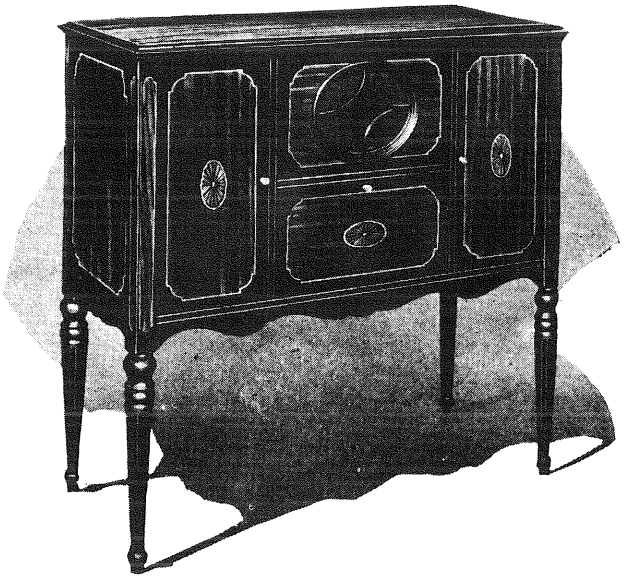
RADIOLA 30

Reg. U. S. Pat. Office

SERVICE NOTES

NS-30-2

Second Edition—November, 1926



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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 National 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.

RADIOLA 30 SERVICE NOTES

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INTRODUCTION

Radiola 30 is a complete, self contained, radio broadcast receiver of the super-heterodyne type operating entirely from an A.C. source of supply. (Figure 1.) The service problems encountered will not be materially different from those encountered in Radiola 28 and Radiola 104 Loudspeaker. However, the circuits are not identical and tests are not the same. The Radiola 100 Loudspeaker unit is used and the Service Notes prepared for it may be found useful.

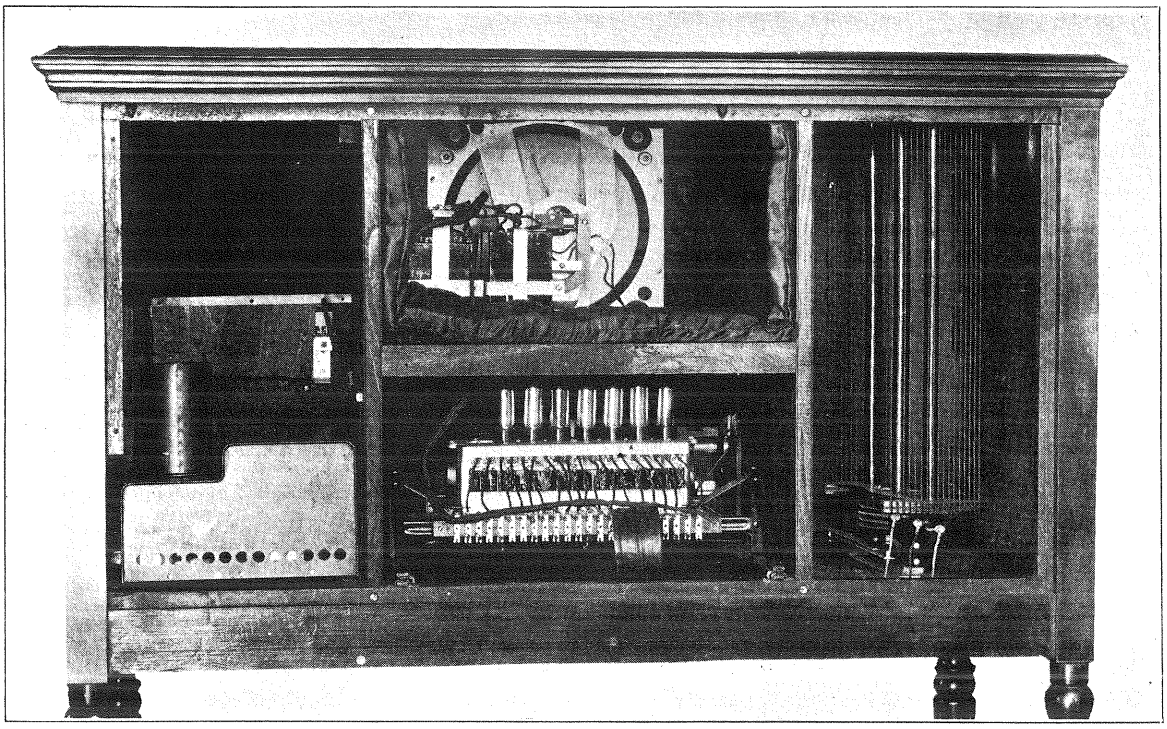


Figure 1—Back view of Radiola 30 showing arrangement of parts

The notes are divided into three sections, namely: Panel Assembly and Loop, Loudspeaker Assembly, and Rectifier-Power-Amplifier Unit. The particular section desired (as conditions may warrant) should be consulted when service work is performed.

PROTECTIVE SEALS AND THEIR USE

The lead seals placed on various units of Radiola 30 by R. C. A. are for the protection of the dealer. Broken seals indicate tampering.

Under no circumstances should a catacomb seal be broken. The special parts that go to make up the catacomb are impregnated in a wax compound and it is neither advisable nor practicable to attempt repairs without proper equipment. If tests indicate a defective catacomb replace it with a new one, returning the defective one through the regular channels to the nearest R. C. A. Service Station.

With exception of the catacomb seals, a service man many find it necessary to break those on other units 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.

PART I

Panel Assembly and Loop

(1) RADIOTRON SEQUENCE

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 I.F. amplification, then skipping tube No. 3, it passes through tube No. 4 which is the second I.F. stage.

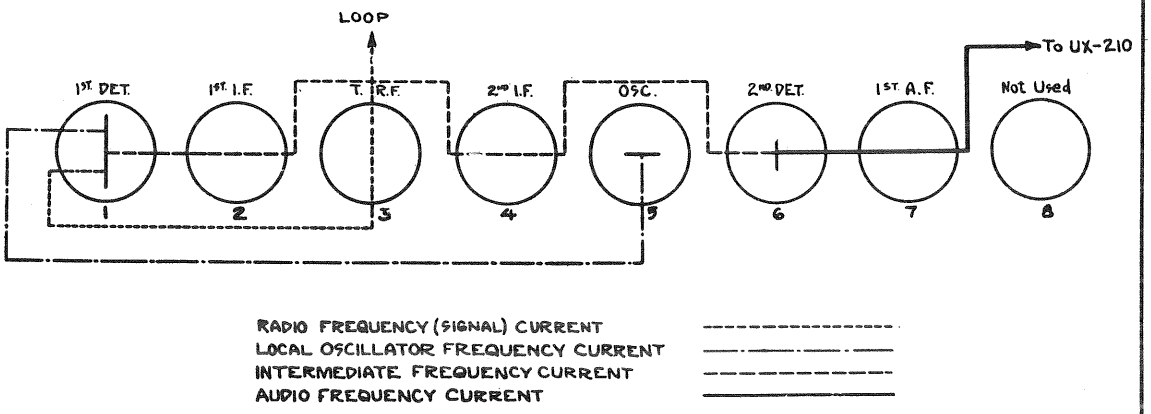


Figure 2—Radiotron sequence and path of the different currents.

