

RCA Radiola 20

SERVICE NOTES

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RCA Radiola 20

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 the 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 RADIOLA 20

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

Radiola 20 is a tuned radio-frequency receiver with regeneration, employing four Radiotrons UX-199 and one Radiotron UX-120. It consists of two stages of balanced tuned radio-frequency, a regenerative detector and two stages of audio frequency amplification. Many new developments conducive to sensitivity, selectivity, efficiency and quality has been combined in this Radiola. Large loudspeaker volume without distortion is made possible by use of the new dry battery operated power amplifier, Radiotron UX-120, in the last audio stage.

To facilitate the tuning and operation of Radiola 20 the three main straight line frequency tuning condensers have been mechanically coupled together and adjusted in phase so that they are operated by one control drum. Two auxiliary vernier condensers have been included to permit very fine tuning adjustments.

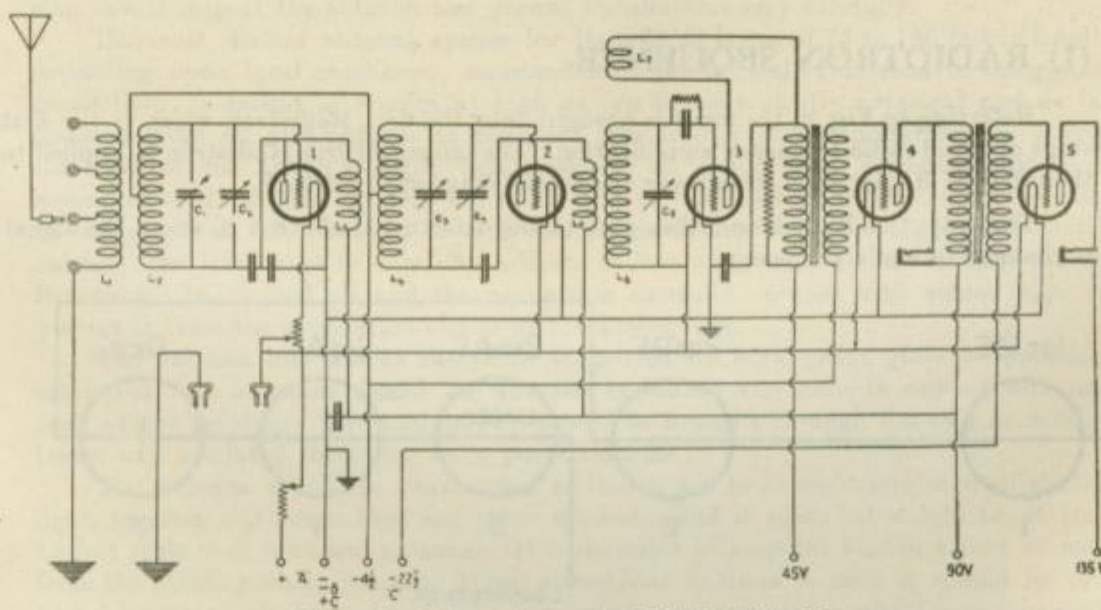


Figure 1—Schematic circuit of RCA Radiola 20

To have the amount of regeneration under full control at all wave-lengths the inter-element tube capacities have been compensated for by the small neutralizing condensers located on the back of the Radiotron shelf.

The operation of Radiola 20 and the function of the various elements may be easily understood by reference to the schematic diagram shown in Fig. 1.

Unlike Radiola Superheterodynes, there is no catacomb assembly in this Radiola. All inductance coils, however, have been specially treated and impregnated with wax to make them moisture proof. Within reasonable limits, therefore, the receiver will not be affected by weather or climatic conditions.

As all parts are exposed, there may be a tendency on the part of some owners to experiment with Radiola 20. Dealers, therefore, should caution their customers against tampering with the parts. This point cannot be emphasized too strongly in the case of the main tuning condensers and the small neutralizing condensers. **THESE NEUTRALIZING CONDENSERS HAVE BEEN CAREFULLY ADJUSTED ON EACH RADIOLA BY MEANS OF SPECIAL APPARATUS AND THE SLIGHTEST CHANGE IN THEIR SETTING WILL AFFECT THE PERFORMANCE OF THE RECEIVER.** The main tuning condensers should not be touched except for cleaning out particles of dust or dirt which may have lodged between the condenser plates, causing noisy operation. This may be accomplished most easily by means of an ordinary pipe cleaner. Any spreading or bending of the plates of a condenser will put that particular condenser out of phase with the other two main condensers. A simple method for lining up the main tuning condensers is described in Section No. 21 of these Service Notes.

(1) RADIOTRON SEQUENCE

Referring to Fig. 2, the input is brought into the first Radiotron which is the first stage of tuned radio frequency amplification. The output of this Radiotron is applied to the input of Radiotron 2, this being the second stage of tuned R. F.

The output of Radiotron 2 then goes to the detector, Radiotron 3, where the signal is changed to audio frequency.

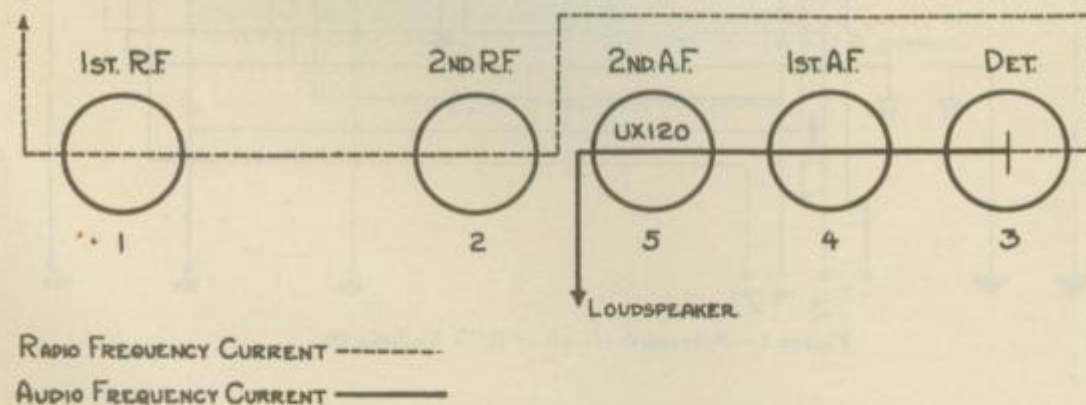


Figure 2—Radiotron sequence in RCA Radiola 20

The audio frequency output of the detector is applied successively to Radiotrons 4 and 5, these being the first and second stages of audio frequency amplification respectively, and the output applied at the loudspeaker jacks.

This lineup makes Radiotron UX-120, which is the last stage of audio frequency amplification, and slightly larger than the other Radiotrons, the center of the group (socket 5). It is imperative that Radiotron UX-120 be used *only* in this socket. Fig. 2 illustrates the proper Radiotron sequence.

