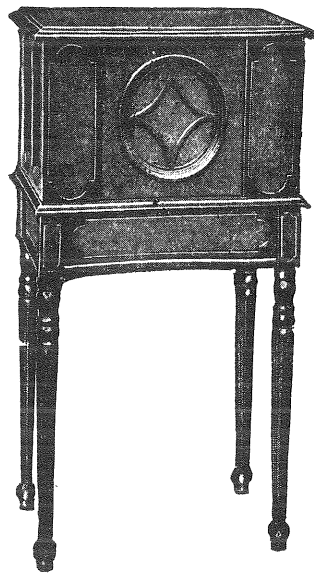


RCA

Loudspeaker 104

SERVICE NOTES

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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 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.

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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.

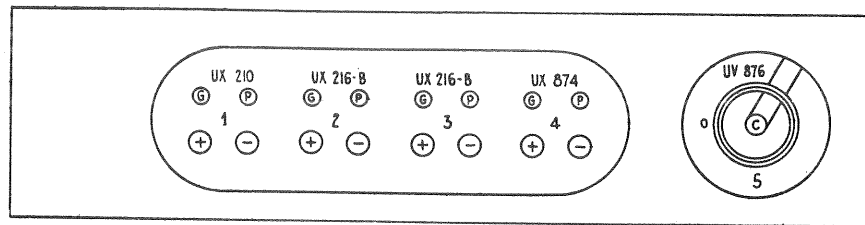


