

RCA

Loudspeaker 105

SERVICE NOTES



RCA Loudspeaker 105

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Radio Corporation of America

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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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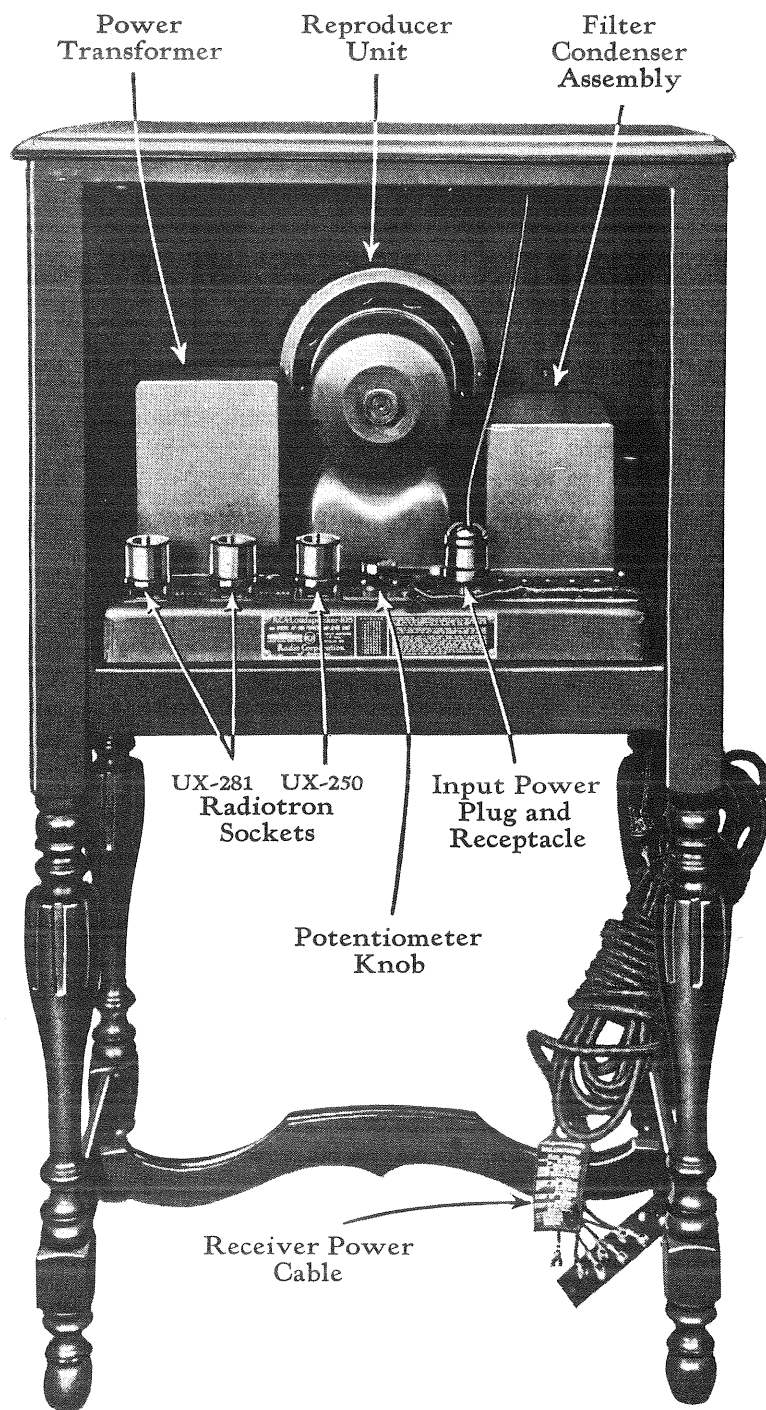


Figure 1—Rear inside view of cabinet, showing various parts.

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.