(2) ANTENNA SYSTEM FAILURES

Complaints of swinging signals, as distinguished from fading effects, or of intermittent reception with probable grating noises, are generally the result of antenna and ground system failures and to this, therefore, the service man should give his first attention. A grating noise may be caused by a poor battery connection, a poor lead-in connection to the antenna or the lead-in, or antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads from Radiola 20 and noting whether or not the grating continues, the service man can soon determine whether or not the cause of complaint is within or external to the receiver and plan his service work accordingly.

(3) ANTENNA INSTALLATION (Outdoor Type)

If the source of complaint has been found to be external to the Radiola the service man should inspect the antenna and ground installations very carefully.

The most efficient antenna system for Radiola 20 is one of 75 to 150 feet in length, depending upon local conditions, measured from the far end of antenna to the ground connection. It should be erected as high as can be conveniently arranged and as far removed from all obstructions as possible. The lead-in should preferably be a continuation of the antenna itself, thus avoiding all splices that introduce additional resistance to the antenna system and which may in time corrode sufficiently to seriously affect reception. If, however, it is absolutely necessary to splice the lead-in to the antenna, the joint must be carefully soldered to insure a good electrical contact. Excess flux should be cleaned off and the connection carefully covered with rubber tape to protect it from the oxidization effects of the atmosphere.

The antenna and lead-in should be supported by high grade glass or porcelain insulators. At no point should the antenna or lead-in wire come in contact with any part of the building. The lead-in wire should be brought through the wall or window frame and insulated therefrom by a porcelain tube.

The antenna should be constructed so that it will be at right angles to all electric light, traction and power lines and other antennae, and if practical should be at least 15 feet from such lines and antennae. It is desirable to keep the lead-in a foot or more from the building where possible. When an outdoor antenna is used it should be protected by means of an approved lightning arrester, in accordance with the requirements of the National Fire Underwriters' Code.

(4) INDOOR TYPE ANTENNA

Where the installation of an outdoor antenna is not practical, satisfactory results may be had by using about 50 feet of insulated wire strung around the picture molding.

The size of the wire is not particularly important, though No. 18 B. & S. bell wire is suggested. In buildings where metal lathing is employed, satisfactory results are not always possible with this type of antenna. Under such conditions, various arrangements of the indoor antenna should be tried in event of the first one not giving satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

(5) GROUND

Enough emphasis cannot be laid upon the necessity of a good ground. It is quite as important as the antenna. No specific recommendations can be given in this matter as conditions vary in different locations. Water and steam pipes usually make good grounds. Gas pipes usually make poor grounds, and as a rule are to be avoided. If neither water nor steam pipes are available, a pipe or metal rod may be driven into the ground to a depth of several feet. The success of this type of ground depends upon the moisture present in the soil. The ground lead should be connected by means of an approved ground clamp to a section of pipe that has been scraped and thoroughly cleaned. The connection should be inspected from time to time to make certain that a clean and tight electrical contact exists between the clamp and pipe.

It is recommended that the service man experiment with various grounds, and employ the one giving the best results. Radiola 20 is capable of good distant reception when connected to an efficient antenna and a low resistance ground. A poor ground connection may not be apparent on local reception, but it is an important element in distant reception.

If the results of experiments seem to indicate that a good ground connection is not possible, the use of a counterpoise is suggested if local conditions permit. A counterpoise is in effect a second antenna. It should be as well insulated as the antenna, but it should not be erected more than six or eight feet above the ground. When possible the counterpoise should be constructed directly under the antenna and should have approximately the same dimensions. The counterpoise should be connected to the Radiola in place of the ground connection.

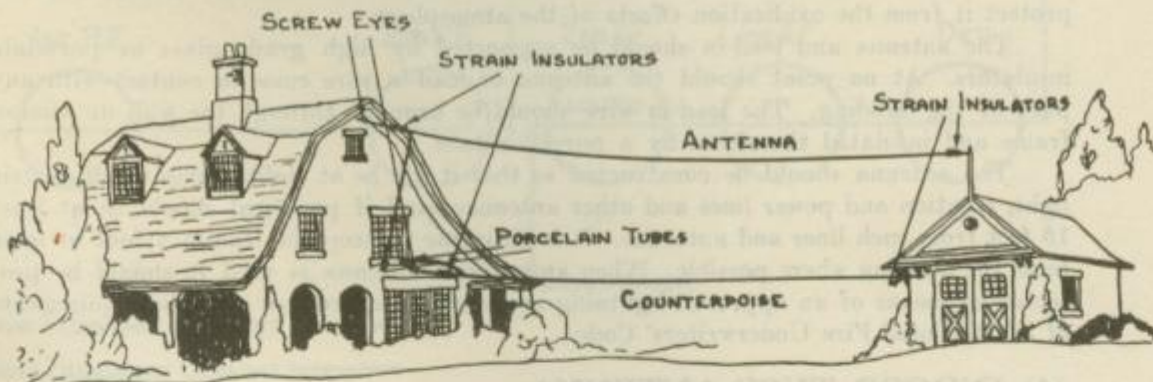


Figure 3—Typical Outdoor Antenna Installation
(Showing use of counterpoise where good ground is not available)

(6) BATTERY CIRCUIT FAILURES

If trouble is experienced in the battery circuits such as the absence of a voltage reading at the voltmeter pin jacks, none of the Radiotrons lighting, or the absence of a "B" battery click when the loudspeaker plug is inserted in the jack with the filaments lighted, check up all the battery voltages at the terminal board. The proper readings are outlined below, the terminal numbers referring to those in Fig. 4 or reading from left to right when facing Radiola. Batteries reading 25 per cent below normal should be replaced.

TABLE I

From (-)	To (+)	Voltage Limits	Volts
1	2	68 to 90	Volts
1	3	34 to 45	"
4	1	4 to 4.5	"
5	1	17 to 22½	"
1	10	3.5 to 4.5	"
1	11	104 to 135	"
1	7	3	"

NOTE: The reading from 1 to 7 is the filament terminal voltage and should correspond with the reading obtained at the voltmeter pin jacks on the front panel.

If the terminal voltages are satisfactory, but trouble still exists, even after replacing the Radiotrons, remove the four screws at the bottom of the cabinet holding the panel in place and pull out the panel enough to gain access to the terminal board at the back. Loosen up the screws holding the battery strip to the terminal board and remove the battery strip. Take the panel out of the cabinet.

Using a 4½ volt "C" battery connected in series with a pair of phones, run out the Routine Click Test outlined in Section No. 7. When a discrepancy is noticed, the Complete Continuity Test should be consulted to determine the trouble.

(7) ROUTINE CLICK TEST

(A) A Click should be heard from—

- (1) Short, medium and long antenna taps to ground.
- (2) 1 to all -F and to Frame.
- (3) 2 to P1, P2, P4 and 9.
- (4) 3 to P3.
- (5) 4 to G1, G2 and G4 (weak in last case).
- (6) 5 to G5 (weak).
- (7) 6 to + F1 and 7.
- (8) 8 to P5.
- (9) 10 to all + F (with filament rheostat "on").
- (10) 10 to 7 (with filament rheostat "on").

