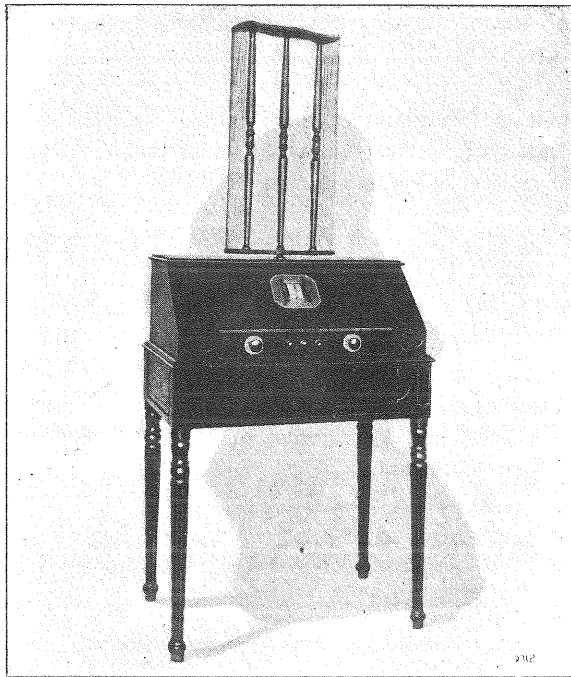


RCA Radiola 28

(Battery Operated)

SERVICE NOTES

Third Edition—5M—June, 1928



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 Radiola owners may be entirely satisfied.

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

To assist in promoting this phase of the Dealers' business the Service Division of the RCA has prepared a series of Service Notes—of which this booklet is a part—containing technical information and practical helps in servicing Radiolas.

This information has been compiled from experience with Radiola Dealers' service problems, and presents the best practice in dealing with them. A careful reading of these Service Notes will establish their value to Dealer and Distributor, and it is suggested they be preserved for ready reference.

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

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PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

Radiola 28 is a broadcast receiver employing the eight-tube super-heterodyne circuit. Excellent sensitivity and selectivity characterize this circuit and ample loudspeaker volume is made possible by use of dry battery power amplifier Radiotron UX-120. A large battery compartment is provided for all batteries which together with the loop pick-up, makes the Radiola completely self-contained. For information regarding the A.C. operated combination Radiola 28 and RCA Loudspeaker 104 consult Service Notes entitled "A.C. Operation of Radiolas 25 and 28."

Seals: Lead seals are placed on the catacomb of Radiola 28 for protection of the dealer. Under no circumstances should a catacomb seal be broken. Broken seals indicate tampering. 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 RCA Service Station.

(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.

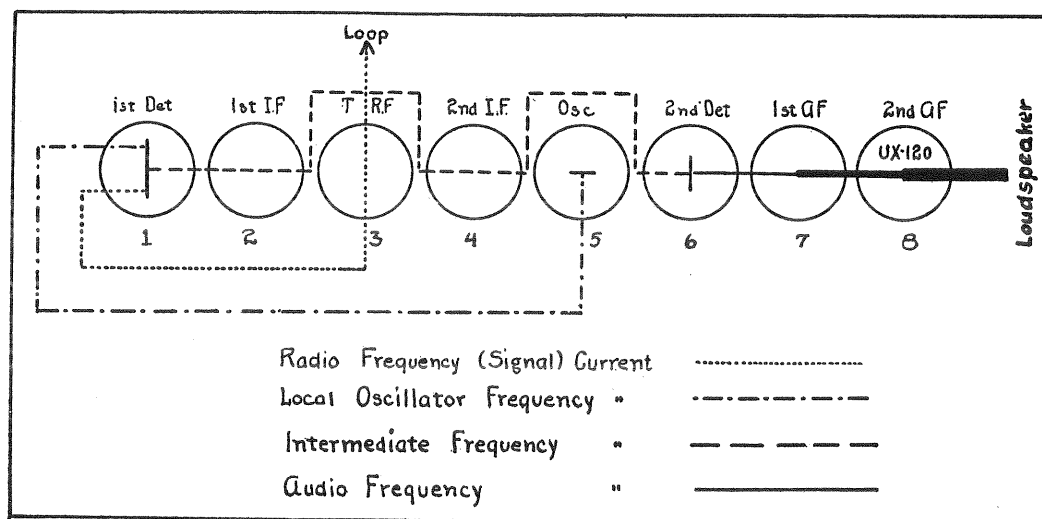


Figure 1—Radiola 28 Radiotron sequence

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.

