RCA Victor
SERVICE NOTES
for
1923 — 1928

RCA Radiolas

RCA Loudspeakers

Victor Radio Receivers

Victor Radio-Electrolas

Miscellaneous Service Information

Service Division

RCA Victor Company, Inc.

Camden, N. J., U. S. A.

RCA Victor

SERVICE NOTES

for

1923 — 1928

RCA Radiolas

RCA Loudspeakers

Victor Radio Receivers

Victor Radio-Electrolas

Miscellaneous Service Information

Service Division

RCA Victor Company, Inc.

Camden, N. J., U. S. A.

INTRODUCTION

The Service Notes and Data Sheets contained herein are for the radio receivers and phonograph combination instruments sold by the Radio Corporation of America and the Victor Talking Machine Company during the years from 1923 to 1928. These booklets have been compiled for RCA Victor Distributors and Dealers for use by their personnel in conjunction with the servicing of the instruments listed.

Proper operation of any radio instrument is dependent upon correct service methods and replacement of defective parts. We earnestly recommend that you follow the instructions given, use the equipment recommended and replace defective parts with Genuine RCA Victor Factory Tested Replacement Parts. Your Distributors will be glad to obtain for you any part or service equipment described in this book and give you any possible assistance in the performance of your work.

CONTENTS

The Booklets and Data Sheets Listed are Contained in this Volume in the Order Indicated

INSTRUCTIONS AND CIRCUIT DIAGRAMS

BATTERY CONNECTIONS

RCA RADIOLA AND LOUDSPEAKER SERVICE NOTES

VICTOR RADIO RECEIVER AND ELECTROLA SERVICE NOTES

SUCCESS IN RADIO SERVICE WORK

The most valuable asset of any business is GOOD WILL. And Good Will is nothing more or less than public confidence in you and your business; confidence to the point that your customers are willing and glad to recommend you and your services to acquaintances and friends.

That kind of Good Will does more to build business than all other forces combined. Three factors are involved in building Good Will for a radio service business, in gaining the confidence of your customers to the point that they will do a selling job for you. These three essentials of success are:

Which one would you do business with?

Technical Ability • • •

Business Methods • • •

Parts and Test Instruments •

Technical Ability. Your technical ability is reflected in the test instruments you employ, by the appearance of your shop and work bench, and by the "kit" that you carry into customers' homes. Like the successful members of any of the professions, the radio service engineer must continually study to keep up with the times.

Business Methods. Insofar as your customers are concerned there are just two indices to your business methods: The way you handle yourself on the job and the quality of the Parts and the Test Instruments you use.

Contrast the picture of the two Service Men shown on this page. Each is about to make a call. Each is a good service man, so far as ability goes. But there the likeness ends. One has *business* written all over him. One has built his success on the foundation of fair prices for good work and highest quality parts. The other wonders why his business is slow even though he offers "cut prices" as a result of the bargain replacement parts he uses.

Parts and Test Instruments. The most tangible of the three factors essential to success in service work are the Parts and Test Instruments used. By these you are judged immediately and permanently, as the job holds up or fails to stand up.

Parts and Test Instruments may be made in either one of two ways. They may be built *up* to a *standard* or *down* to a *price*. No single Part or Test Instrument can be built both ways. It must be done either one way or the other.

And in the long run Parts and Test Instruments built *down* to a *price* cost you more than those built *up* to a *standard*—cost you more in disgruntled customers, prestige and loss of *GOOD WILL.*

Quality pays. Hundreds of leading radio service engineers attribute their success to their adherence to the following pledge:

The RCA Oscillator TMV-97-B, ideal for all service work

In our service work we pledge—

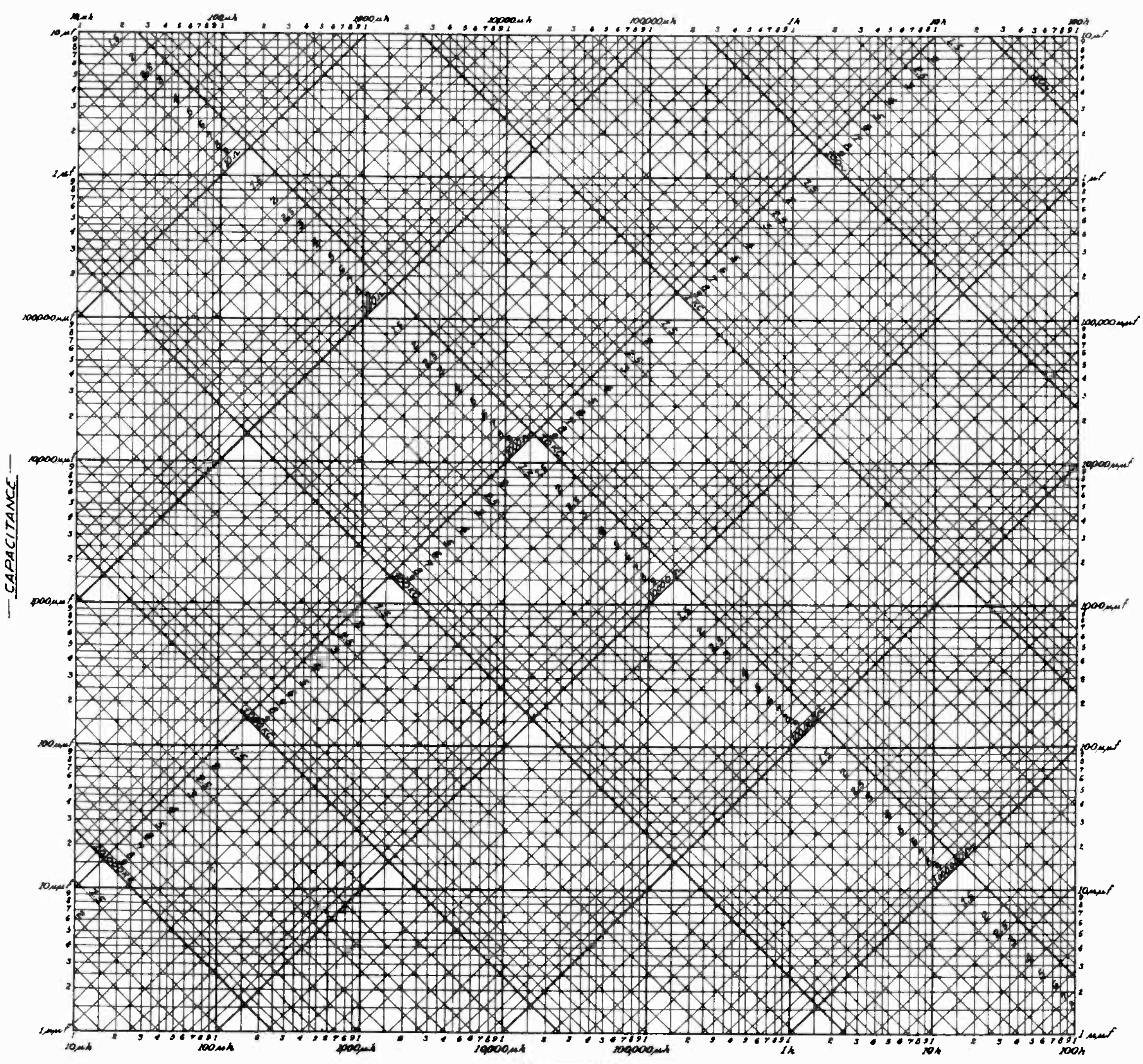
1. To use the highest quality materials.
2. To be thorough in all our work.
3. To handle your property with care.
4. To make reasonable promises and keep them.
5. To charge a fair price for our services.

An output indicator that does not burn out, RCA Type TMV-121-A

BE ON THE SAFE SIDE • • • USE GENUINE FACTORY-TESTED RCA PARTS AND TEST INSTRUMENTS • • •

CHART OF FREQUENCY OR IMPEDANCE
VS.
INDUCTANCE AND CAPACITY

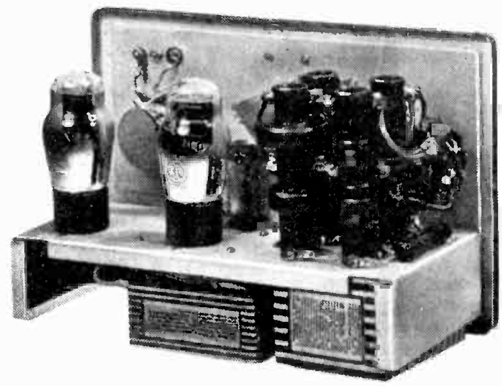
The Chart shown below provides a quick method of determining several unknown factors when one or more are known. The Chart covers a very wide range, namely, from 10 micro-henries to 100 henries inductance, 10 cycles to 50,000 kilocycles, 1 ohm to 10 megohms and 1 micro-microfarad to 10 microfarads. If, for example, one wishes to know the capacitance to use with a 10 henry inductor to have it resonate at 50 cycles, it can be readily seen that it would be a 1 mfd. capacitor. This is determined by finding the intersection of the vertical line representing 10 henries and the oblique line representing 50 cycles. The intersection occurs at the horizontal line representing 1 mfd. The other oblique line at this intersection represents the impedance at this frequency. This is approximately 3000 ohms.



RCA Full Range Test Oscillator

Type TMV-97-B

Front View



Rear View of Chassis

The RCA Full Range Type TMV-97-B Test Oscillator is a modulated R. F. oscillator which supersedes the Type TMV-97-A. New features are a wider frequency range, an improved calibrated tuning dial (reading in frequency) and a direct-reading range switch. All older features such as small compact size, light weight, self-contained batteries, etc., of the Type TMV-97-A are retained.

The frequency range extends continuously from 90 K. C. to 25,000 K. C. (3300–12 meters) and is divided into eight bands. This covers all intermediate, broadcast, police and short-wave frequency line-up points of all makes of receivers. An eight-position range switch provides for the selection of any desired band. An attenuator (output control) gives a means of adjusting the output to any level. This is very important in modern receivers, due to the increasing practice of combining the automatic volume control with other tubes.

Of special interest to amateurs and experimenters is the simplicity with which the modulation may be eliminated. This may be done by the use of a special adapter in the modulator socket. The oscillator then may be used as a heterodyne oscillator for short-wave superheterodyne receivers or for heterodyning the I. F. frequency of all-wave receivers to permit reception of pure CW signals.

SPECIFICATIONS

CIRCUIT—A tuned-grid, plate-modulated circuit is used, which gives good stability over a wide range of voltage and climatic conditions. The output is modulated 50% at 400 cycles.

RADIOTRONS—Two Radiotrons RCA-30 are used, one as an R. F. oscillator and one as an A. F. modulator.

BATTERIES REQUIRED—One 22½ volt "B" battery and one 4½ volt "C" battery are used. The "C" battery provides filament power for the Radiotrons, the filaments of which are connected in series.

SIZE—Height 8½ inches (including raised handle), case alone 6½ inches, width 9¾ inches, depth 4½ inches.

WEIGHT—5 lbs., including batteries.

SWITCH—A toggle-type operating switch for turning the oscillator "on" and "off" is mounted on the front panel.

FREQUENCY RANGE—90 K. C.–25,000 K. C. by eight bands. The Range Switch is located on the front panel and marked directly in frequency.

OUTPUT—Two binding posts on the front panel, together with an attenuator, give an easy means of connecting and adjusting the output.

DIAL—Variable vernier dial adjustable from 6:1 to 20:1 speed reduction. The dial glass has been made thicker so that the indicator line is very close to the dial, thus avoiding a possible parallax.

CALIBRATION—The dial is calibrated directly in frequency to an accuracy of ±3%. Complete individual calibration may be obtained at an additional cost of $5.00.

CASE—The entire oscillator is enclosed in a black wrinkle-finished aluminum case provided with a leather handle.

Net Price $29.50

(WITH RADIOTRONS—LESS BATTERIES)

Order Stock No. 9050

RCA Tools and Accessories

The following tools and accessories are useful for servicing Radio Receivers, Combinations and Short-Wave Instruments of all types and manufacture.

Alignment Tool

Stock No. 4160 **Net Price $0.60**

The Stock No. 4160 Alignment Tool is a bakelite shaft combination screwdriver and socket wrench. The matal screwdriver bit is so shaped that the increase in capacity caused by its touching a trimmer screw is offset by the reduction in inductance caused by its shape. This is very important when making adjustments on all-wave receivers where the screwdriver must be inserted through the end of the coil. The socket end fits the main tuning capacitor trimmer adjustment screws used on numerous RCA Victor Receivers. The bakelite shaft is 7/32" diameter, which gives entrance to 1/4" holes, used on older model Radiola receivers.

Alignment Wrench

Stock No. 7065 **Net Price $0.50**

The Stock No. 7065 Alignment Wrench is a combination screwdriver and alligator jaw end wrench. The metal screwdriver bit is shaped so that it will have a minimum effect on the alignment of the set when it touches a trimmer screw. The end wrench is suitable for adjusting trimmer screws that are accessible only from the side. The shaft is of bakelite, 7/32" diameter and the overall length is 5½".

Riveting Punch

Stock No. 10987 **Net Price $0.50**

The Stock No. 10987 Riveting Punch is a special metal punch for use with a riveting anvil. The punch may be used with the rivets usually used on radio receivers and permits the service man to make a factory type repair, instead of using machine screws to replace rivets. The punch is 5/16" in diameter and 5½" long.

Riveting Anvil

Stock No. 10988 **Net Price $0.70**

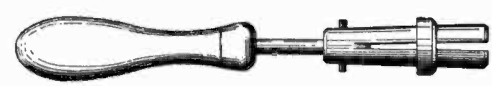
The Stock No. 10988 Off-Set Riveting Anvil is a special anvil that permits riveting in places ordinarily inaccessible. It is to be used in conjunction with a riveting punch such as Stock No. 10987. The Anvil is 5/16" in diameter and 3½" long.

Tuning Wand

Stock No. 6679 **Net Price $1.10**

The Stock No. 6679 Tuning Wand is a special alignment tool which makes possible the checking of alignment in all-wave receivers without disturbing the adjustment of the trimmer capacitors. The tool consists of a bakelite rod having a brass cylinder at one end and a special finely divided iron core at the other end. Inserting the brass cylinder into a coil lowers its inductance, while inserting the iron increases the inductance. From this it is evident that before adjusting trimmers, the adjustment may be checked by inserting each end of the wand into the coil. Proper adjustment is evidenced by a reduction in output with either end of the wand inserted into the coil.

Knurled Nut Wrench



Stock No. 10982 **Net Price $1.20**

The Stock No. 10982 Knurled Nut Wrench is a special wrench designed for tightening or removing the knurled nuts such as are used with toggle type switches. These nuts are ordinarily impossible to remove or tighten without marring. The wrench will hold a nut from 5/8" to 1/2" diameter. The overall length is 8½".

Off-Set Screwdrivers

Stock No. 3064
Net Price $0.50

Stock No. 2930
Net Price $0.50

The Stock Nos. 3064 and 2930 Off-Set Screwdrivers are useful for making adjustments to remote control units and other small screws that are inaccessible with an ordinary screwdriver. The No. 3064 screwdriver is 2½" long while No. 2930 has an overall length of 4⅜".

Socket Wrench

Stock No. 10983 **Net Price $1.80**

The Stock No. 10983 Socket Wrench is a special flexible end socket wrench designed for adjusting the alignment screws of the 1929 and 1930 Victor Receivers, Models R-32, R-35, etc. The overall length is 8¾".

Radiola AR

Radio Frequency Amplifier

INTRODUCTION

Preface—The RADIOLA AR is a three-step radio frequency amplifier designed to be used with the Radiola RA tuner and DA detector-amplifier. It will so increase the sensitivity of the above combination that reception may be accomplished over long distances with a loop antenna. If very great range is desired, an aerial may be used when many stations not previously heard will be received.

RADIOLA AR

Radio Frequency Amplification—The advantage of radio frequency amplification lies in the fact that a signal that is too weak to operate a detector satisfactorily may be amplified while still at radio frequency until it is strong enough. This enables the reception of many stations that are so far away that their signals are too weak to actuate a detector directly.

EQUIPMENT

Standard Equipment—The RADIOLA AR, style 319518, consists of a complete three-step radio frequency amplifier ready to operate, except for tubes and batteries.

Additional Equipment—The following additional equipment is necessary for the satisfactory operation of the RADIOLA AR:—

3 Radiotron model UV 201 vacuum tubes
1 6-volt storage battery
3 or 4, $22\frac{1}{2}$-volt "B" batteries
Suitable tuner and detector, preferably Radiolas RT and DA

APPLICATIONS

General—The RADIOLA AR radio frequency amplifier is one of a series of similar units: Radiola RA, Regenerative Tuner; Radiola RT, Antenna Coupler; and Radiola DA, Detector Amplifier. It is designed to be used with the other units in the various combinations described in this booklet.

With Radiolas RT, DA and Loop—Fig. 1 shows the arrangement of Radiolas RT, AR and DA with a loop. This arrangement will be found excellent where too great a range is not desired. The directional properties of the loop will greatly assist in eliminating interference from nearby stations while the radio frequency amplification will make possible the reception of signals from relatively distant stations.

When using a loop, a condenser is the only thing required to tune the antenna circuit. Therefore, only the condenser of Radiola RT is used. Connections should be made as shown in Fig. 1.

With Radiolas RA, DA and Loop—In case Radiola RA is available, it may be used in place of Radiola RT. The connections will be as shown in Fig. 1, except that the "Tickler" (lowest two) binding posts on Radiola RA will be idle.

With Radiola RC and Loop—When Radiolas RA and DA are available in the form of Radiola RC, the connections will be similar to those shown in Fig. 3, except that the loop will be connected to Radiola RA as shown in Fig. 1. **RADIOLA AR** may be placed on either side of Radiola RC and the connections arranged accordingly.

With Radiolas RT, RA and DA—Fig. 2 shows the best combination. It comprises a coupled circuit with Radiolas RT and RA with radio frequency amplification by RADIOLA AR followed by detection and audio amplification in Radiola DA. This combination provides the selectivity of a coupled circuit which is necessary for satisfactory operation with radio frequency amplification.

It is necessary for best results to provide more coupling between the tuning circuits than is provided by their variometers. To do this, use is made of the tickler winding on the Radiola RA. The antenna circuit will then consist of Radiola RT and part of the tickler winding of Radiola RA as shown in the figure. Usually good results will be obtained with the tickler at two or three divisions from "Min."

With Radiolas RT and RC—If Radiola RC is available instead of Radiolas RA and DA, the sets should be arranged as shown in Fig. 3. This is exactly the same combination of parts as in the preceding paragraph. It will be necessary to exercise care in making the radio frequency connections between Radiolas AR and RC, so that there will not be so much feed back that the amplifier will oscillate. If trouble of this kind is experienced, it is possible to stabilize the circuit by bending the wires into different planes or the connections and stability may be improved by interchanging Radiolas RA and AR by making the necessary extra holes in the cabinets. The arrangement will then become the same as in Fig. 2.

Miscellaneous—It is possible to use RADIOLA AR with other apparatus than that described above. Such uses will suggest themselves to both the experimenter and experienced operator.

INSTALLATION

The RADIOLA AR is an additional piece of apparatus intended for use in one of the combinations previously described. Instructions for the proper installation and operation of the other units are furnished with them.

The binding posts at the back of the cabinet are plainly marked so that no difficulty should be experienced in making connections. It is advisable to connect the filament batteries first and make sure that the tubes light properly. Care must be used to have the right battery voltage for the tubes to be used. Radiotrons UV 201 require approximately 5 volts which may be supplied by a 6-volt storage battery. Three or four 22½-volt "B" batteries connected in series are also required. Both the filament and "B" batteries may be used for the detector and audio frequency amplifier as well as for the radio frequency amplifier.

OPERATION

There are no tuned circuits in the RADIOLA AR and therefore it is not necessary to readjust it except slightly when changing wave length. There are only two knobs near the lower part of the panel. The one on the right, marked "Fil. Rheo". controls the filament current to all the tubes which are permanently connected in parallel. In the "off" position, the knob is turned as far to the left as possible. This opens the filament circuit and the rheostat should always be left in this position when the set is not in operation. The knob on the left marked "Potentiometer" controls the grid bias of the first tube.

In operation, the tuner and detector amplifier are operated as usual. The filaments of the tubes in the AR should be lighted to the proper brillancy. If the connections have been correctly made and all the apparatus is in proper condition, signals may be heard. The potentiometer controls the amplification and should be adjusted to give the maximum response without permitting oscillation to take place. After this adjustment is made, it need be changed only slightly.

MAINTENANCE

With ordinary care, the RADIOLA AR should last indefinitely. However, tubes and batteries will have to be replaced from time to time. The filaments of vacuum tubes gradually evaporate until there is no filament left when the tubes become useless. Filaments also break occasionally. Useless tubes should be replaced by new ones of the same kind.

Storage batteries may be recharged when they have become exhausted. Dry cells are of no value when exhausted. Since "B" batteries are usually made up of small dry cells they must be replaced by new ones.

TROUBLES

In case of trouble, see that the batteries are in good condition, that the tube filaments light to the proper brilliancy and that all connections are tight. If this does not remedy the trouble, renew both batteries and tubes. If the trouble still persists, call in a Service Man or a good Radio Electrician.

ELECTRICAL DESCRIPTION

Fig. 4 is a diagram of connections of the RADIOLA AR. The apparatus consists of three vacuum tubes, "A" "B" and "C" coupled by the transformers "O" "P" and "Q." "D" is the potentiometer and "R" is the rheostat. "E" is a radio frequency bypass condenser.

The signal voltage from the tuner is applied between the grid and filament of the first tube "A". This causes changes in the plate current of tube "A" which flows through the primary "1-2" of transformer "O" This current induces voltage in the secondary "3-4" which is applied between the grid and filament of the second tube "B". "Q" is the final output transformer to the detector. "D" is a potentiometer which controls the steady voltage on the grid of tube "A" so that operation will take place on the right part of the characteristic curve. "R" is a rheostat in the filament circuit which controls the filament current to all of the tubes. Condenser "E" makes it unnecessary for radio frequency currents to flow through the potentiometer. Condenser "S" provides a radio frequency by-pass around the "B" battery.

It will be seen that the output of the RADIOLA AR will be a radio frequency current of the same frequency and wave form as that of the current flowing in the antenna but of greater amplitude. This must then be supplied to a detector in order to be made audible.

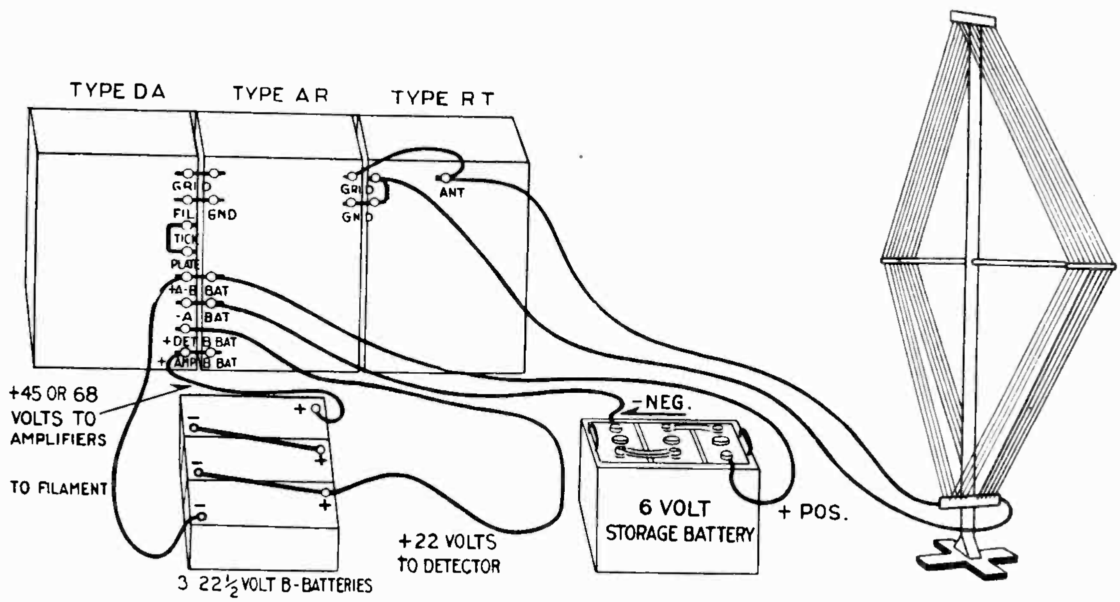


Fig. 1—Radiolas RT—AR—DA

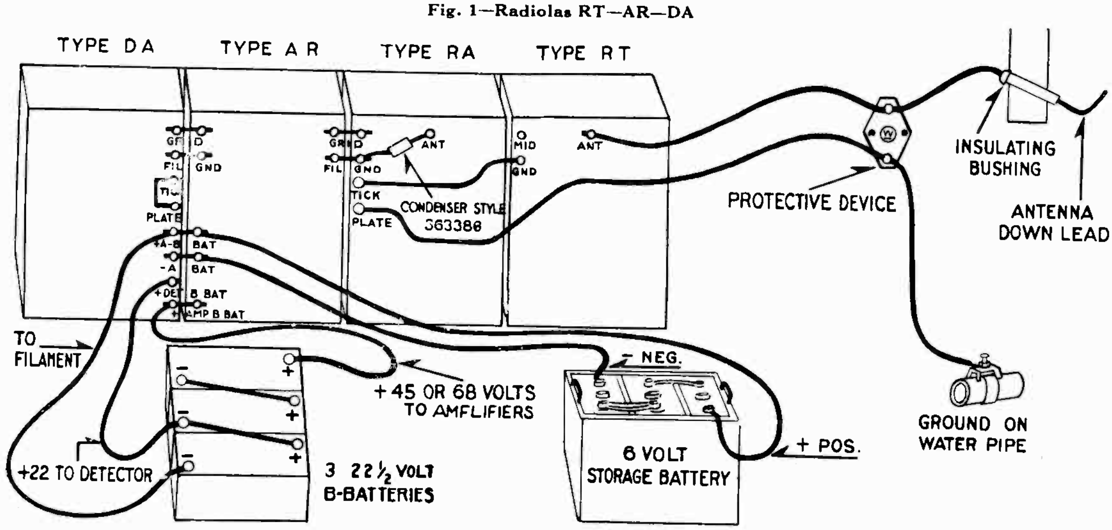


Fig. 2—Radiolas RT—RA—AR—DA

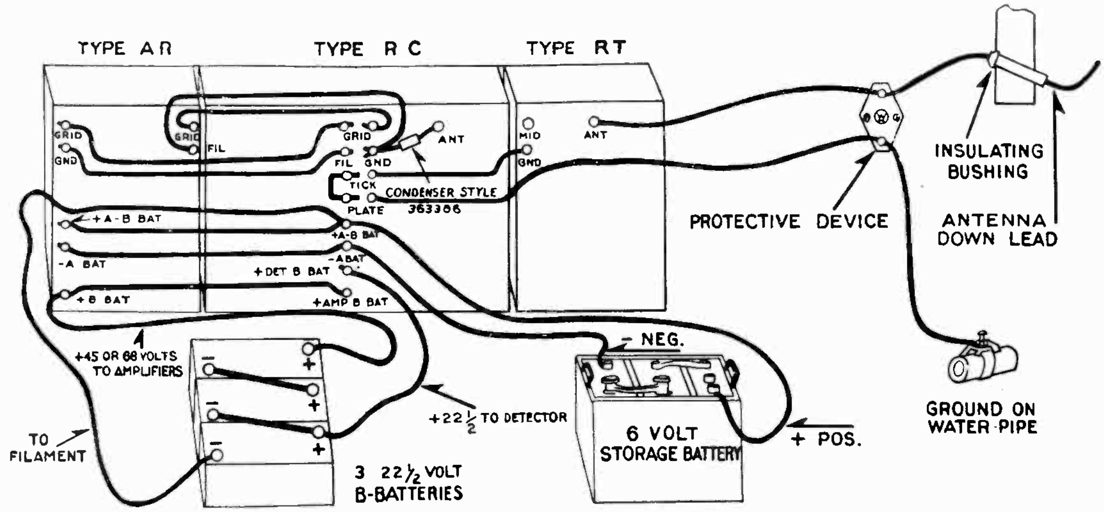


Fig. 3—Radiolas RT—RC—AR

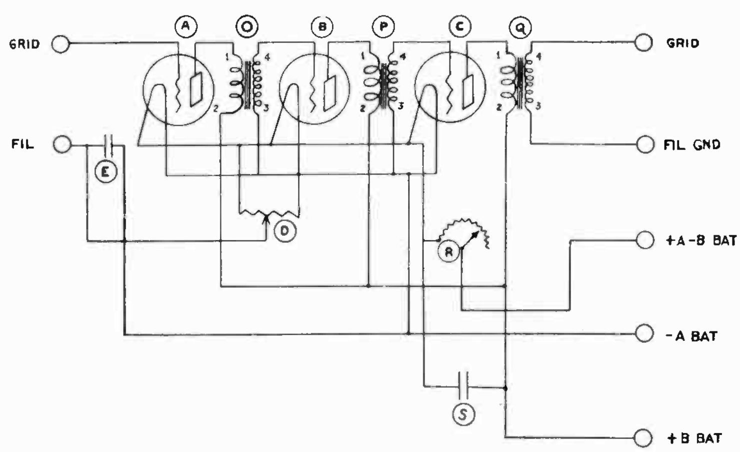


Fig. 4—Diagram of Connections of Radiola AR

Radiola R T
Antenna Coupler

PREFACE

The RADIOLA RT is an adjustable series circuit consisting of a variometer and a variable condenser similar to those used in the Radiola RA, regenerative tuner. It is built for use with the Radiola RA to make a coupled circuit but may also be used with the Radiola AR radio frequency amplifier in ways that will be described later in this booklet.

The advantage of a coupled circuit is the greater selectivity attained over that of a single circuit. This will be appreciated most by those desiring to receive signals from a distant station when another nearby station is operating on nearly the same wave length. The coupled circuit will make it possible to selectively receive the distant station.

EQUIPMENT

Standard Equipment—The standard equipment furnished under the name of RADIOLA RT antenna coupler consists of:

1. Antenna coupler, Type RT
1. Condenser, style 363386

Additional Equipment—The following additional equipment will be necessary to make a coupled circuit receiver:—

1. Radiola RC receiving set or its equivalent consisting of a Radiola RA tuner with a Radiola DA detector amplifier.
1. Complete set of antenna material, type AD style 319486 or its equivalent.
   Batteries, tubes and telephone receivers as required for use with Radiola RC receiver.

DESCRIPTION

The RADIOLA RT antenna coupler consists of a tuning unit similar to that of the Radiola RA regenerative tuner. It is mounted in a polished mahogany cabinet of the same size and general appearance as the other units of this series and is intended for use with them. Three binding posts are located at the rear of the cabinet and make it possible to use either the condenser or the variometer separately or both in either parallel or series connection.

A condenser, style 363386, is furnished with the RADIOLA RT. This condenser is made to fit on the back of the Radiola RA tuner between the antenna and ground posts to complete the tuning circuit. It is of such a value that the wavelength range of the Radiola RA will be correct.

COMBINATIONS

Radiolas RT and RC—This is the best combination for general use. It provides a coupled circuit to give selectivity and a regenerative circuit to give sensitivity. A front view of this combination is shown in Fig. 1, with the RADIOLA RT at the left. Fig. 2 shows a rear view to indicate the method of making connections. Fig. 3 shows a diagram of the internal connections of the two sets. Of course, the two separate units, Radiolas RA and DA, which are assembled in the same box to make the Radiola RC, may be used individually. The same applies to all other combinations including the Radiola RC.

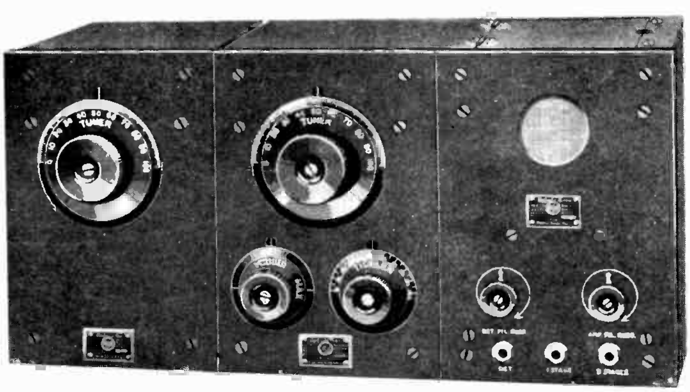


Fig. 1—Radiolas RT and RC

Radiolas RT-RA-AR-DA—If greater range is desired than can be obtained with the combination previously described, it is necessary to use radio frequency amplification because a signal too weak to operate a detector can be amplified at radio frequency and thus brought up to sufficient amplitude. For this purpose, the Radiola AR, a three-step, transformer—coupled radio frequency amplifier has been built. Fig. 4 is a rear view showing the proper sequence of units and the connections between them. Fig. 5 shows the same combination using a Radiola RC in place of the Radiolas RA and DA. This makes a rather poor arrangement of leads and the proximity of input and output to the Radiola AR may result in so much regeneration that the amplifier will oscillate. Therefore, we suggest that the Radiola RA be removed from its cabinet and be replaced by the Radiola AR while the Radiola RA is placed in the cabinet formerly occupied by the Radiola AR. These units are easily removed from the cabinets by taking out the four nickel plated screws at the corners of the panels. The micarta strips on the back of the cabinets will have to be interchanged also and additional holes will have to be made in the back of the cabinets. The sequence of units then becomes the same as that shown in Fig. 4.

It is necessary for best results to provide more coupling between the tuning circuits than is provided by their variometers. To do this, use is made of the tickler winding on the Radiola RA which would otherwise be idle. The antenna circuit will then consist of RADIOLA RT and part of the tickler winding of Radiola RA as shown in the figure. Usually good results will be obtained with the tickler at two or three divisions from "Min"

Radiolas RT-AR-DA with a Loop—If the directive qualities of a loop at the sacrifice of range are desired, they may be obtained by using only the condenser of the RADIOLA RT to tune the loop circuit. It is practically necessary to use radio frequency amplification with a loop. In connection with the portable loop model HG 1380 a wavelength range sufficient to take in the broadcasting stations will be obtained. Fig. 6 shows the connections.

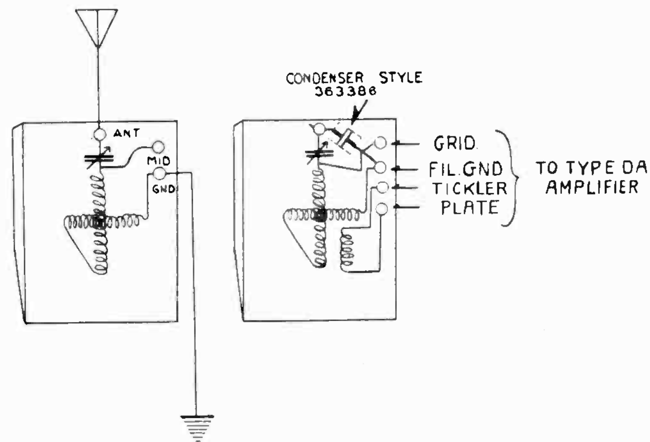


Fig. 3—Diagram of Connections for Radiolas RT andRA

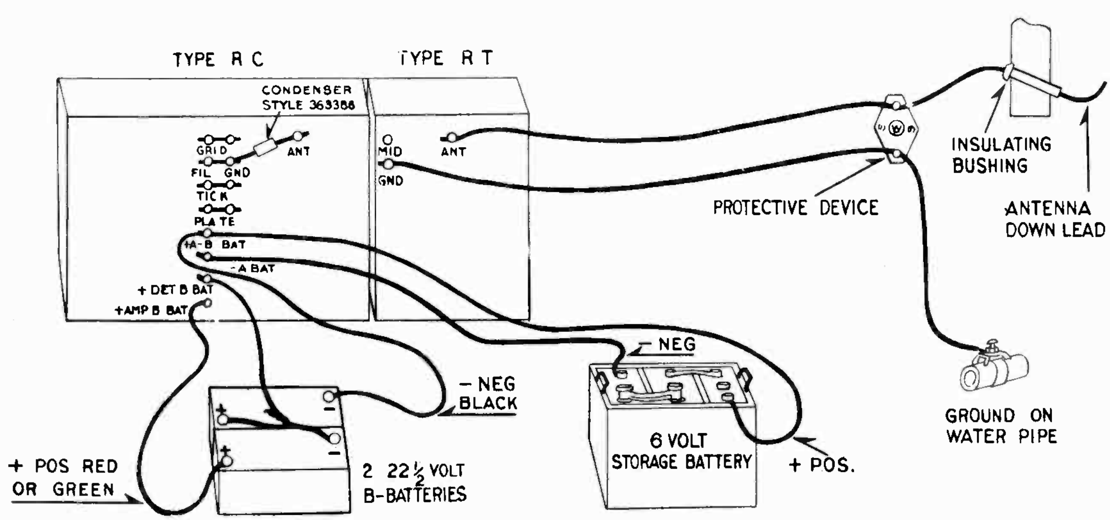


Fig. 2—Radiolas RT and RC

Radiolas RT and DA—It is also possible to use the RADIOLA RT as a single circuit, non-regenerative tuner with the Radiola DA detector amplifier or a crystal. Such a combination will have a very limited range.

Miscellaneous Uses—The experimenter will find the RADIOLA RT a very convenient unit with which to try various circuits. Its variometer can be used to tune the plate circuit if that type of regeneration is desired. It may also be used as a wave trap to eliminate interference from nearby stations. Other uses will suggest themselves.

INSTALLATION

The RADIOLA RT is an additional piece of apparatus for use in one of the combinations previously described. The other units should be installed in accordance with the directions which accompany them.

The RADIOLA RT in a coupled circuit is placed at the left side of a Radiola RA and close up against it. The antenna is connected to the binding post in the middle near the top, and ground is connected to the lower of the two posts at the side. The condenser must be connected between the antenna and ground posts of the Radiola RA. The set is then ready to operate.

OPERATION

The Radiola RA tuner and DA detector amplifier should be adjusted as usual. In order to receive signals, it is necessary that both tuning circuits be tuned to the same wave length and to the wave-length of the desired transmitting station. This may be done as follows: Adjust the tickler on the Radiola RA until it is just below the point of oscillation and keep it there by noting the characteristic breathing noise. Rotate the dial of the Radiola RA very slowly while at the same time turning the dial of the RADIOLA RT through 10 or 15 divisions on either side of the number on the dial corresponding to the number on the Radiola RA dial, listening all the while for signals. When signals are heard, adjust both tuning circuits carefully to the point where the signal is loudest. The final adjustment of the Radiola RA is best made by the vernier. After a little practice the approximate settings for a given station will be remembered so that rough adjustments may be made immediately. It is usually possible to tell when the tuning circuits are adjusted to approximately the same wave length by means of atmospheric noises.

The selectivity of this set can be increased at a sacrifice of sensitivity by moving the RADIOLA RT further away from the Radiola RA. This may be necessary if a powerful station is in operation nearby. It is possible to operate the apparatus with the two tuning circuits several feet apart. Adjustments made before moving the RADIOLA RT will usually need to be slightly altered after the separation is made.

When the RADIOLA RT is used with the Radiola AR radio frequency amplifier, it is operated just like any single circuit receiver, there being but one knob and dial to make all the adjustment necessary. When a loop antenna is used, besides tuning the circuit to the proper wave length, the loop must be turned so that it points in the general direction of the transmitting station, but more important, so that it will be nearly at right angles to an interfering station thus reducing the strength of the interfering signals to a minimum and making the most of the directive effect of the loop.