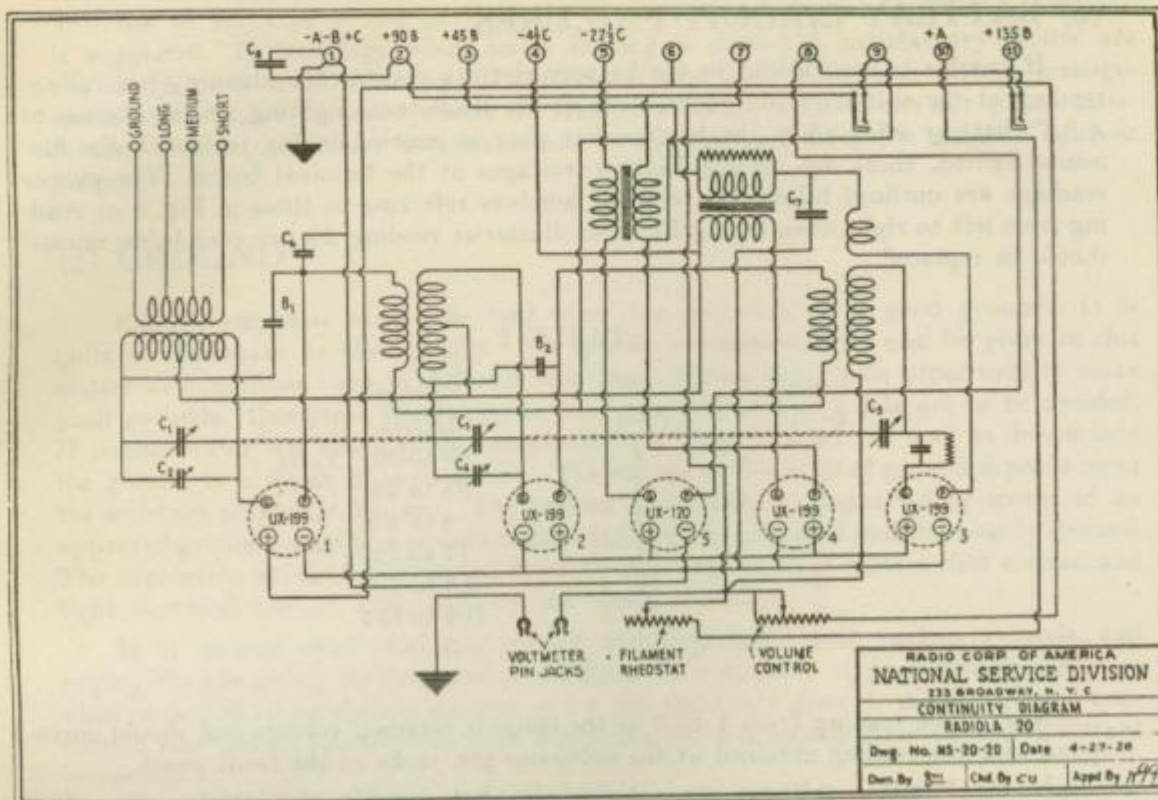


Figure 4—Continuity wiring diagram

(B) No click should be heard from—

- (1) 1 to 2, P1 or P3.
- (2) G1 to P1.
- (3) G2 to P2.
- (4) 7 to G3 (or very slight thru grid-leak).
- (5) 8 to 11.

The numerical test points referred to in the Routine Click Test and Complete Continuity Test apply to the terminals on the battery terminal board at the rear of the panel assembly, and are shown in Fig. 4. The terminals are numbered from left to right when facing the front of the set. 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. P5 would indicate the plate contact of the fifth Radiotron socket. In the same way the indication "F" denotes the filament contact of the tube socket indicated by the number. The filament contacts are also noted as minus and plus. The condenser numbers referred to in the right hand column will also be found in Fig. 4.

(8) COMPLETE CONTINUITY TEST

<i>Terminals</i>	<i>Correct Effect</i>	<i>Incorrect Effect Caused by</i>
1 to all — F	Click, closed thru leads	Open lead
1 to Frame	Click, closed thru leads	Open lead
2 to 9	Click, closed thru primary of 2nd A. F. Transformer	Open in primary circuit of 2nd A. F. Transformer
2 to P1	Click, closed thru primary of 1st R. F. Transformer	Open in primary circuit of 1st R. F. Transformer
2 to P2	Click, closed thru primary of 2nd R. F. Transformer	Open in primary circuit of 2nd R. F. Transformer
2 to P4	Click, closed thru primary of 2nd A. F. Transformer	Open in primary circuit of 2nd A. F. Transformer
3 to P3	Click, closed thru primary of 1st A. F. Transformer and Tickler Coil	Open in primary circuit of 1st A. F. Transformer or in Tickler Coil
4 to G1	Click, closed thru secondary of Antenna Coupler	Open in secondary circuit of Antenna Coupler
4 to G2	Click, closed thru secondary of 1st R. F. Transformer	Open in secondary circuit of 1st R. F. Transformer
4 to G4	Weak click, closed thru secondary of 1st A. F. Transformer	Open in secondary circuit of 1st A. F. Transformer
5 to G5	Weak click, closed thru secondary of 2nd A. F. Transformer	Open in secondary circuit of 2nd A. F. Transformer
6 to + F1	Click, closed thru leads	Open leads
6 to 7	Click, closed thru volume control rheostat	Open volume control rheostat
8 to P5	Click, closed thru leads	Open leads
10 to + F of sockets 2, 3, 4, 5	Click, closed thru rheostat. No click, if rheostat is "off"	Defective rheostat
10 to 7	Click, closed thru filament rheostat. No click, if rheostat is "off"	Open filament rheostat
"Short" to "Ground"	Click, closed thru primary of Antenna Coupler	Open primary of Antenna Coupler
"Medium" to "Ground"	Click, closed thru primary of Antenna Coupler	Open Antenna Coupler or open tap
"Long" to "Ground"	Click, closed thru primary of Antenna Coupler	Open Antenna Coupler or open tap
1 to 2	No Click	Click, condenser C8 shorted
1 to P1	No Click	Click, condenser C6 shorted
1 to P3	No Click	Click, condenser C7 shorted
G1 to P1	No Click	Click, condenser B1 or tuning condensers C1 or C2 shorted
G2 to P2	No Click	Click, condenser B2 or tuning condensers C3 or C4 shorted
7 to G3	No Click (or very slight one)	Click, shorted grid leak or grid condenser
8 to 11	No Click	Click, shorted 2nd stage jack

(9) LOOSE RHEOSTAT CONTACTS

To get at this source of trouble, remove set from cabinet by removing the four outside screws in the bottom of the cabinet. Apply pressure to back of set until panel moves forward sufficiently to enable the service man to support it with his fingers. It may now be gently pulled out, taking care not to permit the metal frame work to mar the finish by riding on the front base of the cabinet.