From Radiotron No. 4 the signal is fed into No. 6, which is the second detector. The audio frequency current is now fed through Radiotron No. 7 and Radiotron UX-210 in the R. P. A. unit. Figure 2 illustrates the Radiotron sequence and the path of the different currents through them.

(2) OPEN LOOP

The symptoms of an open loop circuit in Radiola 30 are somewhat different from those manifested by the Radiola Super-Heterodyne, employing the six-tube catacomb. In the latter type of Radiola an open loop circuit, or broken pig-tail of the loop tuning condenser causes Station Selector No. 1 to have no apparent effect on tuning. Local stations may be received, however, when selector No. 2 is in the proper position for a certain station.

In Radiola 30, however, 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.

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 terminal strip 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 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 to opposite sides of the compensating condenser connected 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 on loop terminal strip.
(b) Open in loop cable.
(c) Open in compensating inductance.
(d) Broken loop pig-tail.

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

(3) 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 one in, as 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.

(4) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation. They should therefore be carefully cleaned occasionally with a piece of fine sandpaper as illustrated in Figure 3. The use of emery cloth or steel wool is not recommended. Before re-inserting Radiotrons in catacomb wipe the prongs and base carefully to make certain that all particles of sand are removed.

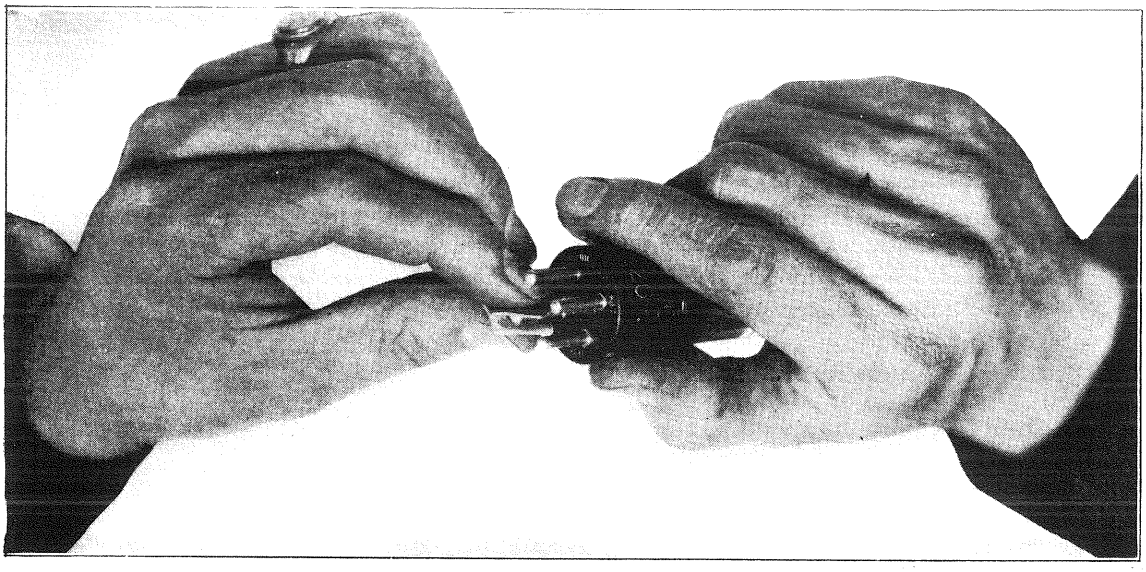


Figure 3—Radiotron prongs may be cleaned with fine sandpaper

(5) LOOSE RHEOSTAT CONTACTS

To get at the rheostat contacts, the panel must be released from the metal track and pulled forward. This is done by opening up the back panel of the Radiola and slipping the panel retaining pins through the small opening in the track. The main panel may then be pulled forward sufficiently to get at the rheostats.

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 back into cabinet. The pins will fall in their respective slots in the track when the panel is pushed into the cabinet.

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

This condition may be due to two causes:

(a) Warped drum control. Check by placing a straight edge on the outer flat 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 previously instructed 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 production from the loudspeaker. The remedy consists of adjusting the drum hex nuts to provide the necessary clearance so that scraping will not take place. If adjusting these hex nuts does not provide the necessary clearance the points touching should be filed until clearance results. Care should be taken to prevent scratching the dials.

(8) DRUMS FAIL TO HOLD POSITION

The following method should be employed in adjusting the tuning drums to their proper position.

(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 inside of the opposite drum. 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. In some models the drums are keyed to the condenser plates, thus eliminating the possibility of incorrect frequency calibration due to slipping of the drum controls on the condenser shaft.

(9) LOOP COMPENSATING CONDENSER

This 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.* In some models the adjusting screw is sealed. This seal will have to be broken should adjustment be found necessary.

The most noticeable need for readjusting the compensating condenser occurs when the Radiola seems to have lost its ability for distant reception. Having made certain that the trouble does not lie elsewhere, the following method should be employed to determine if adjustment of this condenser is required. The necessary equipment consists of a calibrated

modulated oscillator and a non-metallic screw driver. The circuit diagram of the modulated oscillator used is shown in Figure 4. The coil consists of 50 turns of No. 20 D.S.C. wire wound on a 2½-in. 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 Mfd. This oscillator will cover the frequency range of 550 to 1500 K.C. (200 to 546 meters) very efficiently. The grid condenser and leak modulate the output, the note being dependent on the value of the grid leak. A four-megohm leak is recommended, but if a lower or higher audio note is desired it is merely necessary to change grid leaks, a higher resistance leak giving a lower note and vice versa. Do not use a variable grid leak. The grid condenser is .00025 Mfd. A 45-volt "B" battery for plate supply is sufficient. A UX-199 Radiotron will be found to have ample power output. This oscillator will be found useful in servicing all types of receivers, adjusting compensating condenser on Radiola 28 and neutralizing Radiola 20. It will amply repay the dealer for the small outlay of material and labor required.

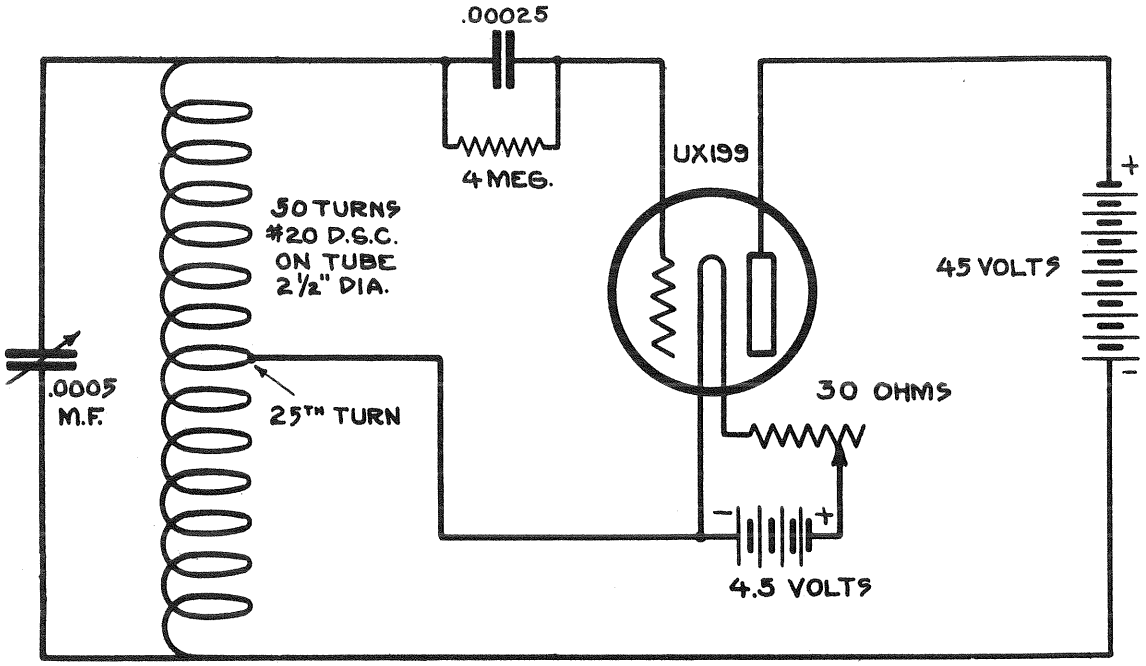


Figure 4—Wiring diagram of the modulated oscillator

To determine if adjustment of the compensating condenser is necessary proceed as follows:—