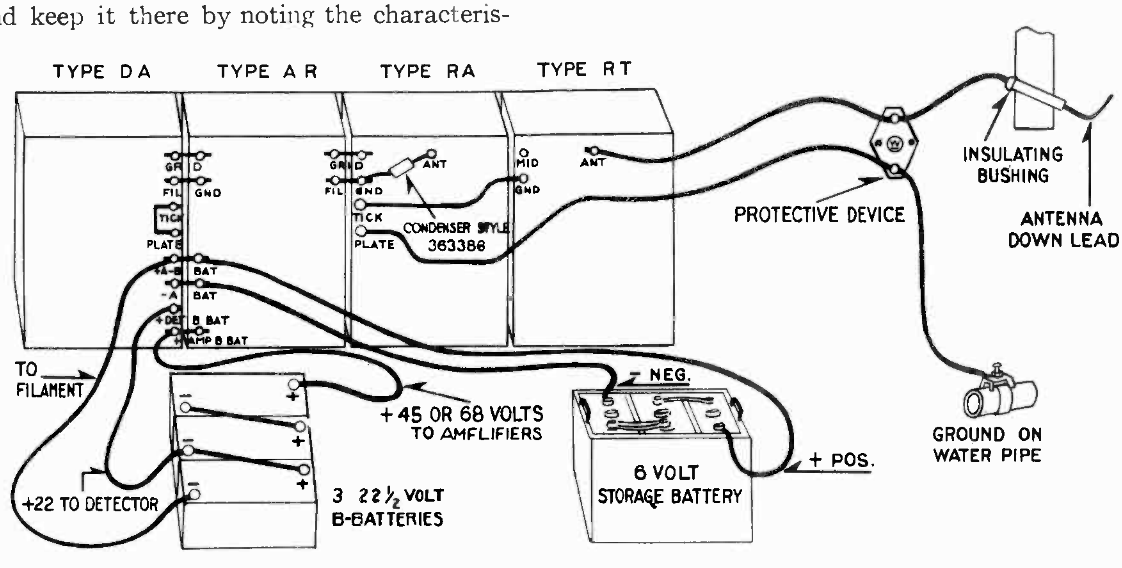


Fig. 4—Radiolas RT, RA, AR and DA

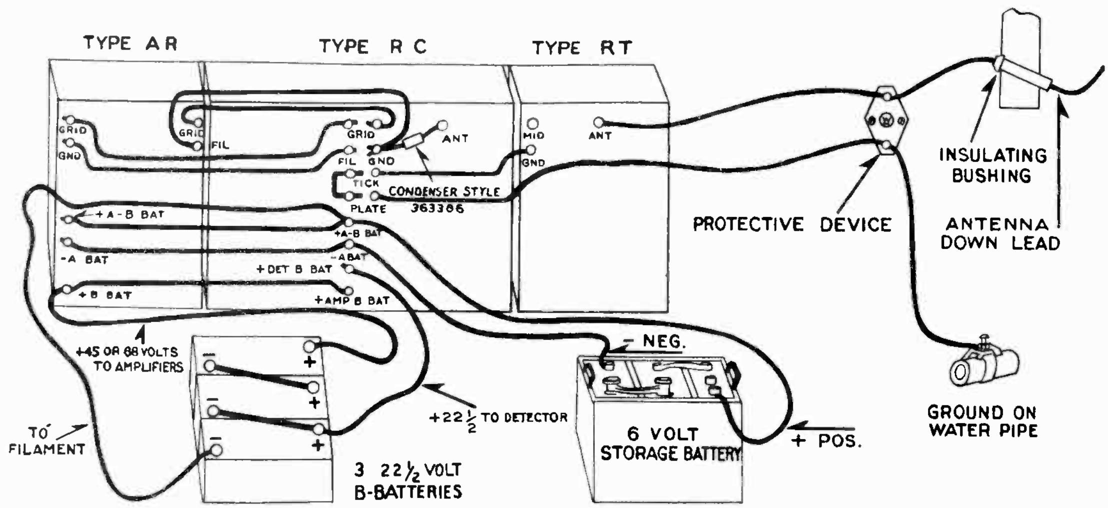


Fig 5—Radiolas RT, RC and AR

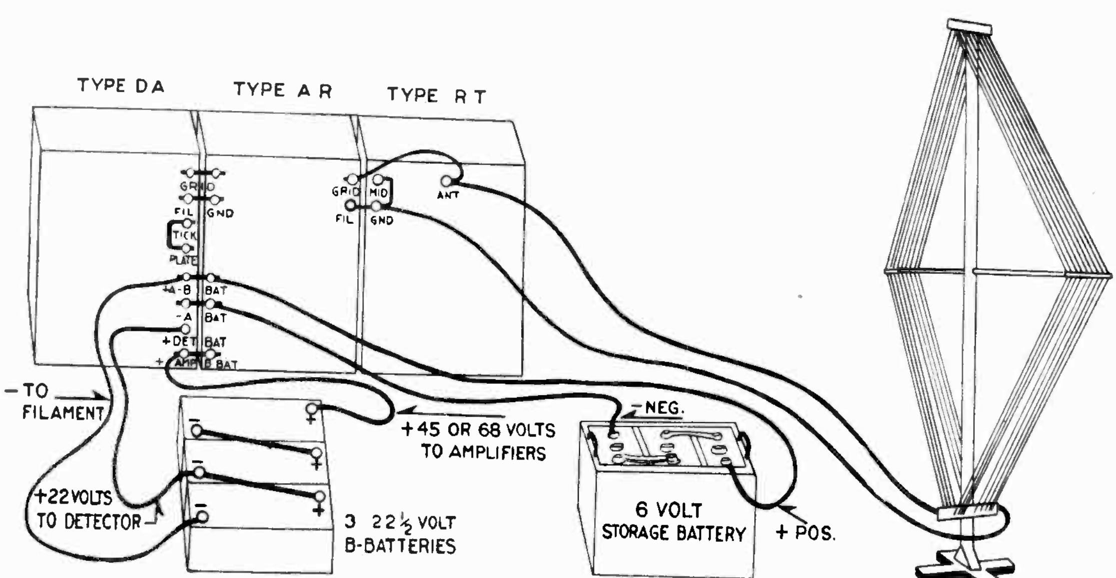
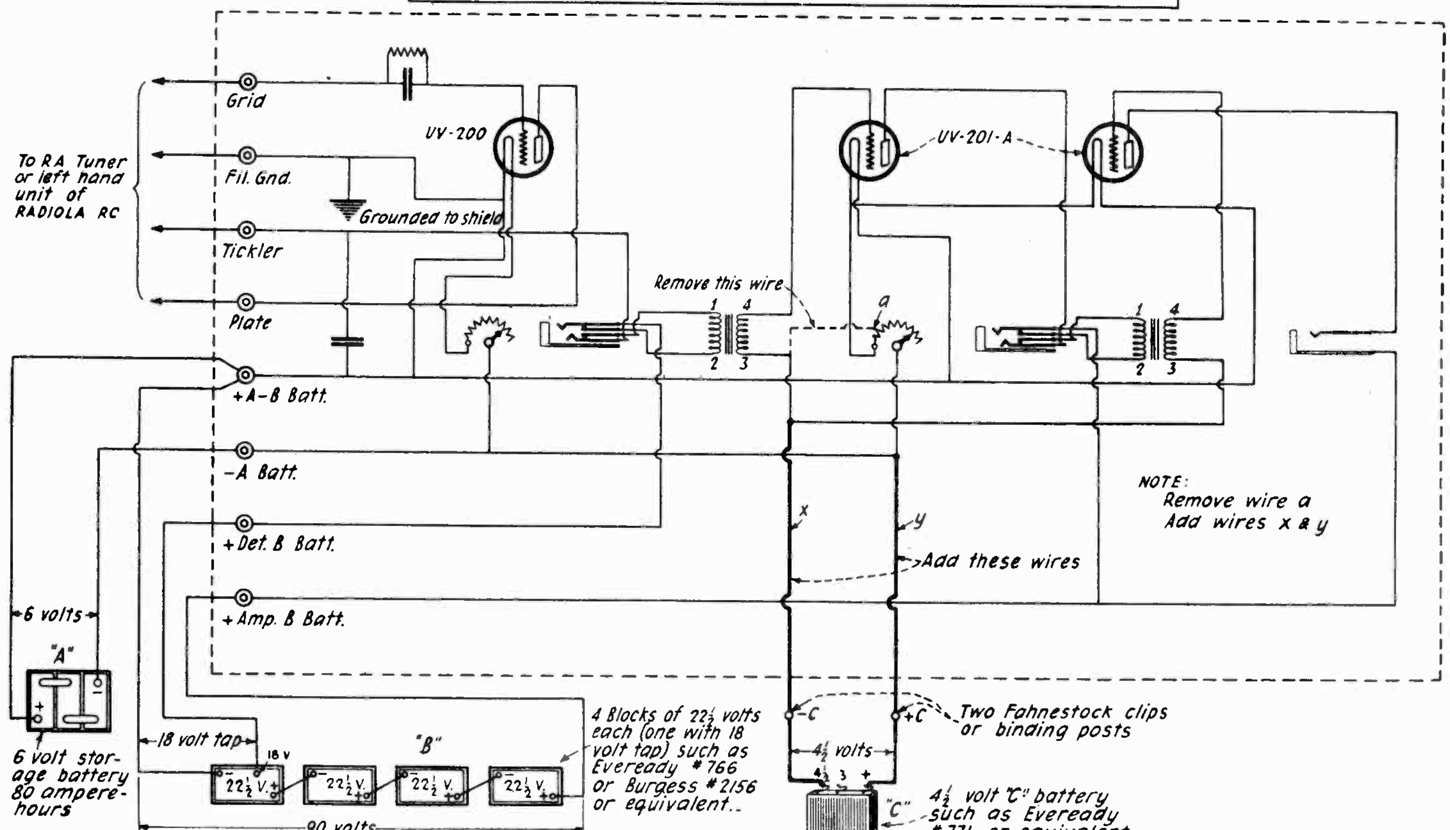


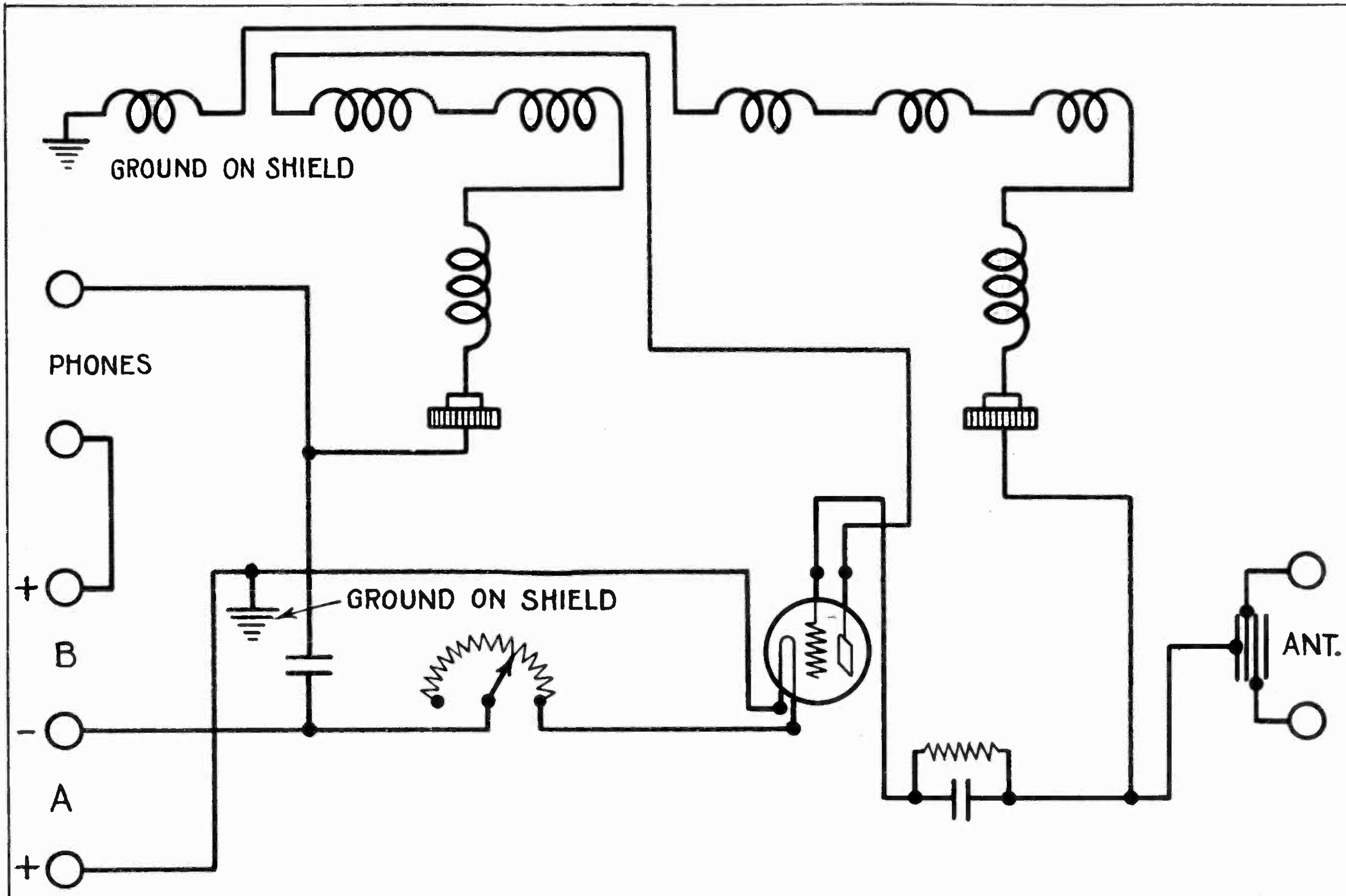
Fig. 6—Radiolas RT, AR and DA with Loop

RADIOLA RC (DA DETECTOR AMPLIFIER UNIT) MODIFIED

TO USE UV-200 DETECTOR AND UV-201-A AMPLIFIER RADIOTRONS ARRANGED FOR "C" BATTERY



AERIOLA SR.



Radiola R S

Regenerative Receiver and Amplifier

INTRODUCTION

A radio receiver is an instrument, which, in connection with an antenna in the form of an elevated wire or a suitable loop, is used to convert the high frequency electro magnetic waves into electric currents which in turn operate a telephone receiver and produce audible sounds.

Radio communication is effected by means of electromagnetic waves which are radiated from the transmitting station and travel in all directions at the velocity of light. This velocity is 186,000 miles or 300,000 kilometers per second which will carry a radio signal seven times around the earth in a second. These waves cannot be heard because they have no mechanical effect on the ear drum and

Fig. 1—Radiola RS

even if they did, the frequency would be so high that the ear could not respond to it. Sound waves have frequencies varying from about 16 cycles per second, which is the note produced by the largest organ pipe, up to about 20,000 cycles per second, which is the highest frequency to which the human ear will respond The velocity of sound waves in air is about 1100 feet per second so that sound waves have a length varying from an inch or so up to 60 or 70 feet. Radio waves are usually much longer, the usual broadcasting wavelength being 360 meters or 1180 feet. Therefore the frequency of these waves will be about 833.000 cycles per second.

Much confusion has arisen among non-technical people between wavelength and distance from which signals may be heard. Actually there is little connection between them. The distance from which signals can be heard depends upon the power of the transmitting station and the efficiency of both the transmitting and receiving apparatus.

The ordinary wire line telephone works with electric currents of the same frequency as the sound waves. Radio communication works with electric currents of a constant high frequency whose amplitude changes at a low frequency corresponding to that of the sound waves. Therefore, the radio receiver must change the high frequency currents of variable amplitude into low frequency currents which will then operate a telephone receiver to produce audible sounds.

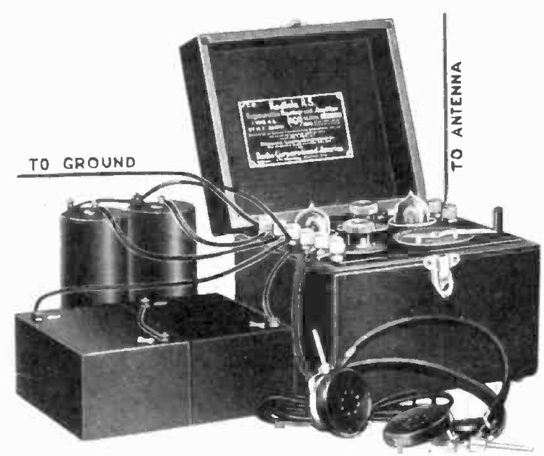


Fig. 2—Radiola RS Connected

THE RADIOLA RS

The Radiola RS is a complete radio receiver consisting of a continuously variable inductance with tickler regeneration, a capacity variable in two steps, a vacuum tube detector and one stage of audio frequency amplification. It has been designed to give strong, clear reproduction of voice and music without distortion, and to be sensitive, compact and easily operated. One of the principle features of this receiver is the use of a low current vacuum tube, the filament of which can be operated satisfactorily by an ordinary dry cell thus eliminating the need of a storage battery and the consequent necessity of charging periodically. Sensitivity and ease of operation combine to make the Radiola RS an ideal receiver for the unskilled operator and as one becomes proficient at its manipulation, he or she will be able to produce remarkable results.

EQUIPMENT

Standard Equipment of Radiola RS:—

The standard equipment of the Radiola RS consists of the following three items.

1—Single circuit regenerative receiver with one stage of audio amplification mounted in a mahogany cabinet
2—Radiotron dry cell vacuum tubes, type WD-11
1—Telephone headset

Additional Equipment Necessary:

It is necessary to have the following additional equipment for the installation and operation of the Radiola RS.

2—No. 6 Dry cells
2—22½ volt radio "B" batteries
1—Complete set of antenna material

Other sources of filament current than the dry cell mentioned above may be used if desired. Sources suggested are a single two volt lead storage cell or three Edison primary cells connected in series.

When either of these sources are used, the posts marked "$+A_1$" and "$+A_2$" should be connected together.

For convenience to purchasers and to meet the requirements of the Fire Underwriters it is recommended that the Radio Corporation of America antenna package, as specified above, be obtained since it contains approved equipment and directions for the installation of a proper out-door antenna.

INSTALLATION

Location:

The Radiola RS should be located as near as practicable to the incoming wire from the antenna. Certain limitations in the room and in the location of an antenna make it difficult to locate the instrument directly under the near end of the antenna. However, in all cases, arrangements should be made to meet the requirement as closely as possible.

Antenna:

Very many of the operating troubles in radio receivers are traced to poor antenna installation. There are several things which govern the size, location and type of antenna installation. If the antenna is not properly insulated the signals will be weakened by leakage. If the antenna runs parallel, and close to electric light wires or grounded metal structures, its efficiency will be greatly impaired. If all joints in the working part of the antenna circuit are not soldered or provided with approved splicing devices, they will corrode and reduce the signal strength because of the introduction of high resistance. If the antenna is too low or short the strength of signals will be reduced. If the antenna is too high or long, the receiver will not give good selectivity, i. e., it will be impossible to tune out nearby strong signals and select a weak signal from a distant point.

The best antenna for all around receiving consists of a single wire size 14 B & S gauge installed 20 to 30 feet from the ground and extending horizontally

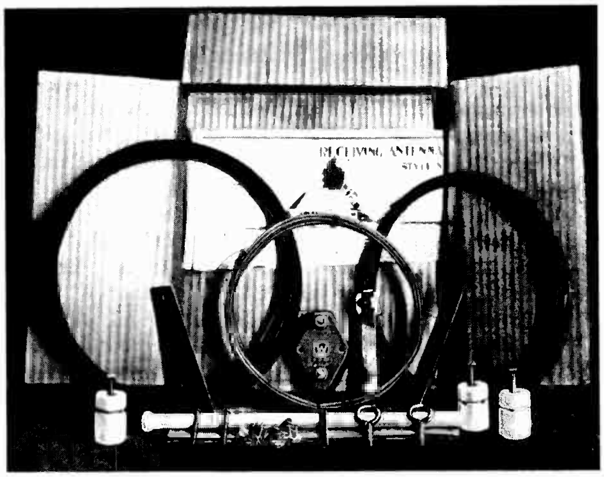


Fig. 3—Antenna Package Complete

100 to 130 feet from the receiver. This antenna should be equipped with an approved protective device and installed in strict accordance with the rules of the National Fire Protection Association.

When too much interference is experienced with the outdoor antenna of the dimensions given, it will be found advantageous to install a smaller antenna. This may be either indoors or outdoors, the outdoor installation in general giving slightly better results, but the indoor one is not subject to the rules of the underwriters and does not require a protective device. The small antenna should consist of not

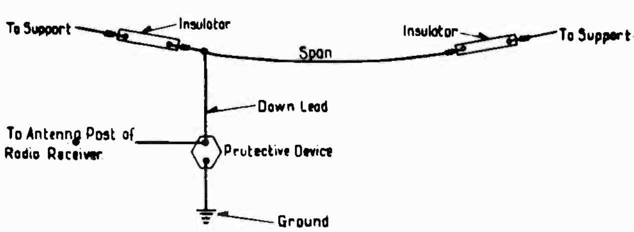


Fig. 4—Diagrammatic Antenna

more than 25 feet of wire. Indoors, it may be concealed in a picture molding or any other convenient place but slightly better results will be obtained if it is supported away from the wall. Such an antenna will produce almost as much strength of signal as a larger one but will tune much more sharply and thus reduce interference.

When the above rules are followed and the technical points mentioned above have been properly considered, the antenna will give good signal strength and there will be no fire hazard.

Figure 3 shows the complete antenna package equipment, type AD, and Figure 4 shows diagrammatically how an antenna should be installed. The center span of wire between insulators is the working span and is connected to the instrument by the "down lead" or lead-in wire. The protective device provides a discharge path from antenna to ground and thus protects the antenna during electrical storms.

The following quotations from the Underwriter's rules will be of value.

"The outside antenna must not be placed over or under power or electric light wires of any circuit of more than 600 volts or railway trolley or feeder wires, nor shall it be so located that a failure of either the antenna or the above mentioned electric light or power wires can result in contact between the antenna and power wires. Antennae shall be constructed and installed in a strong and durable manner"

"Each lead-in wire shall be provided with an approved protective device properly connected and located (inside or outside the building) as near as practicable to the point where the wire enters building". "The protector shall not be in the immediate vicinity of easily ignitible stuff or where exposed to inflammable gases, or dust, or flying combustible material."

"The protective ground wire may be bare or insulated and shall be of copper or approved copper clad steel. If of copper the ground wire shall not be smaller than No. 14 and if of copper clad steel it shall not be smaller than No. 17. The ground wire shall be run in as straight a line as possible to a good permanent ground. Preference shall be given to water piping. Gas piping shall not be used for grounding protective devices. Other permissible grounds are grounded metallic work in the building and artificial grounds such as driven pipes, plates, cones, etc". "The ground wire shall be protected against mechanical injury. An approved ground clamp shall be used wherever the ground wire is connected to pipes or piping".

"The receiving equipment ground wire may be bare or insulated and shall be of copper or copper clad steel as in the case of the protective ground wire". "The receiving equipment ground wire may be run inside or outside the building. When receiving equipment ground wire is run in full compliance with the rules for protective ground wire, it may be used as the ground conductor for the protective device."

CONNECTING RADIOLA RS

General:

The Radiola RS should be connected as shown in Figure 2. Detailed directions follow:

The Antenna Lead-in—The lead-in should be connected to one of the antenna binding posts at the right of the panel. The post marked "Short Wave" should be used for wavelengths from about 180 to 375 meters. The "Long Wave" post should be used for wavelengths from about 340 to 550 meters.

The Ground Wire—The ground wire should be connected to the post marked "Ground + A_1". This ground wire should run as directly as possible to a good permanent ground.

Connection of Filament or "A" Battery—The tubes used in the Radiola RS require a voltage of approximately 1.1 on the filaments so that an ordinary dry cell can be used. Since there are two tubes, two cells should be used. The negative or outside terminals of both cells should be connected together and to the post marked "-A-B Battery". One wire should run from each of the positive or center terminals to a binding post marked "+ A_1" and "+ A_2" respectively. The connections are so arranged that the rheostat will control the current to both tubes and yet each cell will heat the filament of only one tube. It is possible to operate both tubes in parallel from the same cell by connecting posts "+ A_1" and "+ A_2" together and connecting a wire from either to the positive terminal of the cell.

Connection of "B" Battery—Two of the usual 22½ volt "B" batteries should be connected in series by connecting the positive terminal of one to the negative terminal of the other. The remaining positive terminal should then be connected to the binding post marked "+B" and the negative terminal should be connected to the post marked "-A-B".

Connection of Telephone Headset—The two terminals at the end of the telephone headset cord should be connected to the two binding posts marked "Phones".

Insertion of Vacuum Tubes—After all connections have been made and checked, turn the rheostat knob as far to the left as possible. Insert the tubes in their sockets through the holes in the panel. It will be found that the tubes will fit the contacts in but one way. The sockets are so arranged that the large pin is toward the front of the box. Special care should be taken to see that the "A" and "B" batteries have not been interchanged as the high voltage of the "B" battery would instantly burn out the filaments of the tubes and render them worthless.

OPERATION

General:

The Radiola RS is made as simple to operate as is consistent with a high degree of sensitivity and selectivity. After a little practice, it will be found very easy to pick up signals from different stations and with care in making the adjustments, signals from stations many miles away may be heard. Connections are made in the set so that one step of audio frequency amplification is in use at all times.

Control and Tuning:

Figure 5 is a close-up view of the panel of the Radiola RS showing the controls used to make all adjustments during operation. The purpose and effect of each are as follows:

Fig. 5—Close-up of Panel

The Filament Rheostat, near the back of the panel between the two holes for the tubes is used to control the filament current in both tubes. When it is turned as far as possible to the left or "off" position, the filament circuit is open and no current can flow. THE RHEOSTAT SHOULD ALWAYS BE LEFT IN THIS POSITION WHEN THE SET IS NOT IN OPERATION. The correct operating position is best found by watching the filaments of the tubes as the rheostat is turned slowly to the right. At the correct position, the filaments will glow at a dull cherry red color. It is inadvisable to burn a filament at a higher temperature than necessary as this will shorten its life. These low current filaments have an exceptionally long life if not abused.

The Tuning Lever is the nickel plated lever operating over the larger dial at the right of the panel. This lever varies the inductance in the tuning circuit and thus changes the wavelength to which the set will respond. When the index points to "0", the set is tuned to the shortest wavelength.

The Tickler Knob controls the regenerative action of the set. In this instrument, it is so designed that its adjustment will vary but little at the various wavelengths. When the index points to "0", regeneration is practically nothing but increases to a point more than sufficient to produce oscillation when the pointer reaches "10". The best operating point is just below the point at which oscillation begins.

The Antenna Binding Posts provide for two wavelength ranges by introducing different amounts of capacity into the tuning circuit. When the antenna is connected to the "Short Wave" post, the Radiola RS will respond to wavelengths of from about 180 meters to 375 meters. When the antenna is connected to the "Long Wave" post, the range becomes about 320 meters to 550 meters. The ranges given are for an antenna as previously described and will vary somewhat as the antenna dimensions are changed.

Hunting Signals:

Start with all controls turned as far as possible to the left. Now turn the filament rheostat slowly to the right until the filaments of both tubes appear cherry red. Turn the tickler to "3." Put on the headset and turn the tuning lever slowly back and forth over the scale. If no signal is found, increase the regeneration by turning the tickler about one half a division to the right and then turn the tuning lever back and forth as before. Repeat until signals are heard. If still no signals are received, it is an indication that either something is wrong with the installation or that no station within range is transmitting within the wavelength band covered by the receiver. Try again after connecting the antenna lead to the other antenna post.

Final Adjustment of Rheostat:

In order to increase the life of the vacuum tube the filament current should be adjusted to as low a point as possible without affecting the effciency of the set. On a relatively strong signal, adjust the rheostat to the point where any further decrease in filament current will cause the signal strength to decrease.

Regeneration:

Regeneration is the name applied to the process of feeding some of the energy in the output circuit of the vacuum tube back into the input circuit. It is the ability to do this that makes the vacuum tube so much superior to the crystal as a detector for radio communication.

A vacuum tube has three electrical circuits connected with it, all of which are necessary for its operation. The first is the filament heating circuit composed of a battery to supply the current, a variable resistance commonly called a rheostat to control the current, the filament of the vacuum tube and the connecting wires. It is the function of this circuit to heat the filament, just as in an ordinary incandescent lamp, to the proper temperature when electrons are given off by the filament. These electrons are very small particles of electricity and have a negative charge. They are free to travel around inside the tube. The second circuit is the output circuit and is composed of the "B" battery, the telephone headset, the filament of the vacuum tube, the tickler coil, the plate of the vacuum tube and some of the electrons given off by the filament. The negative end of the battery is connected to one end of the filament while the positive end is connected to the telephone headset and through it to the plate of the vacuum tube. This makes the plate positive with respect to the filament and it therefore attracts the electrons which are given off by the filament so that instead of wandering around inside the tube, some of the electrons will reach the plate. These electrons then constitute a flow of negative electricity which is an electric current. The strength of this current will be directly proportional to the number of electrons reaching the plate. This will vary with the attractive force which depends upon the potential difference between the plate and filament or more simply upon the voltage of the "B" battery, and upon the supply of electrons which depends on the filament temperature and is usually kept constant. The third circuit is the input circuit and consists of the filament, part of the tuning circuit, the grid condenser and leak, the grid and the space between the grid and the filament inside the tube. When signals are being received, alternating currents flow in the tuning circuit causing differences of potential between the grid and filament. The grid is placed between the filament and the plate and is usually a helix of fine wire. When the grid is positive with respect to the filament it helps the plate to attract electrons and thus increases the plate current. When it is negative it decreases the plate current. Thus there is superposed on the steady plate current, a small alternating current which has such a high frequency that neither the telephone receiver nor the human ear can respond to it. The frequency is so high that the current prefers to pass through the by-pass condenser instead of the telephone receiver. At the same time, by means of the grid condenser and leak, other potentials of lower frequency and corresponding to the changes in amplitude of the signals are being impressed on the grid and these produce changes in the steady plate current which flows through the telephone receivers and cause changes in the pull on the diaphragms thus producing audible sound. The high frequency currents however are of the same shape as the currents in the tuning circuit and keep step with them. Therefore a coil of wire called the "tickler" is connected between the plate of the vacuum tube and the telephone headset and this coil is so located that the currents flowing in it can induce currents in the tuning circuit which add to those produced by the electro-magnetic waves intercepted by the antenna. Therefore, greater potentials are applied to the grid and greater changes of plate current are produced, which in turn produce a louder sound in the telephone receiver.

It is possible to carry the above process too far, that is, enough potential may be applied to the grid from the tickler so that no incoming signal is necessary. The set then acts as a converter of direct current supplied by the "B" battery into alternating current and is said to be "oscillating". The radio frequency currents produced by the set will combine with those picked up by the antenna and will produce whistling noises called beat notes in the receiver. The music or speech may still be heard but will be mushy and muffled. But it should be remembered that whenever the receiving set is oscillating, that it is acting like a miniature transmitter and is radiating electro magnetic waves. Any other receiving set that may be within range and which is tuned to the same frequency will pick up these waves. Therefore, if your set is adjusted to produce a beat note with a particular broadcasting station, your neighbor, who is listening to the same broadcasting station, will also hear the beat note and will be powerless to do anything about it even though it may ruin his enjoyment of the concert or speech. Therefore, never let your set oscillate when listening to a radio concert.

MAINTENANCE

General:

With reasonable care, nothing in the Radiola RS or the additional equipment should wear out or require replacement except the vacuum tubes and batteries. The following covers the renewal of these parts.

Renewal of Vacuum Tubes:

Radiotron WD-11 vacuum tubes have an exceptionally long life when they are not abused by rough handling or by overheating the filaments. After the filament is broken or burned out the tube is of no more use as it is impracticable to repair it. It should be replaced by a new tube of the same type.

Renewal of "A" Battery:

After a considerable period of use, the dry cells used to heat the filaments will become so weakened that it will be impossible to operate the filaments at a sufficiently high temperature even though the rheostats are turned all the way to the right. When this condition occurs, the cells should be replaced by new ones. A fresh cell should last about fifty days when used two hours per day, supplying one tube.

Renewal of "B" Battery:

After some eight to twelve months of use, the "B" batteries will become exhausted and will no longer be able to supply the proper plate current. They should be replaced by new batteries of the same voltage. The large size "B" battery will give longer service than the small size.

Replacing Grid Leak Condenser:

The combined grid leak and condenser should not require replacement. However, if moisture enters the unit, it will affect its operation. In this case it must be replaced by a new unit. It is mounted in fuse clips under one tube socket.

OPERATING TROUBLE

It is impossible to cover in detail all the possible operating troubles that may occur. The above instructions cover the usual renewals which may be made by the non-technical operator. Troubles due to broken wires, loose connections, etc., are difficult to locate. If they occur, an experienced radio service man should be called in to locate and remedy the trouble. The following description and diagram of connections is included to facilitate trouble hunting.

ELECTRICAL CIRCUIT

Figure 6 gives the diagram of connections of the Radiola RS while Figure 7 is a view of the interior showing the apparatus mounted on the under side of the panel.

The tuning circuit is of the well known single circuit type consisting of a variable inductance (A) in series with a fixed condenser (B), the latter, having two values of capacity which are available through two antenna binding posts. The grid potential is taken off the whole inductance, the grid condenser and leak method of detection being used. The grid condenser and leak (C) are combined in one unit which is mounted in fuse clips.

Two vacuum tubes are provided, one (F) being used as the detector while the other (U) is used as an audio frequency amplifier. The rheostat (V) is connected in the negative lead which is common to both tubes and it therefore controls the filament current to both tubes at the same time. Separate binding posts "+ A_1" and "+ A_2" provide for the use of individual dry cells.

Regeneration is provided by an inductively coupled tickler consisting of a stationary winding (E) and a rotary winding (D) connected in series. Coupling is provided through the feeder windings (G) which are part of the tuning circuit. A by-pass condenser (H) permits the high frequency currents to pass the audio frequency transformer (J). The plate currents from the detector tube pass through the primary of the transformer and produce potentials in the secondary which are then applied to the grid of the amplifier tube (U) producing greater changes in the plate current than in that of the detector. This plate current from the amplifier passes through the telephone headset and produces the audible sounds.

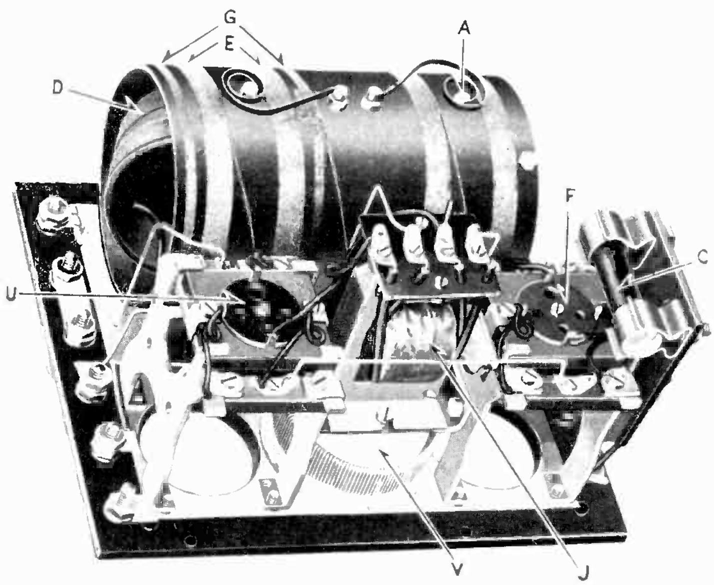


Fig. 7—Working Parts of Radiola RS

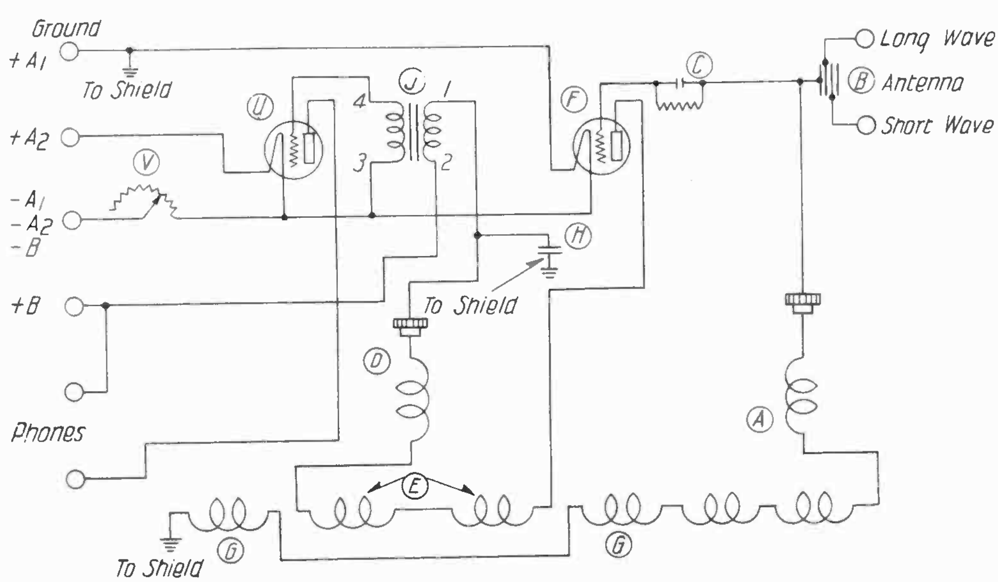


Fig. 6—Diagram of Connections Radiola RS

Radiola A C
2-Stage Audio Amplifier

INTRODUCTION

It frequently happens that the audio frequency signal strength from a crystal or vacuum tube detector is so small that the sound produced in the telephone headset is not sufficient to properly affect the human ear. Also, when this is not the case, it is

Fig. 1—Radiola AC Audio Amplifier

very often desirable to operate a loud speaker so that a telephone headset need not be worn and so that more than one person may listen. In either case, it is desirable to amplify the audio frequency output of the detector. The type WD-11 three electrode vacuum tube is admirably suited to this purpose. The signal currents from the detector are made to pass throug the primary of a transformer and thereby induce potentials in the secondary, these potentials being applied to the grid of the amplifier tube where they cause changes in its output current. If the transformer is properly designed and suitable batteries are provided, the output of the amplifier will be several times that of the detector and yet the wave form of the currents will be similar. A transformer and tube together constitute one stage of amplification. The amount of amplification obtainable in one stage depends upon the ratio of the transformer and the characteristics of the tube. If one stage is not sufficient, two or more stages may be used in cascade.

RADIOLA AC

The RADIOLA A C is a two stage, audio frequency, transformer coupled amplifier. It consists of two transformers designed for the amplification of music and speech, two vacuum tube sockets, two rheostats, a bias battery and three jacks, all mounted below a molded bakelite panel and enclosed in a neat mahogany box. In general appearance it closely resembles the Radiola Sr. and is intended for use with it.

EQUIPMENT

STANDARD—The standard equipment furnished under the style No. 365112 consists of the following items:

1—Two stage audio amplifier as described
1—Telephone plug, style 307425
2—Radiotron dry cell vacuum tubes Type WD-11

ADDITIONAL EQUIPMENT NECESSARY
The following i ems will be needed in addition to the above. They are not furnished since batteries deteriorate when not in use and the other items will probably be at hand.

1—Radio receiving set, including detector, preferably Radiola Sr.
2—Standard No. 6 dry cells
2 or 3—22½ volt "B" batteries
1—Telephone headset or loudspeaking receiver

It is possible and frequently desirable to use other sources of filament heating current than the dry cells specified above. A single lead storage cell giving about 2.2 volts will give excellent results but will require charging at intervals. If it is inconvenient to charge a storage cell, Edison Lalande primary cells may be used. Two cells in series will be required.

USES

WITH RADIOLA SR:

Location—Place the amplifier to the left of the Senior. Corresponding binding posts on both sets will then be in line. Connect the binding posts marked "Phones" on the Senior to the posts marked "Input" on the Amplifier. Connect the "—A—B Battery" posts together.

"A" Battery—Connect the negative (outside) binding posts of three dry cells together and to one of the "—A—B Battery" posts. Connect the positive binding posts of the remaining two cells together and to the "+A Battery" post on the Amplifier.

"B" Battery—Connect two or three 22½ volt "B" batteries in series. Connect the remaining free negative lead to one of the "—A—B Battery" posts. Take a tap from between the first and second "B" batteries and connect it to the "+B Battery" post on the Senior thus supplying the detector tube with a plate potential of 22½ volts. Connect the remaining positive lead from the "B" battery to the "+B Battery" poston the Amplifier, thus supplying the amplifier with either 45 or 67½ volts plate potential.

Telephone Headset or Loudspeaker—Connect the terminals of the cord supplied with the telephone headset or with the loud speaking receiver to the telephone plug provided with the Amplifier. Insert the plug into the jack corresponding with the degree of amplification desired.

WITH ANY OTHER RECEIVER:

Make battery connections as previously described except that the directions for connection to the other set will no longer apply. The same "B" batteries may be used for the detector as for the amplifier. The posts on the amplifier marked "Input" should be connected to the place where the telephone headset is usually connected to the detector. The output of the amplifier is obtained through the jacks.

OPERATION

GENERAL:

The jacks used with the Amplifier are of the type known as filament control jacks. Besides making the proper connections to the telephone plug in the usual way, an extra pair of contacts is provided which controls the filament current. The circuits are so arranged that when the plug is inserted in the jack marked "Detector", telephone connections are made to the detector only and neither of the tubes in the Amplifier will light. When the plug is inserted in the jack marked "1st stage", the filament circuit of the first amplifier tube is closed through the rheostat which should then be adjusted to give the proper filament temperature. Connection is also made between the telephone receivers and the output circuit of the first amplifier tube so that one stage of audio amplification will be in use. A similar condition exists when the plug is inserted in the jack marked "2nd stage" except that both tubes will light and the telephone receivers will be connected to the output of the second stage.

Filament Current Adjustment—The filament current of each tube must be adjusted separately by its own rheostat. After this adjustment has been made, the rheostats may be left in position and the filament current will be controlled automatically by inserting the plug in the proper jack. The tubes used with this Amplifier have an oxide coated filament, the operating temperature of which is just high enough to produce a dull red heat. It is advisable to operate tube filaments at as low a temperature as possible but the temperature should be high enough to produce satisfactory operation. The filaments may be seen by looking through the top of the tube.

MAINTENANCE

General—If the RADIOLA AC is handled properly during shipment and if care is used in operation, nothing should require replacement except the tubes and batteries.

RENEWAL OF TUBES:

If the directions for operating the Amplifier are carefully observed the vacuum tubes will have an exceptionally long life. When the filament of a tube does burn out or break, the tube must be replaced by a new one. Use the style number on the base when ordering spare tubes or replacements.

Renewal of "A" Battery—After about two months of use, the dry cells used to heat the filaments will become exhausted and will be unable to supply sufficient current to heat the filaments to the proper temperature. When this condition occurs, the dry cells must be replaced by new ones. A fresh cell supplying one tube should give about 50 hours of service when used 2 hours per day.

If a storage battery is used, it may be recharged from a suitable source of direct current. If alternating current only is available, a rectifier such as the "Rectigon" may be used.

If Edison primary cells are used, new elements and chemicals may be obtained from the makers or from electrical supply houses.

Renewal of "B" Battery—After "B" Batteries have been in service for 8 to 12 months they become exhausted. When this happens, the signals become weak and erratic. This condition can be remedied by replacing the exhausted battery by a new one.

Renewal of "C" Battery—The "C" or bias battery is the small unit cell mounted in a holder between the tube sockets This cell is not required to furnish any current so should last 8 to 12 months. When exhausted it must be replaced by a new one. The usual symptoms of an exhausted "C" battery are noisy operation and distorted signals. The best plan is to replace the "C" battery whenever the "B" battery is renewed. To do this, the set must be removed from the cabinet by taking out the four nickel plated screws, two at the back and two at at the front edges of the panel. The entire apparatus may then be removed from the cabinet by simply lifting out the panel. To remove the "C" battery from the holder, loosen the two hexagonal nuts that hold the nickel plated bar. Remove the bar and the cell will slip out. Put in a new one taking care that the end with the little brass cap is toward the panel and replace the bar and see that the nuts are securely tightened. Ever ready Unit Cell No. 935 or other make of cell of the same size may be used.

Operating Troubles—If any operating troubles occur which the above renewals will not remedy, a careful inspection should be made to see that all connections are good. If trouble still persists, the services of a competent radio electrician should be obtained. To assist in locating trouble, the following description and diagram of connections is included.

ELECTRICAL DESCRIPTION

Fig. 2 is an interior view of the Radiola AC showing the arrangement of parts. Fig. 3 is a diagram of connections. Corresponding parts in both figures are designated by the same letters.

Audio frequency energy from the plate circuit of the detector comes to the binding posts marked "Input" From there it goes directly to the telephone headset through the jack (R) when the plug is inserted there. Otherwise it goes to the primary of the amplifying transformer (M) which together with the vacuum tube (K) makes the first stage of amplification. The rheostat (0) controls the filament current of tube (K) and connection of the telephone headset is made through jack (S). When the plug is not in jack (S), the output of tube (K) is fed directly into the primary of transformer (N) which together with tube (L) makes up the second stage of amplification. (P) is the rheostat controlling the filament current of tube (L) while (T) is the jack through which connection is made between the telephone headset and the output of the second stage. (Q) is a small flashlight cell which acts as a grid bias for both tubes.

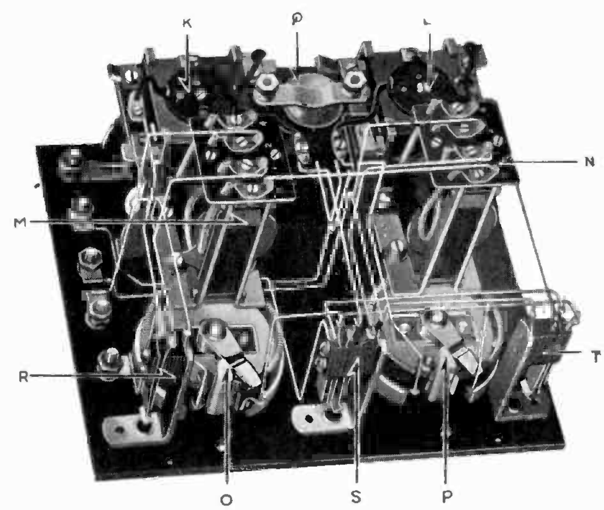


Fig. 2—Radiola AC Audio Amplifier, showing arrangement of parts

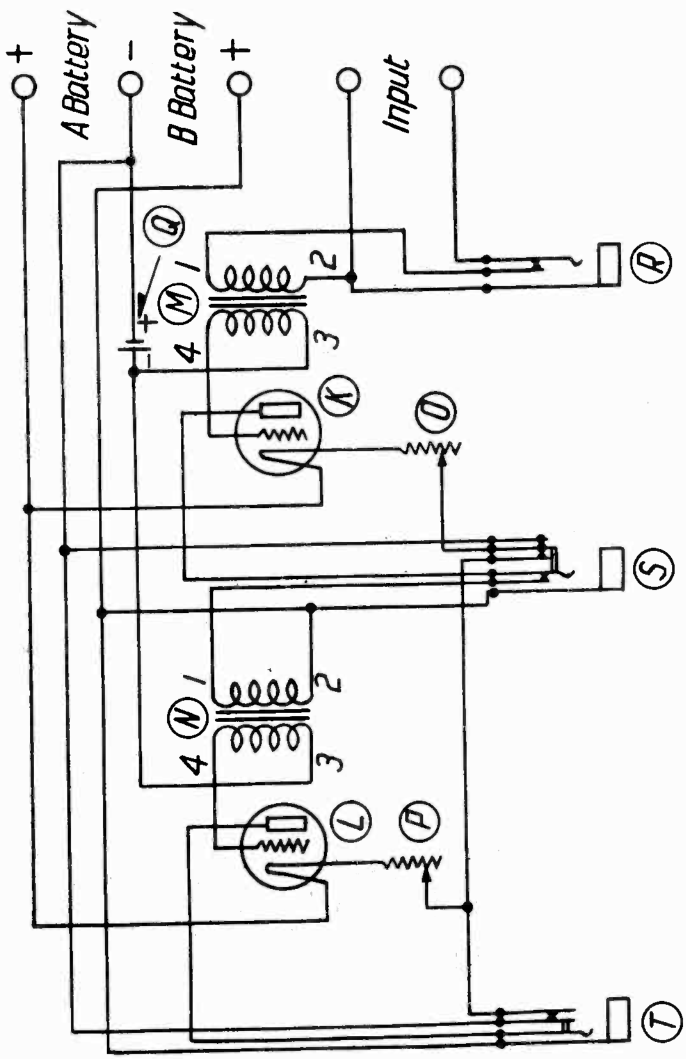
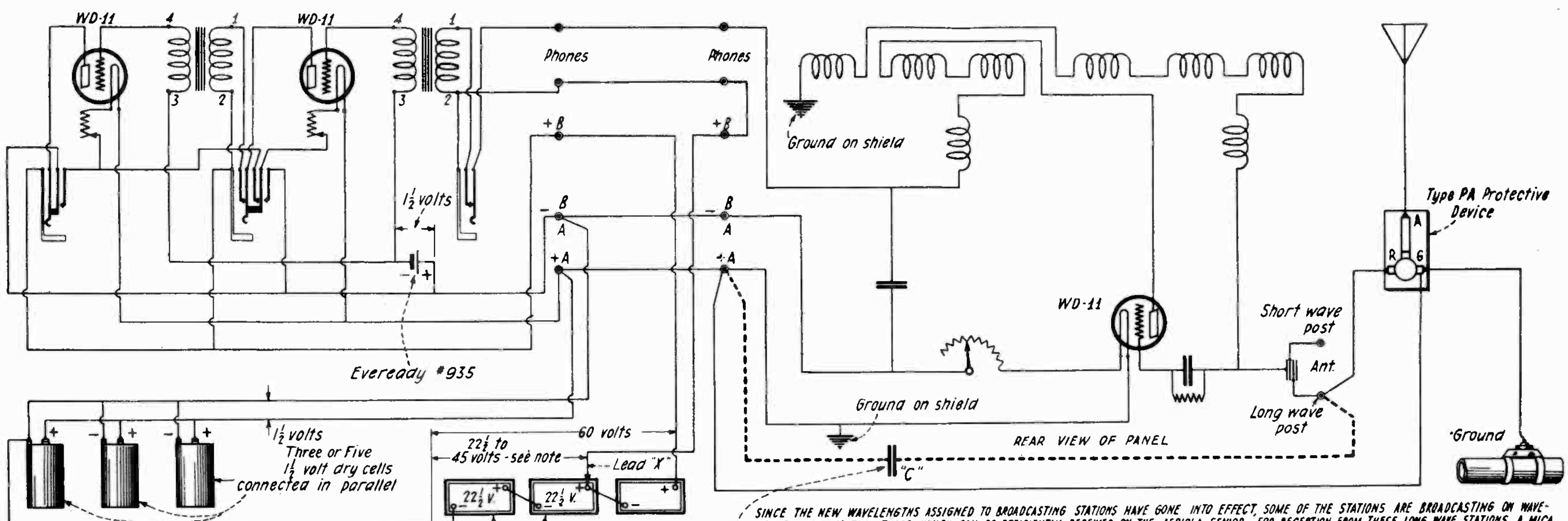


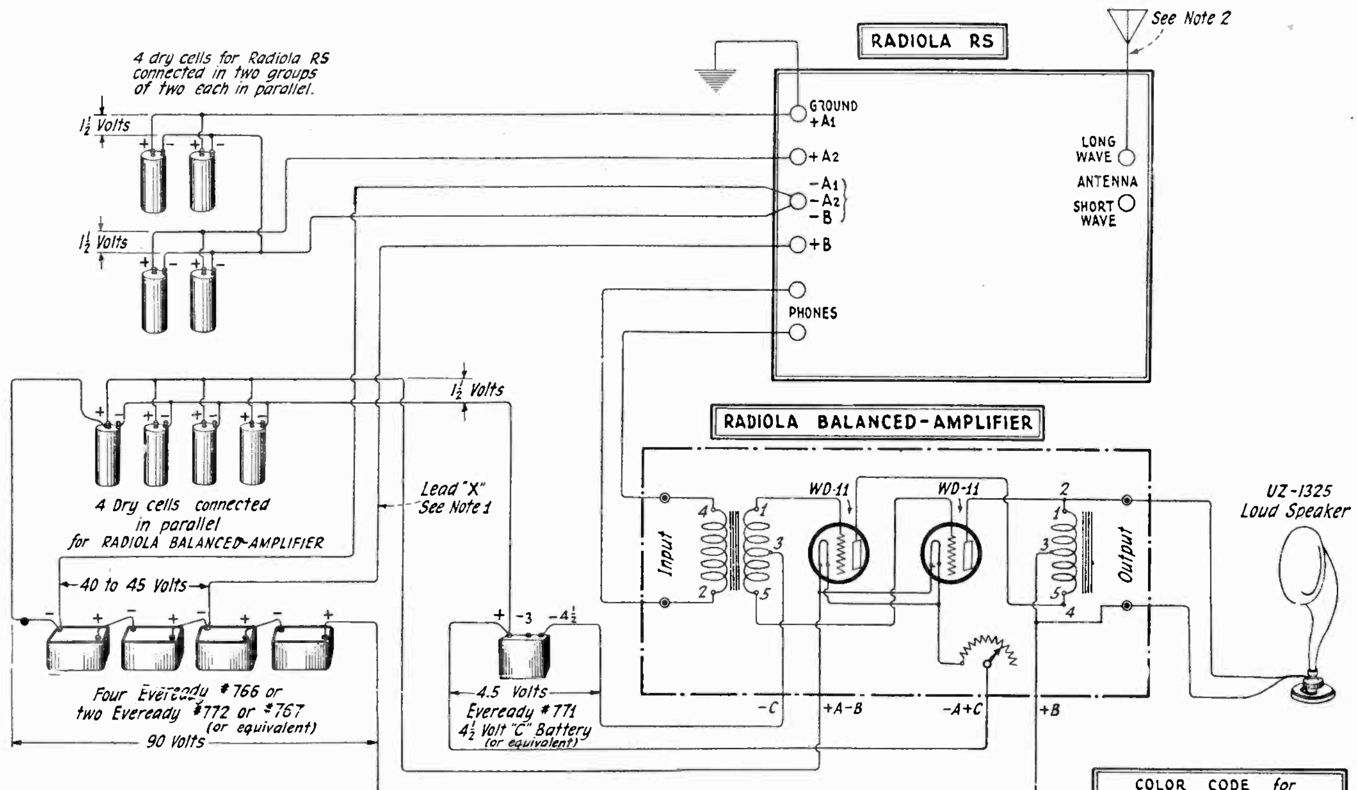
Fig. 8—Diagram of Connections of Radiola AC Audio Amplifier

RADIOLA SR. AND TYPE A C AMPLIFIER



NOTE:
THE BEST DETECTOR PLATE VOLTAGE MAY BE 22½ OR 45 VOLTS AS THE BEST DETECTOR VOLTAGE MAY VARY SOMEWHAT WITH DIFFERENT RADIOTRONS OF THE SAME TYPE. THE USER SHOULD EXPERIMENT WITH BOTH VALUES AND CONNECT LEAD "X" TO THE VOLTAGE TAP GIVING THE LOUDEST SIGNAL.