The square head set screw holding the rheostat 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. Make certain that the resistance strip is clean where contact is made. Insert voltmeter leads in the two pin jacks in the lower right hand corner of the front panel. Set "Volume Control" at "Loud." Adjust the "Battery Setting" knob to a quarter scale division beyond 3. Holding this in place, adjust the rheostat contact arm until a reading of 3 volts is obtained on the voltmeter. Tighten set screw to hold contact arm in this relative position and replace set in cabinet.

(10) NOISY OR LOOSE JACKS

Considerable noise or intermittent operation may originate at either jack. This trouble may be caused by loose connections, jack leaves having lost their tension or by dirty contacts.

To remedy this trouble it will be necessary to remove the panel from the cabinet as described in the preceding paragraph. After this is done the jacks may be examined and necessary adjustments made. As these are both single circuit jacks a general cleaning and tightening should be sufficient to remedy the trouble. A loss of tension may be corrected by applying pressure to the spring leaf and pushing it towards the frame of the jack. The correct amount may be ascertained by inserting the loudspeaker plug and noticing if the leaf is making proper contact. If the soldered connections appear faulty, a hot iron applied to them, heating the solder, will rectify the trouble.

(11) STATION SELECTOR OR AMPLIFICATION CONTROL WHEEL SCRAPING AGAINST ESCUTCHEON PLATE OF PANEL

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

- (1) Warped control wheel: Check by placing a straight edge on the outer flat surface of the knurled control wheel and noting the flatness of the surface by slowly rotating the wheel. If the control wheel is badly warped it will be necessary to replace it.
- (2) Condenser improperly aligned: To correct this condition remove the panel and adjust the mounting screws of the condenser and amplification assembly. There is sufficient play at the mounting screws to allow this adjustment to be made on the station selector drum. The amplification drum may be adjusted by loosening the mounting screws of the large bracket supporting the drum.

(12) LOUDSPEAKER POLARITY

In Radiolas employing Radiotron UX-120 in the last audio amplification stage it is very important that the loudspeaker be so connected that the magnetic field generated by the relatively large plate current from the 135-volt B battery will not oppose the permanent magnetic field of the speaker pole pieces. In Radiola UZ-1325 loudspeakers, one of the leads is brown, the other black with a brown tracer. The solid brown lead should be connected to the *tip* of the phone plug and the black lead with brown tracer to the *sleeve* of the phone plug. In Radiolas it is standard practice to connect the phone pack in such a manner that the tip of the phone plug will go to the plate of the audio amplifying Radiotron and the sleeve to the positive (+) 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 RCA Loudspeakers 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.

(13) AMPLIFICATION CONTROL (Tickler Coil)

The tickler coil is so designed that the regeneration is under complete control throughout the tuning range of Radiola 20. That is, regeneration may or may not be used at any particular frequency. There is a point just before oscillation occurs that gives the greatest amplification and should be used especially on distant reception. The point varies according to the frequency of the incoming signal, but the general rule of a greater setting of the amplification dial with a decrease of frequency will be true.

(14) RADIOLA WILL NOT REGENERATE

If oscillations cannot be obtained, or stop at lower frequencies, trouble may be due to—

- (1) Filament voltage low.
- (2) "B" battery voltage on detector low.
- (3) Radiotron in detector socket has low emission or is otherwise subnormal.

- (4) Shorted turns in "Tickler" coil.
- (5) "Tickler" coil leads reversed.
- (6) Open by-pass condenser C7 or C8.

(15) ACOUSTIC HOWL

This is a familiar howl which is set up by the sound waves striking a microphonic Radiotron and causing the elements to vibrate. The effect of the elements vibrating is in turn amplified and reproduced by the loudspeaker and, conditions being favorable, the howl may increase in intensity, drowning out the broadcast signal.

Howling may usually be eliminated by interchanging Radiotrons. A Radiotron that is quite microphonic in the detector socket will usually operate satisfactorily in one of the R.F. sockets. Do not place a Radiotron having any microphonic tendencies in one of the Audio Amplification sockets.

(16) AUDIO HOWL

An audio howl may be due to an open or a high resistance connection in the plate circuit of an audio stage.

Look for—

- (1) Open in plate circuit.
- (2) Defective "B" battery.
- (3) Very low "B" battery.
- (4) Open by-pass condenser C-8.
- (5) Defective grid leak.

(17) UNCONTROLLED OSCILLATIONS

If Radiola 20 oscillates at any setting of the Station Selector Drum when the Amplification Drum is at zero, or at any position giving greater regeneration than normal, the neutralizing condensers are out of adjustment. (See Section No. 18.) In exceptional cases a defective Radiotron in the R.F. stages will cause uncontrolled oscillations. Replacing or interchanging the Radiotron with that in the Detector or audio stages will generally correct the trouble.

(18) NEUTRALIZING CONDENSERS

Should the neutralizing condensers get out of adjustment through some mishap, they may be readily readjusted by carefully following the method outlined in Section No. 19. The condition is usually manifested by uncontrolled oscillations throughout the tuning range of the receiver regardless of the tickler (amplification) setting. Oscillation at any point of the Station Selector scale with the amplification setting at zero would indicate a necessity for readjustment. The apparatus required for this adjustment consists of a modulated oscillator, an insulated screw driver and a good Radiotron UX-199 specially prepared for the purpose by sawing off one of the filament (large) prongs close to the base. It is important that the Radiotron be otherwise perfect.

Any oscillator that has an audio frequency output and will oscillate at 1100 K.C. will be satisfactory. If one is not available there is described in Section No. 22 a simple modulated oscillator that will serve the purpose.

The insulated screw driver can be procured from most electrical or hardware supply houses or may be made from a strip of bakelite.

(19) NEUTRALIZING PROCEDURE

A step by step procedure for neutralizing is as follows:

- (1) Place Radiola 20 in operation in the usual manner with antenna and ground attached. Phones instead of loudspeaker are used.
- (2) Place modulated oscillator into operation at 1100 K.C. at a point close to the antenna wire and 20 feet or more from the Radiola.
- (3) Tune in Oscillator signal to maximum intensity, carefully adjusting verniers.
- (4) Set Amplification dial at zero.
- (5) Insert special Radiotron in socket No. 1 in place of regular Radiotron UX-199. Note if any signal is heard. If not, this particular stage is neutralized, but if signal is heard even of decreased volume, neutralizing condenser No. 1 (directly behind No. 1 socket) should be adjusted. (See Fig. 5.) This is done with the insulated screw driver and should be adjusted until minimum or no signal is obtained. This point will be found to be very critical and is the correct adjustment for this particular stage.