From Radiotron No. 4 the signal is fed into No. 6 which is the second detector. The audio frequency current is now fed through No. 7 and then into Radiotron UX-120. Figure 1 illustrates the Radiotron sequence and the path of the different currents through them.

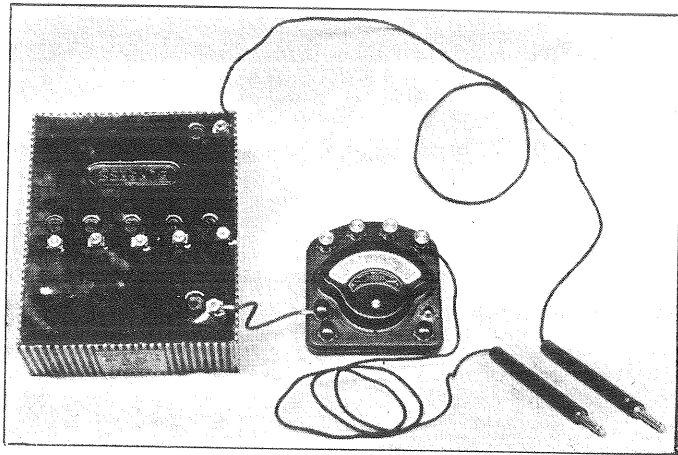


Figure 2—Testing equipment

(2) OPEN LOOP

The symptoms of an open loop circuit in Radiola 28 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 28, 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.

If the center loop connection is open with loop in place hand capacity effect will be quite noticeable when tuning in stations.

The complete loop circuit may be tested for continuity with a battery in series with a lamp, voltmeter or headphone (Figure 2). 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 loop leads connect with loop plug contacts.
- (b) Dirty connections between loop plug and loop socket.
- (c) Broken leads between loop socket and catacomb terminal board.
- (d) Broken loop condenser 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) LOOP NOT VERTICAL WHEN SEATED

To correct this condition remove loop and open lid. Loosen the four machine screws that hold the loop socket collar assembly in place on the horizontal platform of the frame. It will be noted that the construction of the upper and lower portions of the loop socket assembly is similar. When loosening these four screws, keep the nuts from turning. Having loosened the screws the entire loop socket assembly may be rotated in an area sufficient to enable the centering of it directly below the bezel ring in the lid of the cabinet. With the lid closed insert the loop and force it into a vertical position by applying pressure to the centre spindle. When a vertical position is thus attained, remove loop from the socket taking care not to move the socket assembly from its new position. The four screws are then tightened and the loop reinserted. In some models of Radiola 28 a support is provided to hold the loop in a vertical position when properly seated in its socket.