NOTE: SINCE THE NEW WAVELENGTHS ASSIGNED TO BROADCASTING STATIONS HAVE GONE INTO EFFECT, SOME OF THE STATIONS ARE BROADCASTING ON WAVE-LENGTHS HIGHER THAN THOSE WHICH CAN BE EFFICIENTLY RECEIVED ON THE AERIOLA SENIOR. FOR RECEPTION FROM THESE LONG WAVE STATIONS, A MICA CONDENSER "C" CAN BE CONNECTED EXTERNALLY BETWEEN THE "LONG WAVE POST" AND THE "+A OR GROUND POST." THE ANTENNA IS ALWAYS CONNECTED TO THE "LONG WAVE POST" WHEN THE CONDENSER IS USED. ON A LONG ANTENNA (100 FEET OR MORE) CONDENSER "C" SHOULD BE 0.00025 mfd. AND MAY BE THE RCA TYPE UC-567 WITH UX-543 MTG. ON A SHORT ANTENNA (50 FEET OR LESS) CONDENSER "C" SHOULD BE 0.0005 mfd. AND MAY BE THE RCA TYPE UC-568 WITH UX-543 MTG. WAVELENGTH IS THEN INCREASED TO APPROXIMATELY 580 METERS OR 517 KILOCYCLES.



NOTE 1: BEST RESULTS WILL BE SECURED WITH A DETECTOR PLATE VOLTAGE BETWEEN 22½ AND 45 VOLTS AS THE BEST DETECTOR VOLTAGE MAY VARY SOMEWHAT WITH DIFFERENT RADIOTRONS OF THE SAME TYPE. THE USER SHOULD EXPERIMENT BETWEEN THE LIMITS OF 22½ AND 45 VOLTS AND CONNECT LEAD "X" TO THE VOLTAGE TAP GIVING THE LOUDEST SIGNAL.

NOTE 2: AN ANTENNA HAVING A LENGTH OF 65 FEET (INCLUDING THE LEAD-IN) IS RECOMMENDED.

CONNECTIONS FOR RADIOLA RS AND BALANCED-AMPLIFIER COMMON "B" BATTERY SUPPLY

COLOR CODE for RADIOLA BALANCED-AMPLIFIER

LEAD	EARLY PRODUCTION	PRESENT PRODUCTION
-C	YELLOW	BLACK WITH GREEN TRACER
+A-B	RED	YELLOW WITH RED AND BLUE TRACERS
-A+C	BLACK	GREEN WITH YELLOW TRACER
+B	GREEN	RED

Radio Receiver

MODEL AR-1300

THE RECEIVER is complete in itself with the exception of the telephones and antenna. It will receive telephone and telegraph radio signals at a limited distance over the wavelength range of 180 to 700 meters when connected to a suitable antenna.

Telephones with plug and necessary antenna material can be obtained from dealers in radio supplies. ASK FOR G-E ANTENNA EQUIPMENT.

This receiver may be used with any vacuum tube detector, or detector amplifier set. It is especially arranged to operate with its companion set, the Model AA-1400 Detector-Amplifier.

ANTENNA SYSTEM

WIRE. Copper, copper weld, bronze or aluminum, 12 or 14 gauge, bare or insulated, solid or stranded.

INSULATORS. Two insulators are required, one at each end of the antenna. Tube insulators must be used in passing wires through walls.

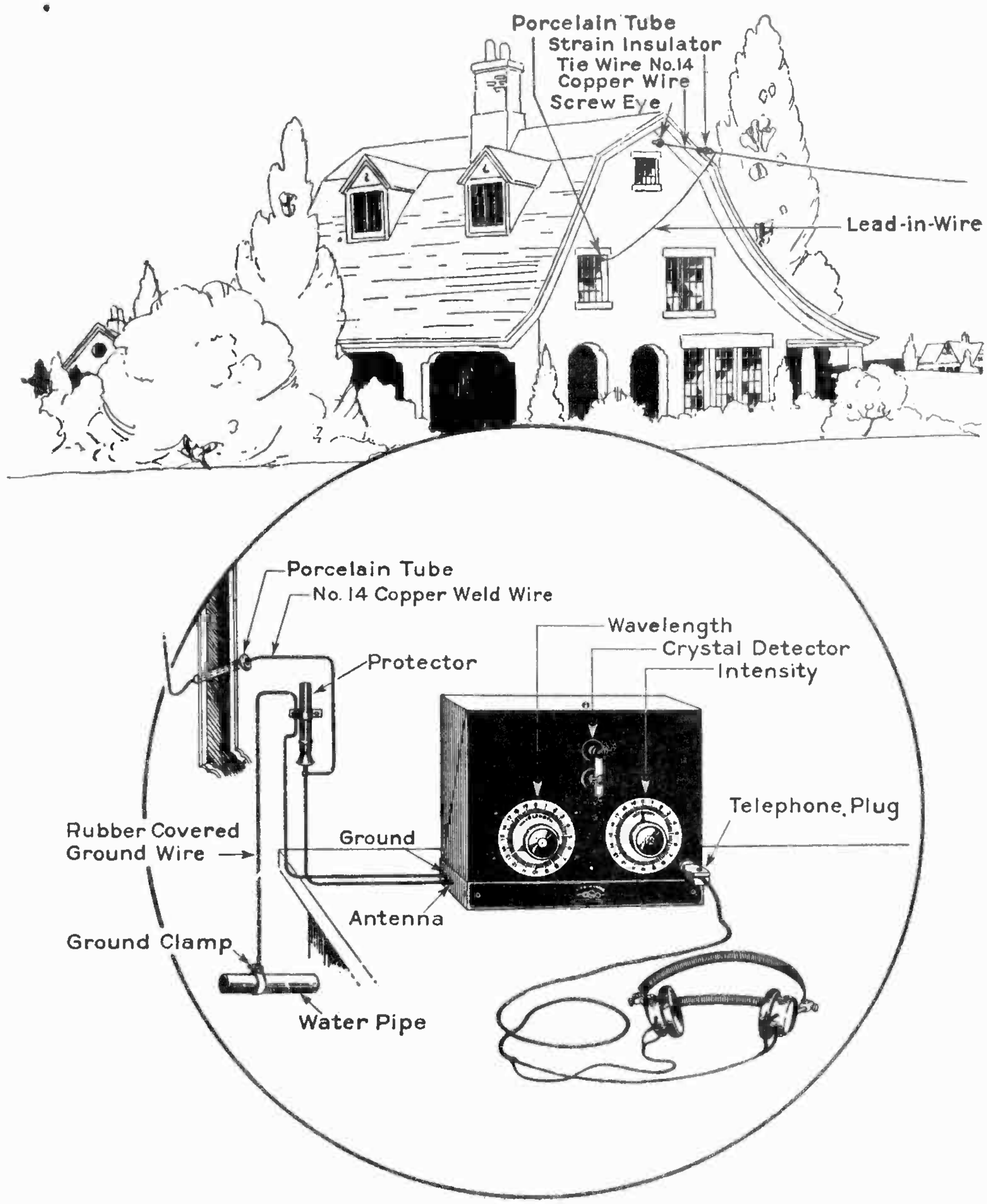
PROTECTIVE DEVICE. An antenna protective device Model UQ-1310 or equivalent should be used.

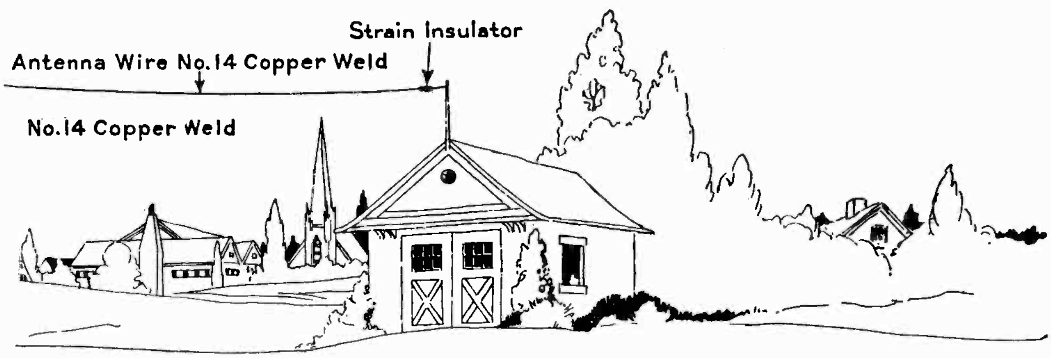
ERECTION. String the antenna wire and make the connections as shown in the sketch. If possible, the lead-in wire should be a continuation of the antenna wire. The antenna wire should have a span of from 75 to 150 feet between the insulators; should be at least 15 feet away from any electric light, power or telephone wire, and should be at least 25 feet above the ground (reception improves with an increase in height of antenna). Neither the antenna nor the lead-in wire should touch any object other than the insulators. The ground wire should be connected to the house water pipes or to a pipe driven deeply into moist ground. The ground wire and pipe should be carefully scraped and cleaned at the point of connection.

In receiving from near-by stations, the antenna may sometimes be put inside the house. A bed spring or metal curtain rod has been known to serve as the antenna.

August, 1922

IC-86933
Second Edition


Porcelain Tube
Strain Insulator
Tie Wire No.14
Copper Wire
Screw Eye
Lead-in-Wire
Porcelain Tube
No. 14 Copper Weld Wire
Protector
Wavelength
Crystal Detector
Intensity
Telephone Plug
Rubber Covered
Ground Wire
Ground
Antenna
Ground Clamp
Water Pipe



INSTALLATION

Remove the cover of the Receiver by raising the catch and at the same time pushing back. The coil should be untied and the crank on the coil turned upward towards the wire. The notch in the driving disc on the inside of the front panel should also be turned upward. The coil should then be seated on its base, care being taken to register the notch in the coil form with the pin on the base.

Inside of the large coil is a small regenerative coil operated by the large right-hand knob marked "Intensity." This regenerative coil is not used unless the Receiver Model AR-1300 is used in conjunction with Detector-Amplifier, Model AA-1400 or a similar device.

Connect from the ground and antenna terminals of the protective device to the respectively marked terminals on the lower left-hand end of the Receiver. They may be left permanently connected to the Receiver.

The terminals on the rear and on the right-hand end are required only when the Receiver is used in conjunction with vacuum tube unit.

Plug the head telephones into the telephone jack on the front of the Receiver at the lower right-hand corner.

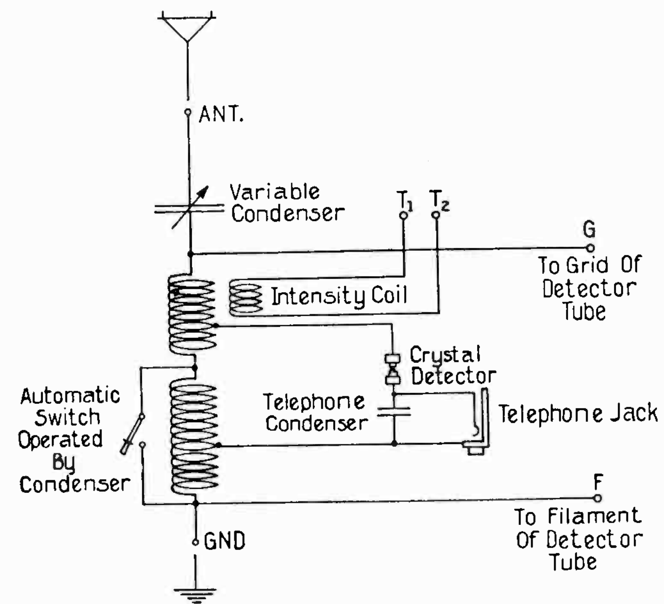
The set is now ready to operate.

OPERATION

Adjust the telephones snugly to your ears. Place the two detector minerals in contact with each other, using lower thumb screw to adjust the pressure and the upper knob to move the arm. Do not touch the metal parts.

The large left-hand knob whose dial is marked "WAVELENGTH" adjusts the set to the wavelength of the various transmitting stations. Move the knob slowly over the scale until signals are heard. Then find the exact point where these signals are loudest. The wavelength adjustment is then complete. The detector may now be re-adjusted, to see if a more sensitive point can be found.

Wavelengths from 180 to 400 meters will be picked up between 0 and 10 on the dial and wavelengths from 380 to 700 meters will be picked up between 11 and 20 on the dial. Broadcasting stations use 360 meter wavelengths and will be picked up at about 4. These figures will vary somewhat with the size of the antenna.



Connection Diagram

PRECAUTIONS

When the receiver is not in use, separate the crystals. Unsatisfactory operation may be caused by improper or loose connections in the antenna or ground wires. Deposits on the crystal may be removed by lightly scraping the surface of the movable crystal with a penknife. Do not operate during thunder storms.

MANUFACTURED BY

General Electric Company, U. S. A.

for

Radio Corporation of America

WORLD WIDE WIRELESS

WOOLWORTH BUILDING ~ NEW YORK CITY

Detector Amplifier

MODEL AA-1400

THE DETECTOR-AMPLIFIER is intended for use in connection with a radio receiver. It is designed particularly for operation with its companion unit, the Model AR-1300 Radio Receiver.

In addition to the DETECTOR-AMPLIFIER the following equipment will be needed. (Use standard equipment.)

Head phones and plug (or Loud Speaker)

Antenna

Radio Receiver

Batteries

One 6-volt, 40- to 80 ampere-hour storage battery to supply current for the tube filaments.

Two standard "B" or plate batteries for supplying voltage to the tube plates. One of these should have an 18-volt tap if a UV-200 tube is used for the detector.

Vacuum Tubes

Three vacuum tubes are necessary. One is used as the detector (UV-200). Two are used as audio frequency amplifiers (Radiotron UV-201.)

For best results use tubes as directed. However, UV-201 may be used in the left-hand socket as a detector. This does not give as loud signals, but is easier to adjust.

This equipment can be obtained from dealers in radio supplies. ASK FOR G-E ANTENNA EQUIPMENT AND RADIO RECEIVER SET.

INSTALLATION

Connect antenna and radio receiver in accordance with instructions furnished with the radio receiver set.

Remove the DETECTOR-AMPLIFIER from its carton and place it at the right of the radio receiver. There are holes in the base for holding down screws.

Locate the storage battery wherever convenient. If at all distant, heavy leads must be used. Locate the plate batteries as near the instrument as possible, regardless of the size of wire used.

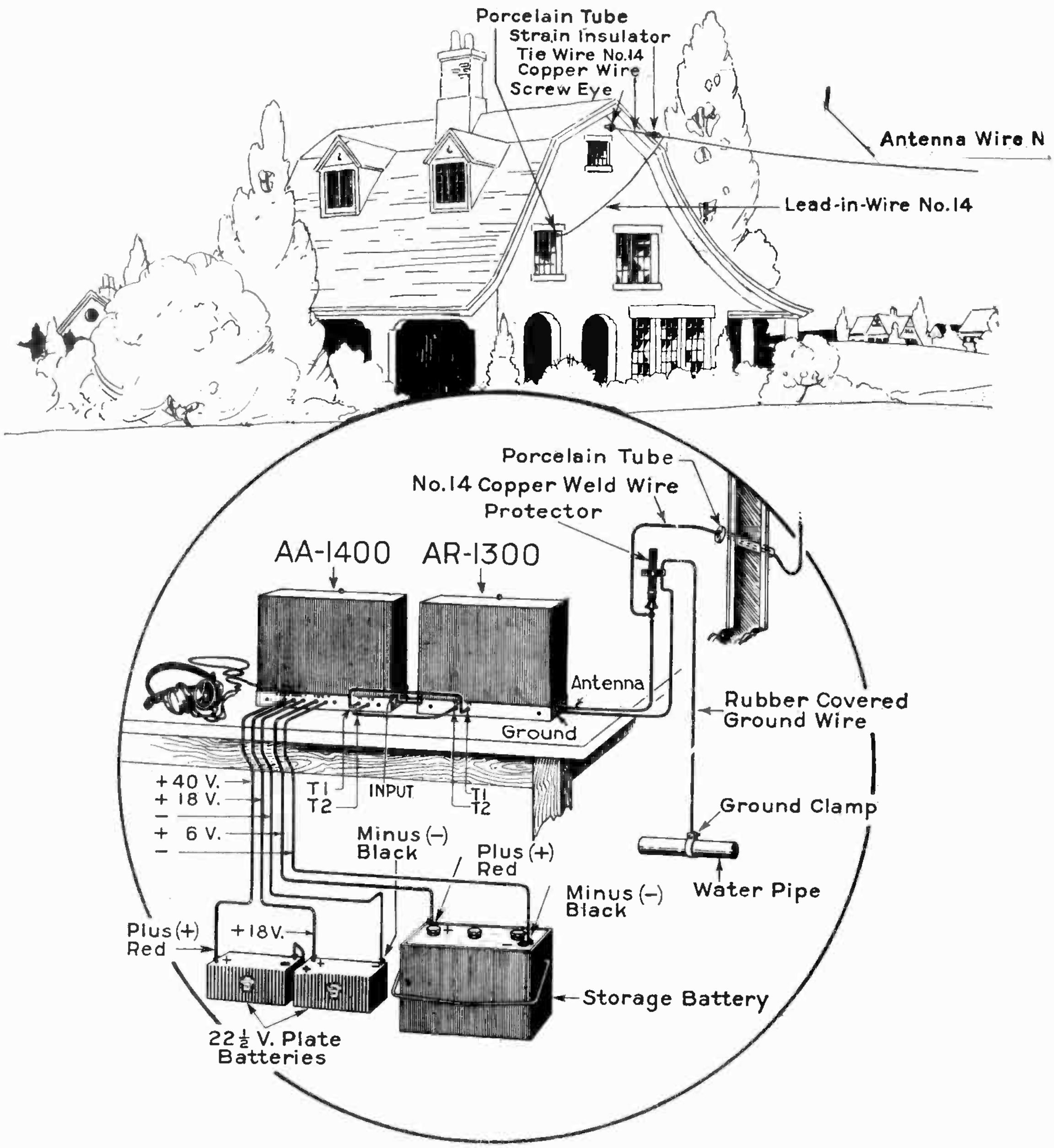
Remove the cover of the DETECTOR-AMPLIFIER by pushing up on the button and back on the cover at the same time.

Make connections as shown in the installation diagram. For wiring between units AA-1400 and AR-1300, use stiff wire (like antenna wire) about 1¼ inches long. If a Radiotron UV-200 is used as the detector, the lead from the 18-volt tap of the battery should be brought up to the "+18 V" terminal. If Radiotron UV-201 is used as the detector, connect the negative and the positive terminals of the plate batteries as indicated on the diagram and connect the "+18 V" terminal on the back of the DETECTOR-AMPLIFIER to the terminal marked "+40 V." The 18-volt tap on the battery is left unconnected.

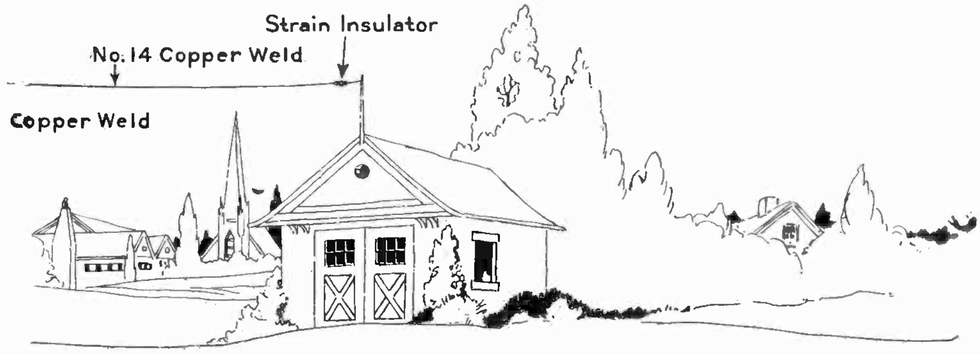
In addition to wiring in diagram, connect terminals "F" and "G" of AR-1300 to corresponding terminals of AA-1400 with 1¼-inch wire mentioned above.

August, 1922

IC86934-A
Supersedes 86934



When using Radiotron UV-200 as a detector maximum efficiency is secured by a careful adjustment of the plate voltage on the tube. This is accomplished by connecting the outside terminals of a Model PR-536 potentiometer (purchased separately) across the 6-volt storage battery and the middle terminal to the negative (—) of the 40-V. plate battery, omitting the connection from the (—) 40 terminal of the detector-amplifier to the plate battery. Pay no attention to the unused terminals on the ends of the DETECTOR-AMPLIFIER. These are for use in connecting additional stages of radio or audio frequency amplification which are built in standard sectional cases by the General Electric Company.



If the receiver unit used does not have a regenerative coil, the terminals marked "T1" and 'T2" on the back of the DETECTOR-AMPLIFIER should be connected together.

The terminals marked "Output" on the right-hand end of the DETECTOR-AMPLIFIER may be used for connecting a loud speaker which will be automatically disconnected when the head telephone plug is inserted in any jack.

In making the connections, use a long screw driver. Put the wire into the hole in the terminal before loosening the screw, then back the screw out until the wire can be pushed all the way in, then tighten the screw down.

OPERATION

1. Separate the crystal detector minerals on the receiver. If they touch, poor vacuum tube detection will result.

NOTE.—The crystal detector may be used whenever wanted, by inserting the telephone plug in the jack or receptacle on the receiver and turning the knobs on the DETECTOR-AMPLIFIER to the "OFF" position.

2. Insert the three tubes in sockets by matching pin inside of tube base with slot in socket, pressing down and turning into place. The left-hand socket is for the detector, the other two for the amplifying tubes.

3. Turn all of the knobs on the DETECTOR-AMPLIFIER almost all of the way around counter-clockwise or in the direction of the arrow. This brings the tube filaments to their proper brilliancy, which is a little less bright than the ordinary incandescent lamp.

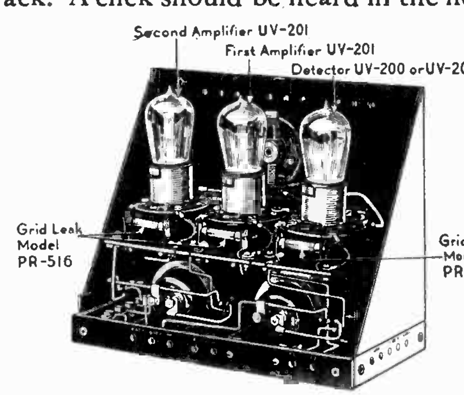
4. Adjust the telephones snugly to the ears.

5. Insert the telephone plug in the left-hand jack. A click should be heard in the head telephones when the plug is inserted or removed.

6. Set the "INTENSITY" knob on the receiver at zero.

7. Slowly rotate the "WAVELENGTH" knob on the receiver. If no signals are heard or if they are very weak, slowly rotate the "INTENSITY knob clockwise, still searching for signals with the "WAVELENGTH" knob.

8. When signals are heard, rotate the "INTENSITY" knob, thus increasing the strength of the signals. If an external potentiometer is used, adjust it to secure maximum signal strength. At



some point the tube will start to oscillate. This condition is denoted by disappearance of the signal and the appearance of a loud mushy sound in the receivers. Turn the "INTENSITY" knob back slightly, until the signals are again loud, and the oscillation of the tube has ceased.

9. Move the telephone plug to the middle jack. The signals will now be very much louder and slight readjustment of "INTENSITY" and rheostats may be necessary. The second stage may then be added in the same manner.

10. If a loud speaker is used, remove the head telephone plug and readjust in accordance with the signals from the loud speaker.

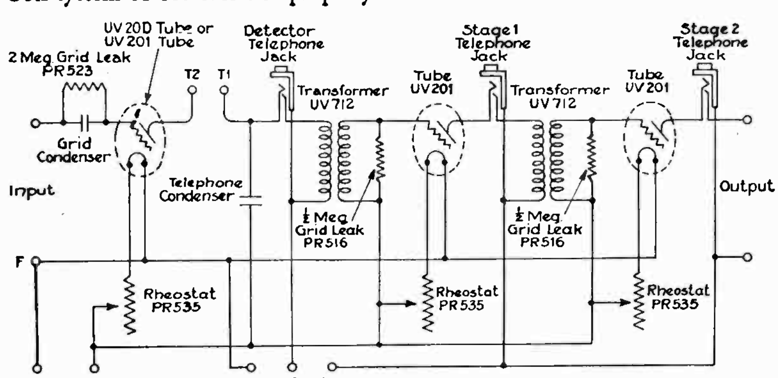
11. In some cases it may be possible to use both amplifying stages on the head telephones, but ordinarily the signals from the second stage will be too loud to be comfortable. In case the last or both stages of amplification are not used, rotate the respective filament control knobs to the "off" position.

12 If the signals being received on the loud speaker are not very loud they may perhaps be intensified by removing the ½ megohm grid leaks from the clips behind the two amplifier tubes. The purpose of these grid leaks is to improve the quality of the signal.

13. The batteries are disconnected by turning all the filament knobs clockwise to the "off" position.

CAUSES OF FAULTY OPERATION

1. Poor connections in antenna or ground wires or defective insulation of antenna.
2. Filament rheostats not properly adjusted.
3. Filament or plate batteries run down. (Indicated by weak signals and noise.)
4. Polarity of batteries reversed. (Wrongly connected.)
5. Intensity control on receiver not properly adjusted.
6. Poor or broken contacts in battery connections or telephone cord.
7. Defective vacuum tubes.
8. Coil system of receiver not properly seated in contacts.



MANUFACTURED BY

GENERAL ELECTRIC COMPANY, U. S. A.

for

Radio Corporation of America

WOOLWORTH BUILDING — NEW YORK CITY

Radio Frequency Amplifier

MODEL AA-1520

(WAVELENGTH 200-5000 METERS)

GENERAL

THE MODEL AA-1520 three-stage RADIO FREQUENCY AMPLIFIER is especially designed for operation with its companion unit, MODEL AA-1400 DETECTOR-AMPLIFIER for loop reception.

While the AA-1520 unit is primarily for use in connection *with an indoor loop*, a variable tuning condenser and MODEL AA-1400 DETECTOR-AMPLIFIER (Fig. 2), it may also be used on an outdoor type of antenna by employing one of the two conventional tuning arrangements:

(1) A single circuit tuner, MODEL AR-1300 (Fig. 4).

NOTE: When this scheme is used, the outdoor antenna should not exceed 40 ft. in length, *including the lead-in wire*. An indoor antenna may also be used.

(2) A two-circuit tuner (Fig. 3).

NOTE: With this arrangement, the antenna may consist of a single wire 75 to 150 ft. in length.

USE WITH A LOOP ANTENNA

The following apparatus should be secured and wired up in accordance with Fig. 2:

1—Loop antenna, MODEL AG-1380 or equivalent.
2—Variable Tuning Condenser, MODEL UC-1820 or equivalent.
3—MODEL AA-1520 Three-stage RADIO FREQUENCY AMPLIFIER with three UV-201 Radiotrons.
4—MODEL AA-1400 DETECTOR-AMPLIFIER with one UV-200 Radiotron and two UV-201 Radiotrons.
5—Head Telephone Receivers with Plug (MODEL UD-824 or UD-825).
6—One 6-volt, 80 to 120 ampere-hour storage battery.
7—Two 22.5-volt plate batteries (one with 18-volt tap).

When the loop is used, it may consist of the Radio Corporation's MODEL AG-1380 loop or equivalent, for receiving signals of broadcast wavelengths. The loop should be mounted so that it can be rotated on a vertical axis. Connect the R.C.A. variable tuning condenser UC-1820 in parallel with the loop and extend the terminals to the "INPUT" binding posts of the RADIO AMPLIFIER. See Fig. 2.

USE WITH AN ANTENNA

(A) If a single circuit tuner, MODEL AR-1300, is used, the apparatus should be wired in accordance with Fig. 4. The following apparatus will be required:

1—Antenna (MODEL AG-788).
NOTE: See proper length of antenna mentioned under "General."
2—MODEL AR-1300 tuner.
3—MODEL AA-1520 RADIO AMPLIFIER with three UV-201 Radiotrons.
4—MODEL AA-1400 DETECTOR-AMPLIFIER with one UV-200 Radiotron and two UV-201 Radiotrons
5—Head Telephone Receivers with Plug (MODEL UD-824 or UD-825).
6—One 6-volt, 80 to 120 ampere-hour storage battery.
7—Two 22.5-volt plate batteries (one with 18-volt tap).

(B) If a two-circuit tuner is used, the apparatus should be wired in accordance with Fig. 3. The following apparatus will be required:

1—Antenna (MODEL AG-788).
NOTE: See proper length of antenna mentioned under "General."
2—A two-circuit tuning arrangement.
3—MODEL AA-1520 RADIO AMPLIFIER with three UV-201 Radiotrons.
4—AA-1400 DETECTOR-AMPLIFIER with one UV-200 Radiotron and two UV-201 Radiotrons.
5—Head Telephone Receivers with Plug (MODEL UD-824 or UD-825).
6—One 6-volt, 80 to 120 ampere-hour storage battery.
7—Two 22.5-volt plate batteries (one with 18-volt tap).

INSTALLATION

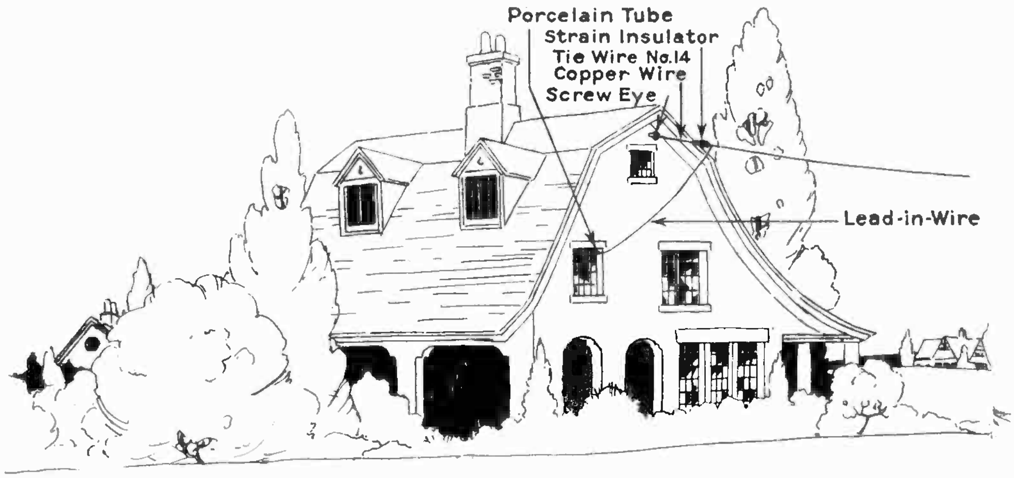
Turn all filament control knobs clockwise to the "OFF" position, before starting to wire up the equipment.

When used in conjunction with DETECTOR-AMPLIFIER, MODEL AA-1400, put the DETECTOR-AMPLIFIER at the right and connect the five terminals at the right end of the AA-1520 unit to the corresponding five terminals at the left end of AA-1400 unit, by means of five stiff pieces of wire, such as antenna wire, each about 1¼ inches long. In making these connections, insert the wire into the terminal opening, turn the holding screw until the wire will pass under it, and then tighten the screw down onto the wire. The filament and plate batteries are connected to the AA-1400 DETECTOR-AMPLIFIER in accordance with instructions accompanying that unit. When thus used with the DETECTOR-AMPLIFIER, no other battery connections are necessary.

The figures show several inches of space between the AR-1300, AA-1520 and AA-1400 units in order to indicate clearly the connections between adjacent ends. By using connecting wires of a length of about 1¼ inches, the units may be placed quite closely together; but in locating the AR-1300 and AA-1520 units end to end neither the cases nor any projecting screw heads should touch each other.

IC-86943A
Supersedes IC86943

February, 1923



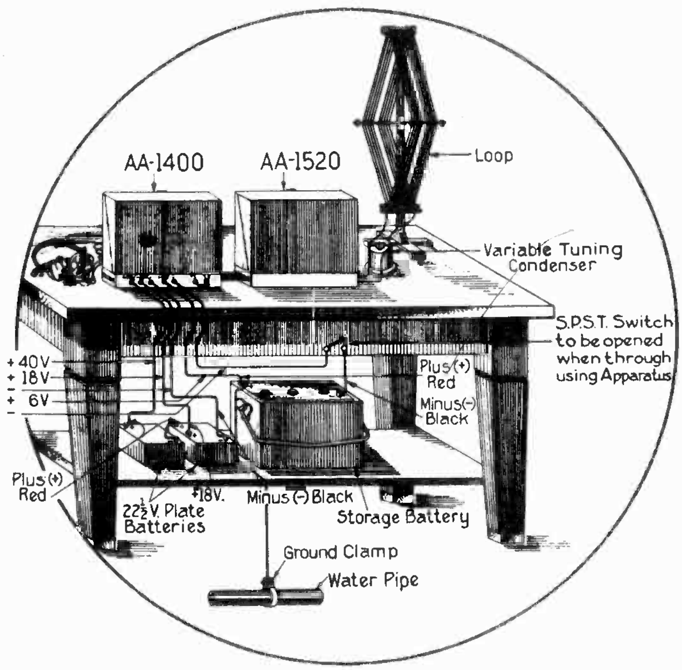


Fig. 2

Be sure to connect together the two terminals T-1 and T-2 on the back of the DETECTOR-AMPLIFIER unit, MODEL AA-1400, and do not connect in a tickler coil at this point, as it will be found that the regenerative coil will not increase the signal audibility very much over what is obtained with Radio Frequency Amplification. The proper operation of a regenerative circuit in conjunction with a RADIO FREQUENCY AMPLIFIER requires an extremely critical adjustment, or the advantages of one will offset the other and poor results will be secured.

If the AA-1520 unit is used in conjunction with a Detector or Detector-Amplifier of a type different than the AA-1400 unit, connect the OUTPUT terminals at the right end to INPUT terminals "F" and "G" of the Detector or the Detector-Amplifier; and connect the battery terminals, also at the right end, to the respective terminals of the batteries. The set is now ready to operate.

It is well to keep the 6-volt "A" battery (80 to 120 ampere-hours) well charged at all times, keeping the specific gravity between 1,250 and 1,275.

The directional properties of the loop may possibly be improved by omitting the ground connection in Fig. 2.

OPERATION

Insert the three UV-201 vacuum tubes in the sockets of the RADIO AMPLIFIER by matching pin on the side of the tube base with slot in socket, pressing down and turning into place. Three stages are always to be used, never one or two.

Insert the UV-200 detector tube in the left-hand socket of the DETECTOR-AMPLIFIER unit, and the two UV-201 tubes in the other sockets.

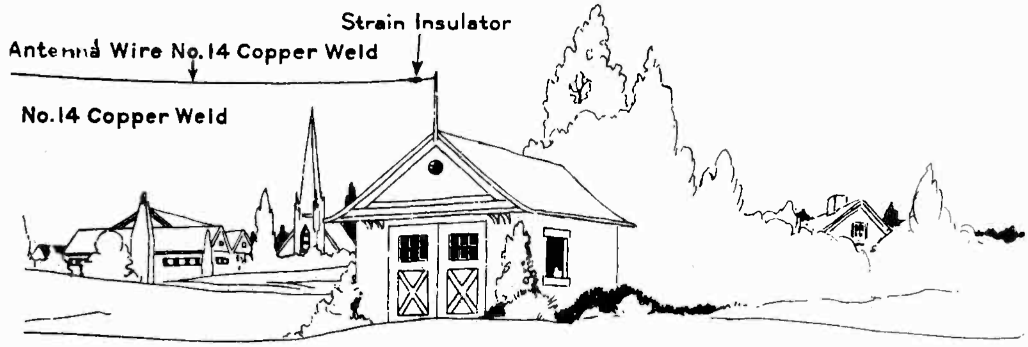


Fig. 1

Turn all the FILAMENT control knobs almost all the way around counter-clockwise, or in the direction of the arrow. It is not always necessary to use the two stages of audio or tone amplification, and these may be left unlighted when not used. The filaments of Radiotrons UV-200 and UV-201 should be somewhat less bright than the ordinary incandescent lamp.

Adjust the telephones snugly to the ears and insert the plug in the left-hand jack of the DETECTOR-AMPLIFIER. A click should be heard in the head telephones when the plug is inserted or removed.

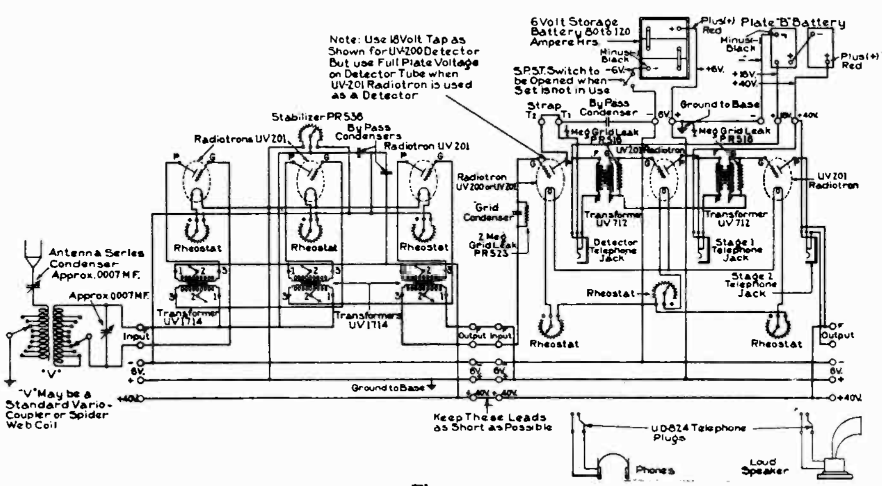


Fig. 3

Turn the "STABILIZER" knob half way around from "o", counter-clockwise.

Note position of the wavelength switch knob in the lower left-hand corner of the RADIO AMPLIFIER panel. For wavelengths below 500 meters the knob should be pulled out, while for wavelengths above 500 meters the knob should be pushed in.

The set is now ready for tuning. If the AA-1520 AMPLIFIER is used with an outdoor antenna in accordance with Fig. 3 or 4, the desired signals should be tuned in by the usual means. If the set is used in connection with an indoor loop (Fig. 2), the desired station can be tuned in by means of the variable condenser connected directly across the terminals of the loop.

If a loop is used it should be set for maximum signal strength by rotating it slowly about its vertical axis. Signals will be strongest when the plane of the loop is pointing in the direction from which the signals are coming.

Readjust the "STABILIZER" knob to the position of best signal intensity. The signal strength will be increased with clockwise rotation of the knob. Should it be advanced too far, a click will be heard in the telephones and then all signals will have a "mushy" sound. AT THIS POINT THE RECEIVER BECOMES A TRANSMITTER AND SERIOUSLY INTERFERES WITH NEIGHBORING RADIO RECEIVERS. THIS CONDITION OF OSCILLATION MUST BE AVOIDED, BUT IF IT DOES OCCUR, IMMEDIATELY TURN THE "STABILIZER" KNOB BACKWARD UNTIL THE SIGNAL CLEARS UP.

Slight readjustments of the filament rheostats may improve the signal strength, but it is not necessary to make especially fine adjustments on the RADIO AMPLIFIER.

The tube filaments are disconnected by turning the filament control knobs to the "OFF" position, but when the set is not used for any length of time one side of the storage battery should be disconnected by opening the single-pole single-throw switch. This removes the potentiometer current which, although small, would be a constant drain on the battery.

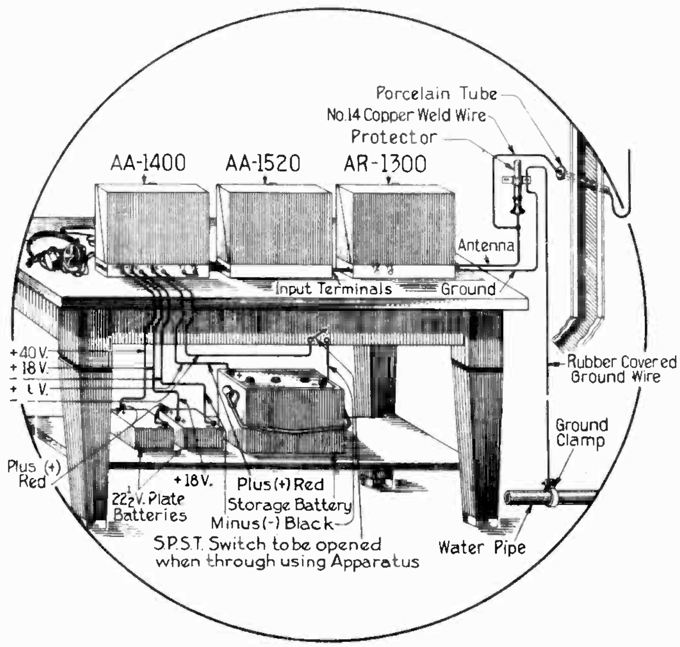


Fig. 4

CAUSES OF FAULTY OPERATION

1. Poor connections in antenna or ground wires or in loop wires or defective insulation of either.
2. Filament rheostats not properly adjusted.
3. Batteries exhausted (indicated by low filament brilliancy or weak signals and noisy operation).
4. Battery connections improperly made, poor, or broken.
5. Stabilizer improperly adjusted.
6. Poor or broken connections in telephone cord or plug.
7. Inoperative vacuum tubes.
8. Transformer wavelength switch in wrong position.

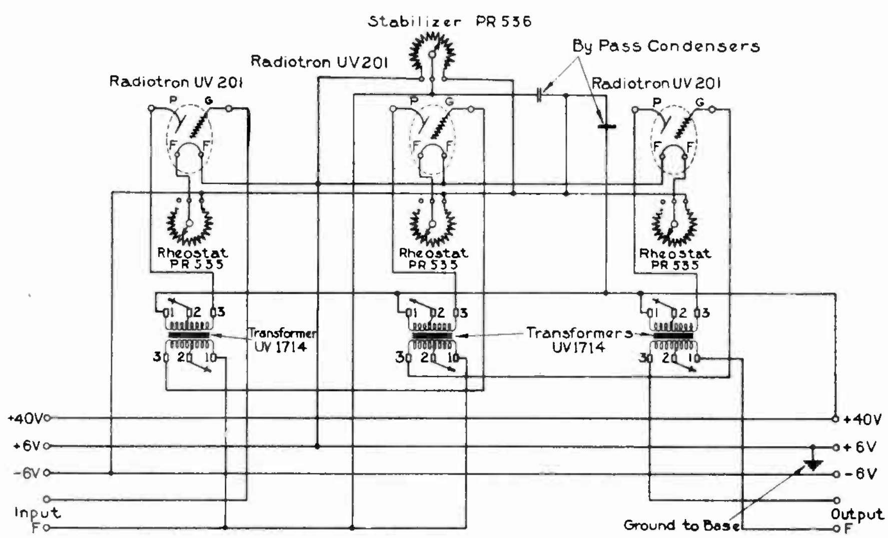


Fig. 5

MANUFACTURED BY

GENERAL ELECTRIC COMPANY, U. S. A.

for

Radio Corporation of America
WOOLWORTH BUILDING ~ NEW YORK CITY

RADIOLA II

MODEL AR-800

RADIOLA II, when used with an average antenna, constitutes a complete equipment for the reception of radio telephone and telegraph signals of any wavelength between 200 and 600 meters. It includes a regenerative tuning system employing a vacuum tube detector and one stage of audio-frequency amplification. The set is made conveniently portable by the use of Radiotrons, Model UV-199, operated entirely by standard dry batteries. Space is provided in the rear compartment for the batteries, for portable use, and in the front cover for the telephones. The carrying handle can easily be removed when not in use.

Radiola II gives excellent results with head telephones. It can also be used with an amplifier to increase signal intensity, for operating a loud speaker. At short distances from broadcasting stations, an additional amplifier will not always be required for this purpose.