(a) Start set up in regular manner using headphones instead of loudspeaker, plugged in at external speaker jack.

(b) Disconnect all three loop connections at loop terminal strip.

(c) Remove back from cabinet and place modulated oscillator in an inductive relation to the R.F. transformer. This transformer is the first winding on the left of the long dilecto tube located directly in front of the catacomb when looking at the front of the Radiola. If more convenient, a pick-up wire from the vicinity of the oscillator wound around the R.F. transformer winding will prove satisfactory. The oscillator is placed in operation at 1500 K.C.

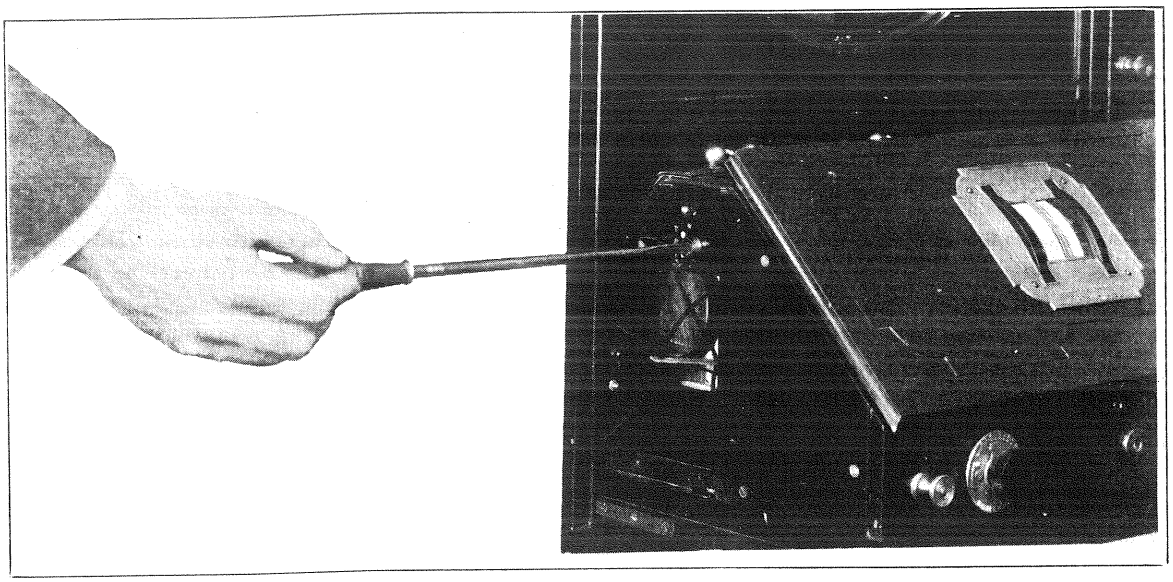


Figure 5—Adjusting the compensating condenser with a non-metallic screw-driver

(d) Tune the Radiola, as in receiving a broadcast signal, until the modulated oscillator signal is heard, carefully adjusting for its point of maximum signal strength. When this is found it should be noted on the left control drum.

(e) Remove pick-up wire if used and place oscillator approximately 20 feet from the Radiola. Reconnect loop terminals and tune in the oscillator signal as before. If the maximum signal point is different from that previously noted on the drum control the compensating condenser requires adjustment.

(f) Before proceeding with the adjustment set control drum at dial point of maximum signal when not using the loop, then, with *loop connected,* and using the non-metallic screw-driver (Figure 5), alter the capacity of the compensating condenser either plus or minus until maximum signal is again obtained. If varying the capacity of this condenser does not bring the signal strength back to that first noted, or if the loudest signal is at either extreme of the condenser setting, it will be necessary to slightly slip the main tuning condensers at their coupling in order to have the resonant point lie within the range of the compensating condenser. In only rare cases, however, will this be found necessary as the resonant point will generally lie within the range of the compensating condenser.

When maximum signal strength is obtained at a certain setting of the compensating condenser the loop is correctly balanced. This procedure should be repeated at 550 K.C. and if necessary a slight readjustment made.

For general purposes it has been found that when the circuits are checked at 1500 K.C. and then at 550 K.C. and the resonant points noted on the dial are within 1 degree of each other the Radiola will operate satisfactorily and is properly balanced.

In the foregoing instructions, it may be taken that these resonant points are the true peaks of these circuits. This is true only of the heterodyne detector circuit as the resonant point with the loop in use is the average point of the two peaks of these circuits. This does not affect the adjustment, however, and when the resonant points are together, the accuracy of the adjustment can be relied on.

(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 inductively coupled to the loop of Radiola 30 by winding a few turns of the lead-in, which should preferably be a continuation of the antenna itself, to a diameter of eight or nine inches, placing this coil at rear of the left compartment and in inductive relation to the loop. (Figure 6.) Enough wire should be left over after forming this coupling coil to serve as a ground lead, connecting same preferably to a cold water pipe by means of an approved ground clamp. It will be noted that no connections whatsoever are made in this length of wire from the far end of the antenna until connected to ground. Thus installed we have a low resistance antenna conveying the Radio waves to an aperiodic coupling coil, to be picked up by the loop of Radiola 30 and transmitted to the tuning elements in the usual manner. The loop loses its directional effect, but the loop tuning condenser calibration remains unchanged.