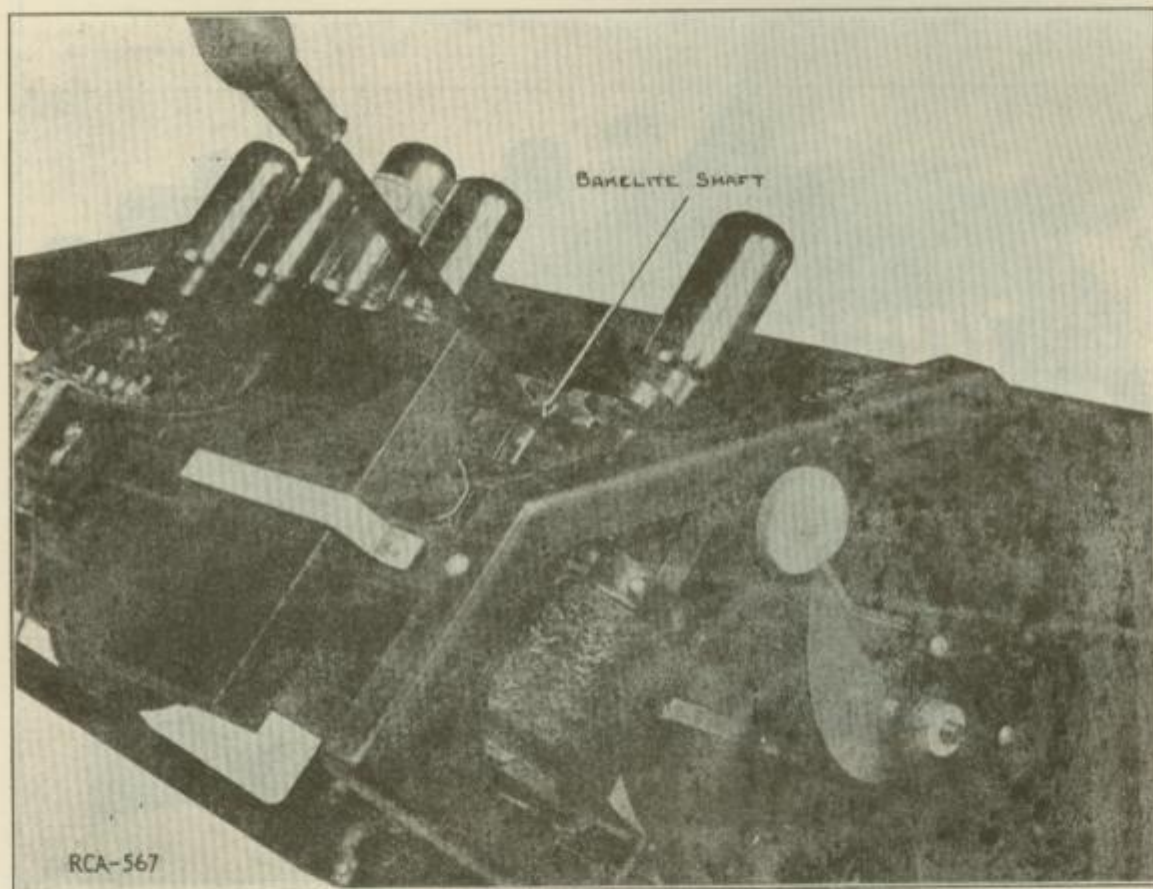


Figure 5

Illustrating method of adjusting first neutralizing condenser

- (6) Remove special tube from socket No. 1 and replace Radiotron UX-199. Place Special Radiotron in socket No. 2 and repeat the process described above.
- (7) Adjust neutralizing condenser No. 2 (directly behind socket No. 2) in the same manner as No. 1 for minimum or no signal. (See Fig. 6.)
- (8) Remove special tube and replace Radiotron No. 2. If these adjustments have been properly carried out, the Radiola will not oscillate at any position of the Station Selector Drum with the Amplification Control at zero, it being necessary to rotate the Amplification Drum approximately half way around before oscillation occurs. This is the correct condition and a notable increase in ease of tuning and sensitiveness will be experienced when Radiola 20 is properly neutralized.