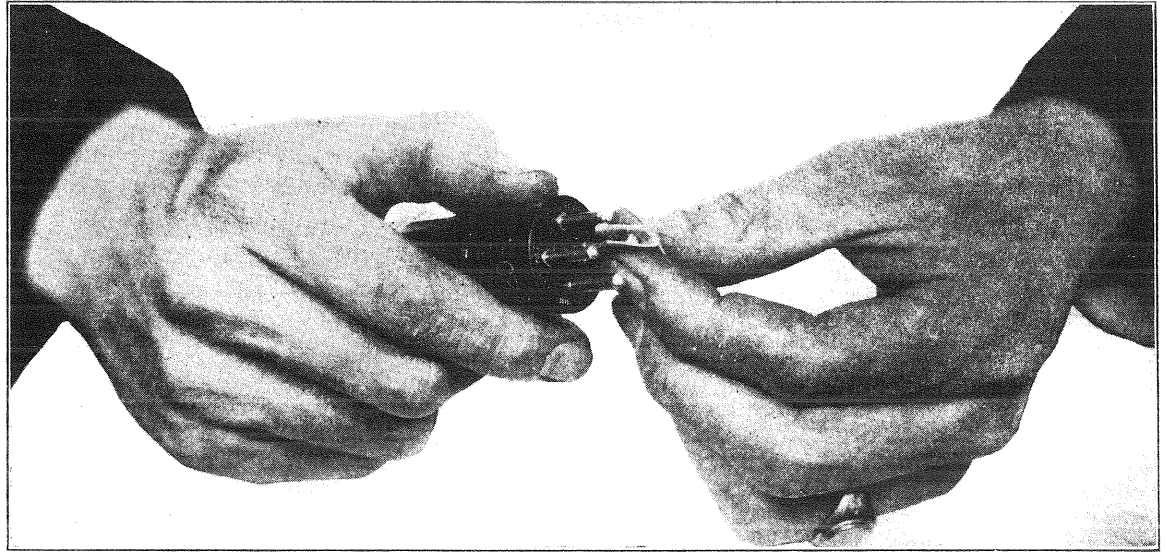


Figure 3—Raditron prongs may be cleaned with fine sandpaper

(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 sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

(5) 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 when operated.

(6) LOOSE RHEOSTAT CONTACTS

To get at the rheostat contacts, the panel must be pulled forward. This is done by removing the four screws which hold the panel. These are located in the top of the battery compartment. The 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. Replace the four screws that were removed.

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

This condition of the control drums may be due to either or both of the following causes:

(a) Warped drum control. Check by placing a straight edge on the outer flat surface of the knurled drum control and noting any irregularity of movement by slowly rotating the drum. If the drum control is badly warped it will be necessary to replace it.

(b) Drums not properly aligned with escutcheon. In most cases shifting the escutcheon plate slightly or slipping the drums on the shafts will remedy this condition.

(8) DRUMS FAIL TO HOLD POSITION

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

(a) Remove panel from cabinet and re-adjust tension screw on the inside of the drum. This screw controls the pressure of the friction shoe against the inside of the opposite drum. If one drum turns too hard when the other is held, the tension screw may be slightly loosened. Some Radiola 28 models use a drum type clutch. If these drums slip the screws that hold the inner drum to the condenser shaft or the outer screw used to adjust the braking action should be tightened.

(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 Radiolas the drums are keyed to the condenser plate shaft, thus eliminating the possibility of incorrect frequency calibration due to slipping of the drum controls of the condenser shaft. Others use a set screw and may require adjustment.

(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 Radiolas the adjusting screw is sealed. This seal will have to be broken should adjustment be found necessary.

The most noticeable need of 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 cali-