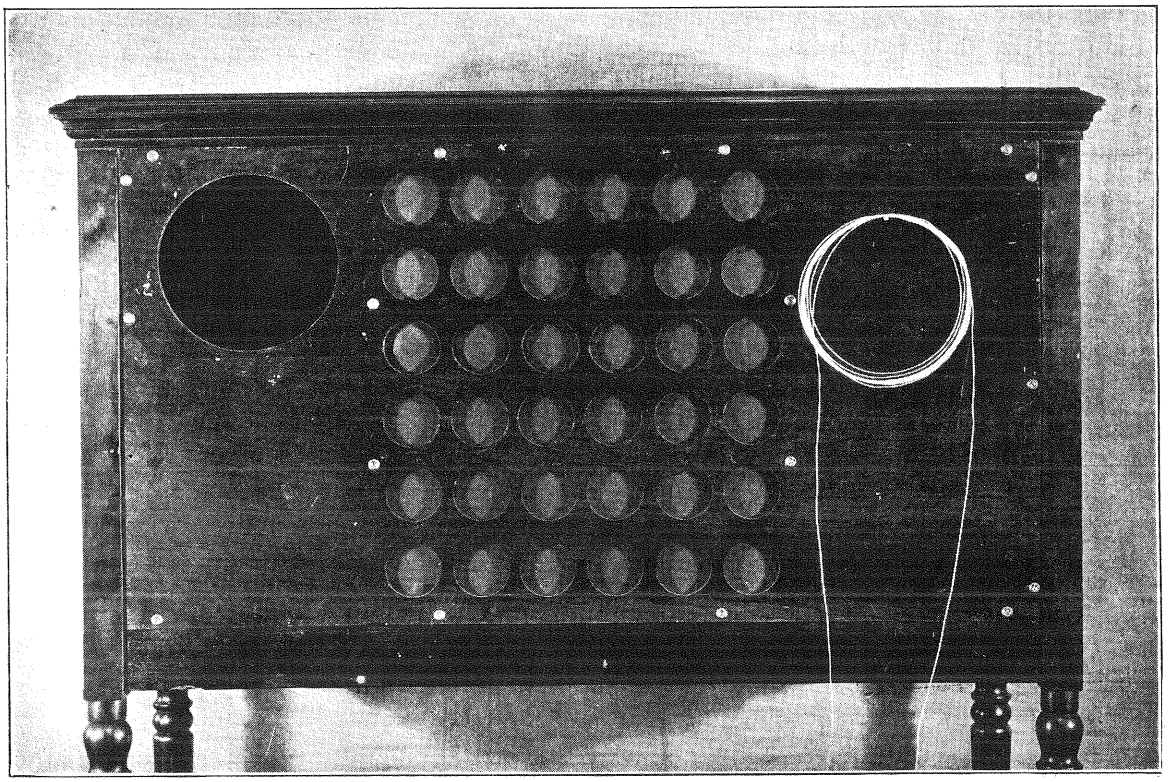


Figure 6—Proper installation of the coupling coil when using a small outdoor antenna to bring in signals in a highly shielded location

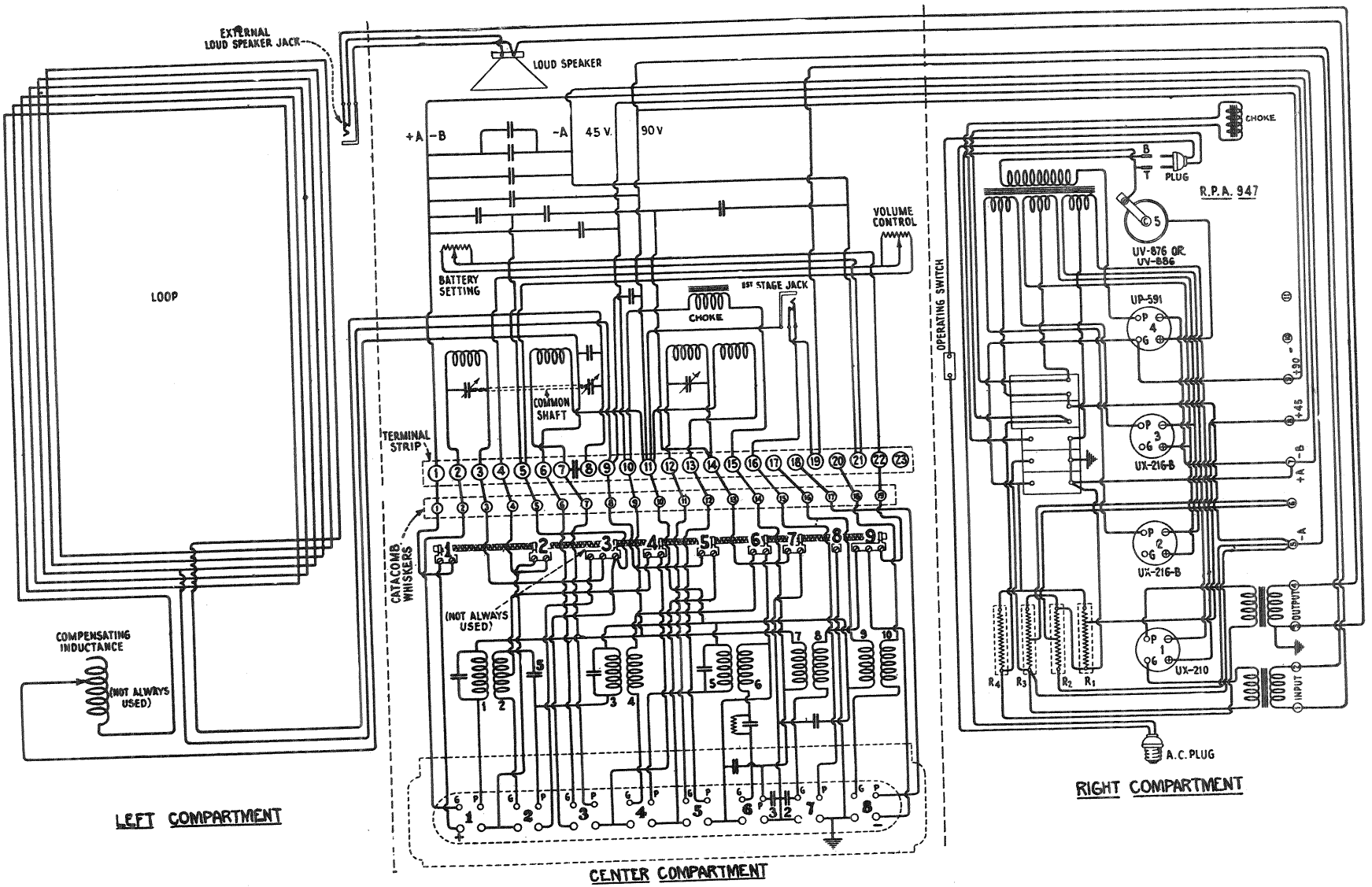


Figure 7—Radiola 30 continuity wiring diagram

(11) CATACOMB AND PANEL CONTINUITY TEST

Both filament control and volume control rheostats should be adjusted so that half the resistance is in the circuit, the loop connections opened and the power supply cable 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 battery terminals should be used in making this test. This arrangement will be found to be very sensitive in checking voltage drop in various circuits.

The contacts of the test equipment should be 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 "Defect." The first column indicates the circuit under test.

The designation "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 7.

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 tag to catacomb and note thereon observed defect.