The following parts are packed with the set:

Two Model UV-199 Radiotrons

One Pair of Head Telephones with UD-824 Plug.

For portable use the batteries required for installation in the rear compartment are:

Filament "A" battery—two 4½ volt, 3 cell flashlight batteries, 1$\frac{5}{16}$ in. in diameter by 7 in. long approximately, such as Eveready Tungsten No. 705, Burgess No. 232, Kwik-lite No. 1301, or equivalent.

Plate "B" battery—two 22½ volt batteries, 2 in. by 2½ in. by 3⅝ in., such as Burgess No. 4156, Eveready No. 763, or equivalent.

For a permanent installation, larger capacity batteries may be used as follows:

Filament "A" battery—three 1½ volt dry cells, such as Columbia Ignitor No. 6, Manhattan Red Seal, Burgess "Super-Six," or equivalent.

Plate "B" battery—two or four 22½ volt dry batteries, such as Eveready No. 768 or No. 766, Burgess No. 5156, No. 5156 BP, or No. 2156, or equivalent.

Grid Bias "C" battery—one 4½ volt 3-cell flashlight battery, such as Eveready No. 751 or No. 703, Burgess No. 432 or No. 532, or equivalent. (See below under "INSTALLATION.")

For antenna material, use the Model AG-788 Antenna Equipment.

ANTENNA SYSTEM

The accompanying drawing shows the correct arrangement of the antenna. A span of from 75 to 100 feet is desirable and should be 25 feet or more above the ground. Reception improves with increased height. If the suggested length and height cannot be secured, approach them as nearly as possible. The antenna should be at right angles to electric light, power, and telephone wires and, if practicable, at least 15 feet distant from them. It must not be touched by any object except insulators. The same precautions apply to the lead-in wire, which should be a continuation of the antenna wire without any joints and run as directly as possible to the receiver. In receiving nearby stations, an indoor antenna even as short as 20 to 30 feet will usually give satisfactory results and will have considerable selectivity. The indoor antenna may consist of a wire run the length of the attic or just below the ceiling of an ordinary size living room.

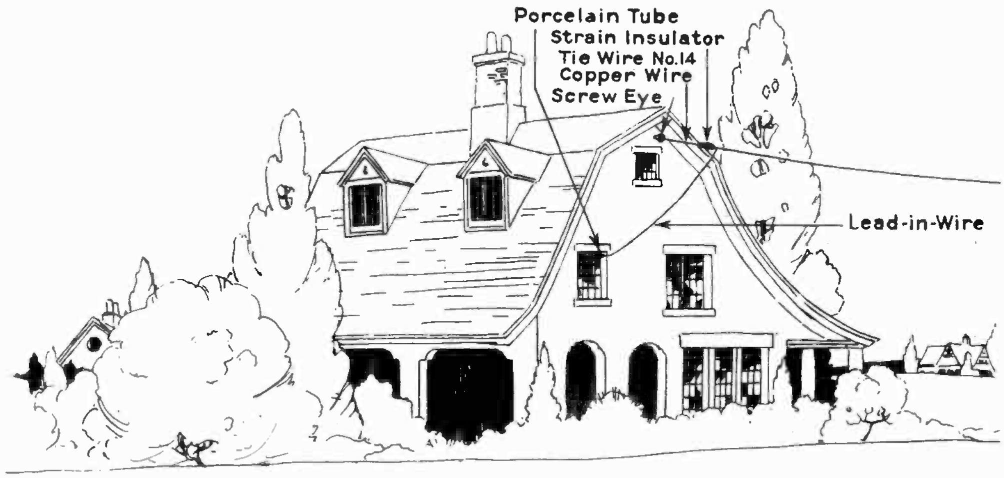
Ground connection is a necessary part of every antenna. The ground wire (rubber covered No. 14 gauge) should be connected as directly as possible to the house water pipes by means of a ground clamp. If water pipes are not available, use a pipe driven deeply into moist ground and as near to the set as practicable. The ground wire and the pipe should be well scraped and cleaned at the point of connection. For a protector, use Model UQ-1310 Lightning Arrester, or some other approved device. Install it where the lead-in wire enters the house and connect as shown in the diagram. The installation shown and described in this diagram is in accordance with National Electric Code standards.

INSTALLATION

Locate the Receiver at a point conveniently near the lead-in and protector. Remove the front cover by pressing the small black button in the upper right-hand corner and then swinging the cover out and lifting it from the hinges.

Before removing the head telephones from the front cover, observe carefully the manner in which they are secured in place by the clips. They must be held thus when they are replaced and the cover is closed. Note also that all knobs must be turned to "0" before the telephones are replaced. The cord is rolled up in a small bundle, a rubber band is placed around the wires, and the cord is then held underneath the clip in the lower left corner of the cover. The telephone plug is held by a clip in the lower right corner. The plug must be pushed into the extreme corner before closing the set.

Run a wire from the antenna terminal of the protector to the lower antenna post (marked "LONG") in the center left side of the receiver panel. This is for wavelengths of from 375 to 600 meters. For wavelengths of from 200 to 375 meters, use the upper post (marked "SHORT"). Connect the "GROUND" post on the receiver panel with the ground terminal of the protective device. The foregoing connections are as shown in the diagram.



The terminal posts marked "PLATE," "FILAMENT," and "GROUND" located on the right side of the panel are provided to permit convenient connections to an additional amplifier, when used. If a loud speaker is used without an additional amplifier, connect the two wires from it to the "PLATE" and "FILAMENT" terminal posts. Make no connections to these posts if neither amplifier nor loud speaker is used.

The location and connection of the batteries in the rear compartment for portable use are shown in Fig. 4. Initial or renewal installations should be made as follows:

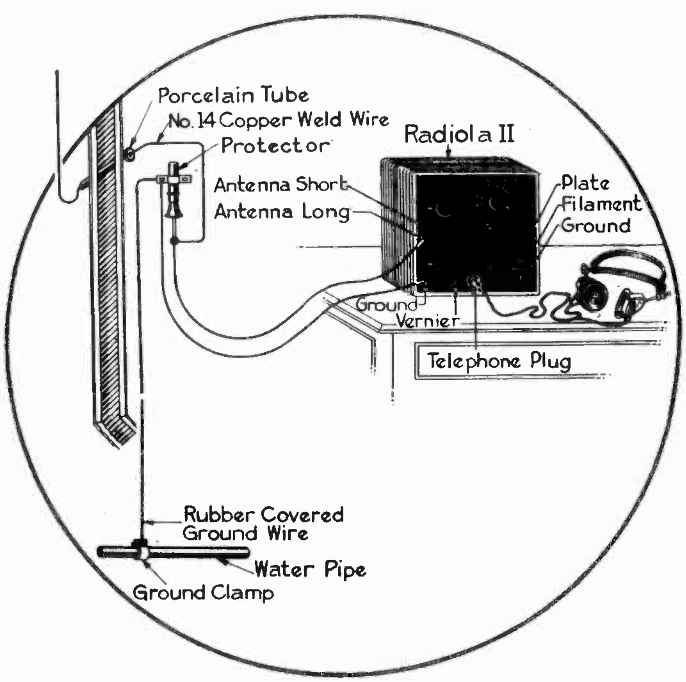


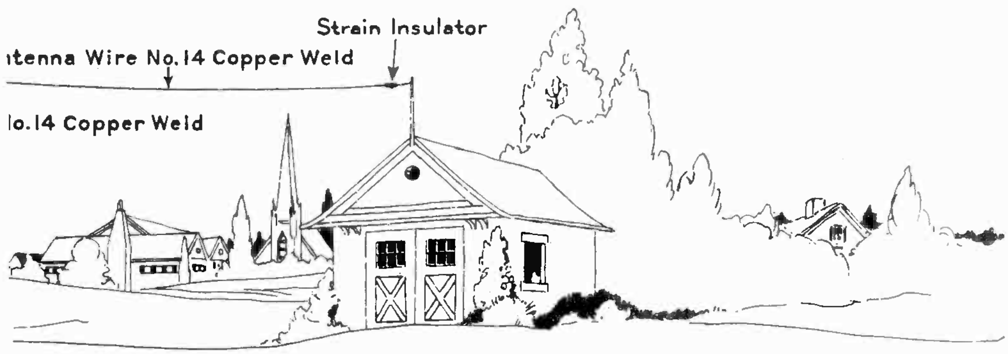
Fig. 2

Remove the spring clamp in the center of the battery compartment, but do not disconnect any of the colored flexible leads that connect the compartment to the set. Put the two flashlight batteries in the central space and tighten the thumb screws at the bottom. Place the two midget "B" batteries on the two shelves at the right. Connect them in series, using the double-ended spring clip. Connect the negative (black) lead to the black spring clip, and the positive (red) lead to the red spring clip marked "+45V."

The installation and connection of larger capacity external batteries are made as shown in Fig. 3.

If those for portable use are installed in the rear compartment, they should be entirely removed or disconnected. To disconnect them, the (+) red lead is disconnected from the red clip marked "+45V" and thrust back into the compartment; the thumb screws clamping the flashlight batteries are loosened, and a small piece of dry paper is folded and placed on top of the batteries to prevent the center battery post from touching the metal contact strip. The three flexible leads (olive, black and red) are then disconnected from the terminal board of the set, folded back into the rear compartment and clamped under the spring clamp provided for this purpose. Loosen the terminal nuts on the vertical terminal board and let the two jumper connections drop down to the positions shown in the figure.

The three external dry cells are connected in series, and the negative (outside) terminal is connected by means of an insulated wire passed through the bushing in the bottom of the set, to the post marked "A − 4½V" on the horizontal terminal board inside the set.



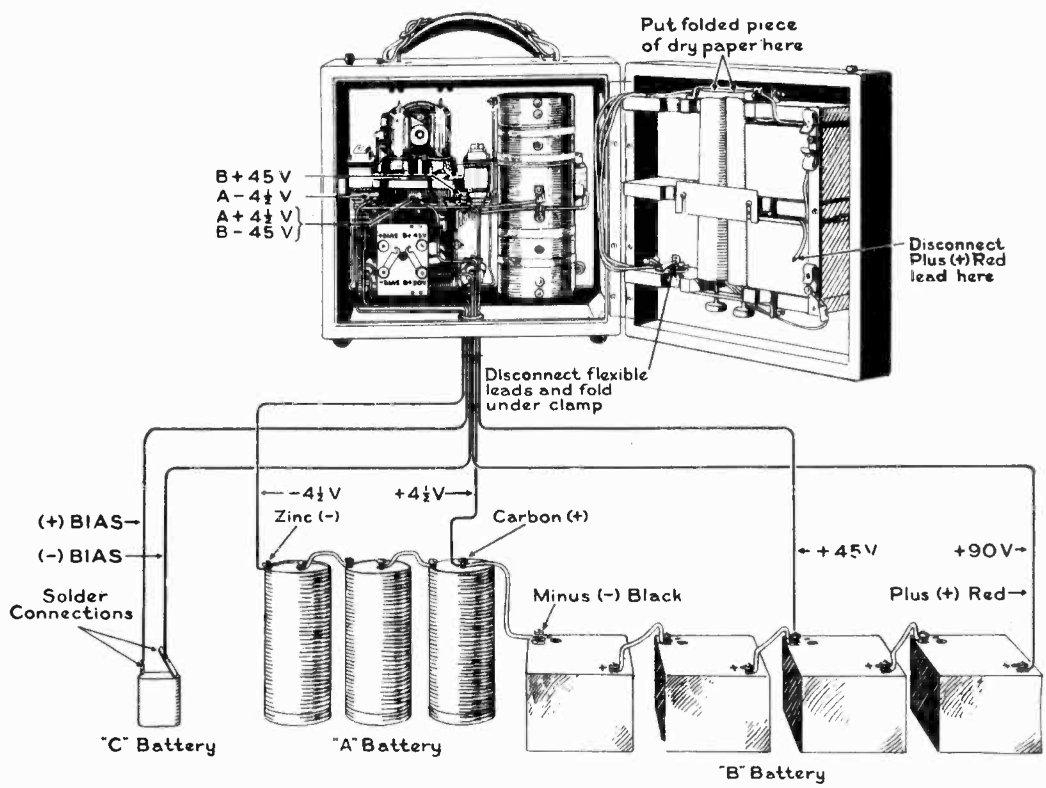


Fig. 3

The four 22½ volt "B" batteries are connected in series. The negative (black) lead is connected to the positive (center) terminal of the "A" battery and this point connected to the post marked "A+4½ V B−45 V" on the terminal board. The positive (red) lead is connected to the "B+90V" post on the vertical terminal board; and the negative (black) lead of the third "B" battery is connected to the "B + 45 V" post on the horizontal terminal board.

The negative (long contact strip) of the grid bias battery is connected to the "−BIAS" terminal on the vertical terminal board, and the positive (short contact strip) to the "+BIAS" terminal. Both connections should be soldered to the grid bias battery.

Four 22½ volt batteries providing a plate supply of 90 volts and a grid bias battery as specified, are recommended if a loud speaker is used. For head telephone reception only, two 22½ volt batteries providing a plate supply of 45 volts will be sufficient. In this case, the grid bias battery should be omitted, and both jumpers should be connected in accordance with Fig. 4.

The grid resistance, a 7 to 9 megohm unit, is held in position by spring clips under the tube socket.

Remember that vacuum tubes must be handled carefully.

Before inserting the tubes in the sockets, be sure that the filament knob is in the "OFF" position. Place the brass base of the tube in the socket and turn until the base pin drops into the slot; then press down gently on the tube and turn it to the right into position.

Radiola II is now ready to operate.

OPERATION

Set the "INTENSITY" knob at "0." Light the tube filaments to a brilliancy explained in the instructions accompanying the tube, by turning the "FILAMENT" knob from "0" toward "10." With new batteries, from 1 to 4 is an average setting, but this will increase as the batteries are used.

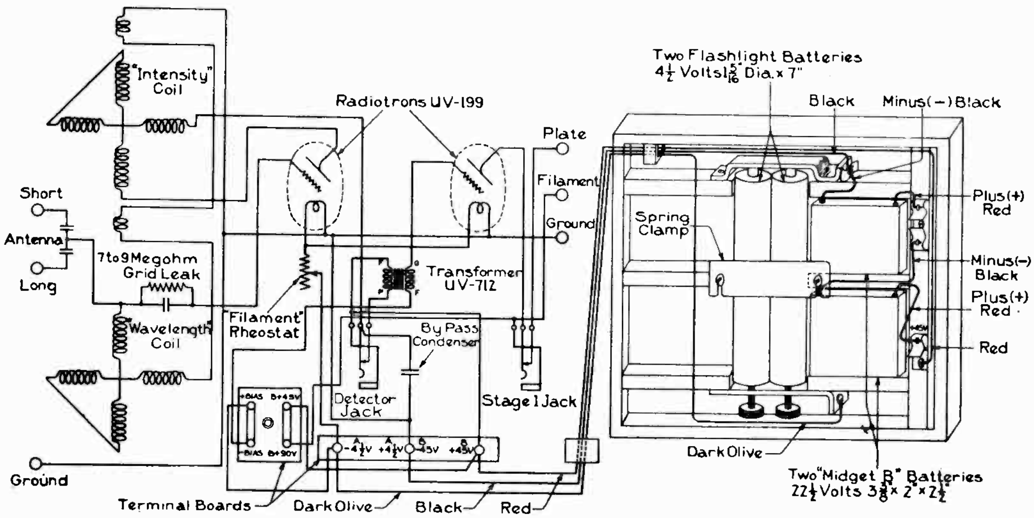


Fig. 4

Adjust the telephones snugly to the ears and insert the plug attached to the telephone cord in the jack marked "DETECTOR" A click should be heard on insertion or removal of the plug.

Turn the "WAVELENGTH" knob slowly until a signal is heard, and set it at the point where the signal is loudest. If no signals are heard or if they are very weak, slowly turn the "INTENSITY" knob clockwise, still searching for signals with the "WAVELENGTH" knob.

When signals are heard, turn the "INTENSITY" knob still farther, thus increasing the signal strength. Should it be advanced too far, a click will be heard in the telephones and then all signals will have a "mushy" sound. AT THIS POINT THE RECEIVER BECOMES A TRANSMITTER AND SERIOUSLY INTERFERES WITH NEIGHBORING RADIO RECEIVERS. THIS CONDITION OF OSCILLATION MUST BE AVOIDED, BUT IF IT DOES OCCUR, IMMEDIATELY TURN THE "INTENSITY" CONTROL BACKWARD SLIGHTLY UNTIL THE SIGNAL CLEARS UP.

To increase the signal strength still further, insert the telephone plug in "STAGE 1." This may require a slight readjustment of the "INTENSITY" knob.

The "VERNIER" knob provides a fine adjustment of the wavelength.

When the telephone plug is withdrawn, the amplifier or loud speaker, if either is connected, will be in circuit.

When the receiver is not in use, be sure to cut off the tube current by turning the "FILAMENT" knob to the "OFF" position.

POSSIBLE CAUSES OF FAULTY OPERATION

1. Poor or broken connections in antenna or ground wires, or defective insulation of antenna.
2. "FILAMENT" control improperly adjusted.
3. Improper adjustment of "INTENSITY," "WAVELENGTH," and "VERNIER" controls.
4. Batteries exhausted (indicated by low filament brilliancy or weak signals and noisy operation).
5. Battery connections improperly made, or broken.
6. Poor or broken connections in telephone cord or plug.
7. Grid leak omitted.
8. Inoperative vacuum tubes.

Radiola III

INTRODUCTION

The RADIOLA III is a high grade regenerative radio receiving set especially designed for broadcasting reception. It uses two WD-11 Radiotrons which are arranged to operate as a detector and audio amplifier. Four antenna binding posts are provided so that a choice of two types of tuning circuit may be had. One is a sensitive single tuning circuit that has made an excellent reputation in the Radiola Senior, while the other is a more selective circuit for use when interference is present. The apparatus is mounted below an attractive horizontal panel of durable molded material and is enclosed in a solid mahogany case. A flexible cable is provided, by which all battery connections are made, thus, the set may be placed on a table while the batteries are placed on the floor or elsewhere out of the way.

EQUIPMENT

Material Furnished

Under the name of RADIOLA III, there is included the following material:

RADIOLA III Receiving Set as described.
Two RADIOTRONS, Type WD-11,
One Telephone Headset.

Additional Material Needed

To complete a new installation, the following material will also be needed:

Complete Antenna and Ground Outfit, A, B and C Batteries as follows:

"A" Battery for filament heating, consisting of from four to six 1½ volt dry cells connected in parallel, such as one of the following:

4 to 6 Eveready Radio "A" Batteries #7111.
4 to 6 Burgess "A" Batteries #6.
4 to 6 Ray-O-Vac "A" Dry Batteries #1211.
4 to 6 Manhattan Red Seal Dry Cells #2445.
4 to 6 Columbia Ignitor #6 Dry Cells.

or any other make of good dry cell having approximate dimensions of 2½ inches diameter by 6 inches high.

A two volt (one cell, lead type) storage battery may be used.

"B" Battery for supplying power to the plate circuits, consisting of two 22½ volt plate batteries connected in series or of one 45 volt plate battery, such as one of the following:

2 Eveready #766 Plate Batteries.
2 Burgess #2156 Plate Batteries
2 Ray-O-Vac #2151 Plate Batteries.
2 Ace #115 Plate Batteries.
or
1 Eveready #767 Plate Battery.
1 Burgess #2306 Plate Battery.
1 Ray-O-Vac #2301 Plate Battery.

or any other good make of radio plate battery. The ones listed are of the large size which are most economical but the intermediate size may also be used.

"C" Battery for producing a negative grid potential, consisting of one 1½ volt dry cell. This may conveniently be the same as one of the cells of the "A" Battery and this is recommended.

INSTALLATION

Location—The RADIOLA III should be placed as near as possible to the incoming wire from the antenna. A good ground, such as a water pipe, should be not far away. The set may be placed on a small table so that the batteries may rest on the floor or elsewhere out of the way.

Antenna

Outdoor Type—In general, best results will be obtained with an outdoor antenna from 50 to 150 feet long and 20 or more feet above the ground. If these dimensions cannot be secured, approach them as nearly as possible. The antenna should be located in a space above the tops of surrounding buildings and in a space as free as possible from other objects. It should not be touched by any other object than the antenna insulators. The same precautions apply to the lead-in, which should preferably be a continuation of the antenna wire to eliminate joints, and should run as directly as possible to the receiver. The antenna should be at right angles to any electric light and other wires and if practicable, at least 15 feet distant from them and from other antennae. It should be erected in a strong and durable manner in accordance with the requirements of the National Electric Code.

Indoor Type—For local reception, and in some cases for distant reception, satisfactory results may be secured by using 20 to 40 feet of ordinary cotton covered magnet or bell wire (about 18 to 22 B & S gauge) strung around a picture moulding or elsewhere as high up as possible. This type of antenna is particularly suitable for use in apartment houses or similar buildings but will not give satisfactory results in steel frame buildings or in ones having metal lath under the plaster.

Ground

A good ground is as necessary as a good antenna. The best ground is a good electrical connection to a water pipe. If this is not convenient, a connection to the steam or hot water heating system will usually serve almost as well. Connections to gas pipes should be avoided. If nothing of this nature is available, a pipe or metal rod may be driven into the ground to a depth of several feet, preferably where the soil is moist. The ground connection should be made with a ground clamp to which the wire is soldered or securely held by gripping under a screw or nut. In any case the pipe must be scraped or filed until clean and bright before attaching the ground clamp. Usually, connecting to more than one ground, for instance, to both water and steam pipes, will improve reception.

Connections

Three separate batteries are needed to operate Radiola III. The "A" battery heats the filament of the Radiotrons, the "B" battery supplies the power to the plate circuits and the "C" battery controls the grid potential of the amplifier Radiotron so that amplification will be undistorted and the "B" battery will last longer.

The connection of these batteries may best be understood by reference to the diagram in Fig. 2. Near the center are shown two #6 dry cells marked "A Battery". These are to be connected in parallel, that is, the outside terminals are to be connected together by one piece of wire and the center terminals by another piece of wire. Under no condition must these two wires touch each other or the cells will be ruined in a few minutes. The Radiola III is provided with a five conductor cable, the lower end of which is shown at the top of figure 2. Each of the conductors has a braid of distinctive color which designates the purpose of that particular conductor. The one with the green field and yellow tracer which carries a small tag marked "—A+C" is to be connected to the negative side (outside terminals) of the "A" battery. It may be connected to either terminal or to the wire which connects them. The conductor having a yellow field with red and blue tracers is to be connected to the positive side (center terminals) of the "A" battery. It may be connected to either terminal or to the wire which connects them. Be sure to make all connections tightly and securely.

Before proceeding further unpack the two WD-11 Radiotrons from their cartons. Turn the knob marked "Battery Setting" near the left rear corner of the panel as far to the left as possible until the pointer rests on "OFF". Then insert the WD-11 Radiotrons in their sockets which are located just below the oval hole in the panel. The pins on the bases of the Radiotrons fit into sliding contacts which are located in holes in the socket panel. The sockets are so arranged that the large pin will be toward the front of the set. The socket panel is flexibly supported on rubber but is equipped with stops which prevent motion too far vertically in either direction. **Be sure to push the Radiotrons down into the sockets as far as they will go, that is, until the molded base of the Radiotron rests upon the socket panel.** Then turn the "Battery Setting" knob to the right until the pointer comes between the two "Ts" of the word battery. Look directly down into the Radiotrons to see that the filaments of both are glowing at a dull red heat. If either one fails to glow see that it is firmly in its socket and if the trouble still exists, interchange the Radiotrons. Both must glow or the set will not operate. If one cannot be made to glow it indicates that the filament has been broken and it must be replaced by a new one. Having determined that both filaments glow turn the "Battery Setting" knob back to "OFF".

Then proceed with the "B" battery shown to the right in Fig. 2. This consists of two 22½ volt blocks which are designated "B Battery". Using a short piece of wire connect one end to a center terminal (positive) of the "A" battery and connect the other end to the negative terminal of one of the "B" batteries. Using another short piece of wire connect one end to the positive terminal of the same "B" battery and connect the other end to the negative side of the second "B" battery. Now find the cable conductor which has a maroon braid and a tag marked "+20 B". Connect this to the positive terminal of the first "B" battery. Also find the conductor with the red braid and a tag marked "+40 B". Connect this to the positive terminal of the second "B" battery.

The "C" battery is shown at the extreme left and consists of a single dry cell similar to one of the units of the "A" battery. Using a short piece of wire, connect one of the outside terminals of the "A" battery to the center terminal of the "C" battery. Then find the cable conductor which has a black field with a green tracer and connect it to the outside terminal of the "C" battery.

The ground wire should be connected to the negative terminal of the first "B" battery or to either positive (center) terminal of the "A" battery, whichever is most convenient. This wire should run as directly as possible to the ground clamp.

The antenna lead from the lightning arrester or switch should be a piece of flexible wire long enough to reach any one of the antenna posts at the right side of the set.

Great care should be taken to keep all connections tight, as failure to do so may result in objectionable noises or render the set inoperative.

OPERATION

Controls

Battery Setting—The control so marked serves to turn on and regulate the current to the filaments of the Radiotrons. When the set is not in use the pointer of this control should always be turned as far to the left as possible, so that it points to "OFF". When it is desired to operate the set, turn the "Battery Switch" knob to the right until the filaments glow at a dull red color.

Station Selector—The control so marked serves to adjust the tuning circuit so that the set will respond to the desired wavelength.

Amplification—The control so marked adjusts the regeneration and thus regulates the sensitivity and selectivity of the set.

Antenna Binding Posts—There are two types of circuit available. One is a straight single tuning circuit noted for its sensitivity and ease of operation. The other is a type of coupled circuit affording more selectivity. Either may be had at will by connecting the antenna to the proper binding post and putting the link in the proper position. Fig. 3 shows the suggested combinations which have the following properties.

No. 1—Antenna on 4, link open. This is a single circuit connection which on an average antenna will cover the approximate wavelength range of 200 to 360 meters corresponding to a frequency range of 1500 to 830 kilocycles.

No. 2—Antenna on 3, link open. This is a single circuit connection which on an average antenna will cover the approximate wavelength range of 250 to 480 meters corresponding to a frequency range of 1200 to 625 kilocycles.

No. 3—Antenna on 2 and 3, link open. This is a single circuit connection which on an average antenna will cover the approximate wavelength range of 315 to 560 meters corresponding to a frequency range of 950 to 535 kilocycles.

No. 4—Antenna on 2 and 3, link on 4. This is a closed single circuit which on a very small antenna, such as an indoor one, will cover the approximate wavelength range of 290 to 575 meters corresponding to a frequency range of 1070 to 520 kilocycles.

No. 5—Antenna on 1, link on 4. This is a selective single circuit connection which on an average antenna will cover the approximate wavelength range of 195 to 375 meters corresponding to a frequency range of 1540 to 800 kilocycles.

No. 6—Antenna on 1, link on 3. This is a selective single circuit connection which on an average antenna will cover the approximate wavelength range of 310 to 640 meters corresponding to a frequency range of 970 to 470 kilocycles.

Finding Signals

Select a suitable antenna connection according to one of the combinations shown in Fig. 3. Generally the first trial may be made using the single circuit connection with the intermediate wavelength range, the second connection from the left. Push the telephone cord tip terminals into the holes at the left of the panel above and below the word "Phones". The contact toward the rear of the panel is positive. Turn the "Battery Setting" to the right until both filaments glow at a dull cherry red. This should happen by the time the pointer reaches the last letter of the word "Battery", when the cells used in the "A" battery are fresh. Set the "Amplification" at "3" and move the "Station Selector" slowly back and forth over the scale. If signals are heard, carefully adjust the "Station Selector" until the signals become loudest and then turn "Amplification" to the right when the signals should become still louder. Do not turn amplification to the point where the signals become distorted or where whistles and howls are produced. If no signals are heard the first time, turn "Amplification" one-half division to the right and try again. Turn "Station Selector" slowly and listen carefully as signals are frequently very weak when first received. Continue this process until results are obtained. If the first antenna combination fails to give results try another.

When "Amplification" is turned too far to the right the set will oscillate. This condition will be apparent by a breathing noise and usually by whistling noises, the pitch of which varies as the "Station Selector" is turned slightly. The proper operating point is with "Amplification" just below the point at which the set will oscillate. After a little practice it will be possible to tell when this condition occurs as it is the most sensitive condition and static noises will be loudest. Then the proper procedure when finding signals is to turn "Amplification" up to this point and then adjust the "Station Selector" until signals are heard. Careful adjustment of both "Station Selector" and "Amplification" will be needed to obtain maximum strength of signals.

The maximum sensitivity is obtained when a regenerative set is adjusted so that it is just ready to oscillate. The ease with which a set oscillates depends upon the antenna and the condition of the detector Radiotron. In case it becomes impossible to make the set oscillate it is an indication that the antenna or ground should be improved, that the detector Radiotron should be replaced, or that the first "B" battery is becoming discharged. To determine whether or not the set is oscillating place a finger upon any one of the antenna binding posts thereby stopping oscillation and causing a distinct click in the headset which will be repeated when oscillation starts upon removal of the finger.

In case it is impossible to make the set oscillate on all antenna combinations, disconnect the maroon cable lead (+20B) from the positive terminal of the first block of the "**B**" battery and connect it to the positive terminal of the second block, (+40 volts).

When a set is oscillating strong whistling noises are produced not only in your own set but in your neighbor's, which vary in pitch as the "Station Selector" is turned. Also, much of the static and other interference is stopped but a characteristic breathing sound is produced. It becomes much more difficult to tune to a station and it is impossible to get good, clear reception.

If the receiver is allowed to oscillate it will disturb other nearby receivers. Therefore care should be exercised to avoid the oscillating condition, and whenever the receiver does oscillate accidently, to stop immediately by turning the amplification control back to the proper point.

SOME CAUSES OF FAULTY OPERATION

Filaments fail to glow—"A" battery may be exhausted: One of the leads may be disconnected: One Radiotron or more may not be making contact in the socket: The filament may be broken: Connections may be loose.

No sound is heard—The filaments may not be lighted: The "B" battery may be disconnected or the leads reversed: The "B" battery may be exhausted: The leads to the head set may not be connected: The "C" battery may be disconnected. If slight noises are heard and no signals, no station within range is operating.

Howling noise—The antenna may be disconnected or the link may be open when it should be closed: "Amplification" may be turned too far to the right: The "C" battery may be exhausted.

Music or speech distorted—The bias battery connections may be reversed: The "B" battery may be exhausted.

MAINTENANCE AND REPLACEMENTS

Radiotrons—Occasionally a Radiotron will become inoperative on account of a broken filament or a cracked or broken bulb. When this happens it should be replaced by a new one. After many hours of service a Radiotron will occasionally lose its sensitivity. It will pay to obtain a new one when this happens.

"A" Battery—When the dry cells used for this purpose become discharged to the point where they will no longer heat the filaments to the proper temperature they should be replaced by new ones. The same directions should be followed as for a new installation. Always remove Radiotrons from their sockets when replacing batteries.

"B" Battery—It is rather difficult to know when these batteries are exhausted, as there is no external indication except weakened signals. The best way is to obtain a reliable voltmeter which will indicate up to 100 volts at least and take weekly readings of your batteries. Discard each block when the voltage per block falls to 17 volts.

"C" Battery—This battery should be replaced whenever its voltage falls below 1.2 volts. The battery of the kind recommended should last for at least a year but a good plan is to use it for one of the new "A" battery cells and replace it by a new one whenever the "A" battery is replaced.

General—When asking for information about or for repair parts for or when reporting troubles with this set please mention the serial number which may be found on the bottom of the box.

A complete diagram of connections is given in Fig. 4.

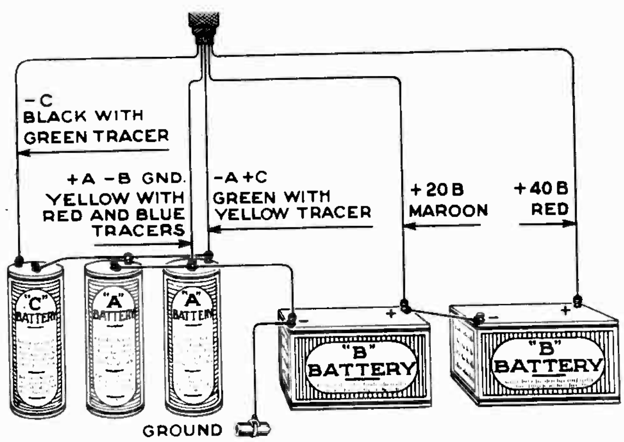
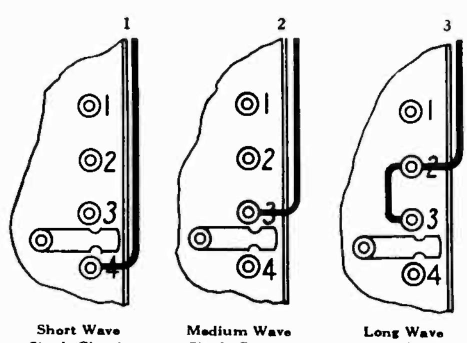
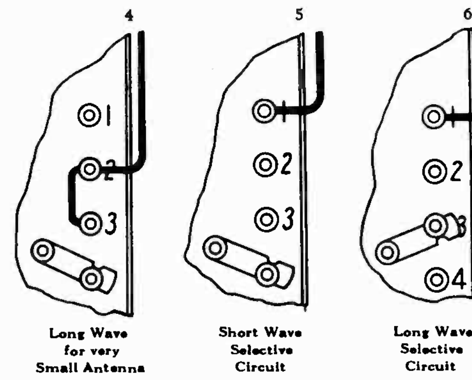


Fig. 2—Battery Connections



For any Antenna



For any Antenna

Fig. 3—Showing Antenna Connections to Different Binding Posts

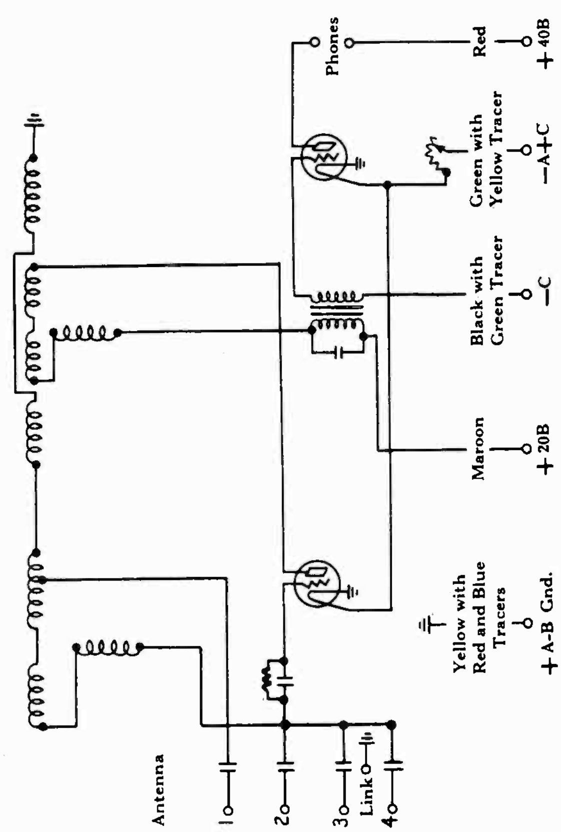


Fig. 4—Diagram of Connections

Radiola III-A

INTRODUCTION

The Radiola III-A is a high grade regenerative radio receiving set especially designed for broadcast reception. It uses four WD-11 Radiotrons which are arranged to operate as a detector and two stage audio frequency amplifier. The second stage uses two Radiotrons in a balanced circuit particularly arranged to operate a loud speaker. By making the proper antenna connection a choice of two types of tuning circuit is afforded. One is a sensitive single tuning circuit that has made an excellent reputation in the Radiola Sr., while the other is a more selective circuit for use when interference is present. The apparatus is mounted below an attractive horizontal panel of durable moulded material and is enclosed in a solid mahogany case. A flexible cable is provided by which all battery connections are made, so that the set may be placed on a table while the batteries are placed on the floor or elsewhere out of the way.

EQUIPMENT

Furnished:

Under the name of Radiola III-A, there is included the following apparatus:

Radiola III-A Receiving Set as described
Four Radiotrons, Type WD-11
One Telephone Headset

Additional Material Needed:

To complete a new installation, the following items will also be needed.

A, B and C Batteries.
Loud Speaker, Radio Corporation, UZ-1325.
Complete Antenna and Ground Outfit.

BATTERIES REQUIRED

(A) Refers to Filament Lighting or "A" Battery
(B) Refers to Plate or "B" Battery
(C) Refers to Negative Grid Bias or "C" Battery

"A" Four or Six 1½ Volt Dry Cells connected in PARALLEL, such as:

4 to 6 Eveready Dry Cell Radio "A" Batteries	or,
4 to 6 Manhattan Red Seal Dry Cells	or,
4 to 6 Burgess #6 Dry Cells	or,
4 to 6 Ray-O-Vac #1211 Dry Cells	

NOTE—A two volt Storage Battery may be used if desired

OR EQUIVALENT

"B" Four 22½ Volt Plate Batteries connected in SERIES, such as:

4 Eveready #766	Plate Batteries	or,
4 Burgess #2156	Plate Batteries	or,
4 Ray-O-Vac #2151	Plate Batteries	

OR EQUIVALENT

Two 45 Volt Plate Batteries may be used instead of four 22½ Volt blocks if desired, such as:

2 Eveready #767	Plate Batteries (45 Volts)	or,
2 Burgess #2306	Plate Batteries (45 Volts)	or,
2 Ray-O-Vac #2301	Plate Batteries (45 Volts)	

OR EQUIVALENT

NOTE—The plate or "B" batteries listed are of the large sizes which are most economical. Other intermediate sizes may be used equally well.

"C" One 4½ Volt Negative Grid Bias or "C" Battery, such as:

1 Eveready #771 Negative Grid Bias Battery	or,
1 Ray-O-Lite #231-R Negative Grid Bias Battery	or,
1 Burgess #2370 Negative Grid Bias Battery	

OR EQUIVALENT

INSTALLATION

Location:

The Radiola III-A should be placed as near as possible to the incoming lead from the antenna. A good ground such as a water pipe should be not far away.

When a loud speaker is used, most pleasing results will be obtained when it is used in a fairly large room which does not have bare walls, as draperies, hangings, irregular surfaces, etc., will prevent undesirable reflections of the sound waves.

Antenna:

Outdoor Type—In general, best results will be obtained with an outdoor antenna from 50 to 150 feet long and from 20 to 40 feet above the ground. If the suggested dimensions cannot be secured, approach them as nearly as possible. The antenna should be located in a space above the tops of surrounding buildings and trees or in a space as free from other objects as possible. It should not be touched by any object other than the antenna insulators. The same precautions apply to the lead-in wire which should preferably be a continuation of the antenna wire to eliminate joints, and should run as directly as possible to the receiver. The antenna should be at right angles to any electric light and other wires which may cause disagreeable noises, and if practicable at least 15 feet distant from them and from other antennae. It should be erected in a strong and durable manner in accordance with the requirements of the National Electric Code.

If an antenna is already available, it may be used provided that it is erected in accordance with the above instructions.

Indoor Type—For local reception, and in some locations for distant reception, satisfactory results may be secured by using 20 to 40 feet of ordinary double cotton covered magnet or bell wire (about #18 to 22 B & S gauge) strung around the picture moulding or elsewhere as high up as possible. This type of antenna is particularly suitable for use in an apartment house or similar building.

Ground:

A good ground is as necessary as a good antenna. The best ground is a good electrical connection to a water pipe. If this is not convenient, a connection to the steam or hot water heating system will usually serve almost as well. Connections to gas pipes should be avoided. If nothing of this nature is available, a pipe or metal rod may be driven into the ground to a depth of several feet, preferably where the soil is moist. The ground connection should be made with a ground clamp, the wire being soldered or held securely by the clamping screw. In any case, the pipe must be scraped or filed until clean before making the ground connection. Usually, connecting to more than one ground, for instance to both water and steam pipes, will improve reception.

Batteries:

Three separate batteries are needed to operate Radiola III-A. The "A" battery heats the filaments of the Radiotrons, the "B" battery supplies the power to the plates for amplification and to operate the loud speaker, and the "C" battery controls the grid potential of the Radiotrons so that amplification will be undistorted and the drain of current from the "B" battery will be decreased.

The connection of these batteries may best be understood by reference to the diagram in Fig. 2. Remove the four WD-11 Radiotrons from their sockets while making the battery connections. In the center are shown five #6 dry cells. These are connected in parallel, that is, all the outside terminals are connected together by one piece of wire and then all the center terminals are connected together by another piece of wire. Under no conditions must these two wires touch each other or the cells will be ruined in a few minutes. The Radiola III-A is provided with a five conductor cable, one end of which is shown at the top of the figure. Each of the conductors has a braid of distinctive color. The one with the green braid with yellow tracer and the tag marked "—A+C" is to be connected to the negative side of the "A" battery formed by the four dry cells. It may be connected to any one of the outside terminals or to the wire which connects them together. The wire with the yellow braid with red and blue tracers and the tag marked "+A—B Gnd" is to be connected to the positive side of the "A" battery. It may be connected to any one of the center terminals or to the wire which connects them together. Be sure to make all connections tightly and securely. Before proceeding further with the batteries, unpack the four WD-11 Radiotrons from their cartons. Turn both knobs marked "Battery Setting" as far to the left as possible or until the pointer rests on "OFF". Then insert the WD-11 Radiotrons in their sockets which are located below the openings in the panel. The Radiotrons can be inserted in but one way and that is with the large pin toward the front of the set. **Push them down firmly.** Then turn both "Battery Setting" knobs about a quarter turn to the right. By looking directly down into each Radiotron, the dull red glow of the filament should be visible. It will probably be necessary to darken the room or at least shield the Radiotrons from direct illumination to see the glow of the filaments. If any filament does not glow see that the Radiotron is firmly in its socket, and if the trouble persists, try it in one of the other sockets in place of a Radiotron which does glow. If it still fails to glow, the filament is broken and it is of no more use. Having determined that all filaments are glowing, turn the "Battery Settings" back to "OFF" to conserve the filament battery.

Then proceed with the "B" battery which is shown to the right of the figure as consisting of four of the usual 22½ volt blocks. These are connected in series, that is, the positive of block number 1 to the negative of block number 2. To do this, provide four pieces of wire about 8 inches long. Arrange the blocks about as shown. Call the one to the left number 1. One terminal (negative) of this block will be marked "—" or "NEG". Connect this to a positive terminal on the "A" battery. The other terminal (positive) of this block (number 1) will be marked "+", "+22½" or "Pos". Connect it to the negative terminal of block number 2. Also connect the positive of block number 2 to the negative of block number 3, and the positive of block number 3 to the negative of block number 4. One of the cable leads has a maroon braid and a tag marked "+ 20 B". Connect it to the positive terminal of block number 1. Another cable lead has a red braid and a tag marked "+ 80 B" Connect it to the positive terminal of block number 4.

The "C" battery consists of a 4½ volt battery especially designed for this purpose. One terminal is marked "+" or "Pos". Connect this by a short piece of wire to a negative terminal on the "A" battery. Connect the remaining cable lead with black braid and green tracer and with the tag marked "—C" to the terminal marked "—4½".

The wire to the ground connection should be connected to a positive terminal on the "A" battery. It may not be convenient to connect so many wires to the same battery terminal but it is permissible to distribute them over several of the center terminals so long as they all remain connected together.

Great care should be taken to keep the battery connections tight, as failure to do so may result in objectionable noises, or complete inoperation of the set.

OPERATION

Controls:

Battery Setting—The two knobs so marked serve to turn on and control the current flowing through the filaments of the Radiotrons. When the set is not in use, both pointers should be turned as far as possible to the left so that they rest on "OFF". The knob in the center of the panel controls the filament current to the two Radiotrons to the right while the knob at the left front corner controls the two Radiotrons immediately behind it.

Station Selector—The control so marked serves to adjust the tuning circuit so that it will respond to the desired wavelength. The long handle makes accurate tuning easy.

Amplification—The control so marked adjusts the regeneration and thus regulates the sensitivity and selectivity of the set.

Regeneration is obtained by the tickler method and the construction is such that changing the adjustment of the regeneration causes no appreciable change in the tuning.

Antenna Binding Posts—There are two types of circuit available. One is a straight single circuit noted for its sensitivity and ease of operation. The other is a type of coupled circuit affording more selectivity. Either may be had at will by connecting the antenna to the proper binding post and putting the link in the proper position. Fig. 3 shows the suggested combinations which have the following properties.

No. 1. Antenna on 4, link open. This is a single circuit connection which on an average antenna will cover the approximate wavelength range of 200 to 360 meters corresponding to a frequency range of 1500 to 830 kilocycles.

No. 2. Antenna on 3, link open. This is a single circuit connection which on an average antenna will cover the approximate wavelength range of 250 to 480 meters corresponding to a frequency range of 1200 to 625 kilocycles.

No. 3. Antenna on 2 and 3, link open. This is a single circuit connection which on an average antenna will cover the approximate wavelength range of 315 to 560 meters corresponding to a frequency range of 950 to 535 kilocycles.

No. 4. Antenna on 2 and 3, link on 4. This is a closed single circuit which on a very small antenna, such as an indoor one, will cover the approximate wavelength range of 290 to 575 meters corresponding to a frequency range of 1070 to 520 kilocycles.

No. 5. Antenna on 1, link on 4. This is a selective single circuit connection which on an average antenna will cover the approximate wavelength range of 195 to 375 meters corresponding to a frequency range of 1540 to 800 kilocycles.

No. 6. Antenna on 1, link on 3. This is a selective single circuit connection which on an average antenna will cover the approximate wavelength range of 310 to 640 meters corresponding to a frequency range of 970 to 470 kilocycles.