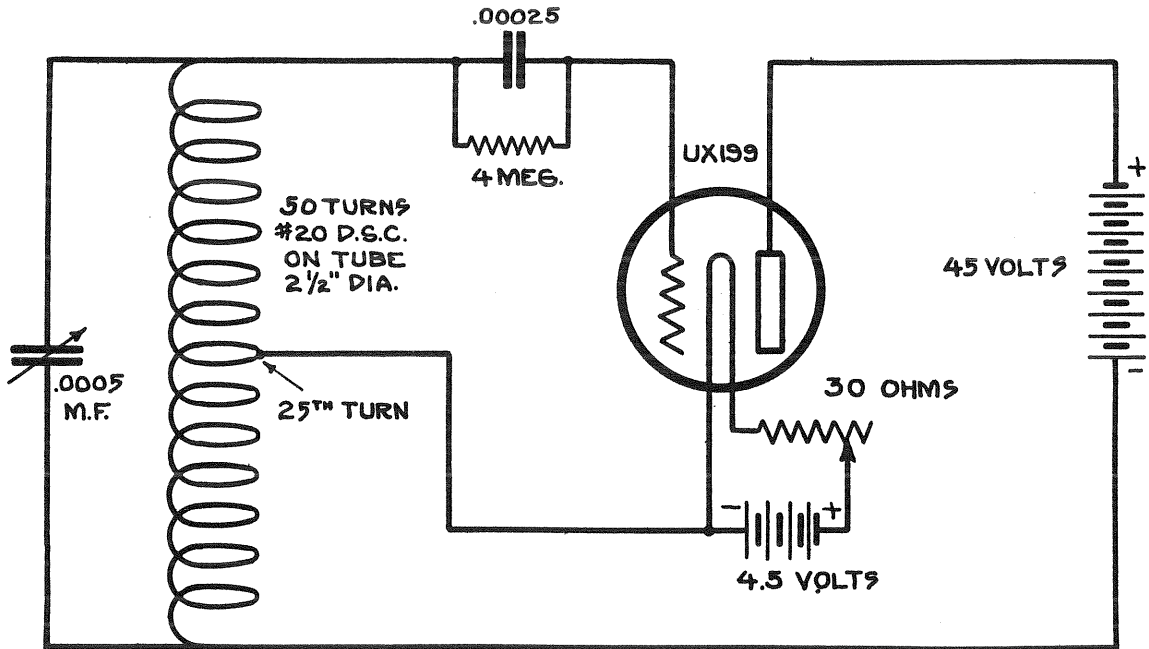


Figure 4—Wiring diagram of the modulated oscillator

brated 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 2 1/2-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 depending 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 30 and neutralizing Radiola 20. It will amply repay the dealer for the small outlay of material and labor required.

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

(a) Start set up in regular manner using headphones instead of plugged in at second audio jack.

(b) Remove loop.

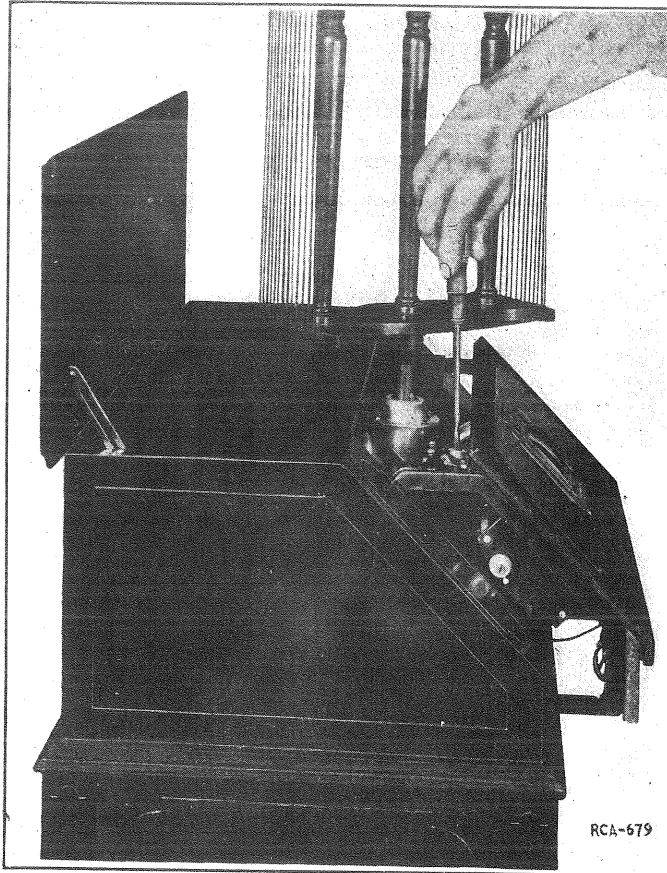


Figure 5—Adjusting the loop compensating condenser

(c) Pull panel forward 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, or, 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.

(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. Replace loop 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 inserted, and using the non-metallic screwdriver (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 condition manifest itself, the installation of antenna coupler AL-953 is recommended. This coupler should be installed as described in the instruction book accompanying it. A short antenna of 25 or 30 feet in length made of insulating wire may be erected outside of the building or if this is not convenient, hung out of the window. The lead-in should be a continuation of the antenna itself and connected to the antenna post of the coupler. A good ground such as a cold water pipe or steam radiator should be connected to the ground post of the coupler. Thus installed we have a low resistance antenna connected to an aperiodic coupling coil. The tuning condenser calibration remains unchanged.