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

CATACOMB TEST (Coils and Connections)
(Remove Terminal Strip)

Circuits	*Terminal*	*Correct Effect*	*Defect*
Grid	2 to G 1	Closed	Open connection
	5 to G 2	Closed	Open ½ coil No. 2, resistance strip, or catacomb connection
	6 to G 3	Closed	Open connection
	9 to G 4	Closed	Open coil No. 4, or resistance strip
	12 to G 5	Closed	Open connection
	20 to G 8	Closed	Open coil No. 10
	22 to G 7	Closed	Open coil No. 8

CATACOMB TEST (Coils and Connections)—*Continued*

Circuits	*Terminal*	*Correct Effect*	*Defect*
Plate	7 to P 3	Closed	Open connection
	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 Term. 17	Closed	Open coil No. 9
	13 to P 5	Closed	Open connection
	16 to P 7	Closed	Open connection
	18 to P 8	Closed	Open connection
Filament	+ F 1 to 1	Closed	Open connection
	— F 1 to + F 2	Closed	Open connection
	— F 1 to 4	Closed	Open connection
	— F 2 to 5	Closed	Open connection
	+ F 3 to 5	Closed	Open connection
	— F 3 to 9	Closed	Open connection or resistance strip
	— F 3 to + F 4	Closed	Open connection
	— F 4 to 9	Closed	Open connection
	— F 4 to + F 5	Closed	Open connection
	— F 5 to 14	Closed	Open connection or resistance strip
	— F 5 to + F 6	Closed	Open connection
	— F 6 to 14	Closed	Open connection
	— F 6 to + F 7	Closed	Open connection
	— F 7 to 14	Closed	Open connection or resistance strip
	— F 7 to + F 8	Closed	Open connection
	— F 8 to 22	Closed	Open connection

CATACOMB TEST (Condensers)
Resistance Strip Removed

Circuits	*Terminal*	*Correct Effect*	Defect
Grid	+ F 6 to G 6	Open or very weak	Shorted grid condenser or grid leak
	G 7 to + F 7	Open	Shorted condenser No. 2
Plate	— F 6 to P 6	Open	Shorted condenser No. 3

The various panel parts are comprised in the following tests:—

PANEL TEST
(Terminal Strip Removed)

Terminal	*Correct Effect*	*Defect*
22 to 21	Closed	Open filament rheostat
19 or 17 to 16	Closed	Defective contact in first stage jack
14 to 12	Closed	Open Oscillator coil
13 to 11	Closed	Open Oscillator coil
11 to 7	Closed	Open primary of R.F. transformer
5 to 4	Closed	Open volume control rheostat
3 to 2	Closed	Open secondary of R.F. transformer
Replace Terminal Strip		
9 to 8	Closed	Open one-half loop
9 to 6	Closed	Open one-half loop

PANEL TEST (Condensers)
Loop Disconnected

Terminal	*Correct Effect*	*Defect*
8 to 6	Open	Short in either or both loop tuning or compensating condenser
8 to 7	Open	Shorted neutralizing condenser

(12) RESISTANCE STRIP TEST

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 8.

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

$$R = \frac{E}{I} \quad \begin{Bmatrix} \text{Where R equals ohms, E equals} \\ \text{volts and I equals amperes} \end{Bmatrix}$$

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

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.

The resistance strip terminals will be found numbered from left to right in Figure 7.

The values of resistance for the different sections of the strip are tabulated in the following table when a 375-ohm volume control is used.

Resistance Terminals	*Lower Limit*	*Normal*	*Upper Limit*
1—2	185	190	195
2—3	350	400	450
3—4	158	163	168
4—5	150	155	160
5—6	125	130	135
6—7	116	120	124
7—8	111	115	119
8—9	45	50	55

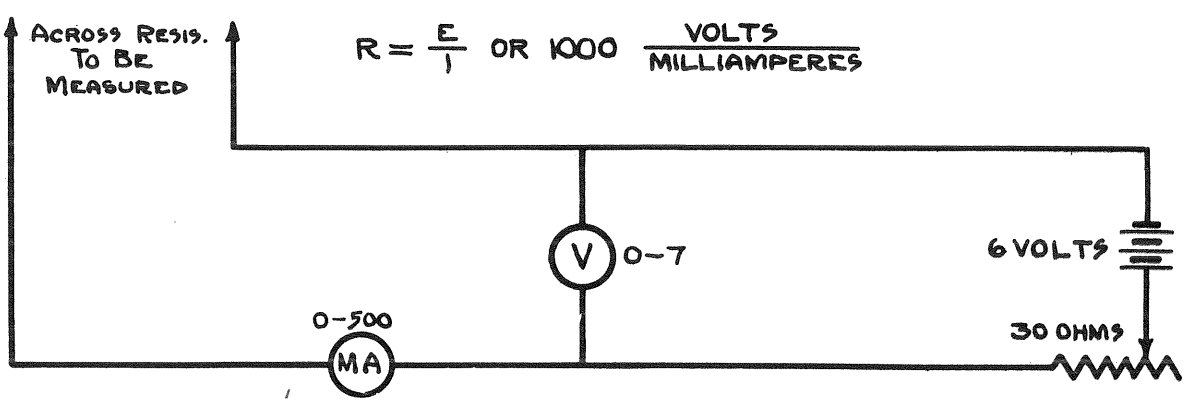


Figure 8—Wiring diagram for resistance measurement

When the volume control is of 250 ohms resistance the following are the correct values:

Resistance 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

PART II

Loudspeaker Assembly

The loudspeaker incorporated in Radiola 30 (Figure 9), is a standard Model 100 unit with a special mounting for the cone. This speaker is carefully adjusted at the factory and should be very stable in operation regardless of volume. Should adjustments seem necessary the quality of output may first be checked by plugging a speaker of known quality into the jack provided for an external speaker (in left compartment), and the quality of reproduction noted. This will isolate trouble to the loudspeaker or other units.

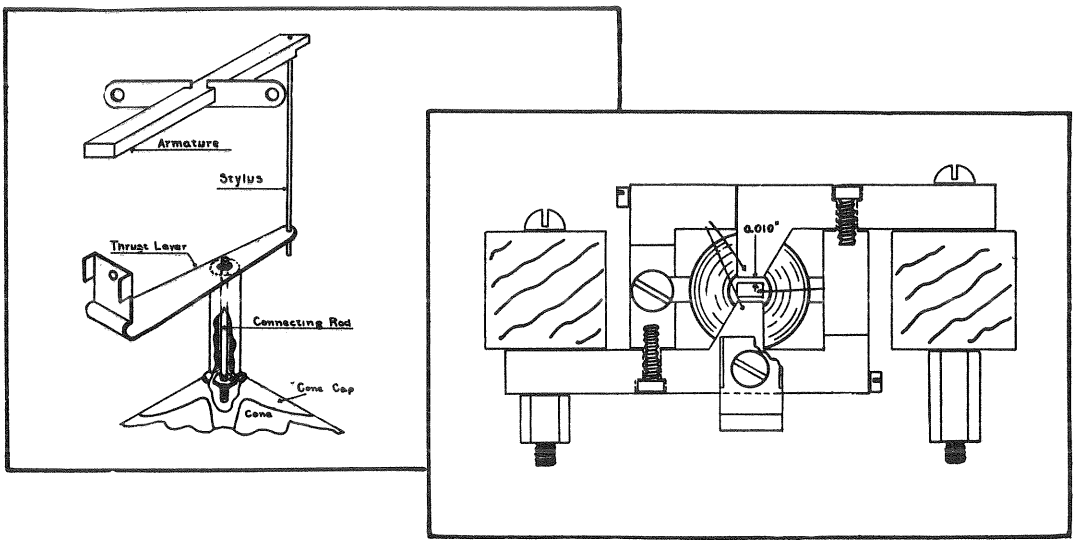


Figure 9—Details of loudspeaker unit

(1) DISTORTION OR RATTLE

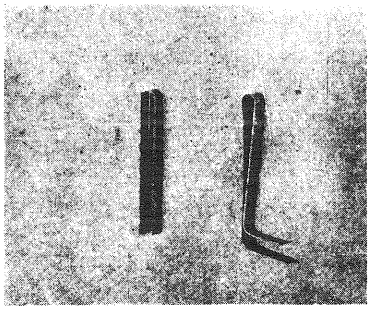
If distortion or rattle is isolated to the reproducer unit, look for:

(a) Foreign matter interfering with armature action.
(b) Armature striking pole pieces.
(c) Excessive pressure on stylus.
(d) Bent stylus.
(e) Loose or bent connecting rod.
(f) Defective cone.