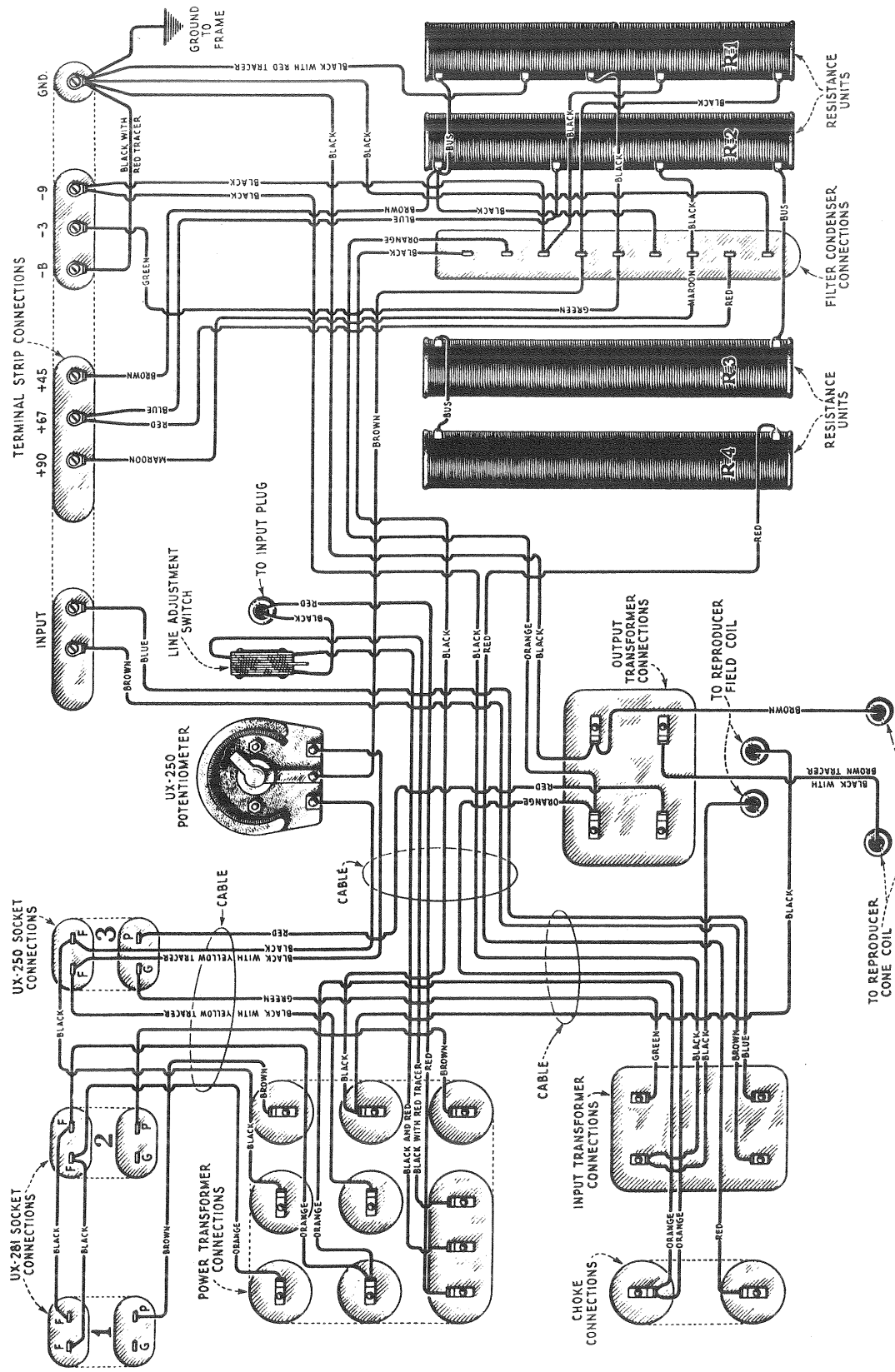


Figure 3—Sub-chassis assembly and continuity wiring diagram.

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.