Finding Signals:

Select a suitable antenna connection according to one of the combinations shown in Fig. 3. Generally, the first trial may be made using the single circuit connection with the intermediate wavelength range, the second combination from the left. If a loud speaker is to be used, push its cord terminals into the pin jacks on either side of the word "Output" at the left of the panel. Then turn both "Battery Setting" knobs to the right until the filaments of all four Radiotrons glow at a dull red color. If a headset is to be used, push its cord terminals into the pin jacks just above the words "1st stage" near the front of the panel, and then turn only the "Battery Setting" near the middle of the panel until the filaments of the two Radiotrons at the right, glow at a dull red color. The pin jack at the left is positive. The cord tip on the lead with the colored tracer thread should be inserted in this jack. The other "Battery Setting" should be left in the "OFF" position, unless the loud speaker is used. Then set the "Amplification" at about "3". Turn the "Station Selector" slowly back and forth over the scale. If signals are heard, carefully adjust the "Station Selector" until the signals become loudest and then turn "Amplification" to the right when the signals should become still louder. Do not turn "Amplification" to the point where the signals become distorted or where whistles and howls are produced. If no signals are heard the first time, turn "Amplification" one half division to the right and try again. Continue this procedure until results are obtained. If the first antenna combination fails, try another.

When "Amplification" is turned too far to the right, the set will oscillate. This condition will be apparent by a breathing noise and usually by whistling noises, the pitch of which varies as the "Station Selector" is turned slightly. The proper operating point is just before the set starts to oscillate. After a little practice, it will be possible to tell when this condition prevails. Then the proper procedure in finding signals is to turn "Amplification" up to the proper point and then turn "Station Selector" until signals are heard. Careful adjustments of both "Station Selector" and "Amplification" will be needed to obtain maximum strength of signals.

The maximum sensitivity is obtained when a regenerative receiving set is adjusted so that it is just ready to oscillate. With some antennae, it may be difficult to reach this condition, which is indication that the antenna has very high resistance and should be improved. Oscillation should occur before "Amplification" reaches "10". When a set is oscillating, strong whistling noises are produced, whose pitch varies as the "Station Selector" is turned. Also, much of the static and other interference is stopped but a characteristic breathing sound is produced. It becomes much more difficult to tune in a station and it is impossible to get good, clear reception so that oscillation is to be avoided.

ALSO IF THE RECEIVER IS ALLOWED TO OSCILLATE IT WILL DISTURB OTHER NEARBY RECEIVERS AND THEREFORE CARE SHOULD BE EXERCISED TO AVOID THE OSCILLATING CONDITION, AND WHENEVER THE RECEIVER DOES OSCILLATE ACCIDENTLY, THIS SHOULD BE STOPPED IMMEDIATELY BY TURNING THE AMPLIFICATION CONTROL BACK TO THE PROPER POINT.

In case it is impossible to make the set oscillate on all antenna combinations, disconnect the maroon cable lead (+20B) from the positive terminal of the first block of the "B" battery and connect it to the positive terminal of the second block (+40 volts).

SOME CAUSES OF FAULTY OPERATION

Filaments fail to glow—"A" battery may be exhausted: One of the leads may be disconnected: One Radiotron or more may not be making contact in the socket: The filament may be broken: Connections may be loose: The remedy is obvious in each case.

No sound is heard—The filaments may not be lighted: The "B" battery may be disconnected or the leads reversed: The "B" battery may be exhausted: The leads to the loud speaker or head set may not be connected: The "C" battery may be disconnected If slight noises are heard but no signals, no station within range is operating.

Howling noise—The antenna may be disconnected or the link may be open when it should be closed: "Amplification" may be turned too far to the right: The Bias battery may be nearly exhausted.

Music or Speech Distorted—The bias battery connections may be reversed: The "B" battery may be exhausted.

MAINTENANCE AND REPLACEMENTS

Radiotrons:

Occasionally a Radiotron will become inoperative on account of a broken filament or a cracked or broken bulb. When this happens, it should be replaced by a new one of the same type. Occasionally after many hours of service (about 1000) a Radiotron will lose its sensitivity. It will usually pay to obtain a new one when this happens.

In emergency cases, the set may be operated with only one Radiotron in the group at the left. This Radiotron may be used equally well in either socket. The quality of reproduction is much better when four tubes are used, however.

Filament or "A" Battery:

When the dry cells used for this purpose become discharged to the point where they will no longer heat the filaments to the proper temperature, they should be replaced by new ones.

The batteries may be replaced by disconnecting all wires from battery binding posts. Then the cells may be removed and new ones connected in their places. Attached to each lead is a marked metal tag designating to which point the lead is to be connected. Reference to Fig. 2, will preclude the possibility of an error in connection, and will warrant careful attention. The carbon or center post of a standard dry cell is positive.

DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE REPLACING ANY BATTERIES. NEVER BURN TUBES MORE BRIGHTLY THAN REQUIRED FOR A REASONABLE SIGNAL.

"B" Battery:

It is rather difficult to know when these batteries are exhausted, as there is no external indication except weakened signals. The best way is to obtain a reliable voltmeter which will indicate up to 100 volts at least and take weekly readings of your batteries. Discard each block when the voltage per block falls to 17 volts.

Bias or "C" Battery:

This battery should be replaced whenever its voltage falls below 4 volts to insure the proper functioning of the Radiola III-A. This procedure may be carried out readily by reference to Fig. 2. This battery, if of the kinds given in the list recommended, should last at least six months.

When asking for information about, or for repair parts for, or when reporting troubles with these sets, please mention the serial number which may be found on the bottom of the box.

A complete diagram of connections is given in Fig. 4.

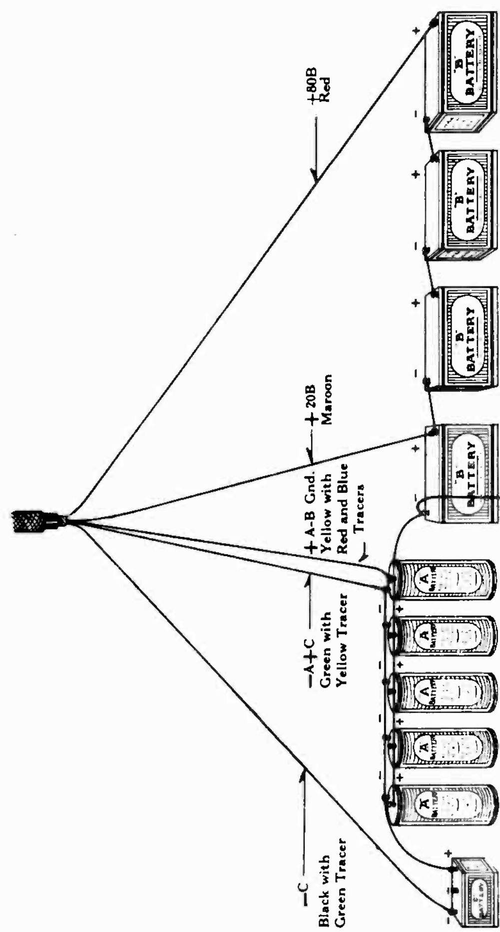


Fig. 2—Showing Battery Connections

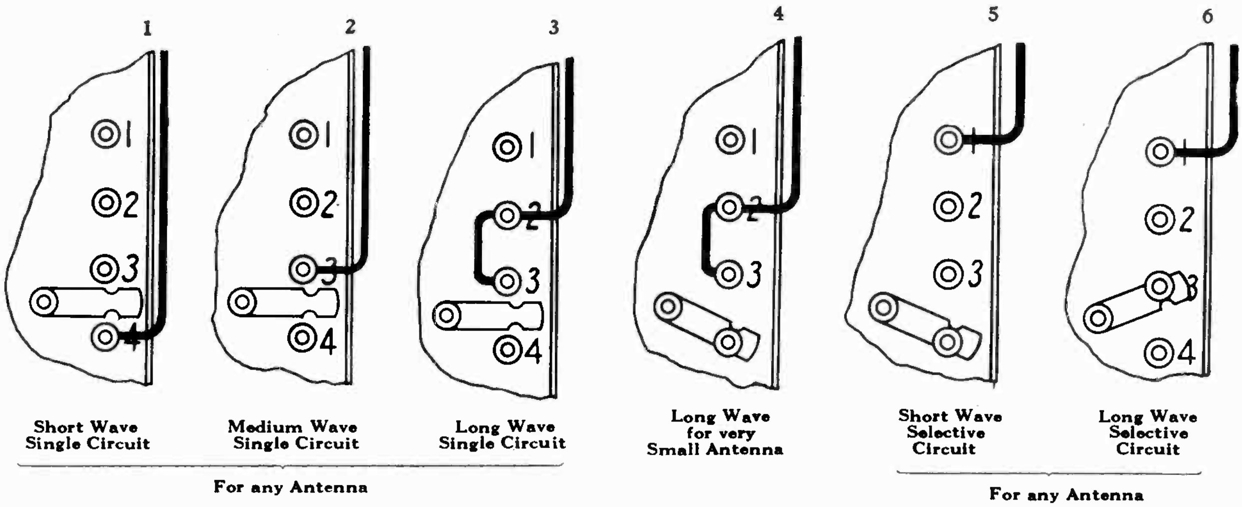


Fig. 3—Showing Antenna Connections to Different Binding Posts

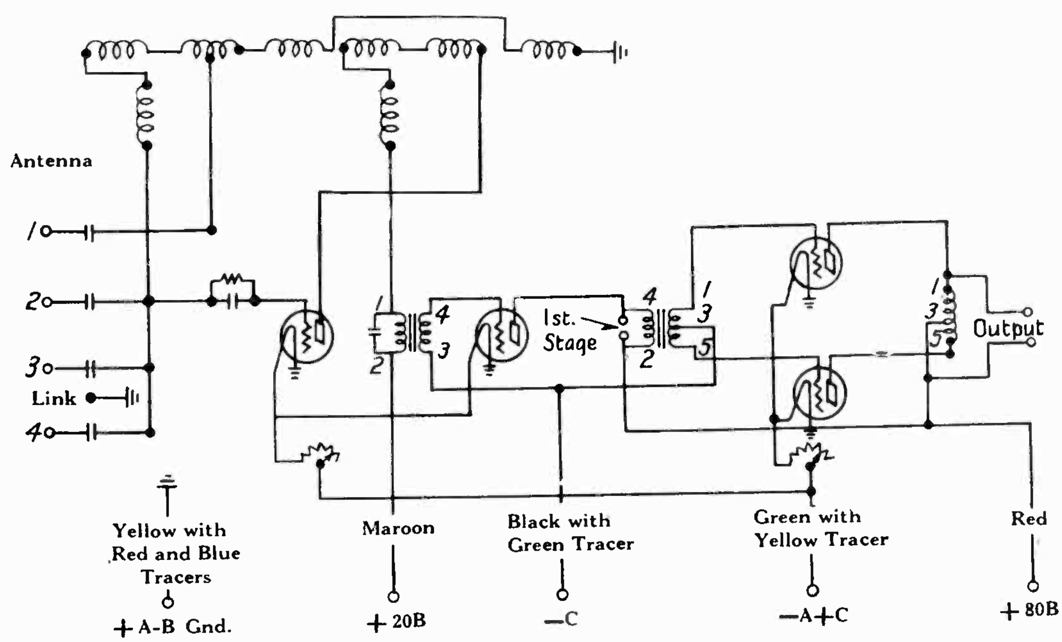


Fig. 4—Diagram of Connections

Radiola

Balanced Amplifier

INTRODUCTION

Radiola Balanced Amplifier is a two-tube balanced audio frequency power amplifier, especially designed for use with the Radiola III, thus providing loud speaker operation under all conditions of reception. It gives an advantage over the ordinary cascade amplifier, as the balanced system minimizes distortion of the voice or music. The apparatus is mounted on a horizontal panel and enclosed in a wood cabinet from which a flexible wire cable is provided for connection to the batteries.

EQUIPMENT

The equipment includes the following:

1. Radiola Balanced Amplifier (less batteries).
2. WD-11 Radiotrons.

BATTERIES

When the Radiola Balanced Amplifier is used with the Radiola III Receiver, a common "A" battery for both units is recommended and the connections are shown in Figure 1.

As the combined units employ four WD-11 Radiotrons, five ordinary 1½ volt dry cells, all connected in PARALLEL, are recommended.

BATTERIES REQUIRED

(A) Refers to Filament Lighting or "A" Battery
(B) Refers to Plate or "B" Battery
(C) Refers to Negative Grid Bias or "C" Battery

(A) Four or six 1½ Volt Dry Cells connected in PARALLEL, such as:

4 or 6 Eveready Dry Cell Radio "A" Batteries	(2½" x 6½")	or,
4 or 6 Manhattan Red Seal Dry Cells	(2½" x 6½")	or,
4 or 6 Burgess No. 6 Dry Cells	(2½" x 6")	or,
4 or 6 Burgess Super Six Dry Cells	(2½" x 6")	or,
4 or 6 Ray-O-Vac No. 1211 Dry Cells	(2½" x 6½")	or,
4 or 6 Ace No. 6 Dry Cells	(2½" x 6½")	or,
4 or 6 Columbia Ignitor No. 6 Dry Cells	(2½" x 6½")	

NOTE—A two volt Storage Battery may be used if desired.

OR EQUIVALENT

(B) When the Radiola III is used alone, a "B" battery voltage of 45 is recommended with a "C" battery voltage of 1.5. When the Radiola III and the Radiola Balanced Amplifier are used together, a "B" battery voltage of 90 is recommended for both. The proper "C" battery voltage is then 4.5. A total of four 22½ volt blocks of "B" battery will be needed.

(B) Four 22½ Volt Plate Batteries connected in SERIES, such as:

4 Eveready No. 766	Plate Batteries	(6⅝" x 4" x 4")	or,
4 Burgess No. 2156	Plate Batteries	(6⅝" x 4" x 3")	or,
4 Ray-O-Vac No. 2151	Plate Batteries	(6⅝" x 4" x 3")	or,
4 Kwik-Lite No. 225	Plate Batteries	(6¾" x 4" x 3")	or,
4 Ace No. 115	Plate Batteries	(6⅝" x 4" x 3")	or,
4 Yale No. 1512-V	Plate Batteries	(6½" x 4" x 3")	or,
4 Bright Star No. 15-90	Plate Batteries	(6½" x 4" x 3")	or,
4 Novo No. 268	Plate Batteries	(6½" x 4" x 3")	

OR EQUIVALENT

Two 45 Volt Plate Batteries may be used instead of four 22½ Volt blocks if desired, such as:

2 Eveready No. 767	Plate Batteries (45 Volts)	(6" x 6⅝" x 3")	or,
2 Burgess No. 2306	Plate Batteries (45 Volts)	(7⅞" x 6⅝" x 3")	or,
2 Ray-O-Vac No. 2301	Plate Batteries (45 Volts)	(8½" x 6⅞" x 3¼")	or,
2 Novo No. 276	Plate Batteries (45 Volts)	(8" x 6½" x 3")	or,
2 Kwik-Lite No. 245	Plate Batteries (45 Volts)	(8¼" x 6¾" x 3")	or,
2 Bright Star No. 30-90	Plate Batteries (45 Volts)	(13" x 4" x 3")	or,
2 Yale No. 3045-V	Plate Batteries (45 Volts)	(8" x 6⅝" x 3")	or,
2 Ace No. 130	Plate Batteries (45 Volts)	(13¼" x 4" x 3")	

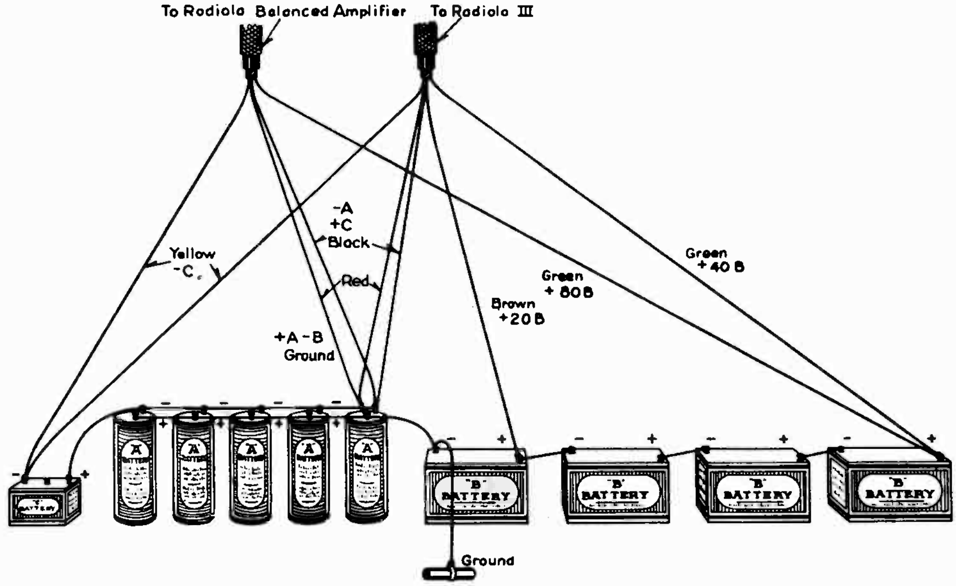


Fig. 1—Showing Connections for Batteries

OR EQUIVALENT

NOTE—The plate or "B" batteries listed are of the large sizes which are most economical. Other intermediate sizes may be used equally well.

(C) One 4½ Volt Negative Grid Bias or "C" Battery, such as:

1 Eveready No. 771 Negative Grid Bias Battery	(4″ x 3″ x 1⅜″)	or
1 Ray-O-Lite No. 231-R Negative Grid Bias Battery	(4″ x 3″ x 1 1/16″)	or,
1 Burgess No. 2370 Negative Grid Bias Battery	(4″ x 3″ x 1⅜″)	or,
1 Yale No. 312 Negative Grid Bias Battery	(4″ x 3″ x 1⅜″)	or,
1 Bright Star No. B-34-17 Neg. Grid Bias Battery	(4″ x 3″ x 1⅜″)	or,
1 Novo No. 288 Negative Grid Bias Battery	(4″ x 3″ x 1⅜″)	

OR EQUIVALENT

INSTALLATION

Location:

The input jacks on the Radiola Balanced Amplifier will be in line with the output jacks of the Radiola III when the Amplifier is placed at the left. Connections may be made by the jumpers furnished with the amplifier.

Connections to Batteries:

All battery connections are made through the flexible cables. Proceed as follows:

Connect the five 1½ volt dry cells in parallel, that is, connect all the center binding posts (positive) together with one piece of wire and then connect all the outside binding posts (negative) together with another piece of wire. Under no circumstances allow these two wires to touch each other.

Find the two black cable leads which are tagged "—A+C" and connect them to one of the outside (negative) battery binding posts.

Find the two red cable leads which are tagged "+A—B Gnd" and connect them to one of the center (positive) battery binding posts.

Turn the knobs marked "Battery Setting" to the left until the pointer rests on "Off". Remove the WD-11 Radiotrons from their packages and place them in the sockets taking care to push them in firmly until the bases rest against the socket panels. The large pin is toward the front of the set. Turn the "Battery Settings" until the pointers extend to the left. Look directly into each Radiotron to see that the filament glows dimly.

Then connect one end of a short piece of wire to the positive (+) terminal of the "C" battery and the other end to an outside (negative) terminal of one of the "A" battery cells.

Find the two yellow cable leads which are tagged "—C" and connect them to the "—4—½" terminal of the "C" battery.

Connect the four "B" batteries in series as shown in the figure. Using short pieces of wire, connect the negative (—) terminal of one block to a center (positive) terminal of one of the "A" battery cells. Then connect the positive terminal of the same block to the negative terminal of the second block and similarly, the positive of the second to the negative of the third and the positive of the third to the negative of the fourth.

Find the brown lead from the Radiola III cable which is tagged "+ 20 B" and connect it to the positive terminal of the first "B" battery.

Find the two green cable leads, the one from the Radiola III being tagged "+40B" while the one from the amplifier is tagged "+80B" and connect them to the positive terminal of the fourth "B" battery.

Connect one of the center (positive) terminals of an "A" battery cell to the ground clamp.

Connection of Loud Speaker—Push the tips on the end of the loud speaker cord into the jacks at the left side of the Amplifier panel.

OPERATION

Turn the knob marked "Battery Setting" to the right until both filaments glow with a dull red color. No other adjustments of the Amplifier can be made or need to be made. The Radiola III Receiver is to be operated according to the instructions supplied with it.

When the set is put out of use, turn the knob marked "Battery Setting" as far to the left as possible.

Difficulties—If the set fails to operate, there is always a definite reason. Carefully check all connections to see that they correspond with the directions given (See Figure 1) noting particularly the polarity of all the batteries. See that the filaments of both Radiotrons glow at a dull red heat. If there is no sound whatsoever and the Radiola III Receiver is known to be operating well, the "B" battery connections to the Amplifier are probably reversed.

MAINTENANCE

Radiotrons—The WD-11 Radiotrons may become inoperative through a broken filament or otherwise, in which case they should be replaced by new ones of the same type.

Filament or "A" Battery—When the dry cells used for this purpose become discharged to the point where they will no longer heat the filaments to the proper brilliancy, they should be replaced by new ones.

Plate or "B" Battery—If large size "B" batteries are used, they should last for several months and frequently longer. When signals become weak with the filaments at proper temperature, the "B" batteries should be replaced by new ones.

Bias or "C" Battery—If the bias battery is replaced by a new one every time the "B" battery is replaced, it should give no trouble.

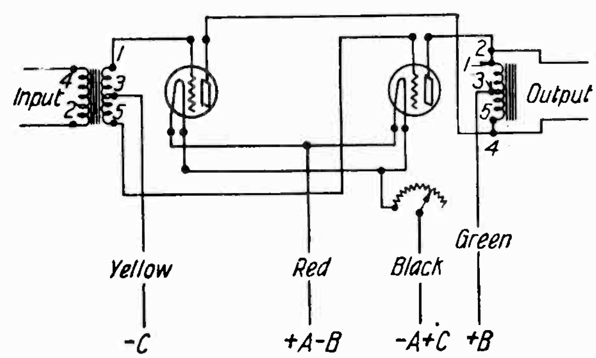


Fig. 2—Diagram of Connections

RADIOLAS III, III-A AND BALANCED AMPLIFIER USING RADIOTRONS UX-199 AND UX-120

As Radiolas III, III-A and Balanced Amplifier were originally designed and equipped with Radiotrons WD-11 a few slight changes in connections and operation become necessary when Radiotrons UX-120 are used, as follows:

RADIOLA III-A

In the case of the Radiola III-A two approved methods of use are suggested: the first being particularly recommended to the layman because of its simplicity; the second being recommended to the dealer who has a service man at his disposal, or to the owner who has the equipment for making the necessary changes.

Method I: (See Figure 1)

A six ohm Rheostat is connected in the battery circuit as shown in Figure 1. The following equipment will be required:

1 Radiola III-A (Stripped)
1 Radiola Loud Speaker UZ-1325 or Model 100
1 Radiotron UX-199 for detector socket
3 Radiotrons UX-120 for other sockets
4 Na-Ald Adapters Model No. 421-X or Marco Adapters No. 206
1 Six ohm Rheostat (table mounting type)
1 Five foot length lamp cord.
"A" Battery consisting of six standard dry cells, 1½ volts each, such as:
6 Burgess No. 6 Dry cells or
6 Eveready Dry Cell Radio "A" Batteries No. 7111 or
6 Columbia Ignitor No. 6 Dry Cells or
6 Ray-O-Vac No. 1211 Dry Cells

OR EQUIVALENT

"B" Battery consisting of three 45 volt extra large Heavy Duty plate batteries, such as:

3 Burgess No. 10308 plate batteries or
3 Eveready No. 770 or No. 486 plate batteries or
3 Ray-O-Vac No. 9303 plate batteries

OR EQUIVALENT

"C" Battery consisting of one 22½ volt plate battery (with taps for variable voltage) such as:

1 Burgess No. 2156 or
1 Eveready No. 766 or
1 Ray-O-Vac No. 2151

OR EQUIVALENT

Before connections are made, the external Rheostat should be turned to its "OFF" position (so that movable arm does not touch resistance winding). All connections should then be checked against Figure 1.

It is important that adapters be fastened to the Radiotrons *before* they are inserted in the sockets of the Radiola. The UX-199 Radiotron is inserted in the detector socket, which is the one nearest the antenna binding posts.

Both "BATTERY SETTING" controls should be set and *permanently* left FULL ON, —that is, turned as far as possible in a clockwise direction.

The filament current to the Radiotrons is turned ON and OFF and is entirely regulated by means of the *external* six ohm Rheostat, which for convenience may be mounted on the side or end of the case of the Radiola.

To insure long life to both Radiotrons and batteries, the external Rheostat should not be advanced any further than necessary to obtain normal results. However, as the voltage of the

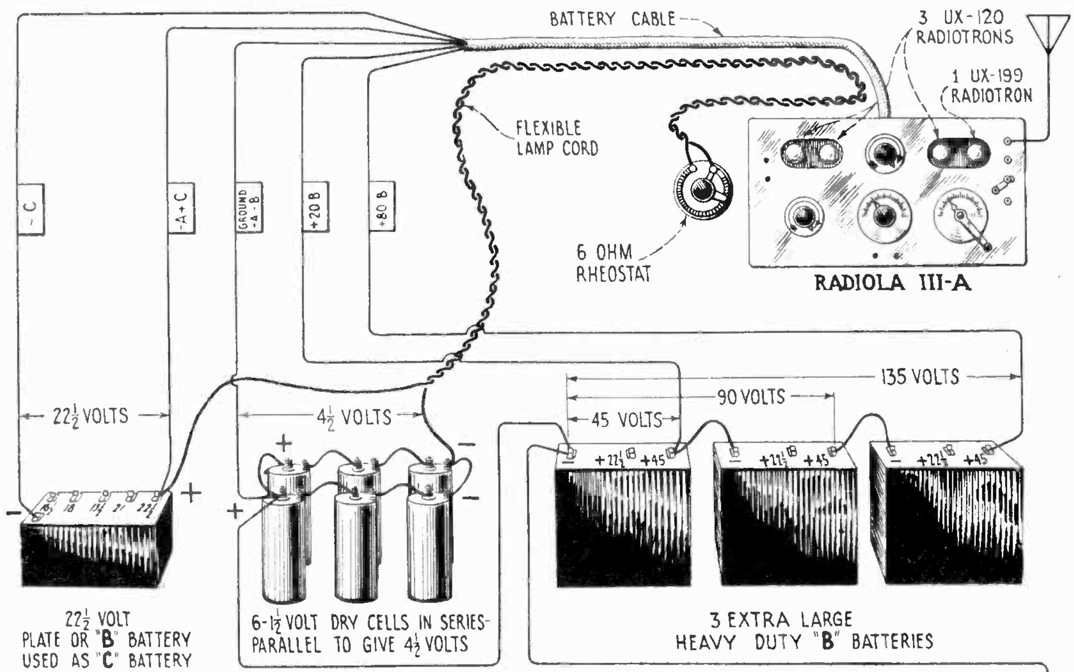


FIGURE 1

RADIOLA III-A
1 UX-199 RADIOTRON
3 UX-120 RADIOTRONS

"A" battery decreases thru use, it will be necessary to advance the setting of the external Rheostat to maintain normal filament terminal voltage. "A" battery renewal is not required until it becomes necessary to advance the external Rheostat to its maximum current position to obtain normal results.

Important: Do not attempt to operate the set with only two of the Radiotrons lighted, for by so doing, excessive filament voltage will be applied.

Method II: (See Figure 2)

No additional Rheostat is required. Only the controls on the panel are used. Two changes in the wiring by which the rheostats of the Radiola are connected in series, will be required as shown in Figure 2.

Equipment required for operation is the same as in Method I above except the external Rheostat and lamp cord are not required. The following tools are necessary to make the change:

1 Screw Driver
1 Small pair pliers
1 Soldering iron.

If it becomes necessary to use additional solder, rosin core string solder is recommended. In order to avoid trouble resulting from corrosion, soldering paste or acid should not be used.

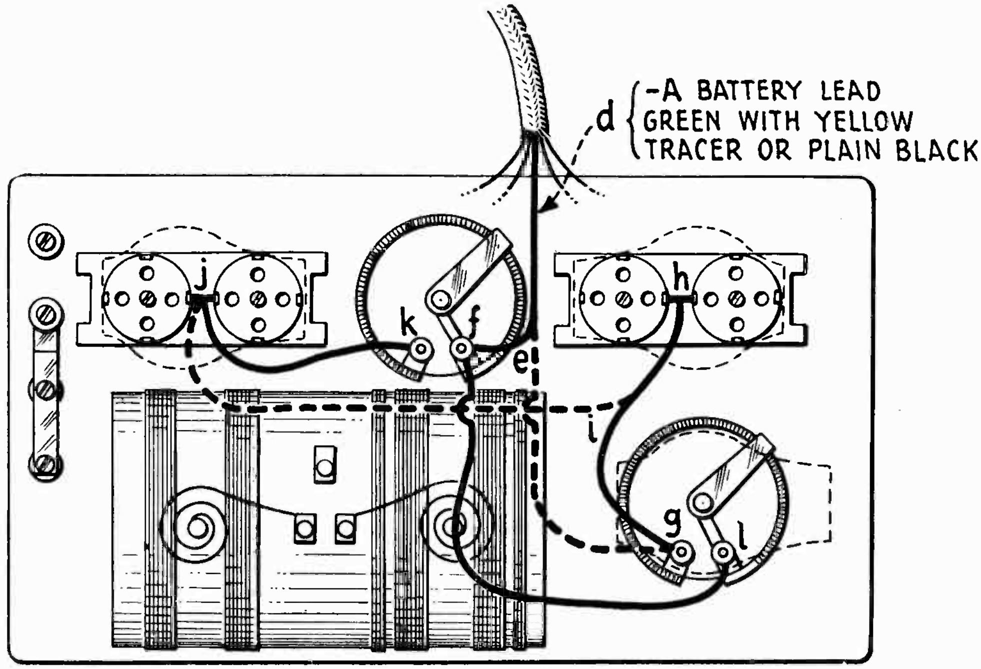


FIGURE 2

RADIOLA III-A

CHANGE WIRES AS FOLLOWS:-

d-e-f TO d-e-g

h-i-g TO h-i-j

j-k AND f-l REMAIN THE SAME

To change wiring of Radiola III-A refer to Figure 2 and proceed as follows:

(1) Remove screws at sides of wooden case. Push several inches of battery cable into case and lift panel.

(2) Untie strain cord which holds cable to frame of transformer.

(3) Unsolder black flexible lead "h-i-g" at "g" (fig. 2) and resolder it to "j".

(4) Without disturbing bus-bar "l-f", unsolder flexible battery cable lead "d-e-f" and resolder to "g" (from which a connection was just removed) thus forming the connection "d-e-g".

(5) Fasten strain cord to frame of transformer so that the individual cable leads are relieved of possible tension.

After either or both "BATTERY SETTING" controls have been set at "OFF", the UX-199 Radiotron with adapter attached should be placed in the socket nearest the Antenna Binding Posts. The UX-120 Radiotrons with adapters should be inserted in the other sockets. Batteries should be connected in the same manner as shown in Figure 1 except that the external rheostat and lamp cord are omitted, and a connecting wire must be added to join the "+C" and "—A" battery terminals.

In operation, both "BATTERY SETTING" controls must be slightly advanced from the "OFF" position to light the filaments of the Radiotrons. Regulation may then be obtained by means of either "BATTERY SETTING" control. "A" Battery renewal is not required until it becomes necessary to advance both "BATTERY SETTING" controls (in a clockwise direction) to their maximum current positions to obtain normal results.

Keeping the "BATTERY SETTING" controls as low as possible consistent with normal operation, insures long life to both Radiotrons and batteries.

RADIOLA III AND BALANCED-AMPLIFIER

Best operation of the Radiola III and Balanced-Amplifier will be realized when Radiola III is equipped with 2 UX-199 Radiotrons and Radiola Balanced-Amplifier with 2 UX-120 Radiotrons.

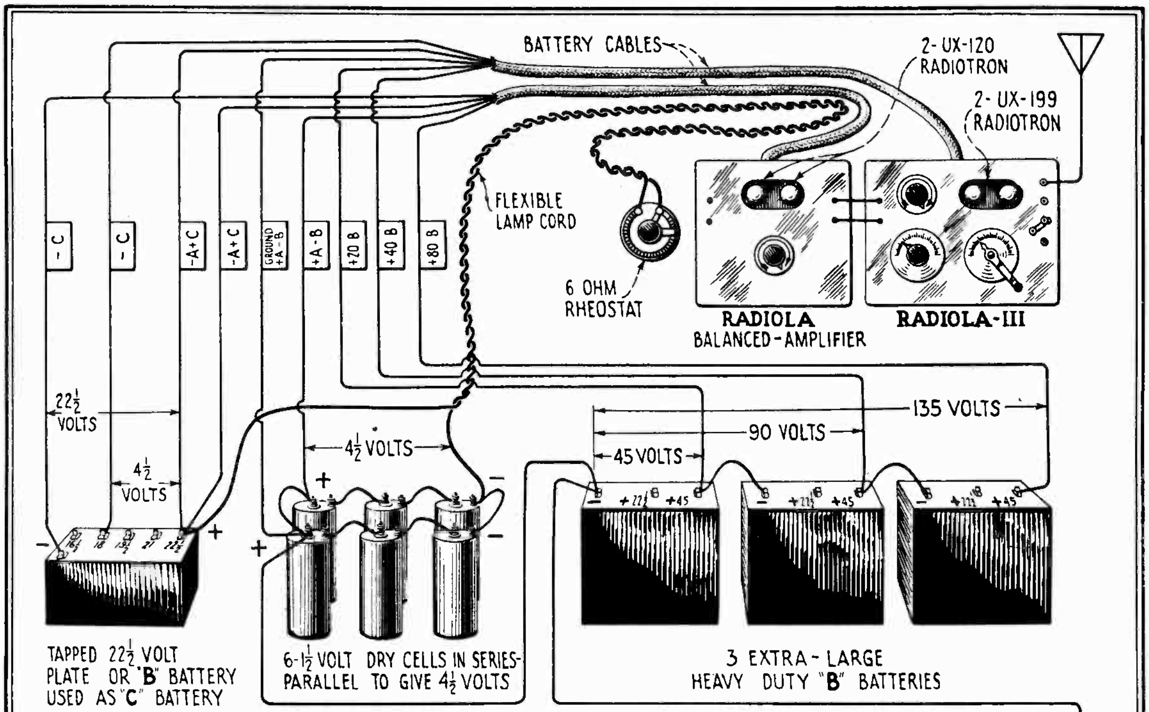


FIGURE 3

RADIOLA-III AND RADIOLA BALANCED-AMPLIFIER
2 UX-199 RADIOTRONS FOR RADIOLA-III
2 UX-120 RADIOTRONS FOR RADIOLA BALANCED-AMPLIFIER

A six ohm external rheostat is connected in the battery circuit according to the diagram in Figure 3. The following apparatus will be required:

1 Radiola III (stripped)
1 Radiola Balanced-Amplifier (stripped)
1 Radiola Loud Speaker UZ-1325 or Model 100
2 Radiotrons UX-199 for Radiola III
2 Radiotrons UX-120 for Radiola Balanced-Amplifier
4 Na-Ald Adapters Model 421-X or Marco Adapters No. 206
1 Six ohm Rheostat (table mounting type)
1 Five foot length lamp cord.
"A" Battery consisting of six standard dry cells, 1½ volts each, such as:
6 Burgess No. 6 Dry Cells or
6 Eveready Dry Cell Radio "A" Batteries No. 7111 or
6 Columbia Ignitor No. 6 Dry Cells or
6 Ray-O-Vac No. 1211 Dry Cells
OR EQUIVALENT

"B" Battery consisting of three 45 volt extra large Heavy Duty plate batteries, such as:

3 Burgess No. 10308 plate batteries or
3 Eveready No. 770 or No. 486 plate batteries or
3 Ray-O-Vac No. 9303 plate batteries
OR EQUIVALENT

"C" Battery consisting of one 22½ volt plate battery *with taps for variable voltage* (tapped battery necessary in this case) such as:

1 Burgess No. 2156 or
1 Eveready No. 766 or
1 Ray-O-Vac No. 2151
OR EQUIVALENT

Before connections are made, the external rheostat should be turned to its "OFF" position (so that movable arm does not touch resistance winding). All connections should then be checked against Figure 3.

It is important that adapters be fastened to the Radiotrons *before* they are inserted in the sockets of the Radiola. The 2 UX-199 Radiotrons with adapters are then inserted in the Radiola III and the 2 UX-120 Radiotrons with adapters in the Balanced-Amplifier unit.

Both "BATTERY SETTING" controls should be set and permanently left FULL ON, that is, turned as far as possible in a clockwise direction.

The filament current to the Radiotrons is turned ON and OFF and is entirely regulated by means of the *external* six ohm Rheostat, which for convenience may be mounted on the side or end of the case of either receiver or amplifier unit.

To insure long life to both Radiotrons and batteries the rheostat should not be advanced any further than necessary to obtain normal results. As the voltage of the "A" battery decreases thru use, however, it will be necessary to advance the setting of the external rheostat to maintain normal filament terminal voltage. "A" battery renewal is not required until it becomes necessary to advance the external rheostat to its maximum current position to obtain normal operation.

Important: Do not attempt to operate the set with only two of the Radiotrons lighted, for by so doing, excessive filament voltage will be applied.

RADIOLA III

Improved operation of the Radiola III may be realized when it is equipped with the new type Radiotrons. Two methods are here suggested: the first is particularly recommended for reception of signals from distant broadcast stations where higher voltage amplification is desired; and the second, which makes available greater loud speaker output without distortion, is particularly recommended for loud speaker operation from local stations where the input energy to the receiver is high.

Method I: (See Figure 4)

Two UX-199 Radiotrons are used with a 20 ohm external Rheostat to control the filament current. The following equipment is required.

1 Radiola III (Stripped)
1 Radiola Loud Speaker UZ-1325 or Model 100
2 Radiotrons UX-199
2 Na-Ald Adapters Model 421-X or Marco Adapters No. 206

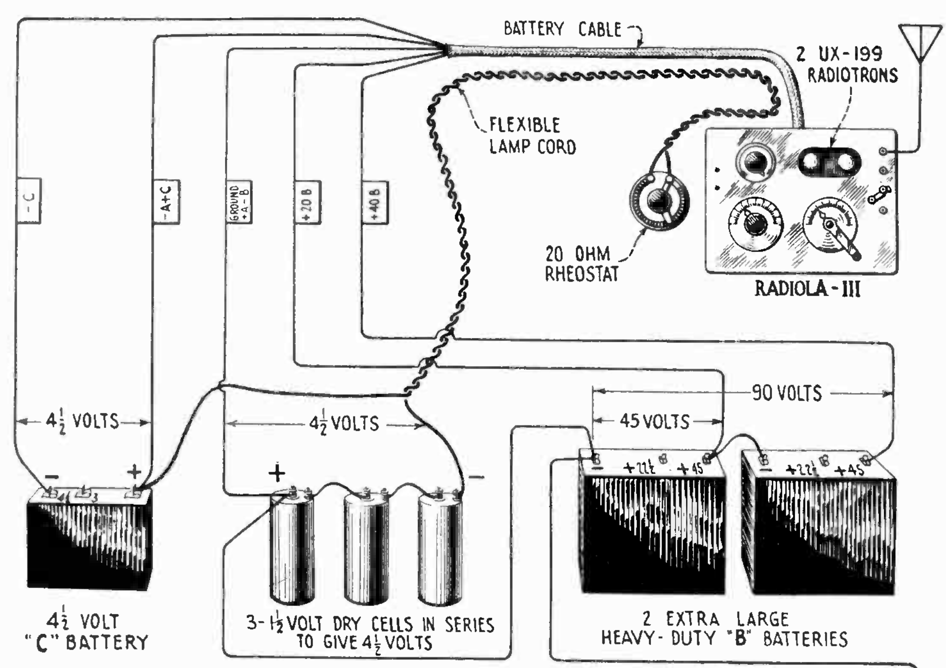


FIGURE 4

RADIOLA - III
2 UX-199 RADIOTRONS

1 Twenty ohm Rheostat (table mounting type)
1 Five foot length of lamp cord.
"A" Battery consisting of three standard dry cells 1½ volts each, such as:
3 Burgess No. 6 Dry cells or
3 Eveready Dry Cell Radio "A" Batteries No. 7111 or
3 Columbia Ignitor No. 6 Dry Cells or
3 Ray-O-Vac No. 1211 Dry Cells

OR EQUIVALENT

"B" Battery consisting of two 45 volt large or extra large plate batteries, such as:

	Large		*Extra Large*
2 Burgess	No. 2308	or	10308 or
2 Eveready	No. 772	or	486 or 770 or
2 Ray-O-Vac	No. 2303	or	9303

OR EQUIVALENT

"C" Battery of 4½ volts, such as:
1 Burgess No. 2370 or
1 Eveready No. 771 or
1 Ray-O-Vac No. 231-R

OR EQUIVALENT

Method II: (See Figure 5)

One UX-199 Radiotron is used in the detector socket (nearest the antenna binding posts), and one UX-120 Radiotron is used in the amplifier or left hand socket. As in Method I, a 20 ohm external Rheostat is used to control the filament current.

The following equipment is required.
1 Radiola III (stripped)
1 Radiola Loud Speaker UZ-1325 or Model 100
1 Radiotron UX-199 for the detector socket
1 Radiotron UX-120 for the amplifier socket
2 Na-Ald Adapters Model 421-X or Marco Adapters No. 206
1 Twenty ohm Rheostat (table mounting type)
1 Five foot length of lamp cord.
"A" Battery consisting of three standard dry cells 1½ volts each, such as:
3 Burgess No. 6 Dry Cells or
3 Eveready Dry Cell Radio "A" Batteries No. 7111 or
3 Columbia Ignitor No. 6 Dry Cells or
3 Ray-O-Vac No. 1211 Dry Cells

OR EQUIVALENT

"B" Battery consisting of three 45 volt large or extra large plate batteries, such as:

	Large		*Extra Large*
3 Burgess	No. 2308	or	10308 or
3 Eveready	No. 772	or	486 or 770 or
3 Ray-O-Vac	No. 2303	or	9303

OR EQUIVALENT

"C" Battery consisting of one 22½ volt plate battery (with taps for variable voltage), such as:
1 Burgess No. 2156 or

1 Eveready No. 766 or
1 Ray-O-Vac No. 2151

OR EQUIVALENT

Figure 5 shows diagram of connections.

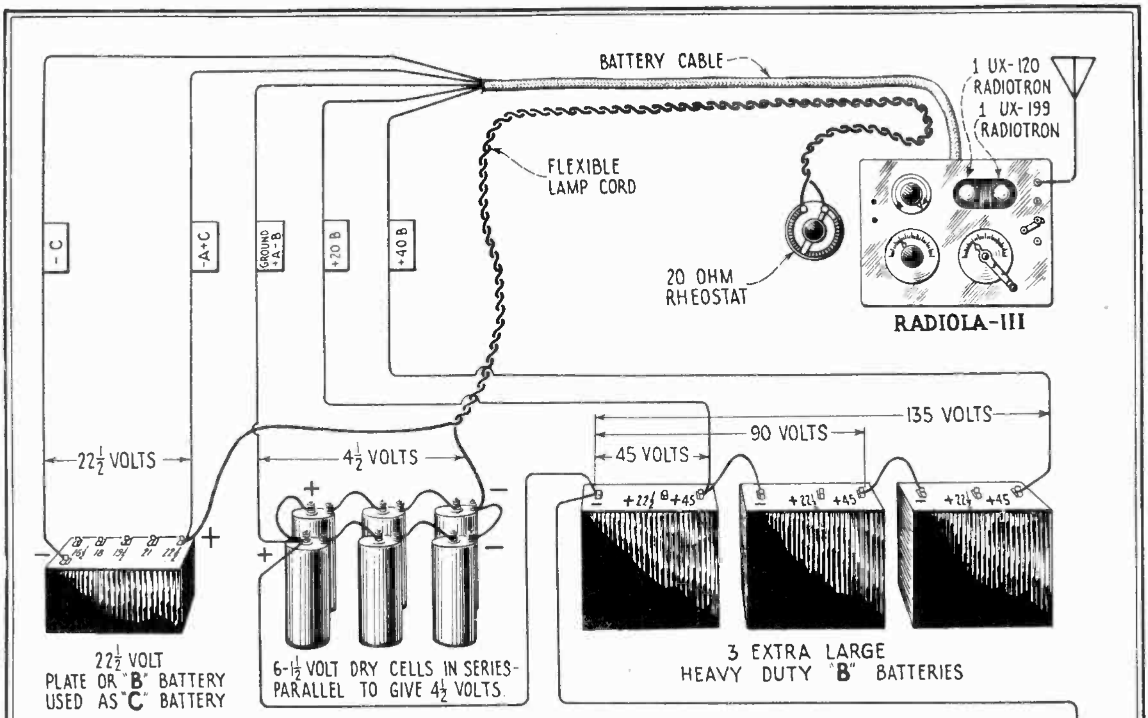


FIGURE 5

RADIOLA-III
1 UX-199 RADIOTRON
1 UX-120 RADIOTRON

Before connections are made the *external* Rheostat should be turned to its "OFF" position (so that movable arm does not touch resistance winding). All connections should then be checked against Figure 5.

It is important that adapters be fastened to the Radiotrons *before* they are inserted in the sockets of the Radiola. The UX-199 Radiotron is inserted in the detector socket which is the one nearest the antenna binding posts.

The "BATTERY SETTING" control should be set and permanently left FULL ON, that is, turned as far as possible in a clockwise direction.

The filament current to the Radiotrons is turned ON and OFF and is entirely regulated by means of the *external* twenty ohm Rheostat, which for convenience may be mounted on the side or end of the case of the receiver.

Important: Keep the external Rheostat setting as low as possible consistent with normal operation to insure long life to Radiotrons and batteries.

Radiola IV

INTRODUCTION

RADIOLA IV is a complete dry cell operated vacuum tube regenerative receiver and amplifier, including a self-contained loud speaker. The only accessories not provided are the antenna equipment and ground connection. Full instructions are given in another section for the erection of antenna and for the ground connection.

UNPACKING

UNPACKING Radiola IV is so important a step that it will be found well worth while to follow these directions carefully. Radiola IV is wrapped in waxed paper as a protection against moisture, and is suspended in a special shock absorbing cradle. The rounded openings at either side of the case allow place for the hands to grasp the entire cradle and lift it free from the case. Next cut away the suspension strings of the cradle, care being taken that Radiola IV is subjected to no severe jars as it is removed.

Remove waxed paper; turn cabinet bottom side up, placing it on a smooth soft surface to avoid scratching or marring the finish. When turning or handling cabinet, care should be used to prevent cover from opening, thereby damaging the finish, stay joint or hinges.