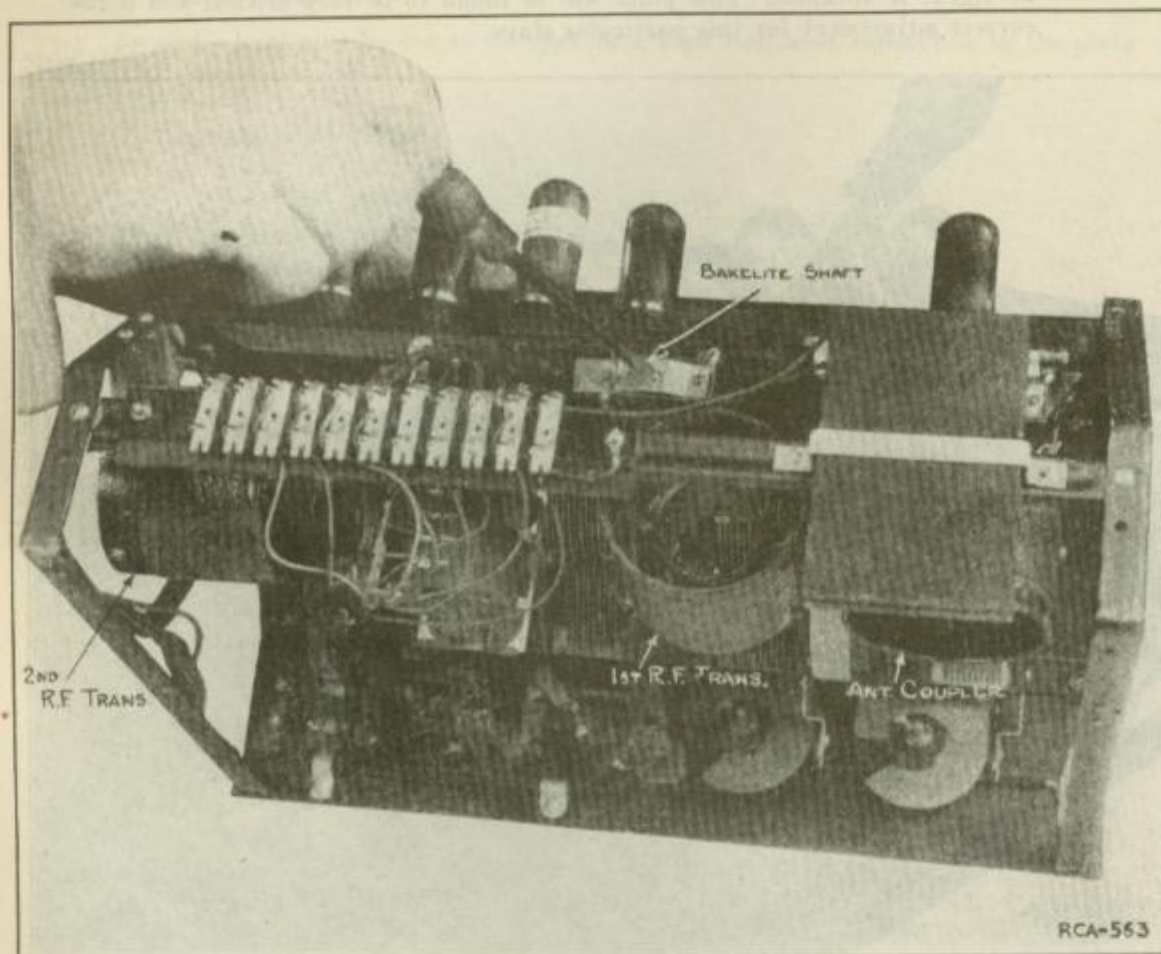


Figure 6
Adjusting the second neutralizing condenser

(20) MAIN TUNING CONDENSERS OUT OF LINE

A large degree of deviation in the line up of the main tuning condensers of Radiola 20 will be readily ascertained by inspection. However, a small degree will be noticed only by certain definite tuning characteristics. That is, one or both of the vernier condensers will tune to either extreme at all settings of the Station Selector Drum, the verniers having no noticeable effect on tuning and general reception results are below normal. However, if these conditions are present, it will be advisable to make sure that the trouble is not an open or shorted vernier condenser. If it is found that the verniers are not shorted and their connections intact, it may be assumed that the main tuning condensers are out of line. The following method is a simple and reliable means of lining up these condensers and also has the advantage of employing a minimum of equipment. The required equipment consists of a modulated oscillator covering the range of 550 to 1500 K.C.—the same as employed to adjust the neutralizing condensers.

This oscillator can be easily made by any dealer, constructional details of which are shown in Section No. 22.

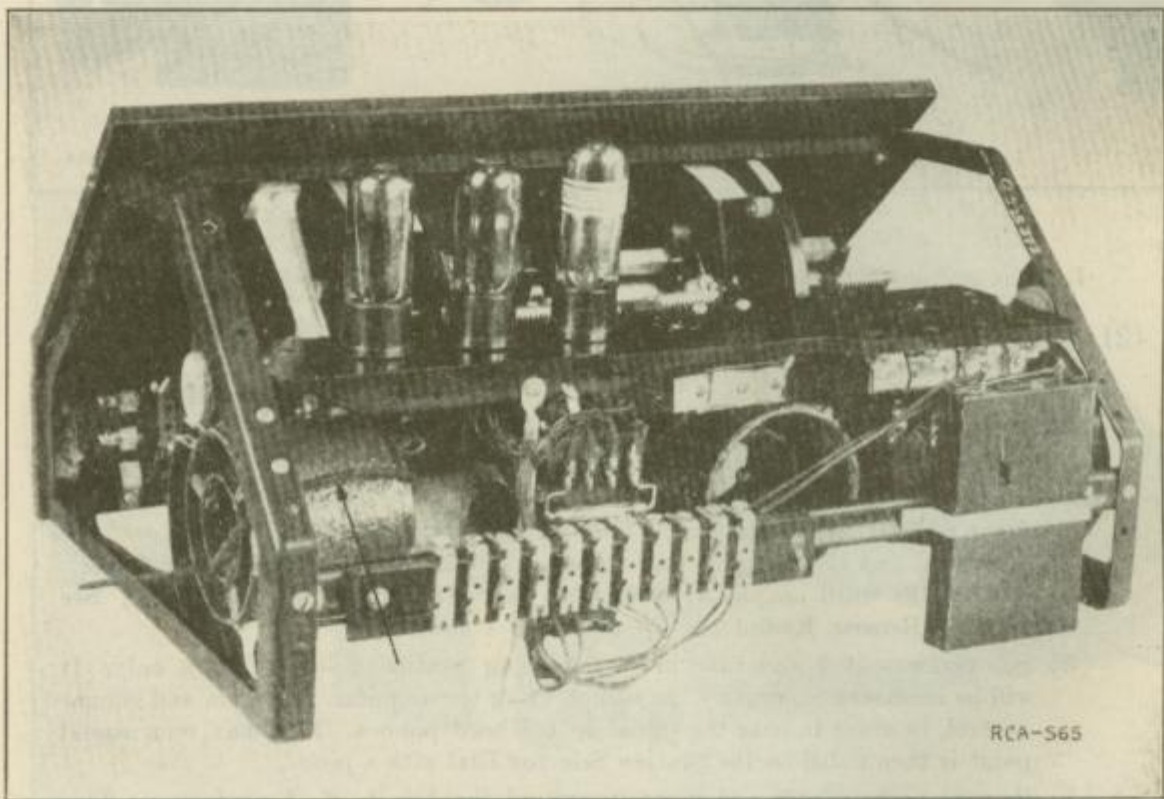


Figure 7

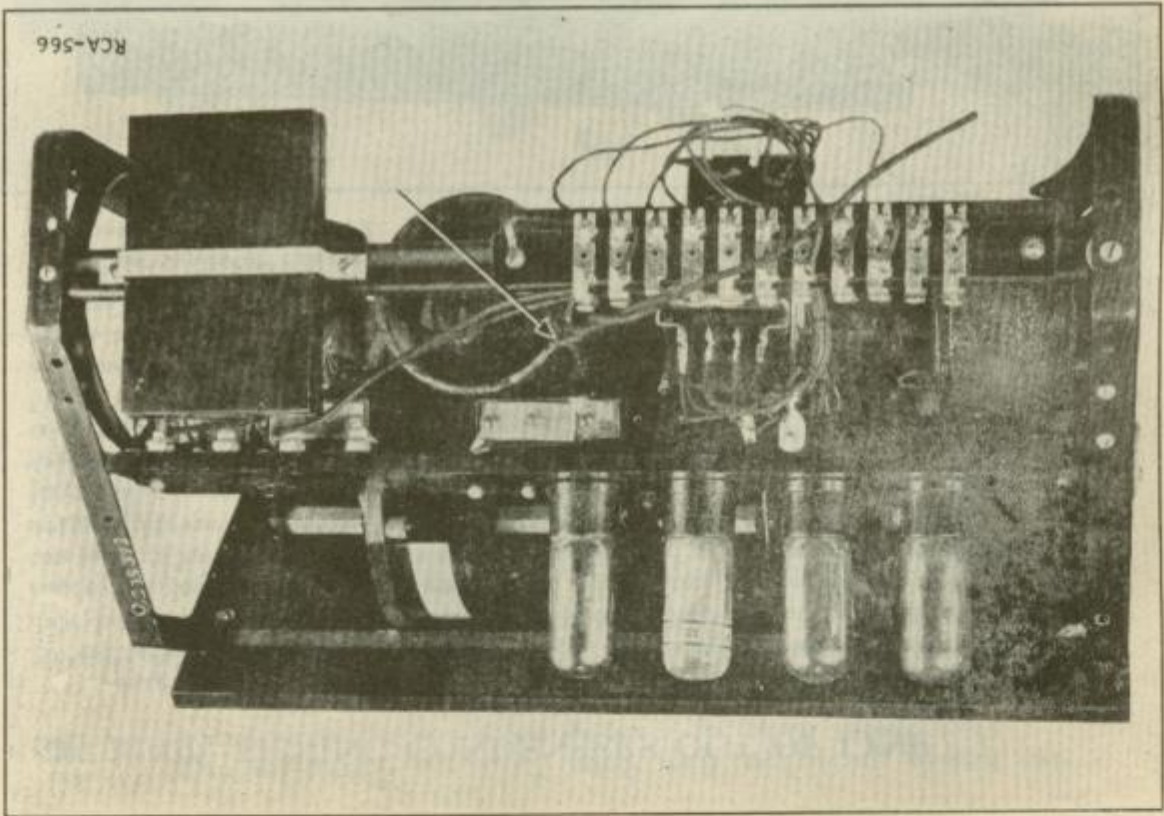
Location of "pick-up" wire with two Radiotrons removed for first step in lining up main tuning condensers