On examination it will be seen that the armature vibrates between the pole pieces, this motion being transmitted through the stylus to the thrust lever. The thrust lever is held rigidly to one side of the end frame. It is attached to the cone by the connecting rod. Dirt at any of these points may cause distortion.

If the stylus is bent, straighten it. The cone is attached to the connecting rod by means of a small nut. The end of the connecting rod is threaded. Make certain that the nut is drawn up tight holding the cone rigidly to the connecting rod.

If the foregoing has been checked and found to be O.K. note whether or not the armature is striking the pole pieces. There should be a space approximately .010 inch clearance between the armature and the pole pieces. This applies to both ends of the armature. To adjust the



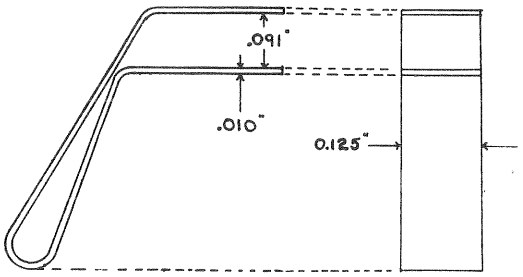


Figure 10—*Constructional details of spacer tools*

armature correctly it will be first necessary to make a set of spacer tools (Figure 10). These are made of 1/8" stock phosphor bronze .010" thick and bent to give two surfaces .091" apart. Two of these tools are necessary. After the two screws are loosened at each end of the armature these tools are inserted at each end between the armature and pole pieces (Figure 11). The screws are then tightened with the spacer tools in place. This completes the adjustment.

Excessive pressure on the stylus can be relieved by applying a hot soldering iron at the soldered connection. When the solder melts the stylus will automatically assume its correct position. The iron should then be removed and the solder allowed to harden.

A loose or bent connecting rod will be disclosed by inspection and should be tightened or straightened. If the bend is excessive it may be necessary to install a new rod.

The various points covered by the foregoing should be checked in the order in which they are listed. The entire reproducer unit may be removed from the cabinet by removing the screws holding it to the front of the cabinet. The terminal leads must also be disconnected.

(2) REPLACING BURNED-OUT FIELD COILS

Should it become necessary to replace the field coils because of burn-out or other causes the following procedure should be used.

1. Remove back panel from the Radiola.
2. If A.C. Package condenser bank or large filament condensers are in upper (speaker) compartment they must be removed. The screws holding them should be removed, but the electrical connections left intact. There is sufficient cable to allow moving to the lower compartment temporarily.
3. Remove the nuts that hold the speaker frame to the felt padding. The speaker is then lifted clear of the Radiola, first disconnecting the various fastenings holding it. These fastenings should be tagged to provide for replacing in correct position.
4. Remove the small nut holding the cone to the connecting rod.
5. Remove the nut and lock washer from the two upper screws holding the speaker unit to the speaker frame.
6. Unscrew and remove the lower supporting screw. The unit may then be removed from the frame. Be careful not to strain the connecting rod or damage the cone when pulling it out.
7. Remove from the unit the three supporting screws.
8. 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.
9. Remove the screw holding the thrust lever to the motor frame.
10. Unsolder the thrust lever from the stylus.
11. Remove the two armature screws.
12. Disassemble the motor by removing the two countersunk screws. The coils are then accessible and the armature is still in position in the center of the coils.
13. 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 any trace of dust or dirt and metal filings. Use a brush to remove foreign matter. Do not use a liquid cleaner as corrosion may result.

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

1. Place the coils in their 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.
2. Place the coils with armature in position on one of the motor side pieces. Place the other motor side pieces in place and screw the assembly together by means of the countersunk screws.
3. Place the thrust lever in position and screw it in place, but do not solder the stylus.
4. Replace the armature screws, but do not tighten them.

5. Insert the spacer tools in position as shown in Figure 11 and tighten the armature screws. It may be necessary to do this several times before the armature is correctly adjusted.
6. Remove the keeper and place the motor in position on the horseshoe magnet. Line the motor up horizontally with respect to the sides of the magnet and tighten screws to magnet.
7. Replace unit on frame. Place the connecting rod through the cone. Replace the two screws and supporting strap and make the unit fast to the frame. Be careful to adjust the unit so that the connecting rod is correctly lined up with the cone before tightening.
8. Lock the cone to the connecting rod by means of the small nut that was removed from the inside when disassembling.
9. Solder the stylus to the thrust lever.
10. Replace the assembly in the upper compartment and replace the nuts that hold it in place.
11. Reconnect the leads to the speaker.
12. Replace any condensers removed.
13. Replace back panel of the Radiola cabinet.

(3) REPLACING A DEFECTIVE CONE

To replace a damaged or defective cone the following procedure is necessary.

1. Remove the complete assembly from the cabinet as described in paragraphs 1, 2, 3 of Section No. 2.
2. Remove the small nut inside the cone holding the connecting rod.
3. Remove the four screws at the four cardinal points of the cone edge.
4. Remove the remaining eight screws.
5. Remove the outer clamping ring.
6. Remove the cone.
7. Put new cone in place. The center of the cone should pass over the connecting rod.
8. Replace the outer clamping ring and replace the last eight screws removed. Do not tighten down at this point.
9. Carefully center the cone and replace the small nut that fastens the cone to the connecting rod.
10. Replace the four screws at the four cardinal points of the cone edge. Take up gradually on all screws until they are properly seated.
11. Make operating tests and necessary adjustments.
12. Replace the assembly in cabinet. Replace the nuts that hold the speaker to the felt pad and connect all leads.
13. Replace any condensers removed and replace back panel of cabinet.

(4) HOWLING

This is caused by microphonic action of UX-199 Radiotrons in the catacomb. The sound waves striking a microphonic Radiotron will cause the elements to vibrate which, in turn, will be reproduced in the loudspeaker. Conditions being favorable, the howl may increase in intensity and drown out the broadcast signal.

The remedy lies in interchanging the Radiotrons. Counting from the left, when facing the front of the Radiola, Radiotrons five and six should be interchanged. If this does not stop the howl then try interchanging Radiotrons two and three and four and seven. A final change of Radiotrons one and six should be made if the preceding shifts do not remedy the condition. Radiotrons six, one and three are respectively, the most sensitive to microphonic action.