A package containing four (4) wooden feet and eight (8) screws will be found in bottom of packing case, held in place by burlap strip nailed to cleat.

These wooden feet are marked 1, 2, 3, 4, corresponding to same marks on bottom of cabinet. Feet should be screwed to cabinet and cabinet turned over and placed on its feet. Care should again be used in turning to keep cover closed.

The top of the case should now be lifted, whereupon the automatic catch will hold it in position. This exposes the vacuum tube cradle and the battery racks. No attempt should be made to remove the box to the right before the battery terminal board which holds it has been removed: loosening the thumbscrews at either end will accomplish this. The box contains a pair of sensitive telephone receivers, a plug to accommodate the telephone cord tips, flexible silk covered connection cords with plugs for connecting to the antenna and ground posts of the antenna protector, two short connectors for use in connecting the three dry cells ("A" battery) and one UV-199 Radiotron.

In the left rear of the cabinet interior there is a three compartment casting for holding the dry cells ("A" battery) in place. For shipment, these compartments are used to hold three of the four vacuum tubes supplied with the set. The thumbscrews of the large clamp should be loosened to remove the tubes in their wadding.

The necessary batteries specified below are packaged separately and will be supplied by the retail dealer.

BATTERIES REQUIRED

A. Three dry cells 1½ volts each, for lighting the filaments, 2⅝ in. diameter or square by 6½ in. high, such as Columbia No. 6, Mesco "Red Seal," Burgess "Super Six," or equivalent. Either the square or round style may be used.

B. Four "B" or plate batteries, each 22½ volts, 2 9/16 in. x 2¾ in. x 4⅛ in., such as Burgess No. 5156 BP, Eveready No. 768, or equivalent.

C. One "C" or grid bias battery, 4½ volts, ⅝ in. x 1¼ in. x 2¼ in., such as Burgess No. 432, Eveready No. 751, or equivalent.

INSTALLING BATTERIES

BATTERY installation may begin with the small 4½-volt grid bias battery, similar to that used in flat pocket flashlights. This should be inserted in the special compartment provided in the rear of the right hand or "B" battery rack, in such position that its protruding brass strips will make connection with the spring contacts projecting to the rear from the under side of the long battery terminal board which holds the "B" batteries in place. The negative (long post) of the grid bias battery should be placed toward the right. The battery clamp should not be fastened down, however, until the four oblong, 22½-volt "B" batteries have been placed in their compartments.

The four "B" batteries are placed side by side in their compartment as shown in Fig. 1. Counting from the left, the first and third batteries are located with their (−) binding posts toward the rear, and the second and fourth batteries with their (+) red leads toward the rear.

Next, the three 1½-volt dry cells should be placed in the rack at the left and made secure by tightening the thumbscrews. These are connected *in series* by means of the two short connectors which come packed in the box with the head telephones (see Fig. 1). Starting from left to right on the three cells in their rack, fasten one end of a connector to the minus or edge post of cell No. 1 at the extreme left, to the plus or center post of cell No. 2. The second connector should be used to connect cells No. 2 and 3 in the same manner. Then the several wires which attach to the terminal board of the radio unit should be connected to the different batteries as follows:

1. The gray wire tagged "A+4½ V." connects with the center (Positive) post of the "A" dry cell at the extreme left.
2. The green wire tagged "+Bias" connects with the left hand terminal post, marked "+Bias" on the battery terminal board.

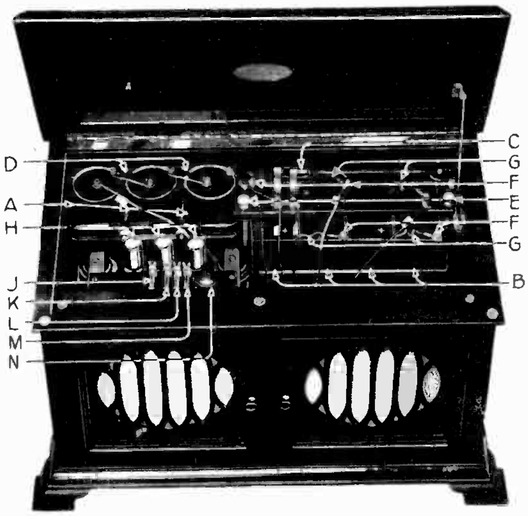


Fig. 1 Interior View Showing Battery Connections

A—1½-volt dry cells ("A" battery—square or round style may be used).
B—22½-volt dry batteries ("B" battery).
C—4½-volt dry battery ("C" battery—long blade toward right).
D—Jumpers.
E—Clamping screws for battery board.
F—Minus (−) binding post terminals
G—Plus (+) red leads.
H—UV-199 Radiotrons.
J—6 to 9 Megohm grid leak.
K—Highest Value Transformer Resistance.
L—Medium Value Transformer Resistance.
M—Lowest Value Transformer Resistance.
N—Volume Control.

3. The golden brown wire tagged "-Bias" connects with the next terminal post to the right marked "-Bias" on the battery terminal board.
4. The small green wire jumper marked "A-4½ V."attached to the terminal marked "+Bias" connects with the edg (-) post of the third "A" dry cell.
5. The black wire tagged "-90 V." connects with the negative (-) binding post terminal in the left rear corner of the left hand "B" battery.
6. The yellow wire tagged "B+45 V."connects with the binding post terminal in the left rear corner of the third "B" battery from the left.
7. The red wire tagged "+90 V." connects with the right hand terminal post marked "+90 V." on the battery terminal board.
8. The red flexible lead (+) in the left rear corner of the right hand "B" battery is also connected to this terminal marked "+90 V."
9. The three remaining red flexible "B" battery leads (positive) are connected to the negative binding post terminals of the adjacent battery to the right.
10. The two brown silk covered flexible wires with plugs connect with the Antenna and Ground posts of the antenna protector and plug into their respective jacks at the rear of Radiola IV. The plug with the red insert should be used as the Antenna Plug.

OPERATION

Vacuum Tube Precautions. Due to the unusually small filament, the vacuum tubes should be very carefully handled.

Before inserting the tubes, be sure that the filament rheostat on the panel is "OFF."

Do not forget to turn the filament pointer to "OFF" when the set is not in use, for if tubes are left lighted, their life and the life of the battery will be prematurely shortened. Each time the tubes are used, it is well to look inside to see that all three are lighted and not at excessive temperature.

Insert one tube in each of the three sockets, and put the extra tube, in its wrapping, down in the bottom of the cabinet. In putting the tubes into the sockets, turn the tube until the pin drops into the slot, then turn slightly to the right.

Before closing the cover, be sure that the small "volume control" switch on the top of the radio unit is turned toward the rear of the set.

Now turn on the filaments as explained in next paragraph, set the "INTENSITY" pointer at zero and the set may be tuned.

Filament. The "FILAMENT" knob controls the brilliancy of the filaments. When the batteries are new, the proper setting of the filament pointer should be somewhere between 1 and 4. As the batteries grow older, it will be necessary to turn the pointer further to secure normal operation.

When a station is heard, slowly decrease the filament brilliancy until the signal strength begins to diminish, then increase the brilliancy just sufficient to restore full signal strength. Burning the filaments brighter than necessary decreases the life of the vacuum tubes.

Tuning. Tuning involves the manipulation of the wavelength control so that the apparatus may be adjusted for a maximum signal from the broadcasting station. First, the head telephones should be connected to the plug and inserted in the jack marked "STAGE 1." After adjustments have been made, the plug may be removed, which will automatically throw on the loud speaker. The "WAVELENGTH" knob should be rotated very slowly back and forth over its scale until a voice or music is heard in the head telephones. When the wavelength control has been adjusted at the point where the sound is loudest, the next step is to increase its intensity.

The final careful adjustment of the "WAVELENGTH" control should be made by turning the "VERNIER" knob in the bottom center of the panel.

Intensity. For the proper regulation of the "INTENSITY" control, one should grasp the wave changing control with the left hand, and the "INTENSITY" knob with the right. Now, with the right hand, advance the "INTENSITY" pointer to the position where best increase of signal strength is obtained.

Should it be advanced too far, a click will be heard in the telephones and then all signals will have a "mushy" sound. *At this point the receiver becomes a transmitter and seriously interferes with neighboring radio receivers. This condition of oscillation must be avoided, but if it does occur, immediately turn the intensity control backward until the signal clears up.*

When the "INTENSITY" knob has been adjusted to the position at which it works loudest and clearest, both the "WAVELENGTH" and "INTENSITY" pointers may be turned slightly back and forth, until the utmost degree of regeneration is obtained. The point just before oscillations start is the most sensitive and most selective condition of the receiver. There is also a condition in which the tubes are on the verge of oscillating. The signals are heard, but the quality is very poor. This condition can be avoided by turning the "INTENSITY" control slightly in the direction of zero.

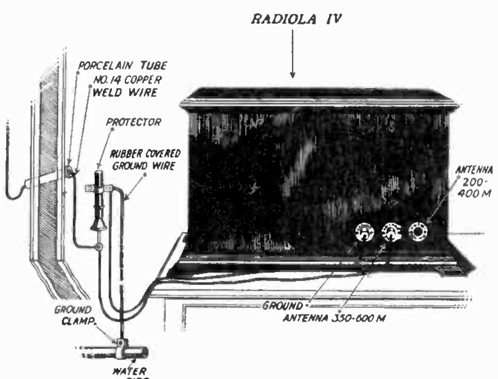


Fig. 2. Installation of Radiola IV

If the signals are coming from a nearby station, they may be so powerful that the amplifying tubes increase them to an intensity greater than necessary. This will also give poor quality of reproduction. The little switch inside the set and adjacent to the tubes gives three steps of decreasing intensity with increasing clarity, as the switch is turned toward the front of the set. Be sure to turn it back when you wish to listen for distant signals. Further reduction in signal strength may be obtained by using a small antenna, by turning the "INTENSITY" knob counter-clockwise, or by slightly detuning the signal with the "WAVELENGTH" knob. This simultaneous adjustment of "WAVELENGTH" and "INTENSITY" knobs is simple enough for any one to perform, yet there is a proficiency which comes of practice that will enable one to make the more careful adjustments necessary to the tuning and amplification of more distant stations. To obtain extreme ranges from Radiola IV, the head telephones should be plugged in the jack of "STAGE 2" on the control panel. The loud speaker is automatically disconnected when this is done. When the head telephones are not in use, they may be placed inside the cabinet, over the horn.

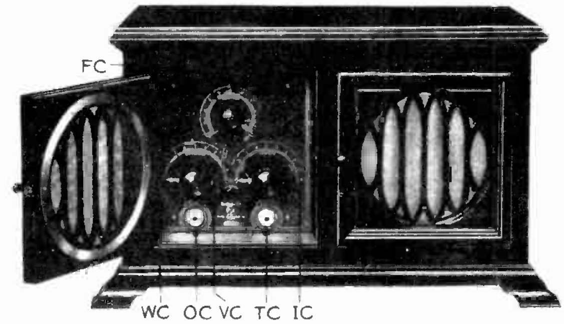


Fig. 3. Front View of Control Panel

FC—**Filament Control.**
WC—Wavelength Control.
IC—Intensity Control.
VC—Vernier Control.
OC—First Stage Telephone Jack.
TC—Second Stage Telephone Jack.

GENERAL INFORMATION

Care and Maintenance. The antenna and ground should be inspected occasionally to see that connections have not become corroded, and that insulators are not dirty or broken. Poor connections or bad insulators will increase the energy losses in the system and will give poor and irregular reception. It will also be well, after the set has been in service a year, to put a drop (not more) of oil on the intensity and wavelength shaft bearings inside the set. Clean the exterior surface of the cabinet as you would any fine piece of furniture.

Replacements. The batteries and the tubes are the only parts that will need to be replaced, unless some other part is accidentally broken.

To replace the batteries, first carefully disconnect all wires from the batteries themselves, and remove the old batteries from the racks. It is not necessary to disconnect the leads from terminal boards.

POSSIBLE DIFFICULTIES

Faulty Operation, Its Causes and Remedies. Anything which tends to increase resistance, or decrease insulation, will give poor operation. As the batteries grow old, they decrease in voltage, and increase in resistance. As the tubes grow very old, the filaments become less and less effective. Each fault however, suggests its own remedy.

1. Poor connections in antenna or ground wires or defective insulation of antenna.

2. "FILAMENT" control not properly adjusted.

3. Batteries exhausted (indicated by low filament brilliancy, weak signals and distortion).

4. Battery connections improperly made, poor or broken.

5. "INTENSITY" control not in correct adjustment.

6. Poor or broken connections in telephone cord or plug.

7. Inoperative vacuum tubes.

8. Glass tube resistances fallen out of their mountings.

If you are not sufficiently familiar with the technical points enumerated above call in the nearest Radiola dealer to assist you.

In general the troubles common to radio sets and in fact all electrical apparatus are reduced to a minimum in the Radiola IV

ERECTION OF ANTENNA

Outdoor Antenna. The receiving antenna is the exposed conductor by means of which a small portion of the energy sent out by the distant transmitter is collected. So far as possible, it should be placed above the tops of surrounding buildings and trees and must be thoroughly insulated so that no portion of the very small amount of energy picked up may be lost.

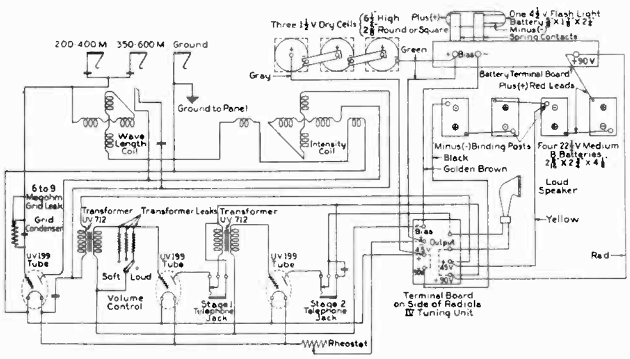


Fig. 5. Schematic Wiring Diagram of Radiola IV

Fig. 4 shows how to string the antenna wire and make the connections. A span of about 80 feet is desirable and should be 25 feet or more above the ground. In general, reception improves with increased height. If the suggested length and height cannot be secured approach them as nearly as possible. The antenna should be at right angles to electric light, power, and telephone wires and, if practicable, at least 15 feet distant from them. It must not be touched by any object except the insulators. The same precautions apply to the lead-in wire, which should be a continuation of the antenna wire without any joints and run as directly as possible to the receiver.

The ground wire (14 B.&S. gauge) should be connected as directly as possible by means of a ground clamp to the house water pipe, or to a pipe driven deeply into moist ground. The ground wire and the pipe should be well scraped and cleaned at the point of connection. For the protector use Model UQ-1310 which has been approved and listed by the Underwriters' Laboratories. Install it where the lead-in wire comes into the house. The antenna system as described and as shown in the diagram is in accordance with National Electric Code Standards.

The instrument should be located conveniently near to the protector. Attach the plug cords to the antenna and ground terminals of the protector, and plug them into the jacks in the rear of the set. There are two antenna jacks, one for wavelengths between 200 and 400 meters, and one for wavelengths between 350 and 600 meters. Since most of the broadcasting stations send on wavelengths between 360 and 400 meters, they may be received with the antenna plugged into either of the jacks. If the low wave jack is used, they will tune between 7 and 10, while if the high wave jack is used they will tune between 0 and 3 on the wavelength dial.

Indoor Antenna. In receiving nearby stations, an indoor antenna even as short as 20 to 30 feet will usually give satisfactory results and will have considerable selectivity. This is because of the extreme sensitiveness of the instrument. The indoor antenna may consist of a wire run the length of the attic or just below the ceiling of an ordinary size living room. The same ground connection is used as previously described.

RADIOLA V

MODEL AR-885

RADIOLA V, when used with an average antenna, will receive radio telephone and telegraph signals of any wavelength between 180 and 700 meters. By the use of the easily installed longwave coil system (Model UL-1340), the set can be changed to receive wavelengths of from 650 to 1150 and 1450 to 2800 meters. A regenerative tuning system, vacuum tube detector, and two stages of audio frequency amplification are provided. For head telephone reception from nearby broadcasting stations, a sensitive mineral detector is supplied.

For a complete equipment, the following items are required:

- RADIOLA V.
- One UV-200 Radiotron (Detector).
- Two UV-201 Radiotrons (Amplifiers).
- Batteries:
  - One 6-volt 40- to 80-ampere-hour storage battery.
  - Two 22½-volt "B" batteries (one with 18-volt tap).
- Antenna Equipment (ask for G-E Model AG-788).
- One Pair of Head Telephones with Plug (Model UD-824).

A loud speaker may also be used if desired.

ANTENNA SYSTEM

The accompanying drawing shows the correct arrangement of the antenna. A span of from 75 to 100 feet is desirable and should be 25 feet or more above the ground. Reception improves with increased height. If the suggested length and height cannot be secured, approach them as nearly as possible. The antenna should be at right angles to electric light, power, and telephone wires, and, if practicable, at least 15 feet distant from them. It must not be touched by any object except insulators. The same precautions apply to the lead-in wire, which should be a continuation of the antenna wire without any joints and run as directly as possible to the receiver. In receiving nearby stations, an indoor antenna even as short as 20 to 30 feet will usually give satisfactory results and will have considerable selectivity. The indoor antenna may consist of a wire run the length of the attic or just below the ceiling of an ordinary size living room.

Ground connection is a necessary part of every antenna. The ground wire (rubber covered No. 14 gauge) should be connected as directly as possible to the house water pipes by means of a ground clamp. If water pipes are not available, use a pipe driven deeply into moist ground and as near to the set as practicable. The ground wire and the pipe should be well scraped and cleaned at the point of connection. For a protector use Model UQ-1310 or some other approved device. Install it where the lead-in wire enters the house and connect as shown in the diagram. The installation described and shown in this diagram is in accordance with National Electric Code standards.

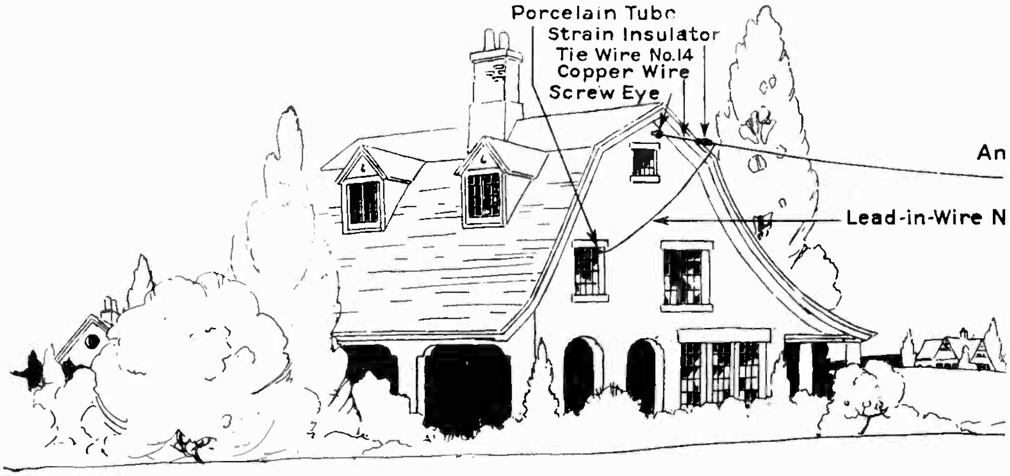
INSTALLATION

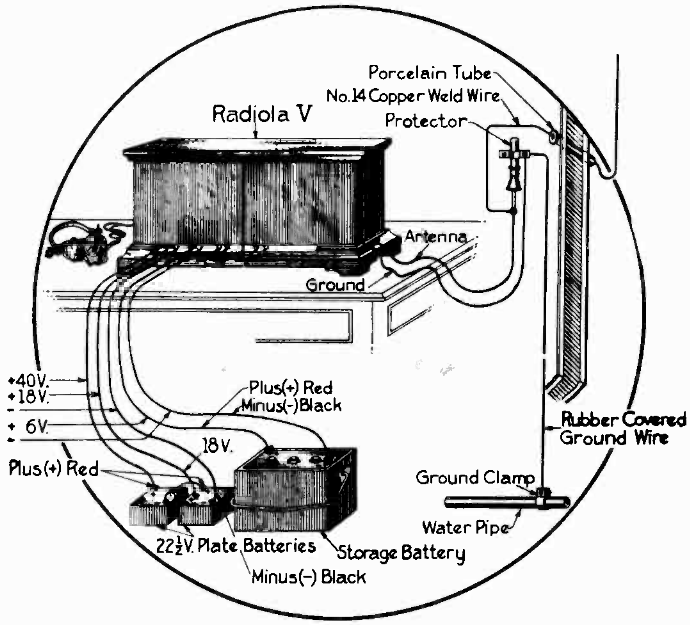
Locate RADIOLA V near the lead-in and protector. Lift the mahogany top and remove the covers of the units by pushing upwards on the catch and lifting the covers backward and up.

When making connections to the receiver, use a long screw driver. Insert the wire in the hole in the terminal before loosening the screw inside the case. Then loosen the screw until the wire can be pushed all the way in, after which tighten the screw.

Run a wire from the antenna terminal of the protector to the antenna terminal on the left end of the receiver. Connect the ground terminal of the protective device to the ground terminal on the left end.

Locate the storage battery in any convenient place. If this is at any considerable distance from the set, use heavy leads. Locate the plate "B" batteries as near the





receiver as possible. When using Radiotron UV-200 as a detector, make the battery and other connections as indicated on the diagram. When Radiotron UV-201 is used as a detector, omit the lead from the 18-volt terminal of the battery and connect together the "+18 V." and "+40 V." terminals on the rear of the receiver.

When using Radiotron UV-200 as a detector, better results are sometimes obtained by very accurate adjustment of the plate voltage. This can easily be accomplished by connecting the outside terminals of the Model PR-536 Potentiometer (purchased separately) across the 6-volt storage battery and the middle terminal to the negative (−) of the 40-volt plate battery, omitting the connections from the "−40 V." terminal of the receiver to the plate battery.

The terminals on the right end of the receiver are for use in connecting a loud speaker, which will be automatically disconnected when a telephone plug is inserted in any jack.

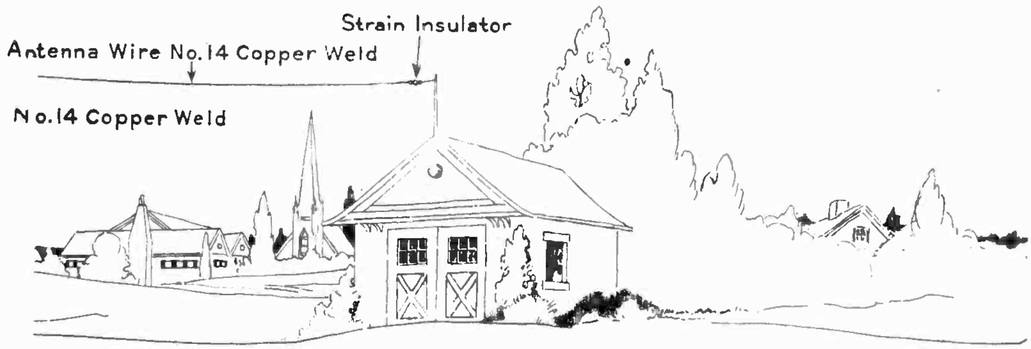
Before inserting the tubes, be sure that the filament knobs are set at "OFF." Place the tubes in the sockets as indicated in the cut and turn into place. The grid leaks should be in position in the clips as shown.

After the covers and top have been replaced, the illumination of the tubes can be observed through small holes in the front.

Radiola V is now ready for operation.

OPERATION

Adjust the telephones snugly to the ears and see that the telephone plug is properly connected to the cord from the phones.



USE OF CRYSTAL DETECTOR

Leave the filament knobs in the "OFF" position and bring the two detector minerals into contact, using the lower thumbscrew to adjust the pressure, and the upper knob to move the arm. Do not touch the metal parts. If there is any dirt or dust on the minerals, clean them by scraping lightly with a penknife. Insert the telephone plug in the left-hand jack.

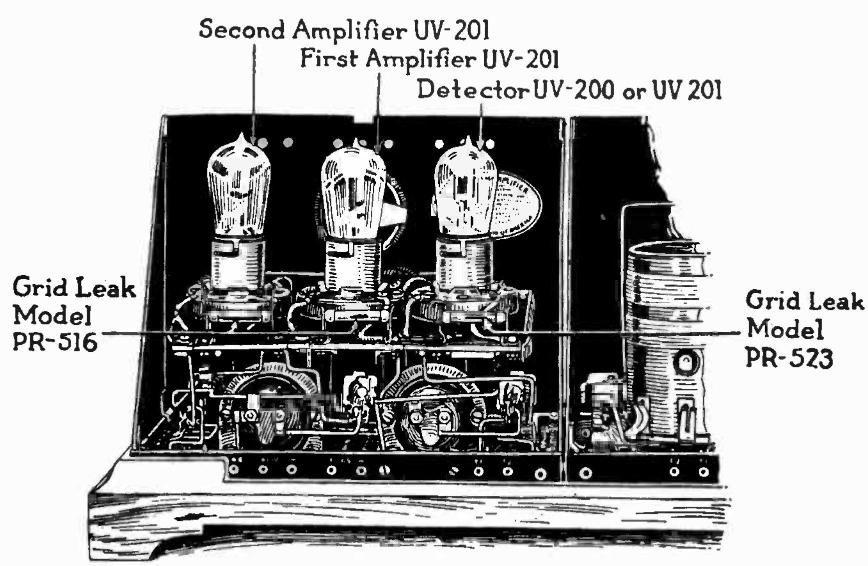
Move the "WAVELENGTH" knob slowly over the scale until signals are heard and let it remain at the point where they are loudest. The final adjustment for wavelength is made with the Vernier knob in the lower left corner. The detector may be readjusted in search of a more sensitive point. This completes the wavelength adjustment. Signals from 180 to 400 meters will be found between 0 and 100 on the dial, and from 380 to 700 meters between 100 and 200.

Always separate the minerals when they are not being used for crystal detector reception.

USE OF VACUUM TUBES

Turn the filament knobs counter-clockwise to bring the tube filaments to proper brilliancy. This is a little less bright than the ordinary incandescent lamp with UV-200 and UV-201 Radiotrons. Plug the telephones into the second jack from the left. A click should be heard in the telephone when the plug is inserted or withdrawn.

Set the "INTENSITY" knob at "0." Turn the "WAVELENGTH" knob slowly



until a signal is heard, and leave it at the point where the signal is loudest. If no signals are heard, or if they are very weak, slowly turn the "INTENSITY" knob clockwise, still searching for signals with the "WAVELENGTH" knob.

When signals are heard, turn the "INTENSITY" knob still farther to increase the signal strength. Should it be advanced too far, a click will be heard in the telephones and then all signals will have a "mushy" sound. At this point the receiver becomes a transmitter and seriously interferes with neighboring radio receivers. This condition of oscillation must be avoided, but if it does occur, immediately turn the "INTENSITY" control backward until the signal clears up.

Move the telephone plug to the next jack at the right. The signals will now be much louder, and slight readjustment of the "INTENSITY" and "FILAMENT" controls may be necessary, particularly the detector tube filament, to get maximum sensitivity. The second stage of amplification can then be added by moving the telephone plug to the last jack.

If a loud speaker is to be used, pull out the telephone plug and readjust the set in accordance with signals from the loud speaker.

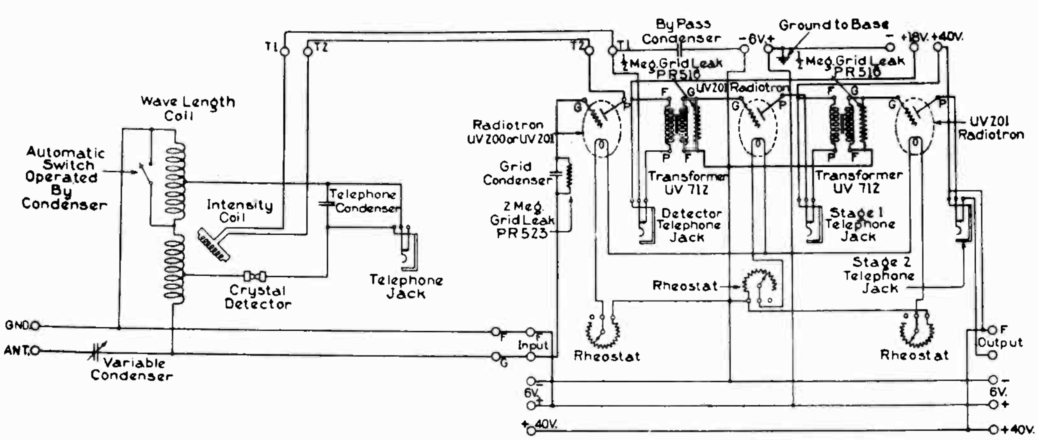
In some cases it may be possible to use both amplifying stages on the head telephones, but ordinarily the signals from the second stage will be too loud for comfort. The filament controls for tubes that are not in use should be turned to the "OFF" position.

If the loud speaker signals are not as loud as desired, they can be intensified slightly by removing the ½ megohm grid leaks from the clips in the rear of the two amplifier tubes. The purpose of these grid leaks is to improve the quality of the signal.

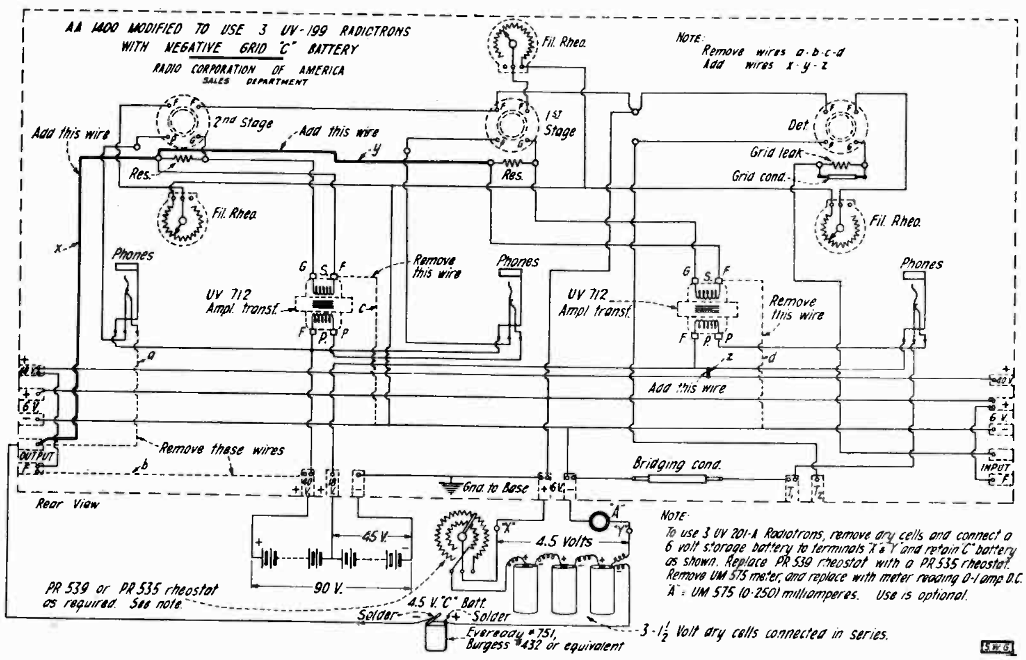
When the receiver is not in use, disconnect the batteries by turning all the filament knobs to the "OFF" position.

POSSIBLE CAUSES OF FAULTY OPERATION

(1) Poor or broken connections in antenna or ground wires, or defective insulation of antenna.
(2) "FILAMENT," "INTENSITY," or "WAVELENGTH" knobs improperly adjusted.
(3) Batteries exhausted (indicated by low filament brilliancy, or weak signals and noisy operation).
(4) Battery connection improperly made, or broken.
(5) Poor or broken connections in telephone cord or plug.
(6) Grid leak omitted.
(7) Coil system not properly seated in contacts.
(8) Inoperative vacuum tubes.



How to Add "C" Battery to Radiola V



RADIO CORPORATION OF AMERICA

RADIOLA VI

MODEL AR-895

RADIOLA VI provides three stages of RADIO FREQUENCY AMPLIFICATION, a VACUUM TUBE DETECTOR, and two stages of AUDIO FREQUENCY AMPLIFICATION over a wavelength range of from 200 to 5000 meters. It is designed for use on a loop antenna with a parallel variable air condenser for tuning purposes.

This method of radio receiving combines the advantages of directivity with a minimum of interference from static, and local electrical disturbances. The use of a loop eliminates the necessity of erecting an outdoor antenna. Either a loud speaker or head telephones can be used, depending on the distance from the broadcasting station.

The following material is required for a complete equipment:

Radiola VI
One UV-200 or UV-201-A Radiotron (Detector)
Five UV-201 or UV-201-A Radiotrons (Amplifiers)
Loop antenna (Model AG-1380 is recommended)
Variable Air Condenser of approximately 0.0007 to 0.001 microfarad maximum capacity (Model UC-1820 is recommended)

Batteries:
One 6-volt 80- to 120-ampere-hour storage battery
Two 22½-volt "B" batteries (one with 18-volt tap)
One Pair of Head Telephones with Plug (Model UD-824)

A loud speaker may be added if desired.

INSTALLATION

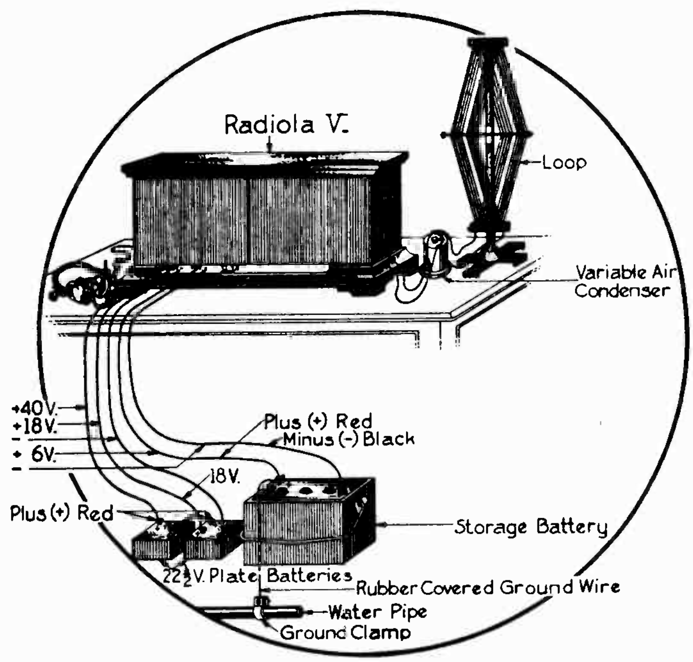
A loop for receiving broadcast wavelengths should consist of ten turns of wire such as single lamp cord or bare or stranded copper at least No. 18 B. & S. gauge spaced about ⅜ in. apart and wound upon a wooden frame three feet square. Provision should be made so that the number of turns in use may be varied from five to ten. Mount the loop so that it can be rotated about a vertical axis. With this loop use a small variable air condenser, about 0.0007 to 0.001 microfarad maximum capacity, to constitute the tuning system.

Set RADIOLA VI upon a table in a desirable place and put the loop and condenser immediately at the left. Lift off the mahogany top and remove the covers of the units by pushing upward on the catch and lifting the covers backward and up. Locate the storage battery in any convenient place. If this is at any considerable distance from the set, use heavy leads. Place the "B" batteries as near the receiver as possible.

When making connections to the receiver, use a long screwdriver. Insert the wire in the hole in the terminal before loosening the screw inside the case. Then loosen the screw until the wire can be pushed all the way in, after which tighten the screw. Connect the tuning condenser and loop in parallel and extend the connections to the two "INPUT" terminals on the left end of the unit.

When using Radiotron UV-200 as the detector, connect the batteries as shown in the diagram. When Radiotron UV-201-A is used as the detector (which will give less critical but not quite so good results as the UV-200), omit the lead from the 18-volt tap of the battery to the terminal marked "+18 V.," and connect the two terminals "+18 V." and "+40 V." on the rear of the set by a short wire.

When using Radiotron UV-200 as a detector, better results are sometimes obtained by very accurate adjustment of the plate voltage. This can easily be accomplished by connecting the outside terminals of the Model PR-536 Potentiometer (purchased separately) across the 6-volt storage battery and the middle terminal to the negative (−) of the 40-volt plate battery, omitting the connections from the "−40 V." terminal of the receiver to the plate battery.



If a loud speaker is used, it may be permanently connected to the "OUTPUT" terminals at the right end of Radiola VI. When thus connected, the loud speaker will automatically be disconnected when a telephone plug is inserted in any one of the jacks, and will automatically be reconnected when the plug is removed.

Turn all six "FILAMENT" rheostat knobs clockwise to "OFF" before putting the tubes in their sockets. Place a UV-200 Radiotron in the left-hand socket of the Detector-Amplifier unit, and UV-201 or UV-201-A Radiotrons in all the other sockets. The tubes are put in place by lining up the pin in the base with the slot in the socket, pressing downward on the tube, and then turning it to the right into position. The grid leaks should be in the clips as shown and need not be disturbed.

After the covers and top have been replaced, the illumination of the tubes can be observed through small holes in the front.

RADIOLA VI is now ready to operate.

OPERATION

Adjust the telephones snugly to the ears and plug into the left telephone jack, marked "DETECTOR." A click should be heard on inserting or removing the plug.

Turn the "FILAMENT" knobs counter-clockwise to bring the tube filaments to proper brilliancy. This is a little less bright than the ordinary incandescent lamp with

UV-200 and UV-201 Radiotrons, and is usually obtained with a setting of from 50 to 100 on the "FILAMENT" knobs. For proper illumination of the UV-201-A Radiotrons, see the instructions accompanying tubes. The setting of the dial in this case will usually be between 10 and 50. Whenever one or both of the audio frequency amplifier stages are not in use, turn the respective knobs to "OFF." This does not apply to the radio frequency amplifier, as all three of its tubes must be lighted when the set is in operation.

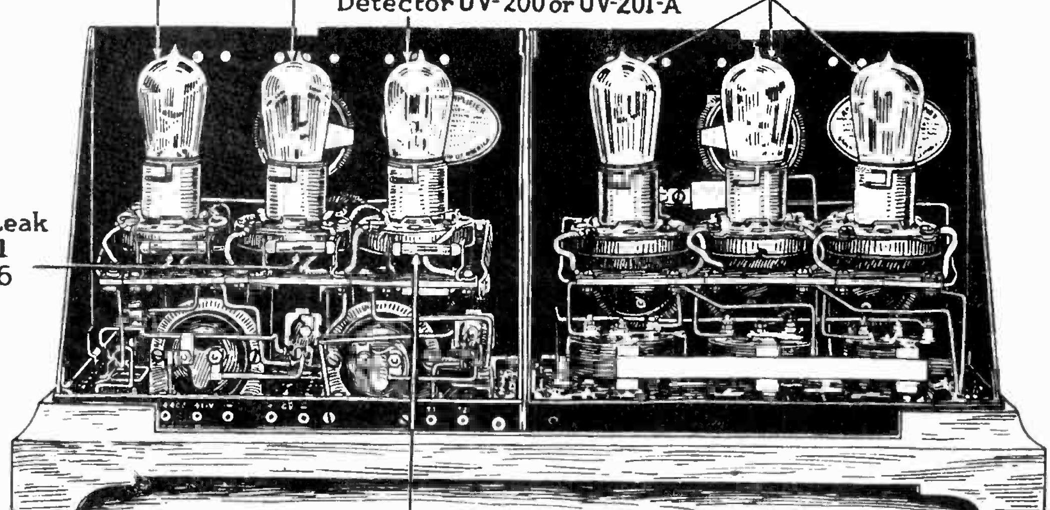
Turn the "STABILIZER" knob to about 50. Set the wavelength switch knob in the lower left corner to the proper position, pulling it out to receive wavelengths between 200 and 500 meters, and pushing it in for wavelengths between 500 and 5000 meters. Tune to the desired signal by turning the variable condenser knob over the scale until a signal is heard. Set the knob at the point where the signal is loudest. Rotate the loop about a vertical axis, setting it also in the position of the loudest signal. Experience in operation will indicate the correct number of turns of the loop which will give the most satisfactory results.

Adjust the "STABILIZER" knob to the position of best signal strength. The intensity will increase as the knob is turned clockwise, but at some position the signal quality will be destroyed. At this point the receiver becomes a transmitter and seriously interferes with neighboring radio receivers. This condition of oscillation must be avoided, but if it does occur, immediately turn the "STABILIZER" control backward until the signal clears up.

After "tuning in" by the above method, the telephone plug may be inserted in either the first or second amplifier stage with an accompanying increase of signal. Slight and careful readjustments of the rheostats may further improve the signal strength, but extremely fine adjustments will not be needed on the radio amplifier.

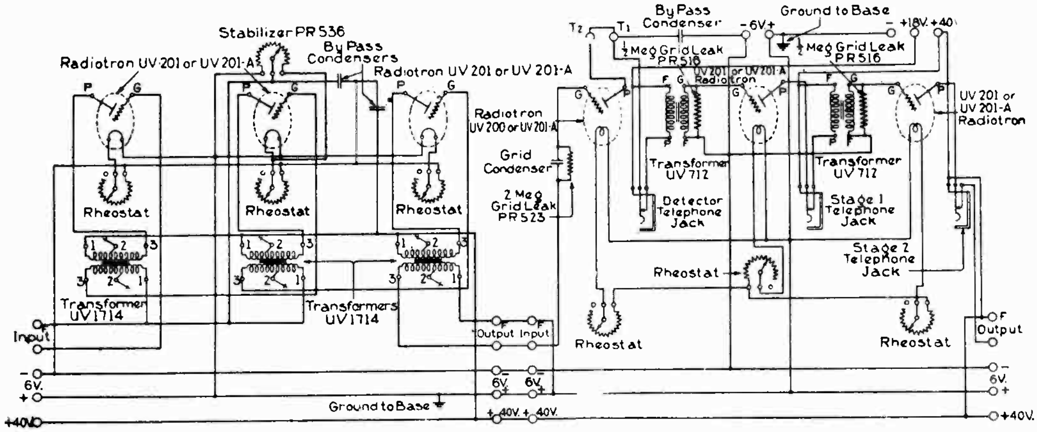
Further slight adjustments may be necessary when the telephone plug is removed and the loud speaker is placed in circuit. If the loud speaker signals are not as loud as desired, they can be intensified slightly by removing the PR-516 one-half megohm grid leaks from the clips at the rear of the two audio amplifier tubes. The purpose of these grid leaks is to improve the quality of the signal.

When the receiver is not in use, disconnect the batteries by turning all filament knobs to the "OFF" position. Turning the "FILAMENT" rheostats to "OFF" also cuts off the "STABILIZER" current.



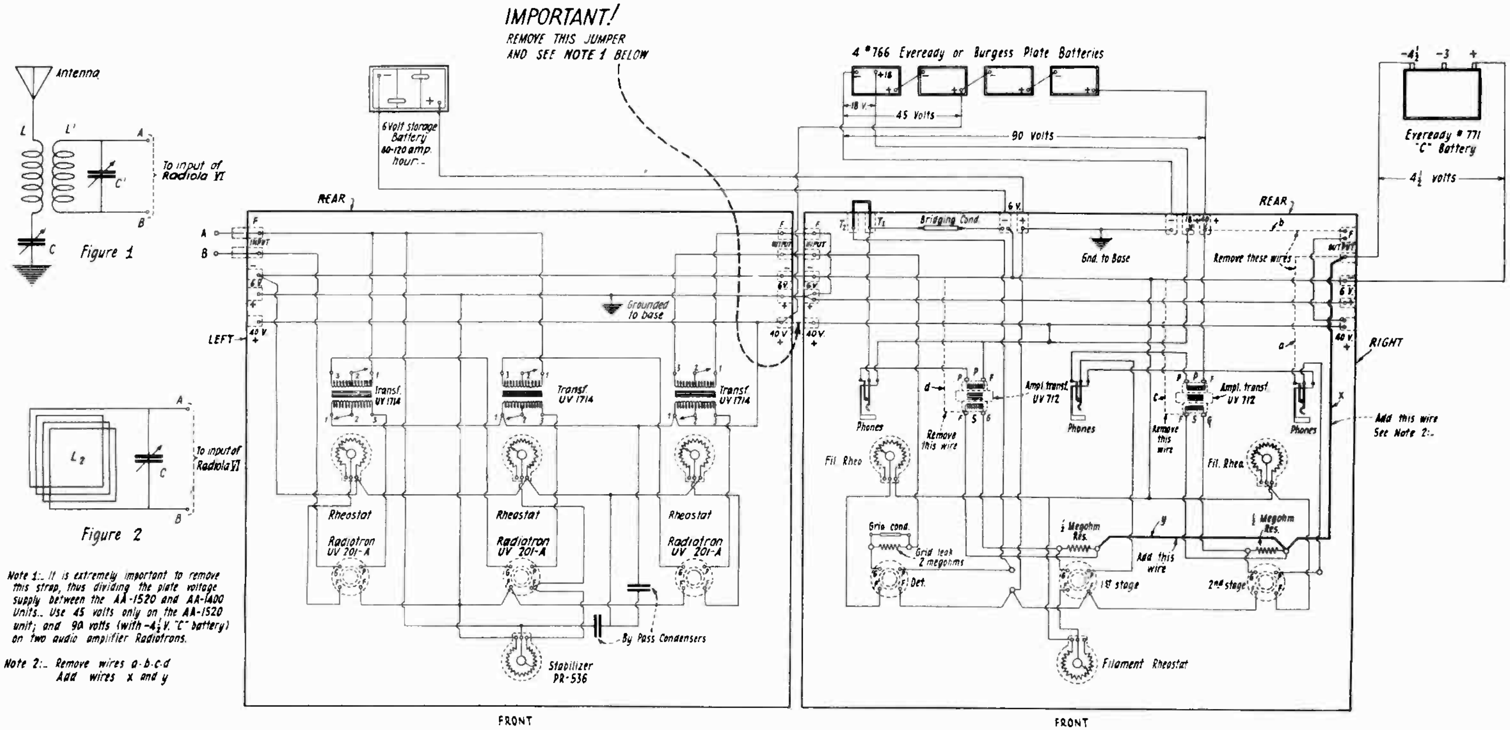
POSSIBLE CAUSES OF FAULTY OPERATION

(1) Poor or broken connections in loop wires or defective insulation of same.
(2) Filament rheostats not properly adjusted.
(3) Batteries exhausted (as indicated by low filament brilliancy or weak signals and noisy operation).
(4) Battery connections improperly made, poor, or broken.
(5) Stabilizer improperly adjusted.
(6) Poor or broken connections in telephone cord or plug.
(7) Inoperative vacuum tubes.
(8) Transformer wavelength switch in wrong position.
(9) Grid leak omitted.
(10) Loop and condenser not properly adjusted.