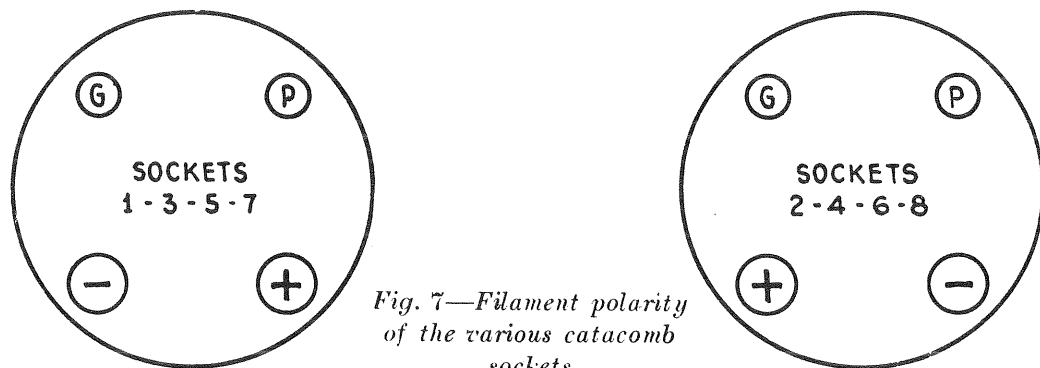
(11) D.C. BUS BAR ON REAR OF CATACOMB

The screws holding the bus bar on the rear of catacomb must always be kept tight, otherwise noisy or intermittent reception may result. The bus bar connects the filaments in parallel for battery operation. Occasionally the screws holding it in place may become loose and for this reason they should be inspected and tightened if necessary.

B battery terminal. If electromagnetic speakers similar to the UZ-1325 are incorrectly connected, they will soon lose their sensitivity through a weakening of the permanent magnetism of the pole pieces. When the leads are properly connected, the magnetic field generated by the steady plate current in the speaker coils intensifies the permanent magnetic field of the pole pieces and maintains the permanent magnetism.

If there is doubt of the correct connection, loud speakers with metallic diaphragms such as UZ-1325 should be so adjusted that the diaphragm just strikes the actuating magnets or pole pieces as will be evidenced by a clattering noise when loudest notes are played. Reversing the loudspeaker leads will either accentuate or lessen the clattering. That connection which gives greatest clattering is the correct one to use. The speaker should then be readjusted so that no clattering occurs on the greatest volume desired.

In Radiola loudspeaker models 100, 102 and 104, however, the polarity is not an important factor. They should accordingly be connected in the manner that gives the most pleasing reproduction.



(15) FILAMENT POLARITY

When testing the filament circuits of Radiola 28 it will be noted that the polarity of the filament contacts of each catacomb socket reverses from that on either side, making four sockets with one combination and four with another. Figure 7 illustrates the correct polarity of the various sockets and when testing catacombs this must be kept in mind.

(16) CATACOMB AND PANEL CONTINUITY TEST

In making the tests for continuity in both the external and internal connections of the catacomb both filament control and volume control rheostats should be adjusted so that half the resistance is in the circuit, the loop in place (except for condenser panel test) and the power supply cable disconnected from the terminal strip at the rear of the catacomb.

A pair of headphones with at least $4\frac{1}{2}$ 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.