Figure 1—R.P.A. socket layout

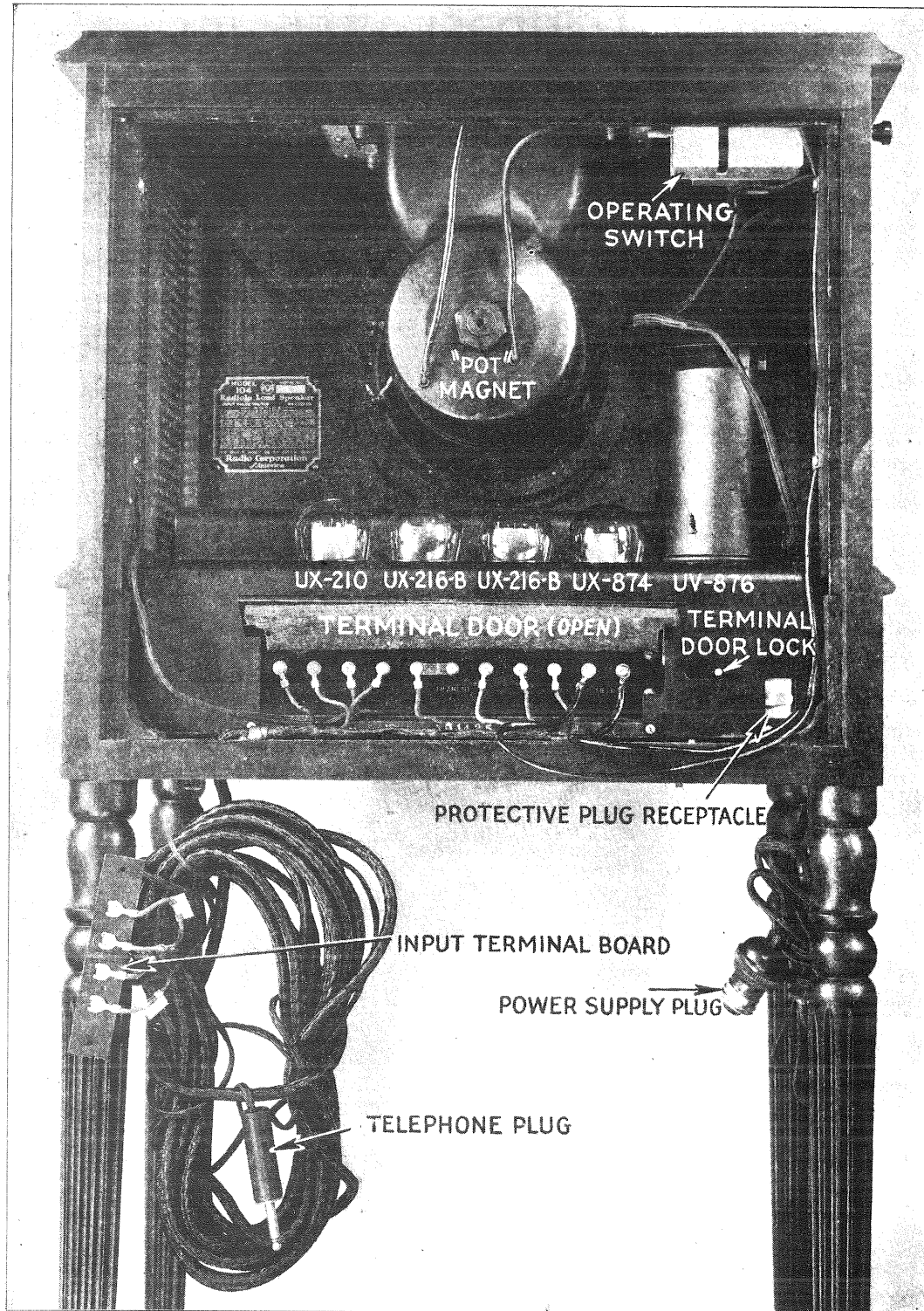


Figure 2—Rear view R.C.A. Loudspeaker, Model 104, showing location of Radiotrons, Rectrons, and parts

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.

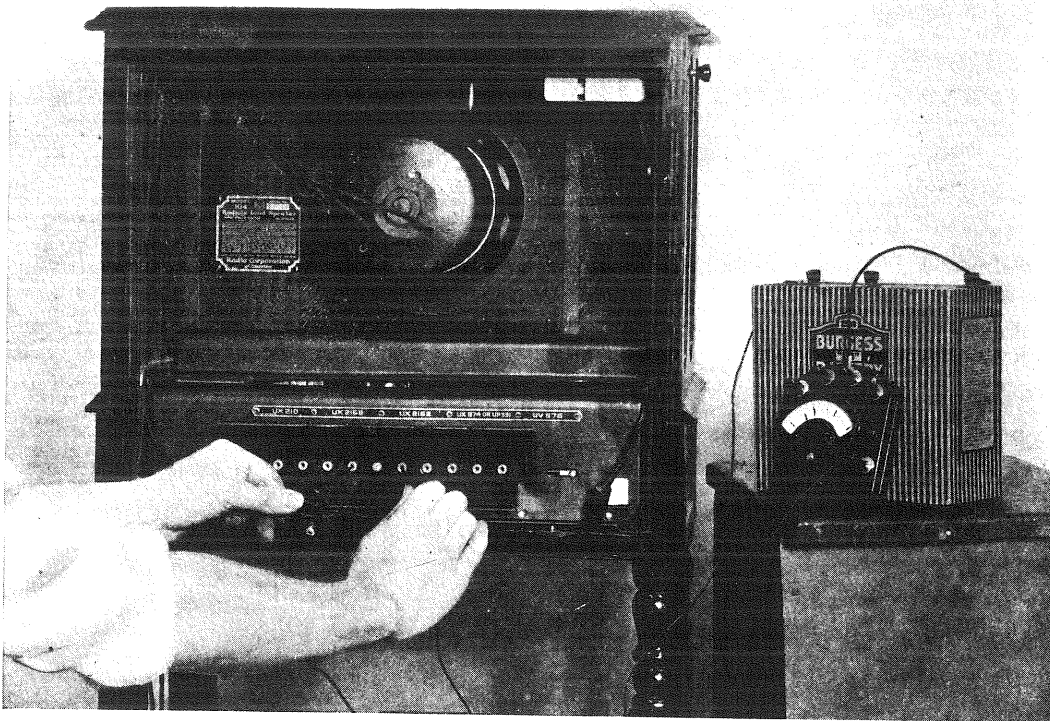


Figure 3—Tests Conducted at the Terminal Board of the R.P.A. Unit

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.