NOTICE

This device is not licensed except for amateur, experimental and entertainment radio use as defined and to the extent indicated in the current issue of the catalogue of the Radio Corporation of America. No express or implied license is granted under any patent owned by the Radio Corporation of America, or under which it is licensed, to use or sell this device as an element or part of any combination or organization except as expressly set forth in said catalogue.



Note 1:- It is extremely important to remove this strap, thus dividing the plate voltage supply between the AA-1520 and AA-1400 Units.- Use 45 volts only on the AA-1520 unit; and 90 volts (with $-4\frac{1}{2}$ V. "C" battery) on two audio amplifier Radiotrons.

Note 2:- Remove wires a-b-c-d
Add wires x and y

AA-1520
3 STAGE R.F. AMPLIFIER UNIT

COMPLETE CONNECTIONS FOR RADIOLA VI
With Detector-Amplifier Unit (AA-1400) Modified
To Permit Use of $4\frac{1}{2}$ Volt "C" Battery
ARRANGED FOR EITHER ANTENNA OR LOOP RECEPTION

AA-1400 MODIFIED
FOR "C" BATTERY OF $4\frac{1}{2}$ VOLTS
(DET. AUDIO FREQUENCY UNIT)

RADIOTRONS AND PLATE VOLTAGES

USE	3	UV-201-A	RADIOTRONS	FOR AA-1520 RADIO FREQUENCY UNIT..	PLATE VOLTAGE	45 VOLTS..
USE	1	UV-200	RADIOTRON	FOR DETECTOR..	PLATE VOLTAGE	18 VOLTS..
USE	2	UV-201-A	RADIOTRONS	FOR AUDIO FREQUENCY AMPLIFIER..	PLATE VOLTAGE	90 VOLTS..

Radiola VII

REG. U.S. PAT. OFF.

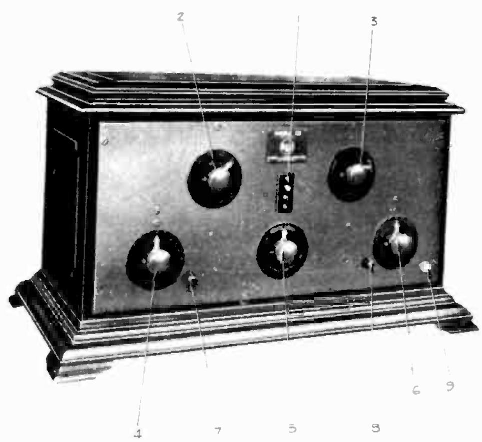


Fig. 1

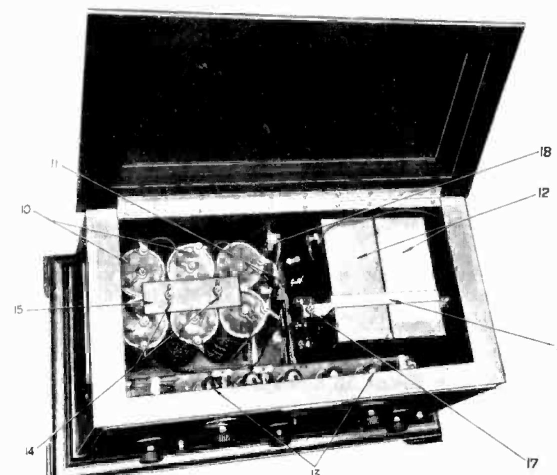


Fig. 2

INTRODUCTION

Radiola VII is a new type of radio receiver, designed for use with Radiotron UV 199, which operates entirely from dry cells. Electrically, it consists of a highly selective 2-circuit tuner and a 5-tube detector-amplifier, self-contained and ready to connect to antenna and ground (or to a loop antenna), and a loud speaker.

The design is such that all batteries are contained within the cabinet. The wave length range covers the entire broadcasting band of 220 to 550 meters.

Radiola VII may be used with a loop, an indoor antenna or an outdoor antenna. For indoor antenna use, a wire 15 to 20 feet long stretched about the room will give very good results, while for an outdoor antenna a single wire 20 to 180 feet long and 20 to 50 feet in height is the usual practice.

There is included with the set a Faradon socket antenna, which may be substituted in place of an indoor or outdoor antenna. In using the socket antenna, it is only necessary to screw it into a lighting socket in the same manner as an ordinary lamp.

UNPACKING

Radiola VII is wrapped in wax paper as a protection against dust and moisture, and placed in a corrugated paper carton, which in turn is surrounded by excelsior and contained in the wooden shipping case.

After the receiver is removed from the carton, the lid should be lifted and the accessories which are packed within the receiver removed. The accessories are contained in two packages; one containing 6 UV 199 Radiotrons, 5 being required for the set, and 1 being a spare; and the other containing 1 pair of head telephones, a telephone plug and a Faradon socket antenna.

BATTERIES REQUIRED

A. Six ordinary dry cells, 1½ volts each, for lighting the filaments, such as:—

6 Eveready Dry Cell Radio "A" Batteries	(2½" x 6½")	or,
6 Manhattan Red Seal Dry Cells	(2½" x 6½")	or,
6 Burgess No. 6 Dry Cells	(2½" x 6")	or,
6 Burgess "Super-Six" Dry Cells	(2½" x 6")	or,
6 Ray-O-Vac No. 1211 Dry Cells	(2½" x 6½")	or,
6 Ace No. 6 Dry Cells	(2½" x 6½")	or,
6 Columbia Ignitor No. 6 Dry Cells	(2½" x 6½")	

OR EQUIVALENT

B. Two 45-Volt Plate Batteries. NOTE: Two 45-Volt Units are recommended instead of Four 22½-Volt Units, such as:

2 Eveready No. 767 Plate Batteries	(8" x 6⅝" x 3")	or,
2 Burgess No. 2306 Plate Batteries	(7⅞" x 6⅝" x 3")	

OR EQUIVALENT

C. Two 3-Volt Negative Grid Bias Batteries, such as:
2 Eveready No. 750 Flashlight Batteries ($2\frac{7}{32}$" x $1\frac{5}{16}$" x $\frac{21}{32}$") or,
2 Burgess No. 422 Flashlight Batteries ($2\frac{1}{4}$" x $1\frac{1}{4}$" x $\frac{11}{16}$") or,
2 Ray-O-Lite No. 421 Flashlight Batteries ($2\frac{1}{4}$" x $1\frac{1}{4}$" x $\frac{11}{16}$")

OR EQUIVALENT

INSTALLATION OF BATTERIES

The A Batteries (No. 10, Figure 2) are held in place by the bakelite clamping plate secured by two wing nuts (No. 14 and 15, Figure 2). They should be connected in two parallel groups each of three cells in series, as shown in Figure 3.

The method of connecting the B battery is shown clearly in Figure 4. After the batteries are properly connected, two units should be placed in the cabinet, fastening down with the clamp and wing nut provided (No. 16 and 17, Figure 2). The units should be placed in the cabinet one at a time. The leads are sufficiently long to permit making connections outside the cabinet for convenience.

Great care should be taken to keep the battery connections tight, as failure to do so may result in objectionable noises, or complete inoperation of the set.

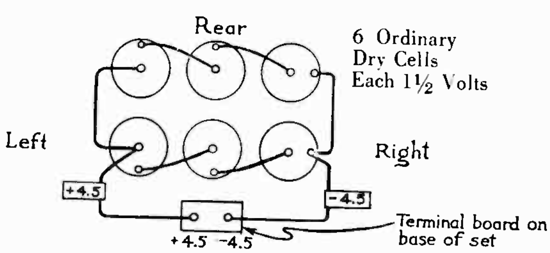
To insert the C battery, first bend the long battery prong out straight (to lay parallel to axis of cells). With prongs toward top of cabinet, slip downward into spring (No. 11, Figure 2), then over towards center of box until the prongs are firmly pinched by the small jaws provided for contact. The same instructions apply to the second C battery. The small jaws are placed at different heights in order to properly take the long and short prongs provided on the flashlight batteries.

Be sure that all tubes are removed from their sockets when installing batteries.

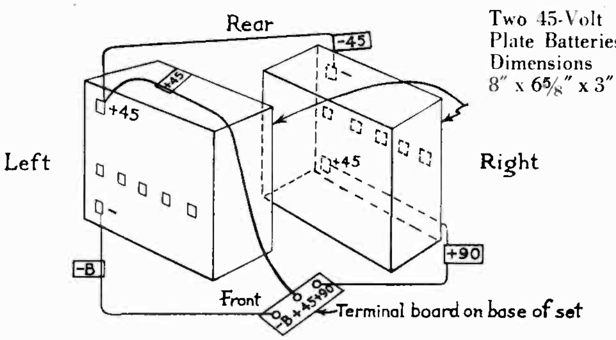
ADDITIONAL ADJUSTMENTS

If Radiola VII is to be used with an outdoor antenna or with the Faradon socket antenna, the small switch inside the cabinet and back of the C battery support (No. 18, Figure 2) should be down in the open position. If a short indoor antenna is to be used, such as a 20′ wire about the room, this switch should be up in the closed position. For long distance work an outdoor antenna is preferable.

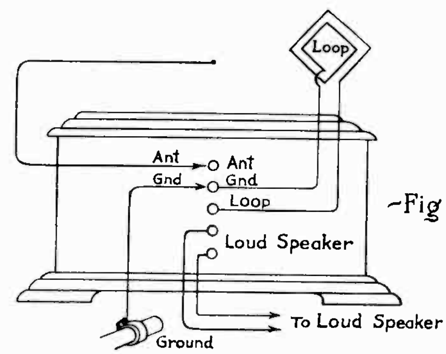
In the instance of either an outdoor or indoor antenna being used, a ground connection must be made. This is made preferably to a water pipe, but if this is inconvenient, a radiator or steam pipe will usually serve the purpose. In making the ground connection, the pipe should be scraped clean and the ground wire firmly connected.



~Fig 3~



~Fig. 4~



~Fig 5~

When Radiola VII is used with a loop, no antenna or ground connections are necessary. As shown in Figure 5, the loop connections are the second and third binding posts from the top.

The two binding posts at the bottom of the receiver in the back are for the externally connected loud speaker. Head telephone reception is also possible by connecting the tips of the telephone cord to the plug and plugging in the jack at the lower right corner of the panel. This automatically disconnects the loud speaker. DO NOT attempt to use the loud speaker plugged into the telephone jack, as the volume will be insufficient to operate it. The jack is intended only for head telephones. In connecting the loud speaker, it is well to try reversing the leads, as with some loud speakers this enhances the volume and quality.

The new R. C. A. Loud Speaker, Model UZ-1320 is recommended as being adapted for use with the Radiola VII.

OPERATION

WITH OUTDOOR OR INDOOR ANTENNA OR WITH FARADON SOCKET ANTENNA:

1. Be sure that set is properly connected, as per diagrams.
2. Be sure that white button (No. 1, Figure 1) of push switch is out.
3. Insert tubes in their bayonet sockets by pressing down slightly and turning to the right.
4. Adjust Vernier condenser controls (No. 7 and 8) so that white lines will be vertical.
5. Be sure filament control (No. 5. Figure 1) is turned as far as it will go to the left, or opposite to clockwise direction.
6. Press white switch button. This should light the tubes dimly. CAUTION: The tubes used in this set burn dimly as compared to the older types of tubes.
7. Advance filament control pointer (No. 5) as far as the word "Increase" on the dial.
8. Place pointer of control (No. 2, Figure 1) in the position on the "Antenna," or upper part of the dial, including the wave length (as marked on the dial) it is desired to receive.
9. Place stabilizer pointer at the maximum position and decrease when "carrier beat" of station desired is heard, as explained below. It should be borne in mind that when two stations of different wave lengths are operating simultaneously, it is usually possible to separate one from the other. This separation can usually be made when stations differ in wave lengths by 10 meters or more, and sometimes when the stations differ by only a few meters, depending upon the skill of the operator. No receiver can separate stations working on exactly the same wave length, although a powerful local station may be easily heard through a weaker and more distant station.
10. With this receiver, when control (No. 2, Figure 1) is on the "antenna" side, seven settings of the "secondary tuning" control for seven different wave lengths are given in the table below:

Dial Setting	*Wave Length Switch Position*	*Wave Length*
	220-280	250
	280-370	300
	" - "	350
	370-460	400
	" - "	450
	460-550	500
	" - "	550

To "pick up" a station, the "second tuning" control should first be set to the approximate wave length of the station it is desired to hear, using the above table for this first setting. Then the "antenna tuning" control (No. 4, Figure 1) should be moved slowly over the scale until signals are heard.

11. When a station is picked up, it should first be carefully adjusted on the Secondary Tuning control, and then on the Antenna Tuning control. Finer adjustment can be made with the two small Vernier knobs No. 7 and No. 8. Signals may be made louder by moving the Stabilizer control toward "increase" until the best adjustment is obtained.

The best stabilizer position will be found at a point just below what is termed the "oscillation point." When the oscillation point is exceeded and secondary control (No. 6, Fig. 1) is moved thru the broadcasting range, whistling sounds known as "carrier beats" will be heard. While receiving a "carrier beat" the procedure is to lower the stabilizer a trifle, at the same time manipulating the secondary vernier (No. 8, Fig. 1) until the carrier beat note disappears indicating that oscillation has ceased and the station is heard without distortion. To strengthen the signal, bring the antenna circuit into tune by varying antenna controls 4 and 7 (Fig. 1). When tuned to maximum intensity by this means gradually increase stabilizer until still further volume is attained. Bear in mind that the stabilizer is an adjustment of sensitivity and not of tuning. Care should be taken that set is not left in oscillating condition.

Increasing the filament current may also help the signal volume, but this control should be kept low as possible to obtain good results, or else the life of the batteries and tubes will be prematurely shortened by the excessive current.

WITH LOOP ANTENNA:

1. Place control (No. 2, Figure 1) in the position on the "loop" side including the wave length it is desired to receive.

2. Other precautions and instructions for tuning remain the same as when used with outdoor or indoor antenna, except that the antenna tuning controls (No. 4 and No. 7, Figure 1) are automatically cut out of use, or removed from the circuit.

The Loop should be rotated about its vertical axis until reception reaches a maximum volume. Interference from an undesired transmitter may also be eliminated by making use of the directional properties of the loop, turning it until the undesired signal is weakened as much as possible.

It is advisable when using a loop to remove the antenna and ground leads from the rear binding posts to improve the directional qualities of the loop.

CAUTION:

When Radiola VII is not in use the black button of the filament switch should be pushed in to turn off the filaments of the tube. It is detrimental to both tubes and batteries if they are permitted to burn unnecessarily. Handle the tubes carefully and DO NOT INSERT THEM IN THE SOCKET WHILE THE FILAMENT SWITCH IS ON.

NOTE: Some tubes are better radio frequency amplifiers than others and if several tubes are tried in the second and third sockets from the left it is possible to select the tube combination giving the best results.

REPLACEMENTS

Batteries and tubes are the only parts which require replacing.

"A" BATTERIES:

With average use these batteries should last about three months. They require replacement when the filament control (No. 5, Fig. 1) must be kept at maximum for best reception, and when the tubes light but dimly with the pointer in that position. The old cells can be removed by disconnecting all wires from battery binding posts and removing the wing nuts (No. 14, Fig. 2). Then the cells may be taken out and new ones connected in their place. Attached to each lead is a marked metal tag designating to which point the lead is to be connected. Reference to figures 3 and 4 will preclude the possibility of an error in connection and will warrant careful attention. The carbon or center part of a standard dry cell is positive. DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE REPLACING ANY BATTERIES. NEVER BURN TUBES MORE BRIGHTLY THAN REQUIRED FOR A REASONABLE SIGNAL.

"B" BATTERIES:

The "B" Batteries should outlast two sets of "A" Batteries. It is rather difficult to know when these batteries are exhausted as there is no external indication except weakened signals. The best way is to obtain a voltmeter which will indicate up to 100 volts at least. The meter should show at least 80 volts when across both batteries (new) and batteries are exhausted when total voltage gets below 70 volts.

To replace, remove clamp strip (No. 16, Fig. 2) taking off wing nut (No. 17, Fig. 2) and swinging clamp upward and toward the front of panel. The battery leads are long enough to permit the units to be lifted out onto the cabinet frame, for their disconnection. DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE REPLACING ANY BATTERIES. Connect the new units exactly as shown in Fig. 4.

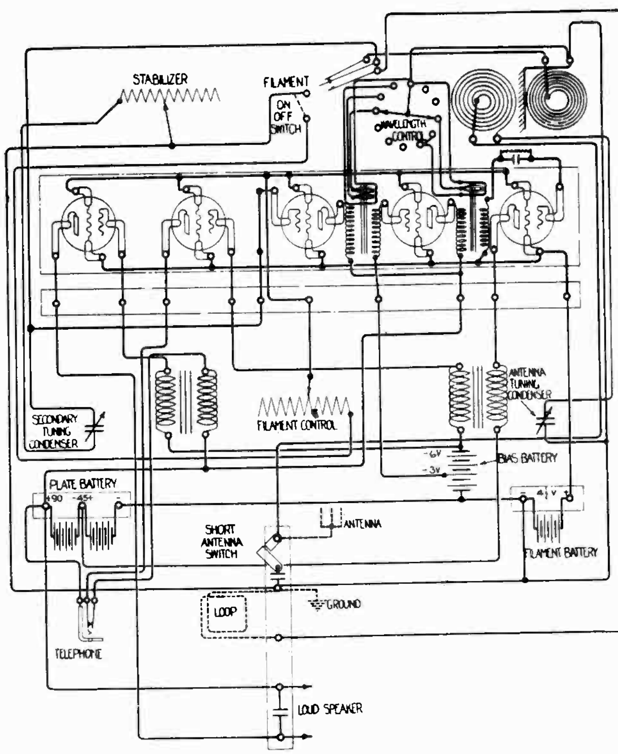
"C" BATTERIES:

These cells should be removed every three months to insure proper functioning of Radiola VII. This procedure may be carried out quite readily by reference to the section of this booklet which treats with the installation of the "C" Batteries.

CARE AND MAINTENANCE

The cabinet of this receiver is highly finished and it should be treated the same as any piece of fine wood furniture. To keep its original lustre give the cabinet an occasional application of good furniture polish.

Care should be taken in the installation of the antenna and ground to insure good and solid connections. The best method is to clean well with a file and then solder securely. In outside antenna the wire should be kept at least ten feet away from trees and large objects such as roofs or other structures, and must be well insulated on each end and at the lead in. As a precaution never have the antenna wire strung over or under electric light wires as its falling might endanger the set and its operator.



WIRING DIAGRAM

Radiola VII-B

INTRODUCTION

Radiola VII-B is a complete receiving unit comprising a set with its batteries and loud speaker mounted within an attractive cabinet.

Electrically, Radiola VII-B consists of a highly selective two circuit tuner, with detector and radio-audio amplifier, using five UV-199 Radiotrons. These tubes are dry-cell operated and all necessary "A," "B" and "C" batteries are contained within the cabinet, and connected to the receiver by a multi-conductor cable. The amplifier supplies energy to a loud-speaker unit attached to the built in tone chamber. A jack is provided at the rear for use with phones which is occasionally desired for long distance reception. Local signals produce an extraordinary volume for dancing purposes.

The wave-length range of the Radiola VII-B covers the broadcasting band of 220 to 550 meters and through the use of specially designed radio frequency transformers practically equal sensitivity is secured over the entire wave-length band. Good results may be obtained with an indoor antenna, using the 18 foot silk-covered, single conductor wire supplied, which should be carried around the room on the picture moulding; or, where greater range is desired, an outdoor antenna of a single wire 20 ft. to 100 feet long, and 30 ft. to 50 ft. high may be employed. For local work, the indoor antenna is sufficient, but for long distance reception the outdoor antenna is preferable.

UNPACKING

Radiola VII-B is wrapped in wax paper as a protection against dust and moisture, and placed in a corrugated paper carton, which in turn is surrounded by excelsior in the wooden shipping case.

After the receiver is removed from the carton the lid should be lifted and the four machine screws removed from the top panel upon which the receiver is mounted. This panel can then be hinged back and held up by the side stops. The 6 UV-199 Radiotrons will be found packed around the horn. The cable with its battery connectors is also contained in this space already for connection to the batteries.

BATTERIES REQUIRED

(A) Refers to Filament Lighting or "A" Battery.
(B) " " Plate or "B" Battery.
(C) " " Negative Grid or "C" Battery.

(A) Six 1½ Volt Dry Cells, connected in two PARALLEL groups of three cells each in SERIES, such as:
6 Eveready Dry Cell Radio "A" Batteries No. 7111 (2½x6) or,
6 Burgess Radio "A" Dry Cells No. 6 (2½x6) or,
6 Manhattan Red Seal Dry Cells, No. 2445 or 2448 (2½x6½)
or,
6 Ray-O-Vac Radio "A" Dry Cells No. 1211 (2½x6½) or,
6 Columbia Ignitor No. 6 Dry Cells (2½x6½) or,
6 Ace Radio "A" Dry Cells No. 61 (2½x6) or,
6 Yale Radio Power Pak No. 101-R (2¾x6½)
OR EQUIVALENT

(B) Two 45-Volt Plate Batteries. NOTE: Though four 22½-volt units may be used two 45-volt units are preferred instead. Such as:
2 Eveready No. 767 Plate Batteries, EACH 45-Volts (8x6⅝x3)
or,
2 Burgess No. 2306 Plate Batteries, EACH 45-Volts (7⅞x6⅝x3) or,
2 Yale No. 3045 V Plate Batteries, EACH 45-Volts (8x6⅝x3)
OR EQUIVALENT

(C) One 4½ Volt Negative Grid Bias or "C" Battery. Such as:
1 Eveready No. 771 Negative Grid Bias Battery (4x3x1⅜) or,
1 Ray-O-Lite No. 231 R Negative Grid Bias Battery (4x3x1$\frac{7}{16}$)
or,
1 Burgess No. 2370 Negative Grid Bias Battery (4x3x1⅜) or,
1 Yale No. 312 Negative Grid Bias Battery (4x3x1⅜) or,
1 Bright Star "B" 34-17 Negative Grid Bias Battery (4x3x1⅜)
or,
1 Novo No. 288 Negative Grid Bias Battery (4x3x1⅜)
OR EQUIVALENT

INSTALLATION

If the set is desired only for local work, the indoor antenna wire supplied with the set should be carried around the room on the picture moulding, or otherwise fastened. If an outdoor antenna is desired, a single wire 20 ft. to 100 ft. long, and 30 ft. to 50 ft. high, should be erected, properly insulated at both ends, and with a lead brought to the point where the Radiola VII-B is to be operated. In the case of an outside antenna, the wire should be kept at least 10 ft. away from trees and large objects, such as roofs and other structures. As a precaution, never have the antenna wire strung over or under electric light wires, for if by falling such wires should come in contact, the set and the operator might be endangered.

Whether an indoor or outdoor antenna is used, a ground connection must be made. This connection is preferably made to a water pipe, but if this is inconvenient, a radiator or steam pipe will usually serve the purpose. Do not connect the ground wire to a gas pipe. Care should be taken in the installation of antenna and ground to insure good and solid connections. The best method is to clean the piping well with a file and then solder securely. An approved form of ground clamp, properly installed, is satisfactory.

If an antenna of less than 40 ft. is used, the flexible lead on shunt condenser, Fig. 3, must be connected to the brown or antenna terminal on the terminal board of the Radiola VII-B. Should a longer antenna be used, this flexible lead should be connected to the black, or ground terminal on the terminal board, which throws the condenser out of circuit.

CAUTION:

Before making any battery installation, be sure that all the Radiotrons are removed from their sockets. Be sure also that the

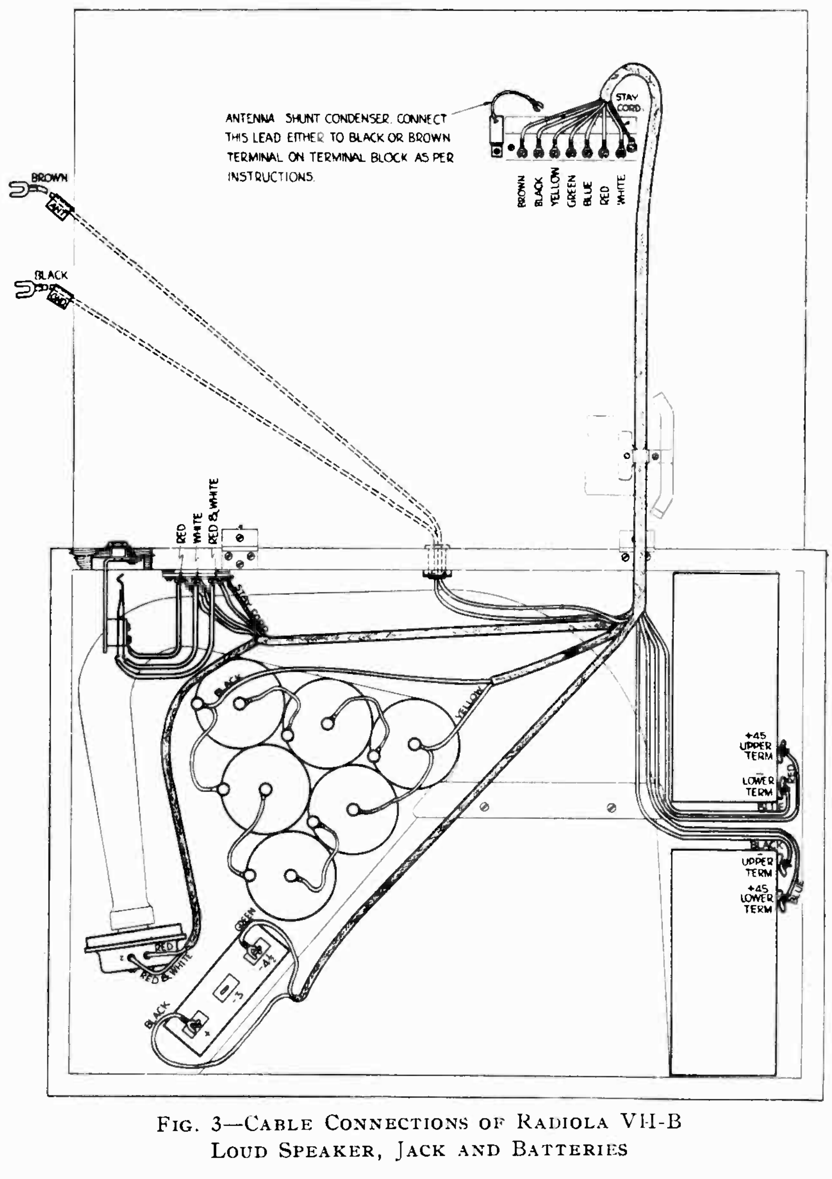


Fig. 3—Cable Connections of Radiola VII-B Loud Speaker, Jack and Batteries

cable is connected first to the receiver terminal board before it is connected to any batteries; otherwise the batteries may be short-circuited and their life materially reduced.

The "A" batteries must be placed in the cabinet with their terminals as shown in Fig. 3. Remove thumb screw and place the four special connectors on batteries as shown. This connects the batteries in three series groups, of two cells each in parallel. The yellow leads are connected to the center of positive terminal of the "A" battery and the black leads to the outside or negative terminal.

The method of connecting the "B" battery is clearly shown in Fig. 3. The leads are sufficiently long to permit making the connection outside the cabinet for convenience. The rear battery shown in Fig. 3 should be placed in the front of the cabinet first and pushed towards the rear, then the front battery shown in Fig. 3 can be lowered in its place as shown in Fig. 3.

The "C" battery fits in the space in front of the "A" battery. The wire with green terminal should be connected to the 4½ volt negative, or minus, clip on the battery and the black terminal to the positive, or plus, clip.

Great care should be taken to keep the battery connections tight, as failure to do so may result in objectionable noises or complete inoperation of the set.

OPERATION

1. Be sure that set is properly connected, as per diagram, Fig. 3.
2. Be sure filament control (Dial No. 1) is turned as far as it will go to the left or counter-clockwise direction. Start with all pointers at the left or zero mark.
3. Insert tubes in their bayonet sockets by pressing down slightly and turning to the right.
4. Advance the filament control to graduations 5 or 6 on its dial.
5. Choose approximate wave-length desired by use of Selector No. 2 with the aid of the chart below:

SERIAL No. ....

Wave Length	2 Selector	3 Secondary
250		
300		
350		
400		
450		
500		
550		

6. Place secondary tuning control (Dial No. 3) on corresponding graduation wave-length band, as shown on dial.
7. Swing antenna tuning control (Dial No. 4) through its range several times.
8. If signals are not heard bring up volume control (No. 5) until a click is heard. This is termed "the oscillation point." Now with this control held just below this point, Vernier controls 3 and 4 must be operated together to give best results, especially on long distance signals, or signals from weak stations.

On weak stations it is best to allow the set to oscillate, that is, bring control well beyond the click point and swing control 3 through its range determined by selector position. When a whistling sound, known as the "carrier beat" is heard, it should be brought to maximum by control 4, then control 5 should be reduced gradually until the oscillations cease, keeping whistling sound in tune at the same time by Vernier control 3. The carrier beat will then disappear and station will be heard without distortion.

To strengthen the signal, work the stabilizer as near the oscillation point as possible and retune with Vernier controls 3 and 4. Bear in mind that the stabilizer is an adjustment of sensitivity and not of tuning. Care should be taken that set is not left in oscillating condition. Better operation can sometimes be obtained by changing the tubes around in the several sockets until the best combination is found.

The filament control (Dial No. 1) should be advanced as the filament batteries are consumed. THIS CONTROL SHOULD, HOWEVER, BE KEPT ALWAYS AS LOW AS POSSIBLE CONSISTENT WITH GOOD RECEPTION, ELSE THE LIFE OF THE TUBES, AND TO SOME EXTENT ALSO THE LIFE OF THE BATTERIES, WILL BE SERIOUSLY SHORTENED.

REPLACEMENTS

Batteries and tubes are the only parts which require replacement.

"A" BATTERIES:

With average use, these batteries should last several months. They require replacement when the filament control Dial No. 1 must be kept at maximum (10) for good reception, and when the tubes light but dimly with the pointer in that location.

The old cells can be removed by disconnecting all wires from battery binding posts. Then cells may be taken out and new ones connected in their place. On each lead is color marking designating the point to which the lead is to be connected. Reference to figures will preclude the possibility of an error in connection, and will warrant careful attention. The carbon or center part of a standard dry cell is positive.

DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE CHANGING ANY BATTERIES. NEVER BURN TUBES MORE BRIGHTLY THAN REQUIRED FOR A SIGNAL OF REASONABLE VOLUME.

"B" BATTERIES:

"B" Batteries may be tested by a high resistance type of voltmeter which will indicate up to 100 volts at least. The meter should show at least 90 volts when across both batteries (new) and batteries are exhausted when total voltage falls below 70 volts.

To replace, lift battery unit out and unclip leads. The battery leads are long enough to permit the units to be lifted out of the cabinet, for their connection. DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE REPLACING ANY BATTERIES. Connect the new units exactly as shown in Fig. 3.

"C" BATTERIES:

These cells should be renewed every six months to insure proper functioning of Radiola VII-B.

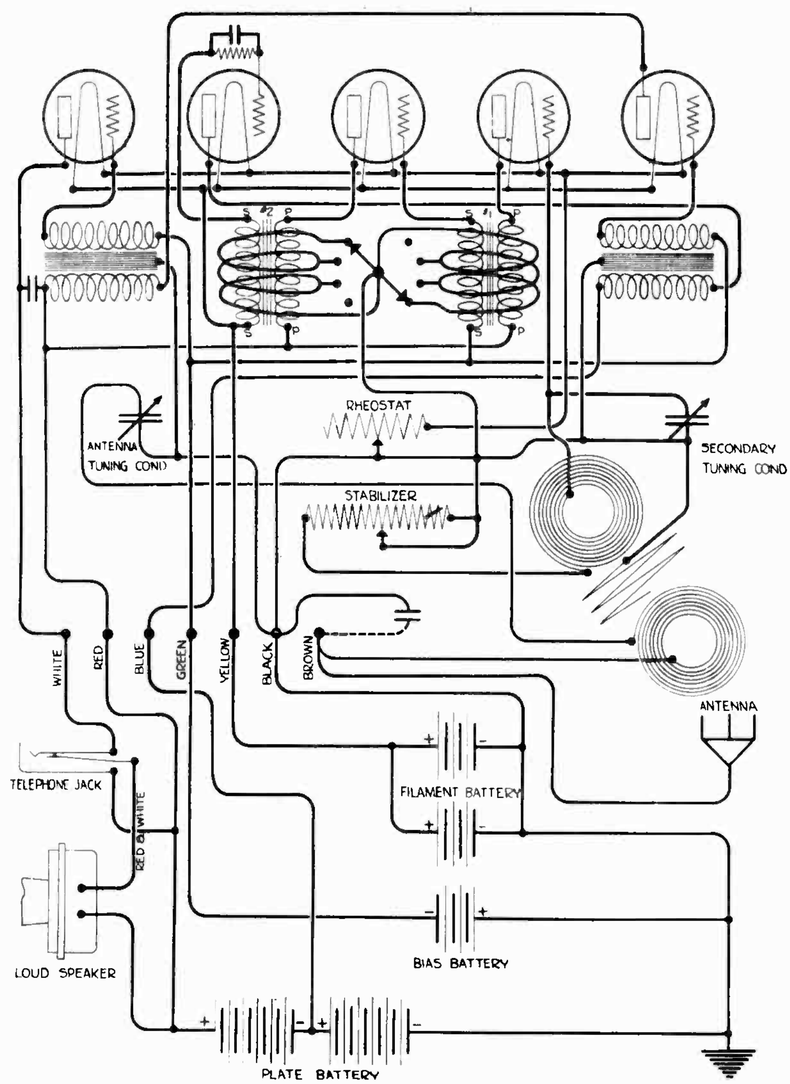


FIG. 4—SCHEMATIC WIRING DIAGRAM RADIOLA VII-B

Radiola Super-VIII

INTRODUCTION

RADIOLA SUPER-VIII is a radio broadcast receiving instrument, utilizing the Super-Heterodyne principle which provides unusual simplicity of operation, selectivity and sensitivity. The cabinet contains the operating mechanism, a loud speaker, and the battery equipment, as well as a loop antenna, making the set *completely* self-contained. It is designed for reception over the broadcast wavelength band 220 to 550 meters (approximately 550 to 1350 kilocycles).

EQUIPMENT

Under the above name there is included the following apparatus:

1 Radiola Super-VIII, as described
6 Radiotrons, Model UV-199

BATTERIES REQUIRED

In addition, there are required the following "A," "B" and "C" batteries which may be obtained from the dealer:

A—Six standard dry cells, 1½ volts each, such as those listed below, for lighting the filaments. These are connected in two groups, each of three cells in series, both groups being connected in parallel.

6 Eveready Dry Cell Radio "A" Batteries	2½ by 6½ in	or
6 Manhattan Red Seal Dry Cells	2½ by 6½ in.	or
6 Burgess No. 6 Dry Cells	2½ by 6 in.	or
6 Burgess Super Six Dry Cells	2½ by 6 in.	or
6 Ray-O-Vac No. 1211 Dry Cells	2½ by 6½ in.	or
6 Ace No. 6 Dry Cells	2½ by 6½ in.	or
6 Columbia Ignitor No. 6 Dry Cells	2½ by 6½ in.	

OR EQUIVALENT*

B—Four 22½-volt plate batteries connected in series, such as:

4 Eveready No. 766 Plate Batteries	6⅝ by 4 by 3 in.	or
4 Burgess No. 2156 Plate Batteries	6⅝ by 4 by 3 in.	or
4 Burgess No. 2158 Plate Batteries	6¾ by 4 by 3 in.	or
4 Ray-O-Vac No. 2151 Plate Batteries	6⅝ by 4 by 3 in.	or
4 Kwik-Lite No. 225 Plate Batteries	6¾ by 4 by 3 in.	or
4 Ace No. 115 Plate Batteries	6⅝ by 4 by 3 in.	or
4 Yale No. 1512-V Plate Batteries	6½ by 4 by 3 in.	or
4 Bright Star No. 15-90 Plate Batteries	6½ by 4 by 3 in.	or
4 Novo No. 268 Plate Batteries	6½ by 4 by 3 in.	

OR EQUIVALENT

*A 4-volt storage battery, such as Philco Type UD-44, may be used instead of the six dry cells, if desired.

Two 45-volt plate batteries may be used instead of four 22½-volt blocks if desired, such as:

2 Eveready No. 767 Plate Batteries (45 Volts)	8 by 6⅝ by 3 in.	or
2 Burgess No. 2306 Plate Batteries (45 Volts)	7⅞ by 6⅝ by 3 in.	or
2 Ray-O-Vac No. 2301 Plate Batteries (45 Volts)	8½ by 6⅞ by 3¼ in.	or
2 Novo No. 276 Plate Batteries (45 Volts)	8 by 6½ by 3 in.	or
2 Kwik-Lite No. 245 Plate Batteries (45 Volts)	8¼ by 6¾ by 3 in.	or
2 Yale No. 3045-V Plate Batteries (45 Volts)	8 by 6⅝ by 3 in.	

OR EQUIVALENT

C—One 4½-volt Negative Grid Bias or "C" Battery, such as:

1 Eveready No. 771 Negative Grid Bias Battery	4 by 3 by 1⅜ in.	or
1 Ray-O-Lite No. 231-R Negative Grid Bias Battery	4 by 3 by 1 7/16 in.	or
1 Burgess No. 2370 Negative Grid Bias Battery	4 by 3 by 1⅜ in.	or
1 Yale No. 313 Negative Grid Bias Battery	4 by 3 by 1⅜ in.	or
1 Bright Star No. B-34-17 Negative Grid Bias Battery	4 by 3 by 1⅜ in.	or
1 Novo No. 288 Negative Grid Bias Battery	4 by 3 by 1⅜ in.	

OR EQUIVALENT

INSTALLATION

Installing Batteries. Access to the battery rack is secured by removing the two screws B (Fig. 1) (found at the center on the left- and right-hand sides of the upper panel A, on the rear of the cabinet)—which releases the panel. Place two fingers in the thumb holes C, raise the rear panel, pushing it farther into the slot in the top of the cabinet, then pull on the panel releasing the lower end, which permits the panel to drop down free from the set.

In the middle and top compartments will be found six UV-199 Radiotrons, two long red jumper connectors, and four short yellow connectors. Remove these from the rack and proceed with the battery installation.

(A) Place the six dry cells in the lower compartment, three in the back row and three in the front row, taking care that the outer binding posts of all cells point in the same direction. Connect the batteries in two parallel groups, each of three cells in series, as shown in Fig. 1, using the four short yellow connectors E.

Before connecting these batteries to the set, make certain that the desk fall G (Fig. 2 and 3) in the front of the set is closed.* Connect the lead marked "+A" (yellow), coming through the hole in the left-hand side of the rack, to the two center binding posts (not yet connected), and connect the other lead marked "−A" (black with yellow tracer) to the two outside binding posts.

*After the set is in operation, closing the desk fall G shuts off the operation of the set completely. When the user has finished with the set, he need not turn any of the other controls, but merely close the desk fall.

(B) Locate two each of the "B" or plate batteries in both the middle and upper compartments; or if 45-volt blocks are used, place one in each compartment.

Connect the two batteries in the upper compartment in series by using one of the long red jumper connectors D, fastening one end onto the "+22½ V." terminal of one battery, and the other end onto the "−" terminal of the other battery. (Should the large size 45-volt blocks be used, the two jumper connectors will not be needed.) Do similarly with the two batteries in the middle compartment.

Connect these batteries to the set, fastening the lead marked "+B" (red in upper compartment, maroon in middle) onto the battery terminal marked "+22½ V.", not yet connected (or onto

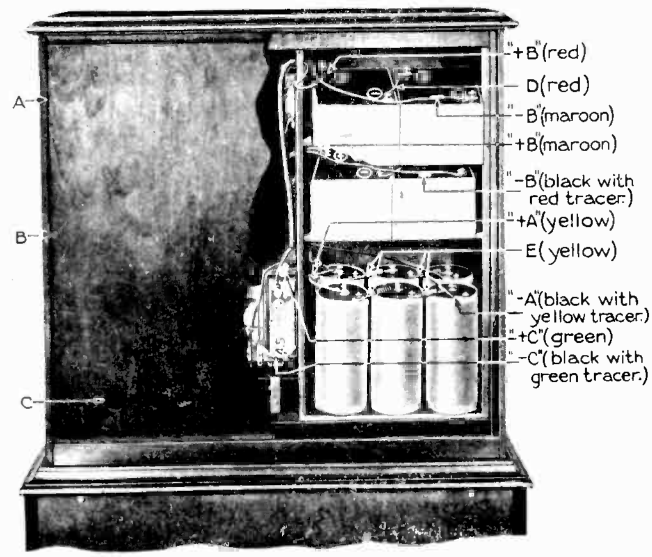


Fig. 1. Rear View, Showing Battery Connections

A—Upper Rear Panel
B—Screws Holding Upper Rear Panel
C—Thumb-hole in Upper Rear Panel
D—Two "B" Battery Connectors (red)
E—Four "A" Battery Connectors (yellow)

the "+45 V." terminal of the 45-volt battery, if one is used). Connect the other lead marked "−B" (maroon in upper compartment, black with red tracer in middle) onto the "−" terminal of the other battery.

(C) Place the "C" or grid bias battery in the compartment built on the left side of the battery rack, with the "+" binding post uppermost. Connect the lead marked "+C" (green) to the "+" terminal of the battery; and connect the other lead marked "−C" (black with green tracer) to the "−4½ V." terminal of the battery.

Location of Set. With the batteries installed and connected, replace the rear panel. Radiola Super-VIII may now be located in any part of the home, convenient and desirable to its owner. It need not be located in any particular place or turned in any particular direction with respect to the room or to the received signal.

Placing Radiotrons in Sockets. Radiola Super-VIII utilizes six Radiotrons, Model UV-199, which should be handled with due care.

After pulling the desk fall G down to the horizontal (Fig. 2), the radio panel F should be pulled forward to the half open position shown in the figure, allowing it to rest against the stay joint J.

Before inserting the Radiotrons, turn the "BATTERY SETTING" knob to "OFF." Remove the six Radiotrons from their individual cartons. Insert one in each of the six tube sockets H, by placing it in the socket, turning the tube until the pin in the base drops into the slot, and then turning slightly to the right.

Swing the panel back in place carefully, noting that there is no binding of the gears just before the panel goes in place. Should the gears bind at this point, slowly rotate the "LOOP" knob until the gears mesh and then let the panel drop back.

OPERATION

Filaments. Turn the "VOLUME CONTROL" knob U (Fig. 3) clockwise to 100. Turn the "BATTERY SETTING" knob K clockwise up to the arrow mark near 47 on the dial. WITH FRESH BATTERIES, DO NOT TURN THE POINTER PAST THAT POINT. THIS IS EXTREMELY IMPORTANT, as you will otherwise shorten the useful life of the Radiotrons and batteries, and little will be gained in ease of tuning, signal strength or otherwise. As the batteries grow older with use, this should be *gradually* advanced from week to week toward "100." Push in the amplifier switch S, which gives the full amplification of the receiver.

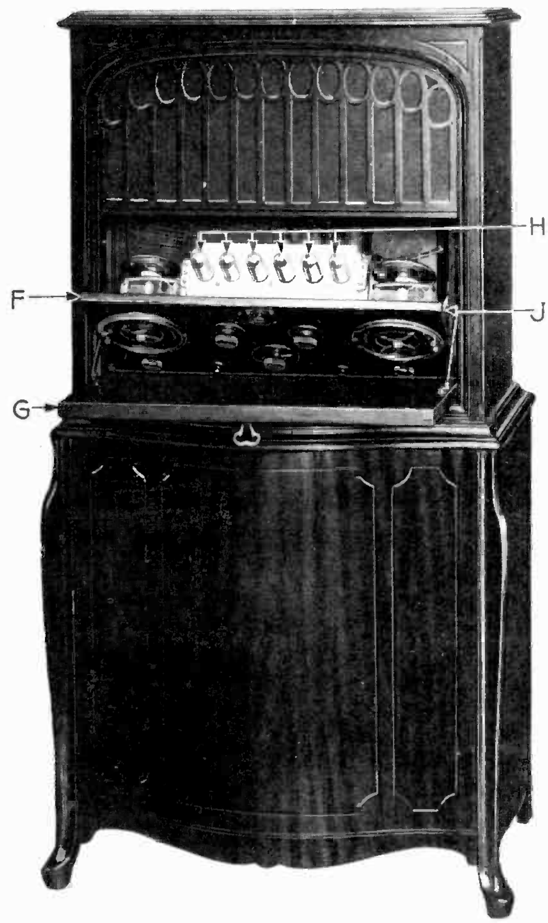


Fig. 2. Front View, Showing Radiotrons in Place

F—Control Panel
G—Desk Fall
H—Six Radiotrons UV-199 in Sockets
J—Stay Joint

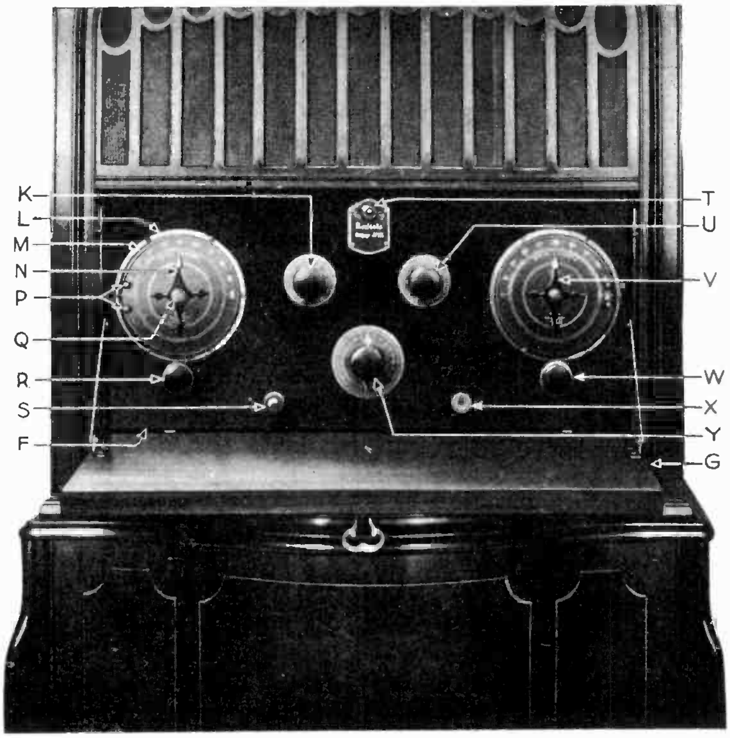


Fig. 3. Front View of Control Panel

F—Control Panel
G—Desk Fall
K—"BATTERY SETTING" Knob
L—Retaining Ring for "STATION SELECTOR" Dial
M—Clamp Wire for "STATION SELECTOR" Dial
N—"STATION SELECTOR I" Pointer
P—Knobs on Clamp Wire
Q—Thumb Nut for Pointer
R—"STATION SELECTOR I" Knob
S—Amplifier Switch
T—Control Panel Knob
U—"VOLUME CONTROL" Knob
V—"STATION SELECTOR II" Pointer
W—"STATION SELECTOR II" Knob
X—Telephone Jack
Y—"LOOP" Knob

Tuning. The tuning of Radiola Super-VIII involves only the manipulation of the two "STATION SELECTOR" knobs R and W—a simple operation if the principle described below becomes thoroughly understood.