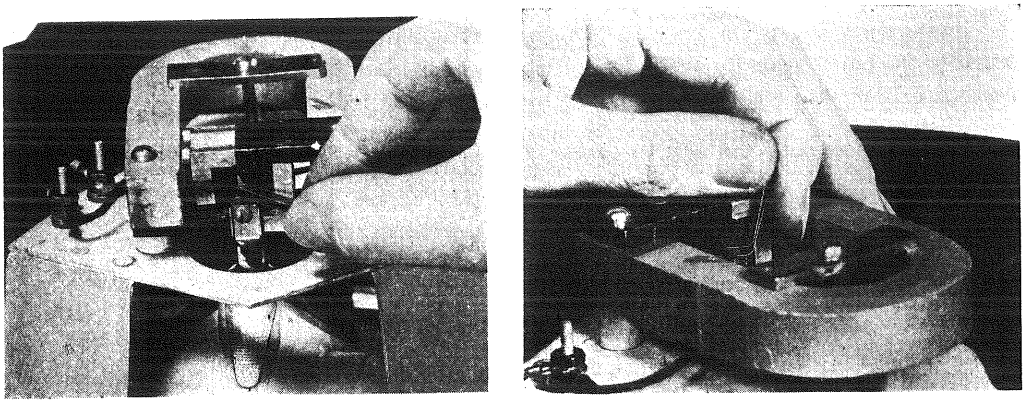


Figure 11—Use of spacer tools in armature adjustment

(5) BLASTING

Local acoustical conditions may sometimes cause blasting with the volume control adjusted near to, or at maximum, when receiving signals from nearby stations. When this effect occurs—

(a) Check loudspeaker for proper adjustment.

(b) Interchange Radiotrons—Radiotrons should be matched as described in Section No. 4.

(c) Adjust the small neutralizing condenser between terminals 7 and 8 of the catacomb terminal strip. Some models have this condenser made so as to allow adjustment. If it is not properly adjusted the Radiola may be operating too close to the oscillation point and on a loud signal will break into oscillation. This will give the effect of a loud blast.

(d) Add choke across terminals 10 and 16 of catacomb terminal strip. This choke should be the primary of a Radiola 30 input transformer or the complete winding of a Radiola III-A output transformer. This may be relied on to clear up the most obstinate cases of blasting.

PART III

Rectifier-Power-Amplifier Unit

Servicing the R.P.A. unit of Radiola 30 will be found very similar to that in the R.C.A. Loudspeaker Model 104. The unit is not the same, however, and tests are individual to it.

The unit makes use of one Radiotron UV-876 (or UV-886) two Rectrons UX-216-B and one Radiotron UX-210 (Figure 12). It is imperative that these various Radiotrons and Rectrons be in perfect operating condition otherwise the various test indications will be misleading.

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

The two Rectrons UX-216-B are rectifying tubes which convert the alternating current into pulsating direct current, which is smoothed out by the filter system to continuous direct current.

Radiotron UV-876 (or UV-886) 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

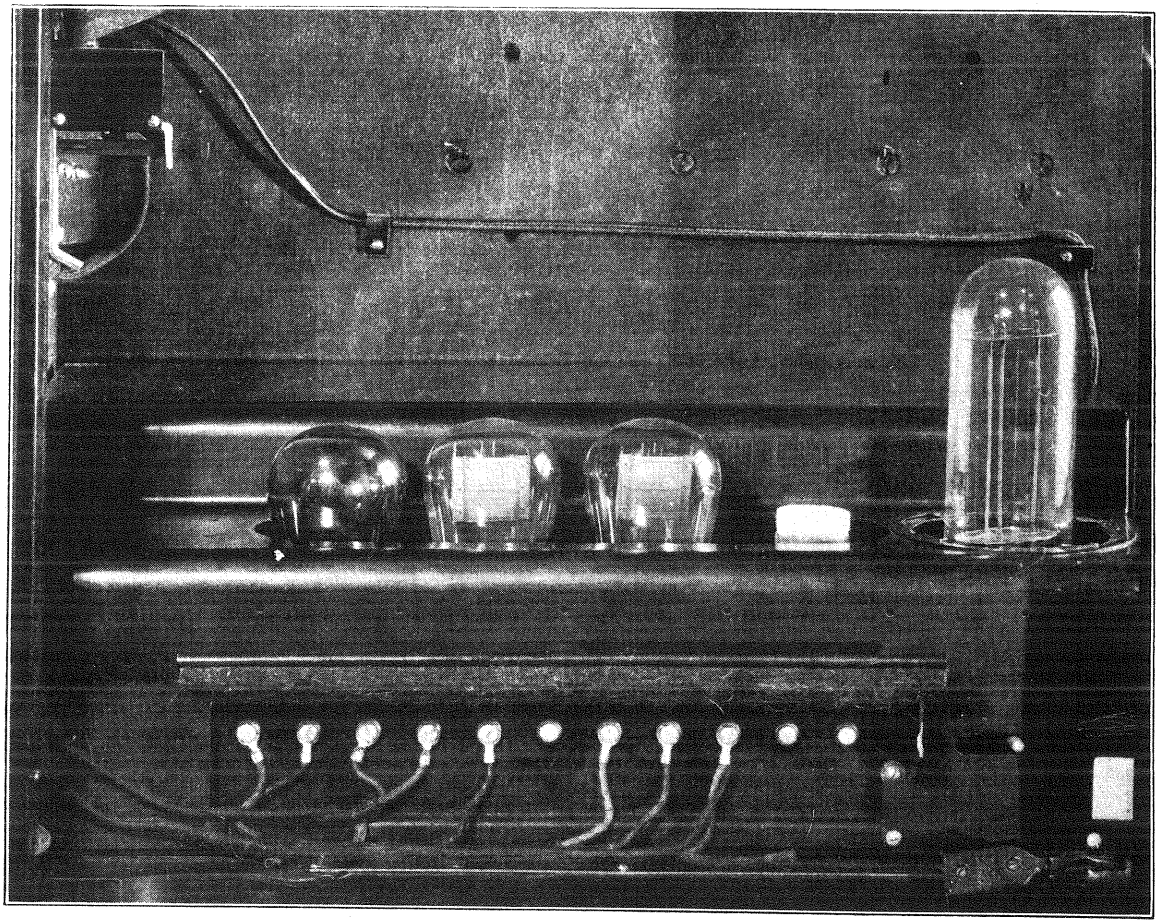


Figure 12—The Rectifier-Power-Amplifier unit

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 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 30 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 in reassembling 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 AND RECTRONS

Should Radiola 30 suddenly cease to operate satisfactorily, open the door of the right hand compartment and note whether or not the tubes are lit. Replace any of the Radiotrons or Rectrons, whose filaments are not burning. If Radiotron UV-876 is apparently operating correctly, as indicated by considerable heat dissipation and the other tubes do not glow, trouble may be due to an open in the filament windings of the power transformer or a defective resistance unit UP-591.

Should all Radiotrons and Rectrons fail to light or operate as indicated in the preceding paragraphs, 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 and Rectrons 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 AND RECTRONS IN R.P.A. UNIT FUNCTION PROPERLY, BUT RADIOTRONS UX-199 IN CATACOMB DO NOT LIGHT

Look for:

(a) Shorted 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.
(f) Shorted external large filament condenser.

(3) IF FILAMENTS OF CATACOMB RADIOTRONS ARE EXCESSIVELY BRIGHT

Look for:

(a) Shorted 2 Mfd. condenser in R.P.A. unit. (The one located next to resistances.) This will be accompanied by a no-voltage reading at the "B" voltage terminals.

(b) Defective UP-591, caused by either extremely low resistance or being shorted.

(4) NO SIGNAL WHEN ALL RADIOTRONS AND RECTRONS 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 connections at loudspeaker.

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

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

(d) Filament to plate short in Rectrons UX-216-B.

(e) Dirty contacts in socket of Radiotron UX-210.

(5) 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). Such a 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 Radiola 30. The Radiotron will not show any other indication of being unsatisfactory. Substituting another UV-876 or stopping the Radiola long enough for the Radiotron to cool and then starting it will be the only way of isolating 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.

