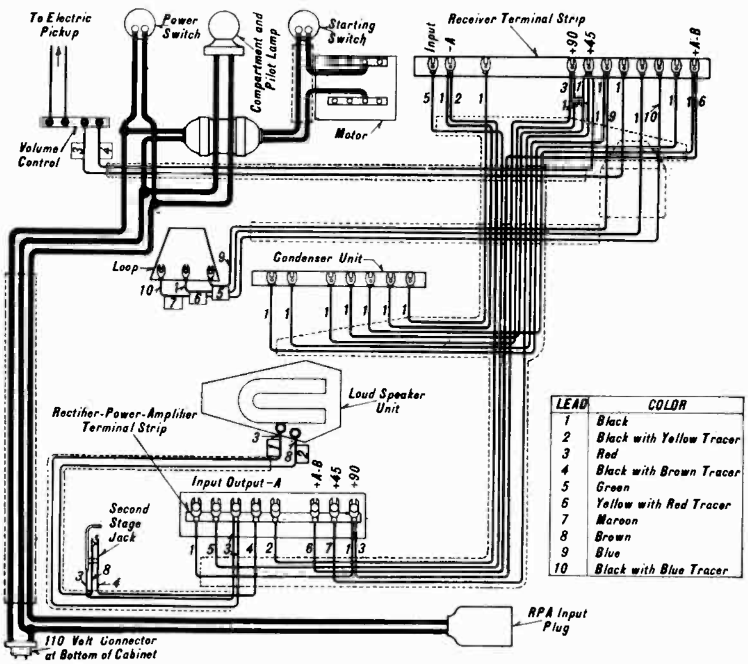
–Schematic Wiring Diagram of Electrola 12-25

Showing connections between terminals of the various units.

Victor Model 15-1 (Hyperion)



Wiring Diagram for Electrola Hyperion



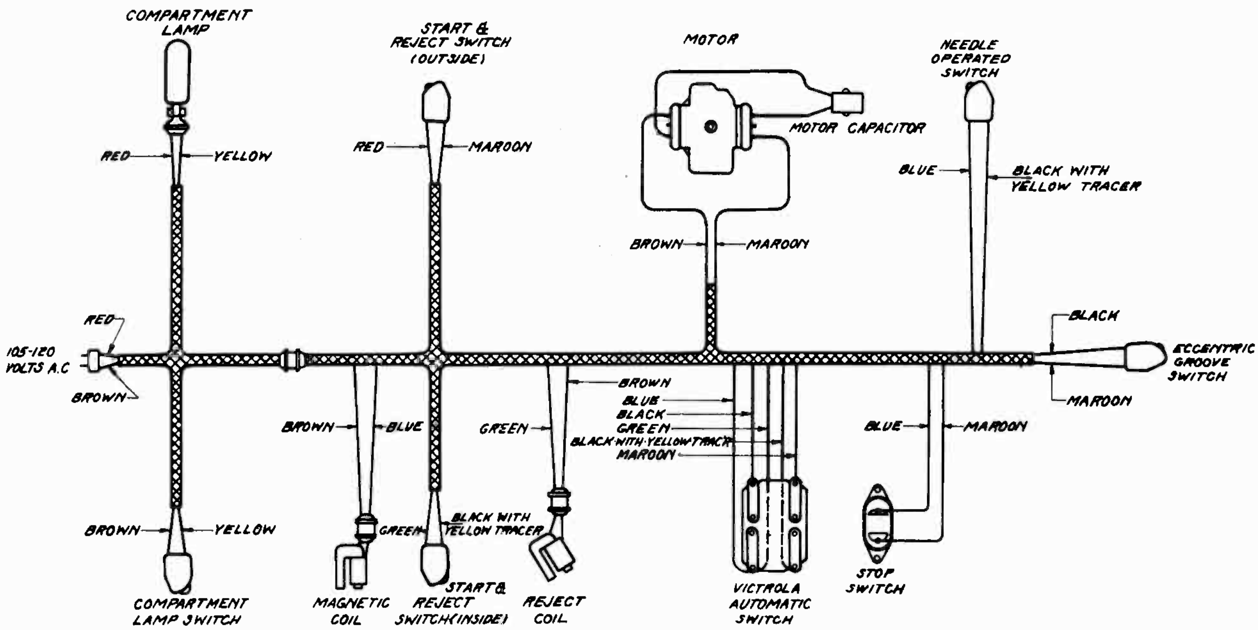
LEAD	COLOR
1	Black
2	Black with Yellow Tracer
3	Red
4	Black with Brown Tracer
5	Green
6	Yellow with Red Tracer
7	Maroon
8	Brown
9	Blue
10	Black with Blue Tracer

Schematic Wiring Diagram

Showing connections between the terminals of the various units. The 110-volt wiring is shown by extra heavy lines.

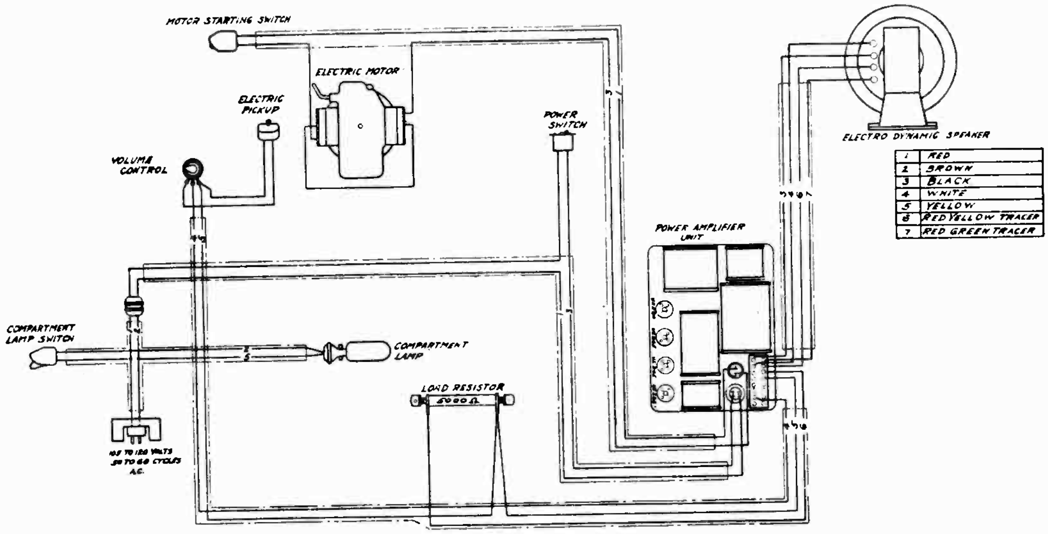
SERVICE DATA ON PICKUP, RADIO RECEIVER AND AMPLIFIER SAME AS MODEL 9—2

MODEL 10—35



—Power Cable Wiring Diagram Automatic Orthophonic Victrola No. 10-35

MODEL E—35



Cable Wiring Electrola E-35

AMPLIFIER SERVICE DATA SAME AS MODEL R—32

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