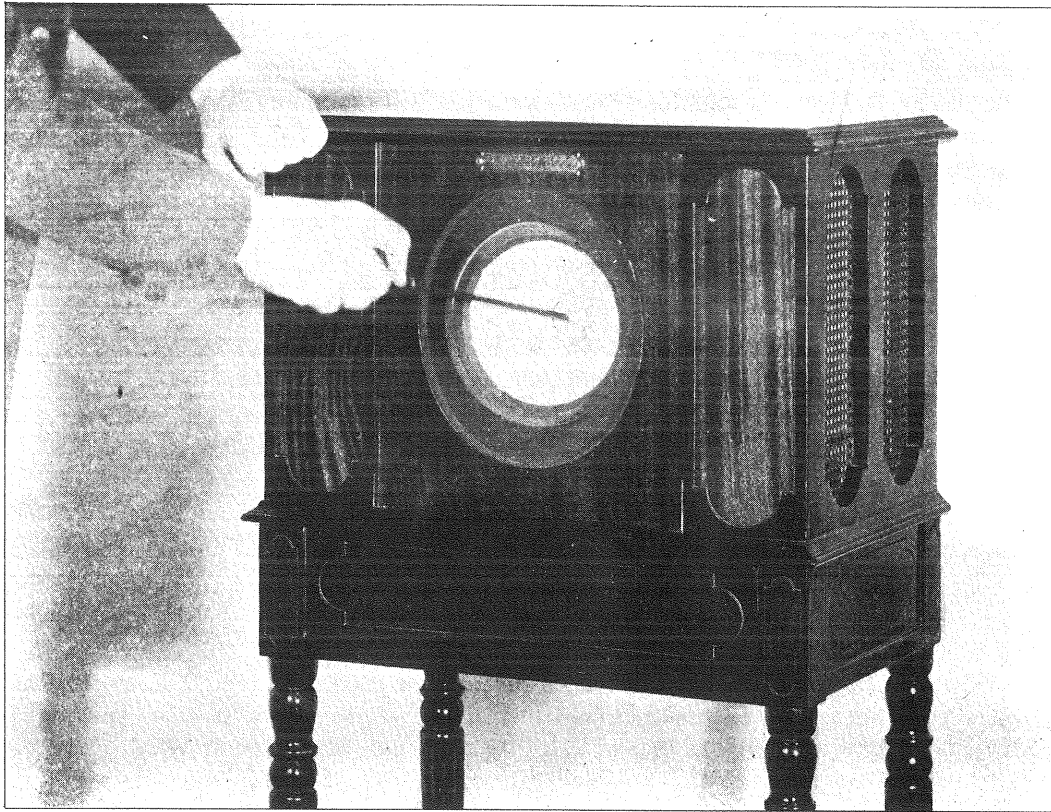


Figure 4—Readjusting cone

(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.

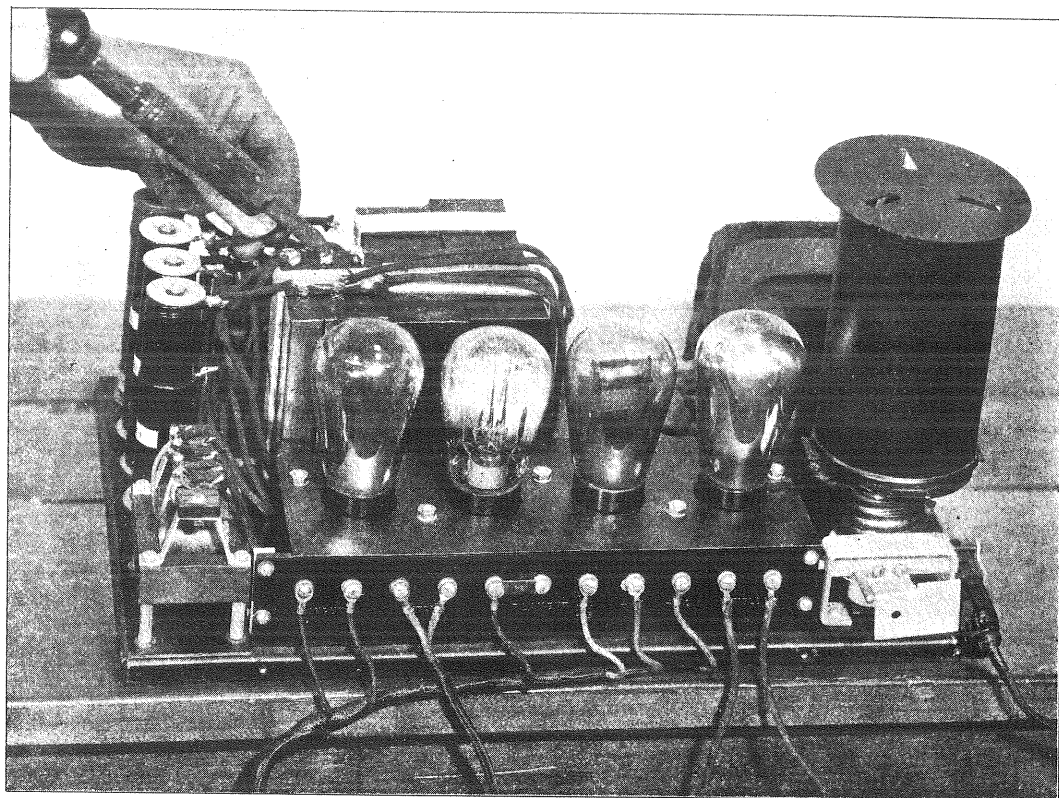


Figure 5—Testing 2 Mfd. condensers for leakage

(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.