(6) EXCESSIVE HUM

This may be due to any of the following causes:

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

(b) Defective 2 Mfd. condenser.

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

(7) DISTORTION AFTER LOUDSPEAKER HAS BEEN CHECKED

Distortion may originate in a leaky 2 Mfd. condenser (located next to 7 Mfd. filter condenser) or may be due to a low emission Radiotron UX-210. The 2 Mfd. condenser may be checked by temporarily disconnecting it from circuit and operating the Radiola, 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 Rectrons UX-216-B removed. If the process fails it will be necessary to use a new Radiotron UX-210.

(8) FLUTTERING

Fluttering sometimes occurs in Radiola 30 installations. This is a loud hum having a 60-cycle base and occurs at the resonant point when manipulating the tuning drums. Any means of changing the electrical constants of the audio circuits will be found helpful. Changing the condenser bank of the A.C. Package or interchanging the Radiotrons UX-199 will generally correct the trouble. If, however, the service man experiences difficulty in locating or correcting this trouble, the matter should be immediately reported to the nearest R.C.A. District Service Station through regular R.C.A. channels, giving catacomb number and serial number of the Radiola.

(9) IF PLATES OF RADIOTRONS UX-210 AND RECTRONS UX-216-B HEAT EXCESSIVELY

Plates of Radiotron UX-210 dull red. Check the following:

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

(b) Defective resistance UP-591.

Plates of Radiotron UX-210 white hot. Check the following:

(a) Open resistance R-4.

Plates of Rectrons UX-216-B dull red. Check the following:

(a) Shorted 7 Mfd. filter condenser. (Located next to 2 Mfd. condensers.)

Plates of Rectrons UX-216-B white hot. Check the following:

(a) Shorted 7 or 4 Mfd. filter condenser. (Located next to power transformer.)

Should one Rectron UX-216-B become a dull red and the other apparently normal, replace Rectron UX-216-B that is apparently normal. (This Rectron is defective causing the other one to heat from overload.)

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

The continuity test covers all circuits of the Radiola 30 R.P.A. unit, the letters and numbers contained therein refer to those of Figure 7. Before running this test remove all connections from the terminal board at the rear of the R.P.A. unit, also the protective plug and all Radiotrons and Rectrons.

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 with 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 unit. Discharge filter condensers by short-circuiting their terminals with a screw driver before starting test.

R. P. A. CONTINUITY TEST (Transformers and Choke)
(Remove All Connections From Terminal Board)

Terminals	*Correct Effect*	*Defect*
1 to 2	Closed thru transformer	Open primary winding of input transformer
3 to 4	Closed thru transformer	Open secondary winding of output transformer
5 to G1	Closed thru transformer	Secondary of input transformer open
5 to P2	Closed thru transformer	One-half of plate winding open
5 to P3	Closed thru transformer	One-half of plate winding open
5 to 6	Closed thru resistance	R2 or R3 open
5 to 7	Closed thru resistance	R2 or R3 open
7 to +F1	Closed thru transformer	One-half of F2 open
7 to —F1	Closed thru transformer	One-half of F2 open
7 to 8	Closed thru resistance	R1 open
7 to —F4	Closed direct	Broken connection
9 to +F3 or —F3	Closed thru R4 and choke	Open choke or R4
P1 to +F2	Closed	Open choke or primary of output transformer
B to P4	Closed thru winding	Open primary of power transformer

The 2 Mfd. and 7 Mfd. filter condensers are by-passed by a resistance. To test them it will be necessary to observe the voltage drop across the resistance. That is, if the voltmeter registers full battery voltage (no voltage drop thru resistance), the condenser is short circuited.

R. P. A. CONTINUITY TEST (Condensers)
(Remove All Connections From Terminal Board)

Terminals	*Correct Effect*	*Defect*
5 to G4	Partial deflection	7 Mfd. filter condenser shorted
5 to +F2	Partial deflection	7 Mfd. filter condenser shorted
5 to 7	Partial deflection	2 Mfd. condenser shorted
7 to center 5th socket	Open	2 Mfd. condenser shorted
7 to 9	Partial deflection	2 Mfd. condenser shorted

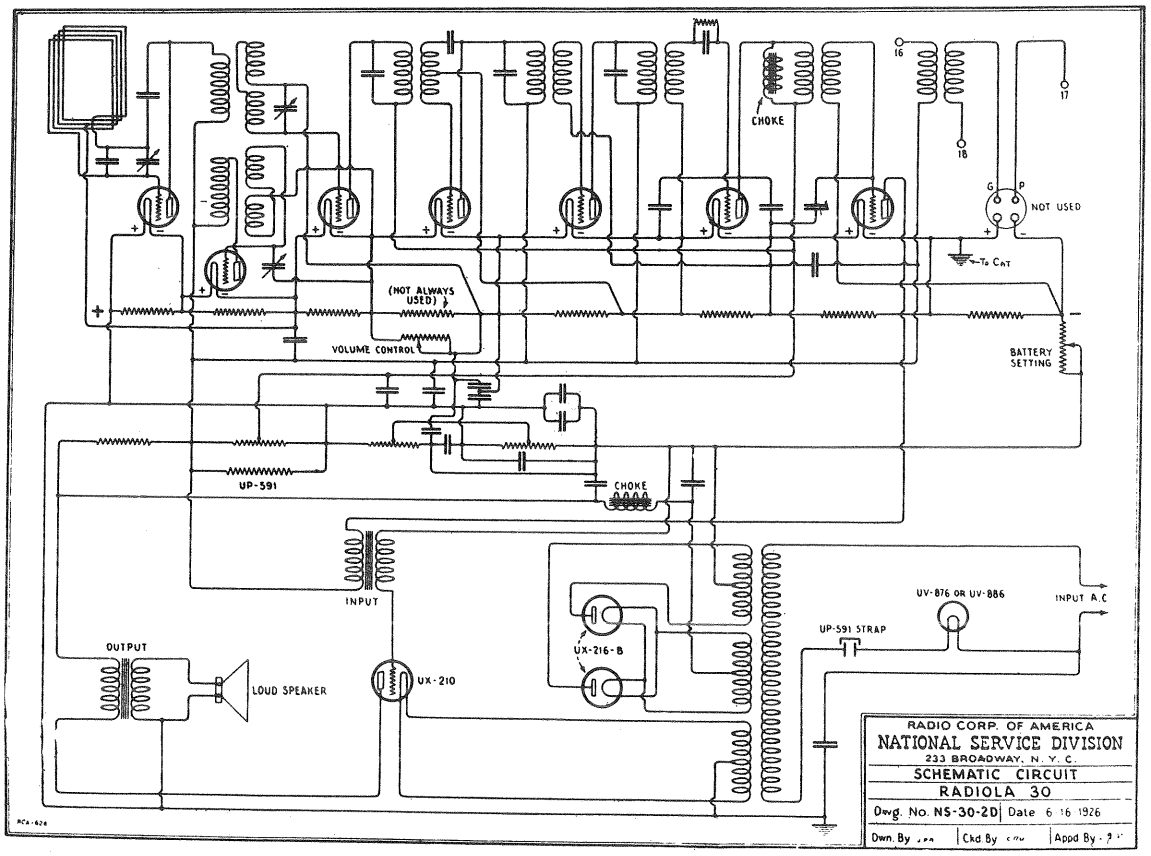


Figure 13—Schematic circuit diagram of Radiola 30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