- Step by step procedure.
- (1) Remove panel from cabinet and connect up in usual manner with the exception that no antenna or ground are used.
 - (2) Put modulated oscillator in operation at 550 K.C., locating it about 20 feet from receiver. One end of the pick-up wire is laid about a foot from the oscillator and the other end wound once around the 2nd R. F. Transformer. This is the third coupler from the left facing the panel from the front. See Fig. 7. Remove Radiotrons from sockets 1 and 2.
 - (3) Set verniers at 5 and tune in signal, using Station Selector Drum only. It will be necessary to amplify the signal, using the amplification drum and volume control, in order to hear the signal in the head phones. This maximum signal point is then noted on the Station Selector Dial with a pencil.
 - (4) Remove pick-up wire and place it around the 1st R. F. Transformer. This is the center transformer. See Fig. 8. Replace Radiotron No. 2, leaving No. 1 out.

(21) LINING UP MAIN TUNING CONDENSERS

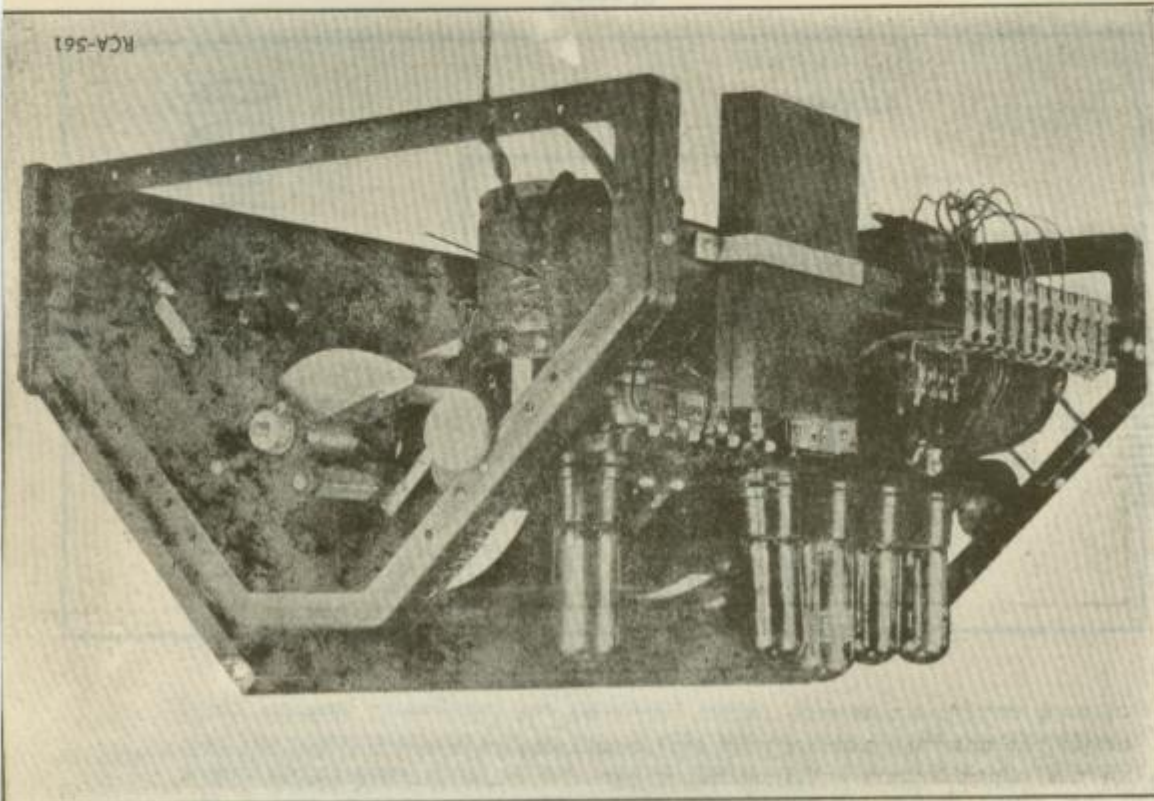
Location of "pick-up" wire for second step in lining up of main tuning condensers

Figure 8



Location of "pick-up" wire for last step in lining up main tuning condensers
Radiotrons shown in their correct position

Figure 9



RCA-561

- (5) Tune in signal as before without using verniers and note if the point of maximum signal as marked on the Station Selector Dial, is the same as when the pick-up was on the 2nd R. F. Transformer. If not, note whether a variation of more than two degrees plus or minus of the vernier (one to the right) will cause the point of maximum signal strength to coincide with the first marking. If more than a two degree vernier adjustment is necessary the center condenser should be slipped slightly at the shaft coupling until not more than 2 degrees plus or minus vernier variation will cause the point of maximum signal strength to coincide with the dial marking.
- (6) Remove pick-up wire from 1st R. F. Transformer and place around antenna coupler in same manner. This is the first transformer from the left when facing the Radiola from the front. See Fig. 9. Replace Radiotron No. 1, thus retaining all Radiotrons in their respective sockets.

- (7) With the verniers at their center points, adjust Station Selector Drum for maximum signal. It is assumed that the preceding circuit has been correctly adjusted and left at its resonance point. Now note whether the maximum signal point coincides with the original 2nd R. F. point and if not whether a two degree vernier variation will bring these points together. If not, the 1st condenser should be shipped at its coupling and adjusted as in paragraph (5).
- (8) When these three points are brought together or close enough so that the allowable variation of the vernier condensers will make the resonance point identical in all three circuits, set oscillator at 1500 K. C. The foregoing procedure is then repeated at this frequency, allowing the same vernier variation as before. Generally when the condensers are checked at one end of the frequency band they will be found to check O.K. at the other end. However, this is not always the case and a slight re-adjustment may be necessary.