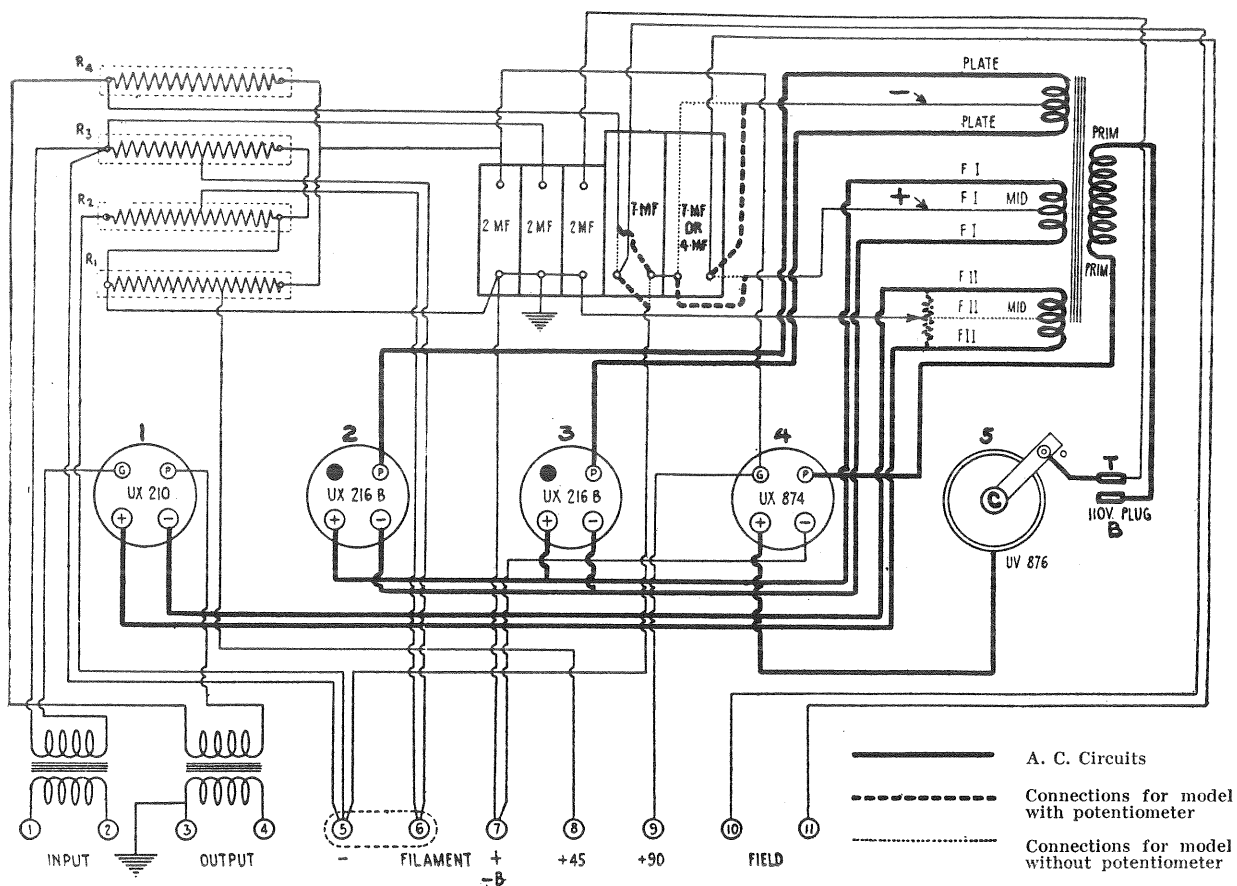
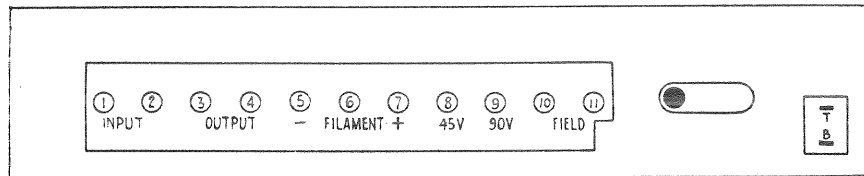


Figure 7—Continuity circuit of R.P.A. Unit

(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)

<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused By:</i>
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 1/2 plate winding of power transformer
5 to P3	Closed	Open 1/2 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 1/2 UX-210 filament winding of power transformer
7 to -F1	Closed	Open 1/2 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 1/2 UX-216B filament winding of power transformer
11 to -F2	Closed	Open 1/2 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)

<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused By:</i>
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 1/2 plate winding of power transformer
11 to P3	Closed	Open 1/2 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 1/2 UX-210 filament winding of power transformer and potentiometer
7 to -F1	Closed	Open 1/2 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.



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