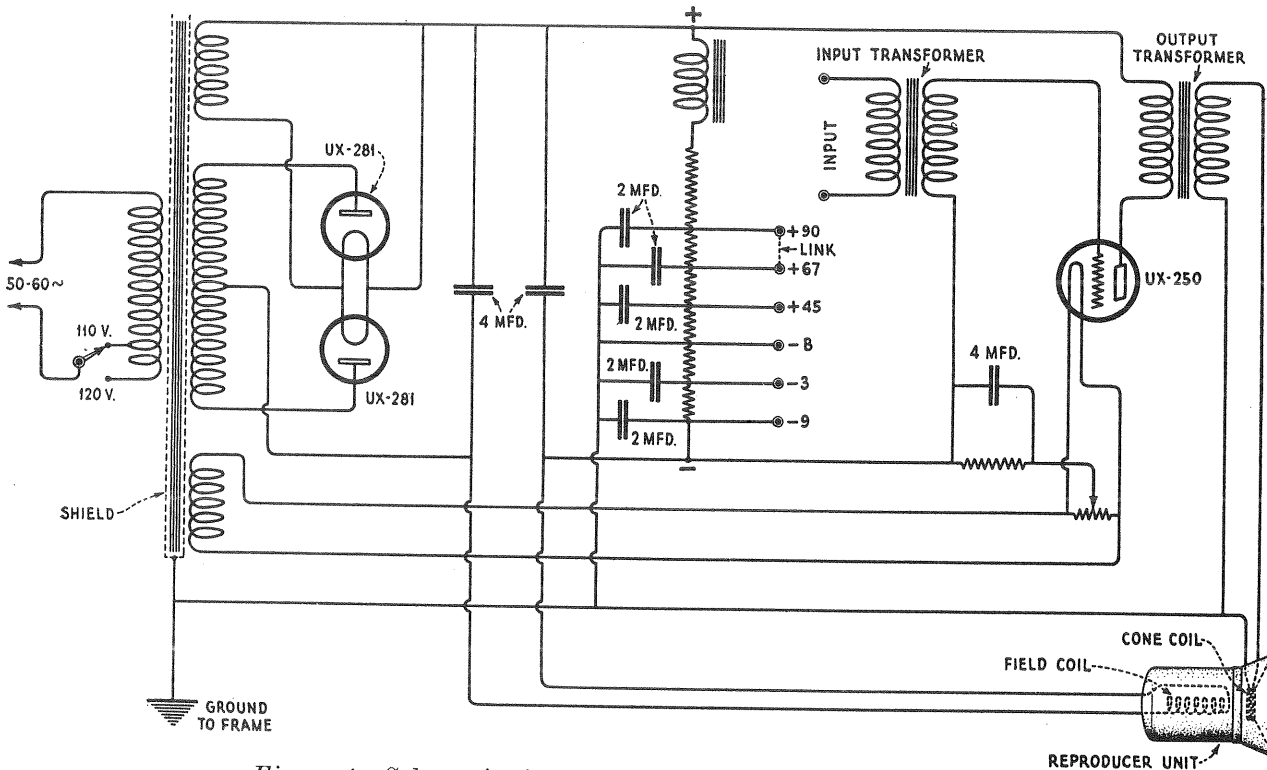


Figure 4—Schematic circuit diagram of RCA Loudspeaker 105.

[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.

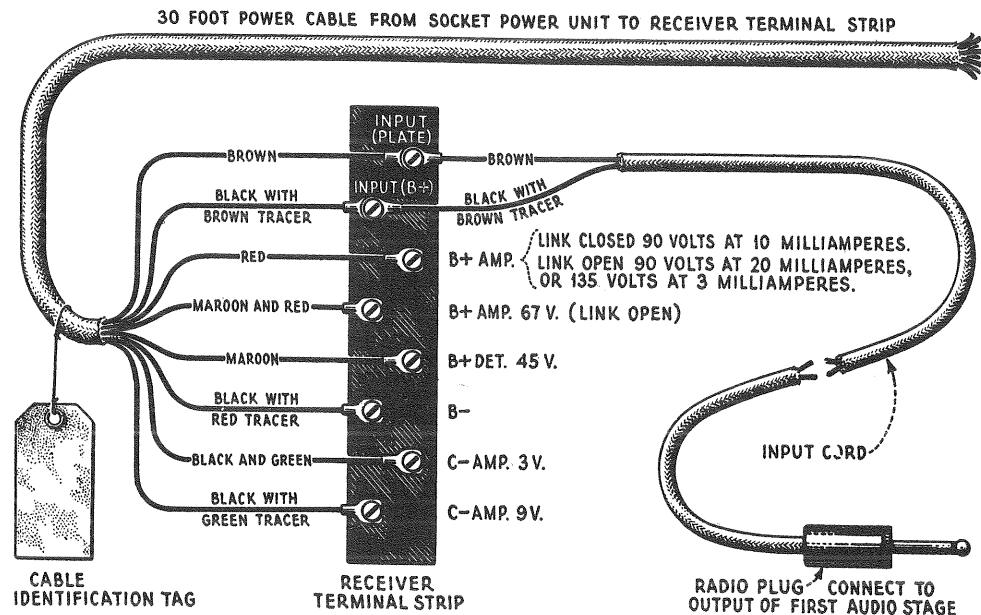


Figure 5—Thirty-foot power cable and receiver terminal strip.

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 receiver 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 loud-

speaker. 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.