In explaining that the allowable limits of the vernier are two degrees plus or minus, it is not to be understood that in tuning a signal the verniers should never exceed that amount of variation as this is not true. These limits are given as the test limits at each end of the scale as it has been found that when this is true all other resonance points throughout the tuning range will lie within the extreme limits of the vernier dials. The most common indication that the condensers are out of line is that one or both of the verniers tune to either extreme throughout the frequency scale.

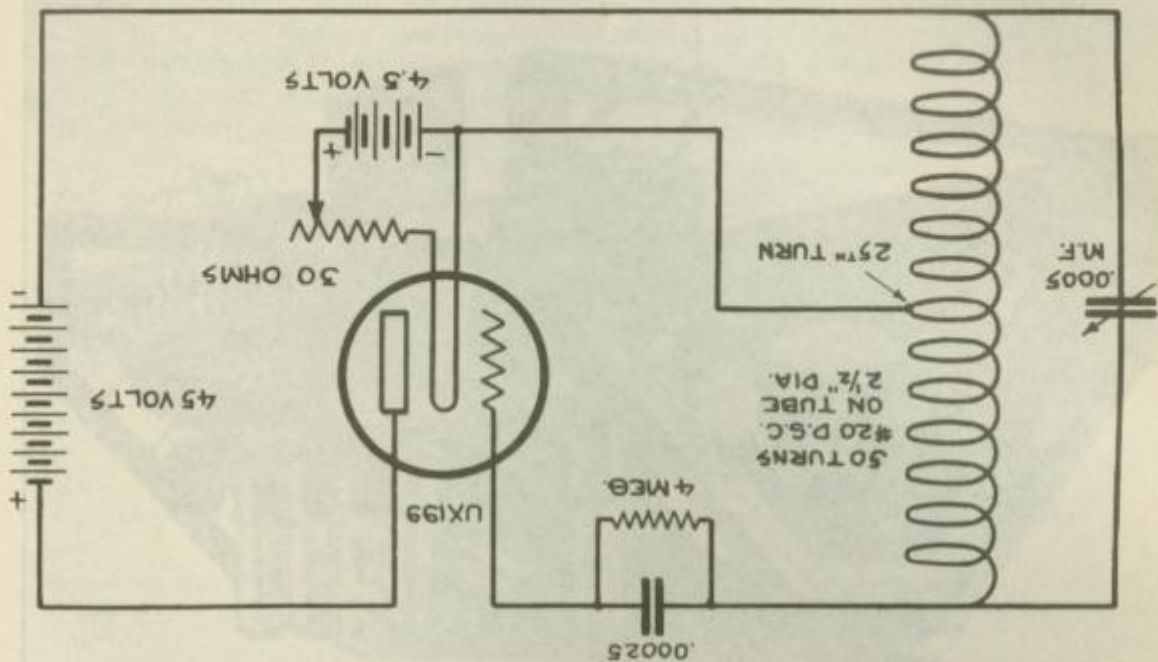


Figure 10

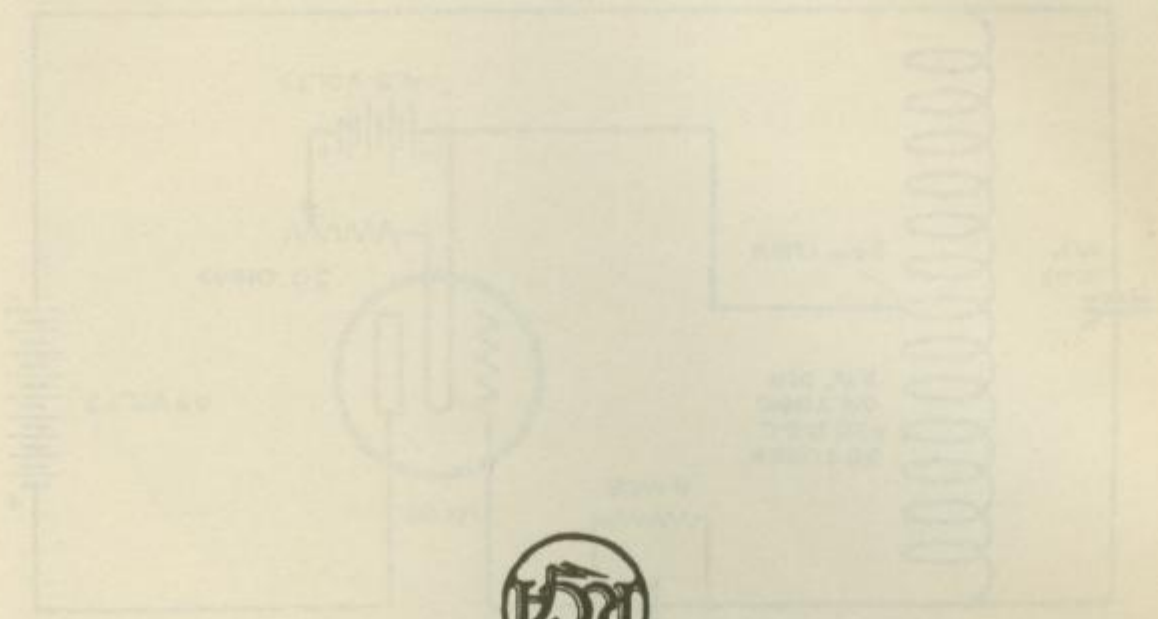
Circuit diagram of Modulated Oscillator used in neutralizing Radiola 20 and
lining up the main tuning condensers

(22) CONSTRUCTIONAL DETAILS OF MODULATED OSCILLATOR

This oscillator, which will be found very efficient for neutralizing and balancing the various circuits of the Radiola 20 may be made in the following manner. The circuit diagram is shown in Fig. 10.

The coil consists of 50 turns of No. 20 D.S.C. wire wound on a 2 1/2-in. tube. A tap is taken off at the 25th turn which is 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 kilocycles (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 LX-199 Radiotron will be found to have ample power output. This oscillator will be found very useful in servicing all types of Radio Receivers, including the balancing of the tuned R. F. circuits of Radiola 28 and Radiola 30 and will amply repay the dealer for the small outlay of material and labor required.

Figure 1. Schematic diagram of the circuit used in the experiment.



The circuit shown in Figure 1 was used to measure the inductance of the coils. The power source was a 100 V AC supply. The large coil was a 100 mH inductor and the small coil was a 10 mH inductor. The voltmeter was connected across the small coil to measure the voltage drop across it. The switch was used to connect the power source to the coils. The inductance of the coils was determined by measuring the voltage drop across the small coil and the current through it. The current was measured by a current transformer connected in series with the small coil. The inductance of the large coil was determined by measuring the voltage drop across it and the current through it. The current was measured by a current transformer connected in series with the large coil. The inductance of the coils was determined by measuring the voltage drop across them and the current through them. The inductance of the coils was determined by measuring the voltage drop across them and the current through them.

RESULTS