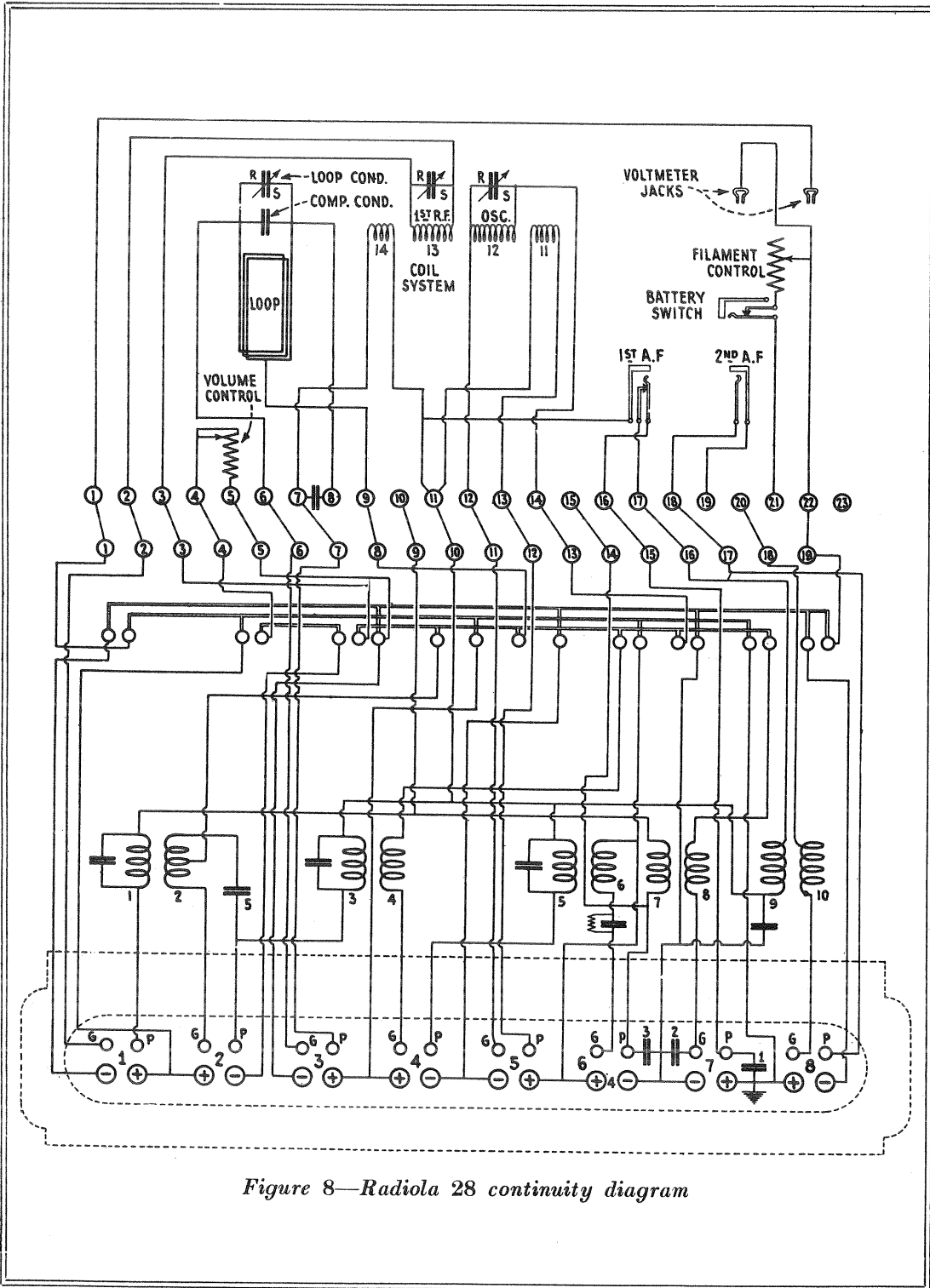


Figure 8—Radiola 28 continuity diagram

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

The numbers of the terminals referred to in these tests apply to the terminals on the connecting strip at the rear of the catacomb frame assembly. The designation "P" and "G" refer to plate and grid contacts of the socket indicated by the number following. For example G2 indicates the grid contact of the second socket; P7 indicates the plate contact of the seventh tube socket. The coil numbers referred to in the right hand column will be found in Figure 8.

PANEL TEST

The various panel parts are comprised in the following tests:

<i>Circuits</i>	<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused by:</i>
Loop	6 to 8	Closed	Open loop
	6 to 9	Closed	Open 1/2 loop
	8 to 9	Closed	Open 1/2 loop
R. F. Coil	7 to 11	Closed	Open R. F. coil
	2 to 3	Closed	Open R. F. coil
Osc. Coil	12 to 14	Closed	Open oscillator coil
	11 to 13	Closed	Open oscillator coil
Rheostat	21 to 22	Closed	Open filament rheostat or switch
Vol. Control	4 to 5	Closed	Open volume control
Jacks	16 to 17	Closed	Defective 1st A. F. jack
	18 to 19	Open	Defective 2nd A. F. jack

PANEL TEST (Condensers) (Loop Removed)

<i>Circuits</i>	<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused by:</i>
Loop	6 to 8	Open	Shorted loop tuning or compensating condenser
	7 to 8	Open	Shorted loop neutralizing condenser

CATACOMB TEST (Condensers)