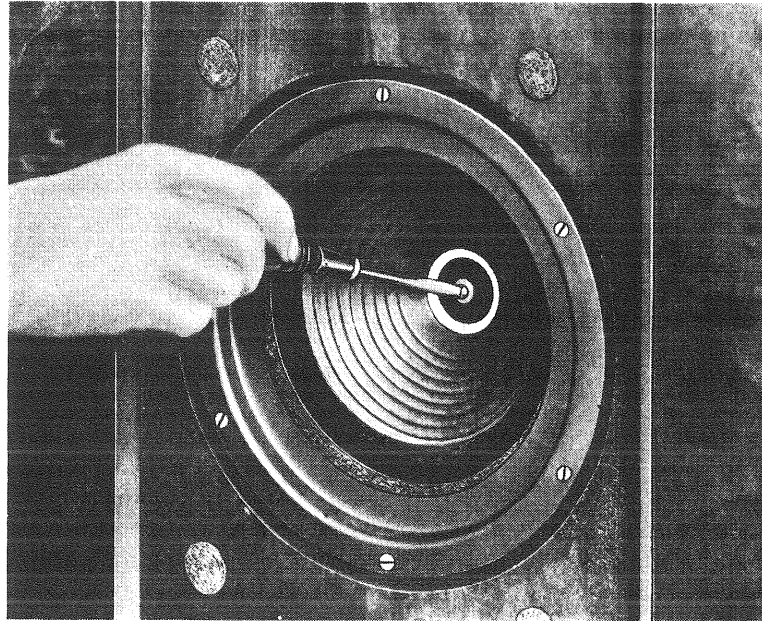


Figure 6—Centering cone.

[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

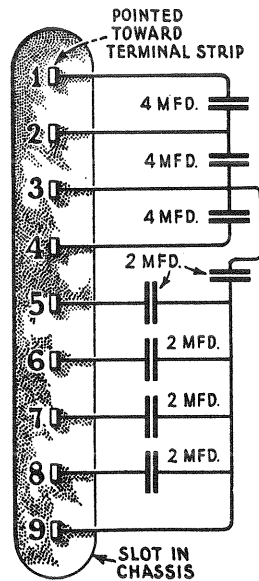


Figure 7—Filter condenser connections.

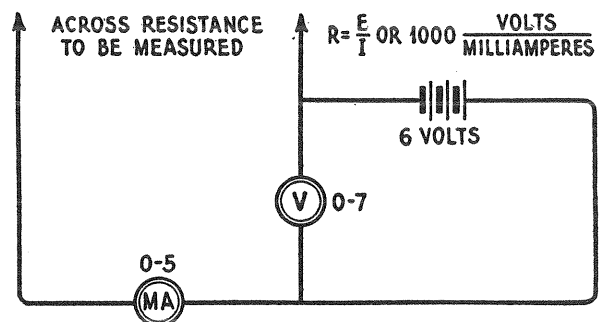


Figure 8—Schematic circuit for resistance measurement.

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.

$$R = \frac{E}{I} \left(\text{Where } R \text{ equals ohms, } E \text{ equals volts} \right) \text{ or } 1,000 \frac{\text{Volts}}{\text{Milliamperes}}$$

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.

<i>Circuit</i>	<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused by</i>
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
Input transformer	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
	G3 to -9	Closed	Open secondary of input transformer
Output transformer	Across input terminals	Closed	Open primary of input transformer
	P3 to +90	Closed	Open primary of output transformer; open reactor, or resistance units R2, R3 or R4
Cone coil	Disconnect cone coil leads and test across terminals	Closed	Open secondary of output transformer
	Across cone coil leads	Closed	Open cone coil
Resistance units	One side of cone coil terminal to ground	Closed	Open ground connection
	-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

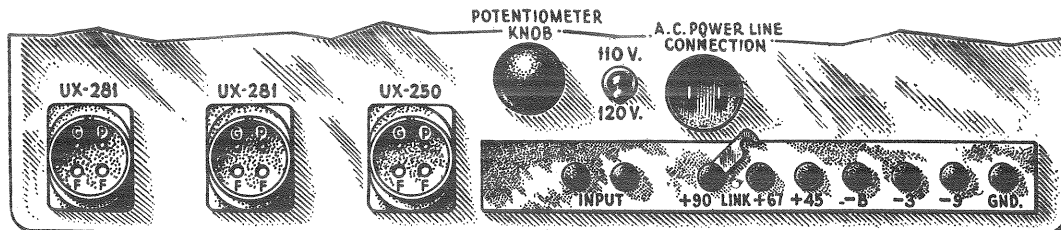


Figure 9—Location of Radiotron socket contacts and socket power unit binding posts.

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 con-

denser 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.

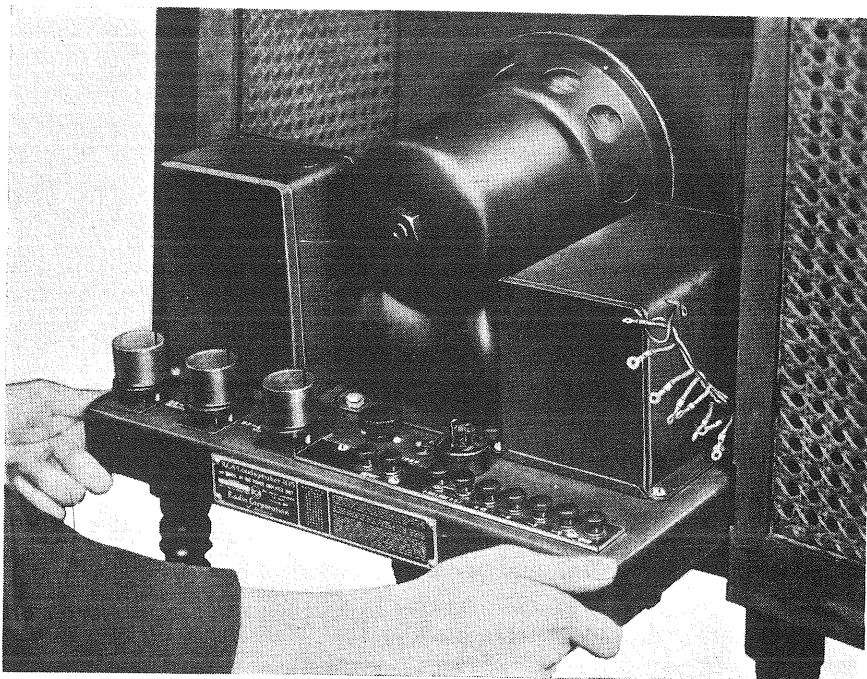


Figure 10—Removing chassis assembly from cabinet.

[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 sub-chassis. 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.

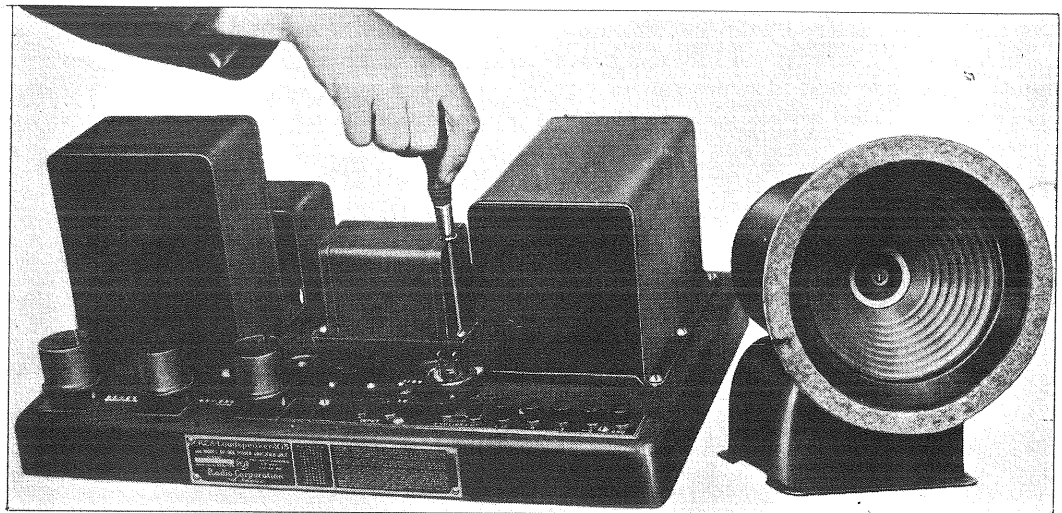


Figure 11—Removing output transformer.

(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	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
Weak signals	Defective cable to receiver . . .	Check and repair or replace defective cable	II	3
	Receiver in shielded locality . .	Use outdoor antenna	—	—
	Defective S. P. U. assembly . . .	Check S. P. U. continuity and repair or replace defect	II	11
Poor Quality	Defective receiver	Check receiver and repair or replace defect	—	—
	Poor input from receiver	Check receiver	II	5
	Cone of Reproducer unit not centered properly	Center cone of Reproducer or replace cone	II	5
Noisy or Intermittent Reception	Wires loose on side of cone . . .	Fasten wires with shellac	II	5
	Dirty Radiotron prongs	Clean Radiotron prongs.	—	—
Howling	Loose connections in receiver . .	Check receiver	—	—
	Sprung socket contacts	Bend socket contacts correctly. . .	—	—
Hum	Microphonic Radiotrons (especially detector) in receiver. .	Interchange Radiotrons	II	8
	Receiver too close to loudspeaker	Increase distance from receiver to loudspeaker	II	8
	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
Hum	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



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