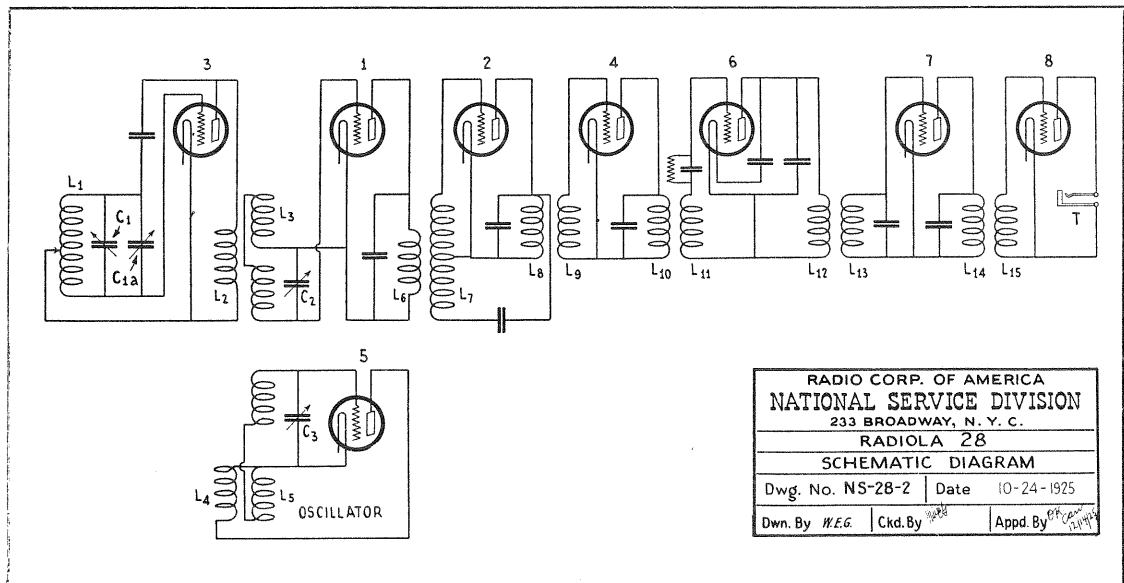
<i>Circuit</i>	<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused by:</i>
Grid	G2 to P2	Open	Shorted condenser No. 5
	G7 to 22	Open	Shorted condenser No. 2
Plate	P6 to 1	Open	Shorted condenser No. 4
	P6 to 22	Open	Shorted condenser No. 3

CATACOMB TEST (Coils and Connections)

<i>Circuit</i>	<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused by:</i>
Grid	G1 to 2	Closed	Open connections
	G2 to 3	Closed	Open 1/2 coil No. 2
	G3 to 6	Closed	Open connections
	G4 to 9	Closed	Open coil No. 4
	G5 to 12	Closed	Open connection
	G6 to +F6	Closed	Open grid leak or if loud click, shorted grid leak or grid condenser
	G7 to 14	Closed	Open coil No. 8
	G8 to 20	Closed	Open coil No. 10
Plate	P1 to 10	Closed	Open coil No. 1
	P2 to 11	Closed	Open coil No. 3
	P3 to 7	Closed	Open connections
	P4 to 11	Closed	Open coil No. 5
	P5 to 13	Closed	Open connections
	P6 to 10	Closed	Open coil No. 7
	P7 to 16	Closed	Open connections
	P8 to 18	Closed	Open connections
	11 to 17	Closed	Open coil No. 9
Filaments	1 to +F1	Closed	Open + filament lead
	1 to +F2	Closed	Open + filament lead
	1 to +F3	Closed	Open + filament lead
	1 to +F4	Closed	Open + filament lead
	1 to +F5	Closed	Open + filament lead
	1 to +F6	Closed	Open + filament lead
	1 to +F7	Closed	Open + filament lead
	1 to +F8	Closed	Open + filament lead
Battery Switch on	22 to -F1	Closed	Open - filament lead
	22 to -F2	Closed	Open - filament lead
	22 to -F3	Closed	Open - filament lead
	22 to -F4	Closed	Open - filament lead
	22 to -F5	Closed	Open - filament lead
	22 to -F6	Closed	Open - filament lead
	22 to -F7	Closed	Open - filament lead
	22 to -F8	Closed	Open - filament lead

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.

Schematic Circuit Diagram of Radiola 28



This circuit diagram is not intended for use in checking continuity tests. Use the continuity wiring diagram illustrated in Figure 7, page 12, for such tests.



Printed in U.S.A., 1928