The two gold-tipped pointers have approximately the same setting, i.e., if one is set at 10 or 30, etc., the other is at or near 10 or 30, etc.

When searching for stations, the settings of which are not known, proceed as follows: Set "STATION SELECTOR I" gold-tipped pointer N at, say, 10 (referring to the metal dial scale under the paper scale). Move "STATION SELECTOR II" gold-tipped pointer V slowly over the scale near 10, say, from 5 to 15. If no signals are heard, there is no station working on that wavelength. Then set "STATION SELECTOR I" pointer at, say, 12, and slowly move "STATION SELECTOR II" from about 7 to 17. If again no signals are heard, set "STATION SELECTOR I" gold-tipped pointer at, say, 14, and move "STATION SELECTOR II" slowly from about 9 to 19. If still no signals, repeat this process increasing the setting of "STATION SELECTOR I" in small steps until the whole scale has been covered. It will be noted after the first few trials that when "STATION SELECTORS I and II" are in resonance, a slight breathing sound is heard indicating that the set is working properly and in resonance.

After hearing a signal, carefully adjust both "STATION SELECTORS I and II" for the clearest reproduction. To decrease the volume of signal, turn the "VOLUME CONTROL" knob U towards the "SOFT" position.

If no stations are heard, the "LOOP" knob Y should be turned 90 degrees from where it was during the preceding adjustments, and the tuning process just described should be repeated.

Control of Volume. As Radiola Super-VIII is a very sensitive receiver, it is often found advisable to reduce the loud speaker volume. This may be accomplished by employing one or all of the methods described below.

(1) Turn the "VOLUME CONTROL" knob U away from "100" toward "SOFT."

(2) Pull out the amplifier switch S.

(3) Turn the "LOOP" knob Y.

Interference. Signals from an interfering radio station may be eliminated or at least minimized by either of the following methods:

(1) Turn "STATION SELECTOR II" pointer V either to the right or left, by approximately ¾ inch to 1 inch, to find another position of this control, where the desired station will be again heard. The setting of "STATION SELECTOR II" nearer the left end of the scale is technically called the "lower wavelength peak," and the other the "upper wavelength peak." Two settings of this nature will be found for all broadcast stations, and the separation between them becomes greater and greater for the higher end of the scale, i.e., nearer the right-hand end. It is recommended that "STATION SELECTOR II" be consistently set on the "lower peak" in the usual manipulation of the set. When interference is encountered, shift to the upper peak, and use whichever one at which minimum interference occurs.

There are certain wavelengths (greater than 440 meters) where four tuning positions, instead of the usual two positions, can be found on "STATION SELECTOR II," when the receiver is located close to a powerful broadcasting station. This does not however, interfere with reception either from the local station or from a distant one. In the case of the local station, the user should, under such circumstances, turn "STATION SELECTOR II" to either of the two positions which correspond most nearly to the setting of "STATION SELECTOR I" for the local station. In the case of the distant station, shift "STATION SELECTOR II" to the other "wavelength peak" either "upper" or "lower," as the case may be, where interference (if present) will probably not be encountered.

(2) Turn the "LOOP" knob Y on the panel from zero toward "360." For every transmitting station, there are two positions at which the signal strength will rise to a maximum, and two others at right angles where it is at a minimum. Set the "LOOP" knob where best results are secured, trying to locate the position where the interference does not come in, but the desired signals do.

GENERAL INFORMATION

Paper Dials. Four paper dials for each of the "STATION SELECTORS" will be found with the set, three each in the envelope for the Instruction Book, and one each in place on the panel. To put another "STATION SELECTOR I" dial in place, grasp pointer N with the left hand, turn and remove the knurled nut Q which holds it in place. Grasp the two knobs P on the end of the clamp wire M, pinch the knobs together, and pull the clamp wire free from its retaining ring L. Remove the old dial, and place a "STATION SELECTOR I" dial on the panel, taking care to locate properly the central hole and the notch on the left-hand side. Replace clamp wire M, pointer N, and knurled nut Q in the order mentioned.

Follow the same process for "STATION SELECTOR II" dial.

Calibration of Set. The paper dials provide a means of recording the settings of the "SELECTORS" for the various stations. Once recorded, the pointers may be reset at any later time to these positions, and if the station is broadcasting, it will be heard. After a station is tuned in as above, mark the positions of one of the tips of each of the "STATION SELECTORS" as well as the call letters of the station. It is suggested that only the "lower peak" of "STATION SELECTOR II" be recorded.

Note that in a few places throughout the country, particularly in the metropolitan areas, there may be two or more stations assigned to the same wavelength or frequency, but apportioned different hours of the day so that they will not be "on the air" at the same time. For example, Philadelphia, Pa., has two stations, WOO and WIP, working on the same wavelength, but dividing time. Other examples will be found in the "Partial List of Class 'B' Broadcasting Stations" in the rear pages of this booklet. Under such conditions, the "STATION SELECTOR" settings should be the same for both stations.

Each of the "STATION SELECTORS" is provided with four pointers, in order that stations of nearly the same setting may be recorded on the dials without crowding the markings. It is suggested that the gold-tipped pointers be reserved for wavelength or frequency markings, and that the station settings be recorded on the three remaining pointers in the following order: long black pointer, right short pointer and left short pointer. Mark as many stations as possible on the long black pointer. When a new station is tuned in, quite close to one already recorded, then use the short pointers for the markings.

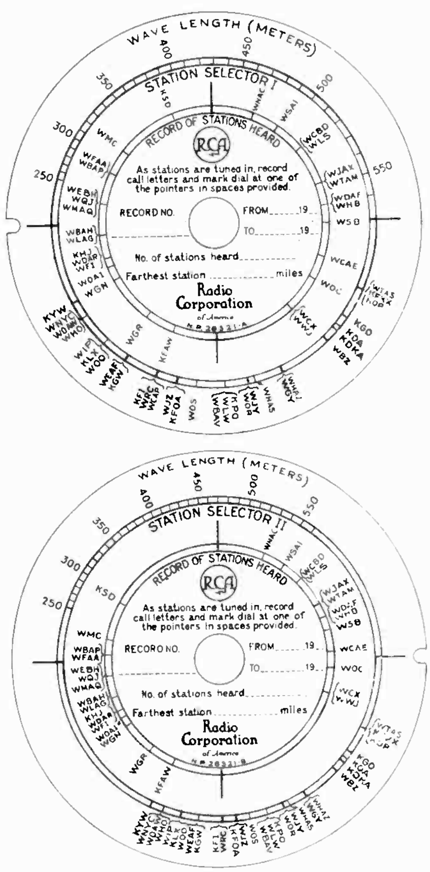


Fig. 4. "STATION SELECTOR" Dials. Showing Approximate Markings of Principal Broadcasting Stations

The only precaution to be observed when making these markings is to see that the set is not located near any large metal objects, such as a steam radiator, or that it is not near any aerials or electric wiring. Such positions may cause changes in the settings of "STATION SELECTOR I."

In order to facilitate the tuning process, and to give an approximate idea of where stations should come in, Fig. 4 shows a reproduction of both dials, with the average markings of the principal broadcasting stations, marked in accordance with the method described.

Batteries and Radiotrons. The only parts ordinarily needing replacement will be the batteries and Radiotrons.

It is important to adjust the "BATTERY SETTING" and "VOLUME CONTROL" knobs properly. With fresh batteries, turn the "BATTERY SETTING" knob up to the arrow on the dial, but no farther. Turn the "VOLUME CONTROL" to 100. Then search for stations as described on page 8. Having located a station, turn the "VOLUME CONTROL" knob to the left, if it is desired to decrease the volume of the signal.

The accuracy of the setting of the filament voltage may be checked by a good filament voltmeter (of the high resistance type). Turn the "VOLUME CONTROL" to 100. Turn the "BATTERY SETTING" to the arrow. Touch the positive (+) voltmeter terminal to the case of the tube socket unit which holds the tube sockets H, and touch the negative (−) terminal to the movable blade of the "VOLUME CONTROL" on the rear of the panel. If the voltmeter reads greater or less than 3 volts, adjust the "BATTERY SETTING" knob until a reading of 3 volts is obtained.

With the filaments burning too brightly ("BATTERY SETTING" knob too close to 100), the active material in the filaments is rapidly driven off, and the useful life of the Radiotrons and batteries is shortened. Should this occur, the Radiotron life may be restored, provided they have not been too seriously abused.

This process of "reactivation," as it is called, may be accomplished by turning the "VOLUME CONTROL" knob to 100, and the "BATTERY SETTING" knob to approximately 47 (or to 3 volts), and by removing either one of the two "B" battery connectors D in the upper or middle battery compartments which are shown in Fig. 1. Keep the Radiotrons lighted for about thirty minutes, replace the connector and then try tuning.

Maintenance. Very little maintenance will be required on Radiola Super-VIII, outside of an occasional oiling of a few of the parts. The oiling operation is important, and should be done about once every six months. To oil the moving parts, turn both "STATION SELECTOR" pointers as far to the right as possible, and open the panel of the set half way as in Fig. 2. Then place one drop of good grade oil, such as typewriter oil, on each of the following parts of both "STATION SELECTORS":

(1) On the front and rear bearings of the shafts, where the shafts pass through the black moulded sub-panels.
(2) On the bushings in the panel which hold the "SELECTOR" knobs.
(3) On the universal or ball joint just back of the "SELECTOR" knob shaft.
(4) On the spring bearing of the slanting knob shaft (which spring bearing presses against the black insulation collar).

Polishing the Exterior. If finger marks result from handling the cabinet, a little rubbing or polishing with furniture polish will restore the finish. The polish chosen should be of a grade which will leave the cabinet free from an oily appearance. Use a soft piece of cotton cloth or cheesecloth, free from lint. Saturate the rag lightly with a small quantity of the polish and rub it on the surface to be restored. Wipe thoroughly dry with clean, dry cheesecloth, making sure that all crevices are dry and clean. The surface should be rubbed until the finish is restored to a dull gloss.

Storage Battery. If the user desires to use a 4-volt storage battery, such as that recommended on page 3, it should be located in the lower battery compartment, in place of the six dry cells shown in Fig. 1. Connect one of the terminals on the "+A" lead to the "+" battery terminal (red) and wrap the other terminal on this lead with some insulating tape. Connect one of the terminals on the "−A" lead to the "−" battery terminal (black), and similarly wrap the other terminal on this lead with tape. When operating the set with storage battery, turn the "BATTERY SETTING" knob to 65, but no farther. It will be possible to leave this knob set at this point when operating the receiver. The battery should be kept well charged, but it is recommended that it be removed from the cabinet during this process to prevent damage to the set.

POSSIBLE DIFFICULTIES

Should any trouble develop in the use of Radiola Super-VIII, it will in all probability be due to loss of life of the Radiotrons or to the exhaustion of the batteries. As the batteries grow old, they decrease in voltage, and increase in resistance. After the Radiotrons have been used for a long time, their filaments tend to lose emission. If the difficulty appears to be elsewhere, it is recommended that the services of the dealer from whom the set was purchased, be enlisted.

If the set becomes inoperative, try interchanging the Radiotrons. The second tube from the right (when facing the front of the set) is the important one and it is well to determine first whether this tube is working properly. This may be done by touching the moistened finger to the stationary condenser plates of "STATION SELECTOR II," on the rear of the panel. A sharp click should be heard in the loud speaker. If none is heard, try interchanging this tube with either the third, fourth, or fifth Radiotrons, applying the click test each time. Use for the second Radiotron from the right (when facing the front of the set), the one which gives the sharpest click in the loud speaker. If the set is still not operative, push in the amplifier switch S, and remove the Radiotron on the extreme left-hand end, from its socket. Try substituting this tube for the first, third, fourth and fifth Radiotrons, operating the set each time, to ascertain if reception has been improved. If no improvement is noted, an examination of the batteries and their connections should be made. It is of advantage to keep a spare Radiotron UV-199 on hand, to meet emergencies.

There are several indications by which the user may determine that the filament or "A" batteries are becoming exhausted. These are low filament brilliancy, weak signals, and distortion, the signals becoming less and less recognizable. When it is found necessary to turn the "BATTERY SETTING" knob up to "100," and the operation of the set is still unsatisfactory (or when it is necessary to turn the "BATTERY SETTING" knob to 100 to get 3 volts on the filament, if a voltmeter is used), it is a definite indication that the filament batteries are exhausted.

When fresh batteries are installed for the first time, listen to the loud speaker, while pushing the amplifier switch in and out. Sharp "clicks" will be heard in the loud speaker. Do this sufficiently to learn just how loud the click should be. If the "B" batteries have become fairly well exhausted, these clicks will become practically imperceptible—an indication that they need replacement. A better method of test is, of course, to use a volt-

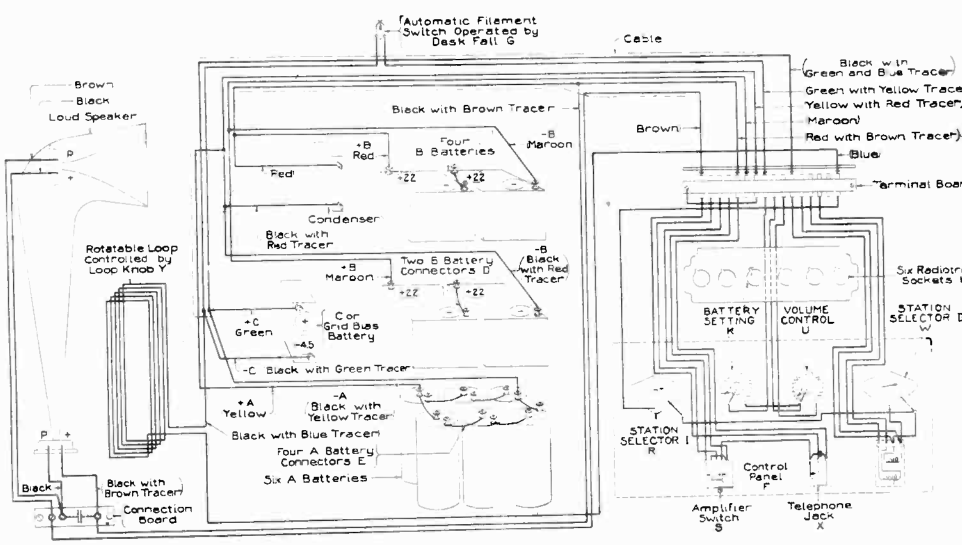


Fig. 5. Connection Diagram of Radiola Super-VIII

meter of suitable range (100- or 150-volt scale), for measuring the "B" battery voltage. Connect the positive (+) voltmeter terminal to the "+B" lead in the upper battery compartment (Fig. 1) and the negative (−) terminal to the "−B" lead in the middle battery compartment. When the voltage has dropped to 68 volts total, or to 17 volts per battery, the batteries should be replaced.

An indication of exhausted "C" batteries may be had by listening to the loud speaker with no stations tuned in. If the loud speaker gives forth a continuous noise, the battery needs renewal. The noise may be either a high pitched whistle, a high cackling sound or a low gurgling murmur. Frequently the whistle is so high as to be above the range of audibility for some persons, but, in any case, the noise becomes more audible as the batteries age.

Instructions for Using Model UR-556 Adapter

The Model UR-556 Adapter is designed for using Radiotron UX-120 in the *last audio stage only* of radio receiving sets originally using Radiotrons Model UV-199, and more particularly in Radiola Super-VIII or Radiola Super-Heterodyne (Second Harmonic). The use of this Radiotron as the last audio amplifier will provide greater volume of signal along with increased quality of reproduction. The Adapter takes care of the difference in size and arrangement of the contact pins in the bases of the two Radiotrons, and provides terminals for making ready connection to the additional plate and grid bias batteries required for the new Radiotron.

APPLICATION TO RADIOLA SUPER-HETERODYNE SECOND HARMONIC

Additional Batteries Required. Radiotron UX-120 with its Adapter will require the following batteries, in addition to those already installed:

B–Two 22½-volt plate batteries connected in series. Approximate size, 4 1/16 in. by 2¾ in. by 2 11/16 in. such as: 2 Burgess No. 5156 BP plate batteries, or 2 Eveready No. 768 Plate Batteries, or 2 Ray-O-Vac No. 5151-BP Plate batteries,

OR EQUIVALENT

Or, One 45-volt battery may be used instead of two 22½-volt batteries. Approximate size 2½ in. by 4¼ in. by 5¼ in., such as 1 Burgess No. 5308 plate battery, OR EQUIVALENT.

C–One 22½-volt "B" battery used as a grid bias or "C" battery, such as those listed as follows:

	Horizontal	Vertical
1 Burgess	No. 5156 BP or	No. 5158 plate battery or
1 Eveready	No. 768 or	No. 764 plate battery or
1 Ray-O-Vac	No. 5151 BP or	No. 1153 plate battery OR EQUIVALENT.

Installation of Equipment in Radiola Super-Heterodyne (Second Harmonic).

Remove the control panel C by turning the control panel latch T, pulling the panel forward, unhooking the stay joint D, lifting the panel off its hinges and laying it face down in front of the set, all as shown in Fig. 2 of the Instruction Book 86963. *Remove the six UV-199 Radiotrons from their sockets.*

Place a block of wood (6 in. long by 3 in. wide by ½ in. thick) in the rear left-hand corner of the compartment behind the panel, laying it on the loop frame. Make the connections described in the next paragraph for the two "B" batteries, and stand them on end, facing each other, on top of the block as shown in Fig. 1. (If one 45-volt block is used lay it on its side.) Make the connections required for the "C" battery, and place it on top of the two batteries just put in place, also as shown in Fig. 1.

The connections referred to above are made as shown in Fig. 3. The two "B" batteries are connected in series by fastening the "+ 22.5" (red) lead of the first battery to the negative "−" binding post of the second. The negative "−" binding post of the first battery is connected by a flexible lead (a 20-inch length of No. 18 rubber covered lamp cord, or equivalent) to the Adapter terminal marked "−45B." The "+22.5" (red) lead of the second battery is connected by a second flexible lead to the "+45B" Adapter terminal. The junction between the battery and flexible lead may be made by using a machine screw (say No. 8-32 by ¼ in. long) with nut and lock washer, or by soldering, if convenient. In any case, make the joint securely and *cover it with friction tape.* (In case a 45-volt "B" battery is used in place of the above, connect the negative "−" and "+45" binding posts to the "−45B" and "+45B" Adapter terminals respectively.) On the "C" battery, connect the "−" binding post and the "+22.5" (red) lead to the "−22C" and "+22C" Adapter terminals, respectively. Use the screw or soldered joint on the battery lead, as described above, and insulate it with friction tape.

While making the above connection, take care to avoid permitting any wires on battery terminals (or the terminals themselves) to come into contact with other wires, battery terminals or metal parts of the set. Make and keep all connections secure. Check the connections with the diagram when they have been completed and before inserting the Radiotrons. It is very important that the batteries be connected to the Adapter in the proper way.

Insert the Adapter UR-556 in the *left-hand socket* (see Fig. 1) letting the bayonet pin drop into the slot, pressing the Adapter down and giving it a twist to the right. Push the Radiotron UX-120 into the Adapter. It will be noticed that Radiotron UX-120 has two small and two large diameter pins in the base. The Radiotron should point toward the panel, with the large pins in the lower holes. Replace five of the UV-199 Radiotrons in the remaining sockets (1 to 5 counting from the right). Replace and latch the panel.

Operation. The operation of Radiola Super-Heterodyne will not be changed by the substitution of the new Radiotron, except for the position of the "BATTERY SETTING" knob. This will have to be advanced slightly to the right (about 4 dial graduations) beyond the setting when the six UV-199 Radiotrons were being used. Set it at 55 instead of at 47 or the arrow mark, when batteries are fresh. The most desirable method of setting this control is to measure the filament voltage, as described on pages 11 and 12 of Instructions 86963, setting the voltage at 3.0 volts.

Push in the amplifier switch (S in Instructions 86963), when using the second audio stage. In case the signal is too loud, and it is desired to operate on the first audio stage, interchange the Adapter (with Radiotron UX-120 in place) with the Radiotron UV-199 in socket 2, counting from the left. Then pull out the amplifier switch.

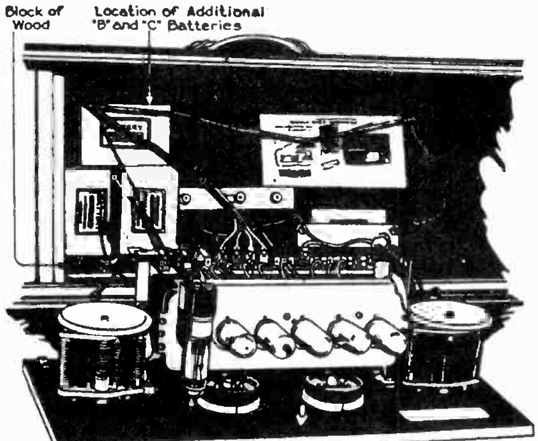


Fig. 1

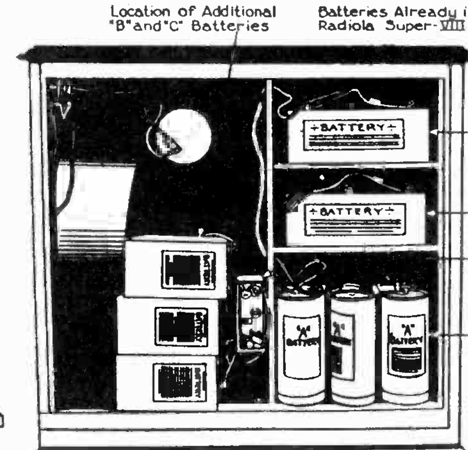


Fig. 2

APPLICATION TO RADIOLA SUPER-VIII

Additional Batteries Required. The batteries required are as follows:

B–Two 22½-volt plate batteries, connected in series. Approximate size 2¾ in. by 3¼ in. by 6 in., such as 2 Eveready No. 764 or 2 Ray-O-Vac No. 1153, OR EQUIVALENT

C–One 22½-volt plate battery, used as a grid bias or "C" battery. Size as above, such as: 1 Eveready No. 764 or 1 Ray-O-Vac No. 1153, OR EQUIVALENT

Installation of Equipment in Radiola Super-VIII. Remove the upper rear panel as described on page 4 of the Instruction Book 86962 for that set. Remove the control panel and place it face down on the desk fall of the set, using the same method as described in the foregoing for Radiola Super-Heterodyne. ***Remove the six Radiotrons from their sockets.***

Connect the batteries as shown in Fig. 3, and as described for Radiola Super-Heterodyne. In this case, however, no screw joints are needed, as all the batteries listed have binding posts and terminals, but no flexible leads. Place the batteries on the loop bearing plate as shown in Fig. 2.

Insert the Adapter and Radiotrons, replace the control and back panels and operate the receiver as under the instructions for Radiola Super-Heterodyne.

APPLICATION TO OTHER RECEIVERS

Additional Batteries Required. When substituting a UR-556 Adapter and UX-120 Radiotron for a UV-199 Radiotron in the *last stage* of other receiving sets, it will be necessary to provide additional "B" and "C" batteries to give 135 volts for the plate and 22½ volts for the grid of ***this Radiotron only,*** instead of the 90 volts plate and 4½ volts grid usually employed with the UV-199 Radiotron.

The user should determine what plate voltage was being used on the plate of the Radiotron being replaced. If 90 volts were being used by connecting four 22½-volt or two 45-volt blocks in series, the additional 45 volts will be obtained by connecting two 22½-volt or one 45-volt block to the "B" terminals of the Adapter, similar to the manner described above. The actual size and arrangement of contacts on the batteries may be as required by the particular set, but no batteries smaller than those listed for Radiola Super-Heterodyne above should be used.

The "C" battery should be a 22½-volt block, of size at least as large as those listed above, and should be connected in a way similar to that already described.

If the Radiotron UV-199 was being used with plate and grid voltages other than those mentioned, the user should provide sufficient additional "B" battery voltage so that this voltage plus that already used equals 135 volts. Then provide an extra 22½-volt block for "C" battery.

Rheostat. The UX-120 Radiotron will require the same "A" battery voltage as the UV-199 being replaced,—three dry cells connected in series, giving a total voltage of 4½ volts. Sufficient of these groups should be connected in parallel to provide the needed current.

The value of the rheostat used to control UX-120 Radiotron depends upon the set used and its connections. Radiotron UX-120 may be used with a UV-199 rheostat (usually 33 ohms), although a rheostat of only 15 ohms resistance is all that is required. For other conditions follow the table below:

Number of Radiotrons Controlled by Rheostat	Value of Rheostat (Ohms)
1 UX-120 alone	15 ohms
1 UX-120 and 1 UV-199	10 ohms
1 UX-120 and 2 UV-199	7½ ohms
1 UX-120 and 3 UV-199	6 ohms*
1 UX-120 and 4 UV-199	5 ohms*
1 UX-120 and 5 UV-199	4 ohms*

***NOTE.**—These combinations generally use same rheostat as in the radio receiver, and the proper filament terminal voltage for all the Radiotrons may be secured by advancing the rheostat pointer slightly beyond the position usually required when UV-199 Radiotrons were being used throughout.

The rheostat should be set to prevent overvoltage on the Radiotrons. To do this, measure the filament voltage with a high-grade, high-resistance voltmeter, and adjust the filament terminal voltage of all the Radiotrons to 3.0 volts. Aside from the readjustment of the filament voltage, there will be no difference in the operation of the set.

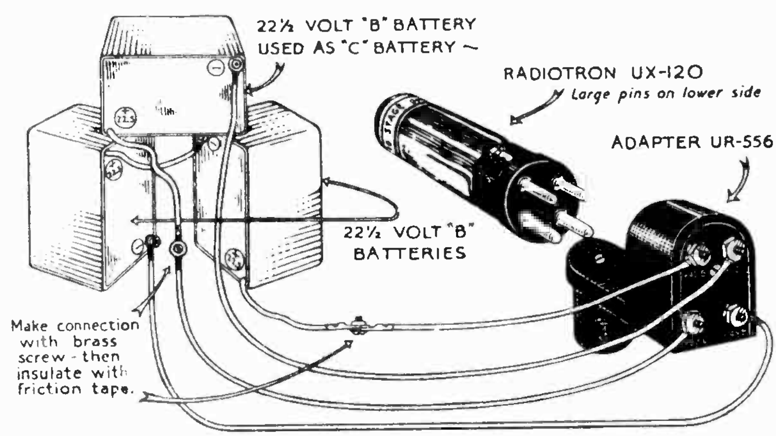


Fig. 3

NOTICE

The apparatus and devices which, or the use of which, are covered by patents, are sold only under certain specified licenses set forth in a notice attached permanently to the said apparatus and devices, or if this is impracticable on account of size, then on tags or wrappers attached to the said apparatus and devices or on the cartons containing the same. This license notice is as follows:

"In connection with devices it sells, Radio Corporation of America has rights under patents having claims: (a) on the devices themselves and (b) on combinations of the devices with other devices or elements, as, for example, in various circuits and hook-ups.

"The sale of this device carries a license under the patent claims of (a), but only for (1) talking machine uses, (2) radio amateur uses, (3) radio experimental uses and (4) radio broadcast reception; and only where no business features are involved.

"The sale does not carry a license under patent claims of (b) except only (1) for legitimate renewals and repairs in apparatus and systems already licensed for use under such patent claims on combinations, (2) for assembling by amateurs and experimenters, and not by others, with other licensed parts or devices, or with parts or devices made by themselves, but only for their own amateur and experimental radio uses where no business features are involved, and not for sale to or for use by others, and (3) for use with licensed talking machines and licensed radio broadcast receiving devices; and only where no business features are involved."

Radiola IX

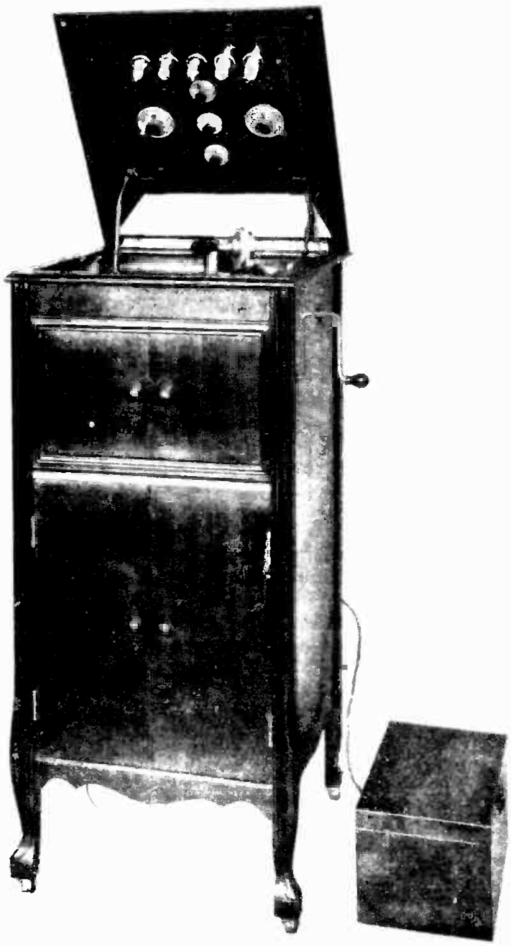


FIG. 1—RADIOLA IX INSTALLED IN STANDARD PHONOGRAPH

INTRODUCTION

Radiola IX is an improved type of radio receiver, designed and adapted for use in combination with, and as an adjunct to, the phonograph, and is so constructed that it may be placed in the lid of the phonograph, in the record cabinet, or in the upper left section of console models, dependent upon the particular make and model of phonograph involved.

Electrically, Radiola IX consists of a highly selective two circuit tuner, with detector and radio-audio amplifier, using five UV-199 Radiotrons. These tubes are dry-cell operated and all necessary "A," "B" and "C" batteries are contained in a separate battery box furnished with the receiver, and connected to the receiver by a multi-conductor cable. The amplifier supplies energy to a loud-speaker unit which has a special attachment for connection to the tone arm of the phonograph, thus preserving good quality of reproduction through the original tone arm and horn of the phonograph. Local signals produce an extraordinary volume for dancing purposes.

The wave-length range of the Radiola IX covers the entire broadcasting band of 220 to 550 meters and through the use of specially designed radio frequency transformers practically equal sensitivity is secured over the entire broadcast wave-length band. Good results may be obtained with an indoor antenna, using the 18 foot silk-covered, single conductor wire supplied which should be carried around the room on the picture moulding; or, where greater range is desired, an outdoor antenna of a single wire 20 ft. to 100 ft. long, and 30 ft. to 50 ft. high may be employed. For local work, the indoor antenna is sufficient, but for long distance reception the outdoor antenna is preferable.

UNPACKING

Radiola IX is shipped complete in one large carton. Inside this carton will be found a smaller carton, which contains the receiver itself, wrapped in waxed paper, together with the side strips and corner pieces, where it is ordered for installation in phonograph lids, or the hinges and latch which are supplied for other types of installations.

There is also contained in the large carton the battery box, containing the following:

6 UV-199 Radiotrons (5 being required for the set and 1 being a spare).
1 Cable with all necessary leads and connections for batteries, loud speaker, antenna and ground.
2 Battery Connectors for "A" Batteries.
1 Loud Speaker.
1 Loud Speaker Support.
1 Loud Speaker Adapter, to fasten loud speaker to tone arm.
2 Cable Escutcheons and Screws.
4 Special Brackets for Mounting Radiola IX to Phonograph Lid.
4 Nuts for same.
4 Special Screws for Border Frames.
8 Copper Tacks for Fastening Border Frame to Panel.
1 Instruction Book.

In the Radiola IX's which are furnished for installation in the lids of Columbia Phonograph Model G-2, there is also contained the following part:

1 Longer Supporting Bracket for Phonograph Lid.

In Radiola IX's which are designed for the lids of Victrolas, VV-100, all of the above material is furnished except the longer supporting bracket for phonograph lid, this being unnecessary in the case of the Victrola, in which the original supporting bracket is of sufficient length.

Where the set is to be installed in the lids of certain phonographs, a template for drilling the phonograph covers will be found in the large carton.

BATTERIES REQUIRED

(A) Refers to Filament Lighting or "A" Battery.
(B) " " Plate or "B" Battery.
(C) " " Negative Grid or "C" Battery.

(A) Six $1\frac{1}{2}$ Volt Dry Cells, connected in two PARALLEL groups of three cells each in SERIES, such as:

6 Eveready Dry Cell Radio "A" Batteries No. 7111 ($2\frac{1}{2}$x6)*or,
6 Burgess Radio "A" Dry Cells No. 6 ($2\frac{1}{2}$x6) or,
6 Manhattan Red Seal Dry Cells, No. 2445 or 2448 ($2\frac{1}{2}$x$6\frac{1}{2}$)

or,

6 Ray-O-Vac Radio "A" Dry Cells No. 1211 ($2\frac{1}{2}$x$6\frac{1}{2}$) or,
6 Columbia Ignitor No. 6 Dry Cells ($2\frac{1}{2}$x$6\frac{1}{2}$) or,
6 Ace Radio "A" Dry Cells No. 61 ($2\frac{1}{2}$x6) or,
6 Yale Radio Power-Pak No. 101-R ($2\frac{3}{4}$x$6\frac{1}{2}$)

OR EQUIVALENT

(B) Two 45-Volt Plate Batteries. NOTE: Though four $22\frac{1}{2}$-volt units may be used two 45-volt units are preferred instead. Such as:

2 Eveready No. 767 Plate Batteries, EACH 45-Volts (8x$6\frac{5}{8}$x3)

or,

2 Burgess No. 2306 Plate Batteries, EACH 45-Volts ($7\frac{7}{8}$x$6\frac{5}{8}$-x3) or,
2 Yale No. 3045 V Plate Batteries, EACH 45-Volts (8x$6\frac{5}{8}$x3)

OR EQUIVALENT

(C) One $4\frac{1}{2}$ Volt Negative Grid Bias or "C" Battery. Such as:

1 Eveready No. 771 Negative Grid Bias Battery (4x3x$1\frac{3}{8}$) or,
1 Ray-O-Lite No. 231 R Negative Grid Bias Battery (4x3x$1\frac{7}{16}$)

or,

1 Burgess No. 2370 Negative Grid Bias Battery (4x3x$1\frac{3}{8}$) or,
1 Yale No. 312 Negative Grid Bias Battery (4x3x$1\frac{3}{8}$) or,
1 Bright Star "B" 34-17 Negative Grid Bias Battery (4x3x$1\frac{3}{8}$)

or,

1 Novo No. 288 Negative Grid Bias Battery (4x3x$1\frac{3}{8}$)

OR EQUIVALENT

INSTALLATION

THE INSTALLATION OF THE RADIOLA IX IN A PHONOGRAPH SHOULD BE LEFT TO A PHONOGRAPH DEALER OR CABINET MAKER.

If the set is desired only for local work, the indoor antenna wire supplied with the set should be carried around the room on the picture moulding, or otherwise fastened. If an outdoor antenna is desired, a single wire 20 ft. to 100 ft. long, and 30 ft. to 50 ft. high, should be erected, properly insulated at both ends, and with a lead brought to the point where the Radiola IX is to be operated. In the case of an outside antenna, the wire should be kept at least 10 ft. away from trees and large objects, such as roofs and other structures. As a precaution, never have the antenna wire strung over or under electric light wires, for if by falling such wires should come in contact, the set and the operator might be endangered.

Whether an indoor or outdoor antenna is used, a ground connection must be made. This connection is preferably made to a water pipe, but if this is inconvenient, a radiator or steam pipe will usually serve the purpose. Do not connect the ground wire to a gas pipe. Care should be taken in the installation of antenna and ground to insure good and solid connections. The best method is to clean the piping well with a file and then solder securely. An approved form of ground clamp, properly installed, is satisfactory.

If an indoor antenna of less than 40 ft. is used, the flexible lead on shunt condenser, Fig. 4, must be connected to the brown or antenna terminal on the terminal board of the Radiola IX. Should a longer or outside antenna be used, this flexible lead should be connected to the black, or ground terminal on the terminal board, which throws the condenser out of circuit.

CAUTION:

Before making any battery installation, be sure that all the Radiotrons are removed from their sockets. Be sure also that the cable is connected first to the receiver terminal board before it is connected to any batteries; otherwise, the batteries may be short-circuited and their life materially reduced.

The "A" batteries must be placed in the box with their terminals as shown in Fig. 4. Remove thumb screws and place special connector on batteries as shown. This connects the batteries in three series groups, of two cells each in parallel. The yellow leads are connected to the center or positive terminal of the "A" battery and the black leads to the outside or negative terminal.

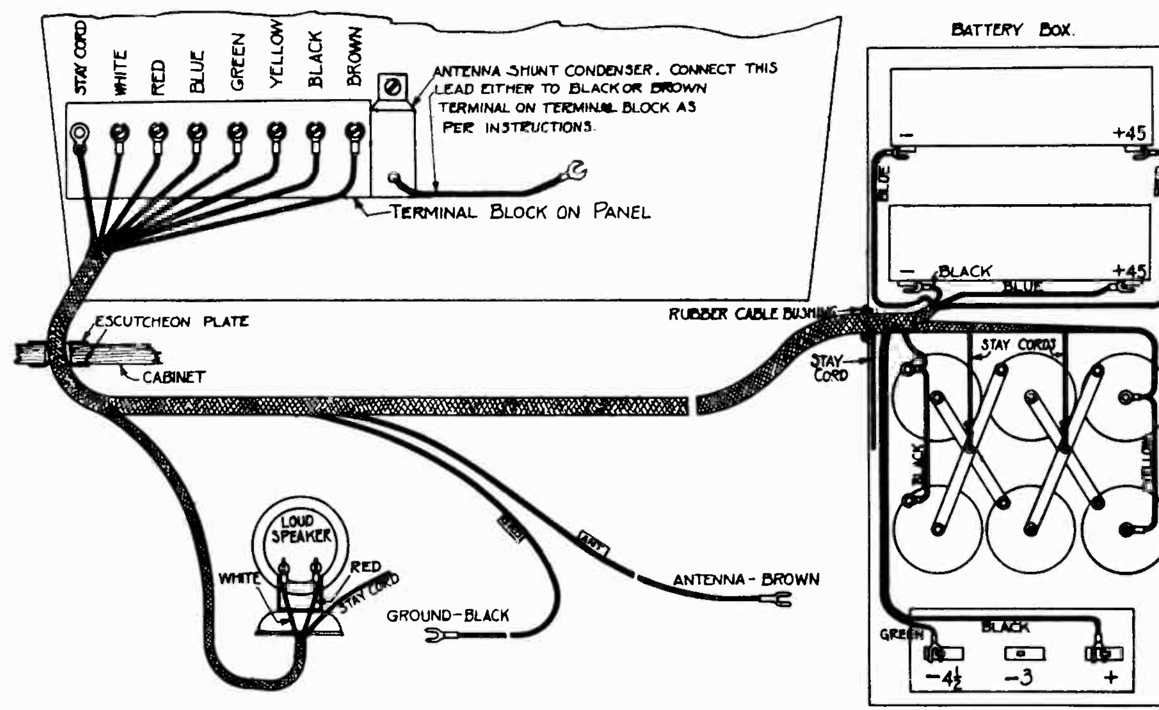


FIG. 4—CABLE CONNECTION OF RADIOLA IX LOUD SPEAKER AND BATTERY

The method of connecting the "B" battery is clearly shown in the diagram in the battery box, Fig. 4. The leads are sufficiently long to permit making the connection outside the box for convenience. Then the batteries should be placed in the box as shown, taking care that no terminals touch the box.

The "C" battery fits in the smaller space to the left of the "A" battery. The wire with green terminal should be connected to the $4\frac{1}{2}$ volt negative, or minus, clip on the battery and the black terminal to the positive, or plus, clip.

Great care should be taken to keep the battery connections tight, as failure to do so may result in objectionable noises or complete inoperation of the set.

OPERATION

1. Be sure that set is properly connected, as per diagram, Fig. 4.
2. Be sure filament control (Dial No. 1) is turned as far as it will go to the left or counter-clockwise direction. Start with all pointers at the left or zero marks.
3. Insert tubes in their bayonet sockets by pressing down slightly and turning to the right.
4. Advance the filament control to graduations 5 or 6 on its dial.
5. Choose approximate wave-length desired by use of Selector No. 2 with the aid of the chart below:

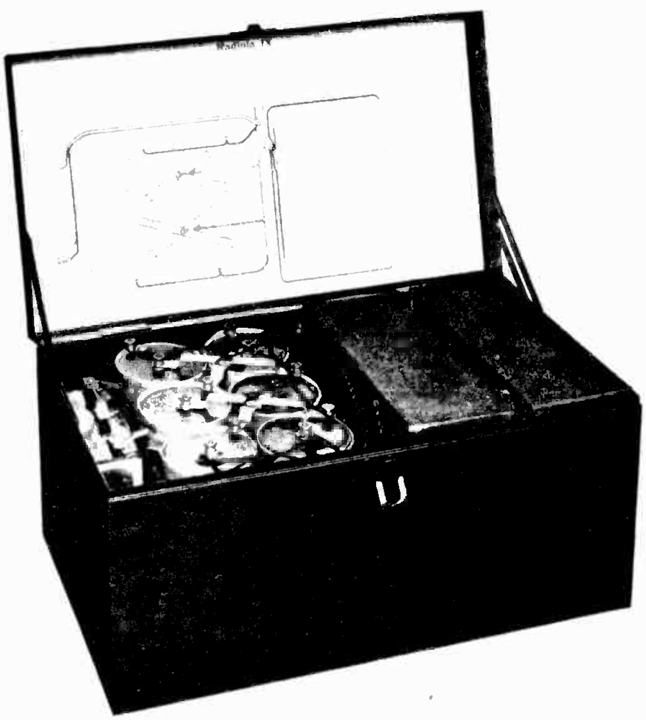


FIG. 5—PHOTOGRAPH OF BATTERIES CONNECTED AND IN BOX

SERIAL No. ....

Wave Length	2 Selector	3 Secondary
250		
300		
350		
400		
450		
500		
550		

6. Place secondary tuning control (Dial No. 3) on corresponding graduation wave-length band, as shown on dial.
7. Swing antenna tuning control (Dial No. 4) through its range several times.
8. If signals are not heard bring up volume control (No. 5), until a click is heard. This is termed "the oscillation point." Now with this control held just below this point, Vernier controls 3 and 4 must be operated together to give best results, especially on long distance signals, or signals from weak stations.

On weak stations it is best to allow the set to oscillate, that is, bring control well beyond the click point and swing control 3 through its range determined by selector position. When a whistling sound, known as the "carrier beat" is heard, it should be brought to maximum by control 4, then control 5 should be reduced gradually until the oscillations cease, keeping whistling sound in tune at the same time by Vernier control 3. The carrier beat will then disappear and station will be heard without distortion.

To strengthen the signal, work the stabilizer as near the oscillation point as possible and retune with Vernier controls 3 and 4. Bear in mind that the stabilizer is an adjustment of sensitivity and not of tuning. Care should be taken that set is not left in oscillating condition.

The filament control (Dial No. 1) should be advanced as the filament batteries are consumed. This control should, however, be kept always as low as possible consistent with good reception, else the life of the tubes, and to some extent also the life of the batteries, will be seriously shortened.

REPLACEMENTS

Batteries and tubes are the only parts which require replacement.

"A" BATTERIES:

With average use, these batteries should last several months. They require replacement when the filament control Dial No. 1 must be kept at maximum (10) for good reception, and when the tubes light but dimly with the pointer in that location.

The old cells can be removed by disconnecting all wires from battery binding posts. Then cells may be taken out and new ones connected in their place. On each lead is color marking designating the point to which the lead is to be connected. Reference to figures will preclude the possibility of an error in connection, and will warrant careful attention. The carbon or center part of a standard dry cell is positive.

DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE CHANGING ANY BATTERIES. NEVER BURN TUBES MORE BRIGHTLY THAN REQUIRED FOR A SIGNAL OF REASONABLE VOLUME.

"B" BATTERIES:

"B" batteries may be tested by a high resistance type of voltmeter which will indicate up to 100 volts at least. The meter should show at least 90 volts when across both batteries (new) and batteries are exhausted when total voltage falls below 70 volts.

To replace, lift battery unit out and unclip leads. The battery leads are long enough to permit the units to be lifted out of the box, for their connection. DON'T FORGET TO REMOVE TUBES FROM SOCKETS BEFORE REPLACING ANY BATTERIES. Connect the new units exactly as shown in Battery Box cover.

"C" BATTERIES:

These cells should be renewed every six months to insure proper functioning of Radiola IX.

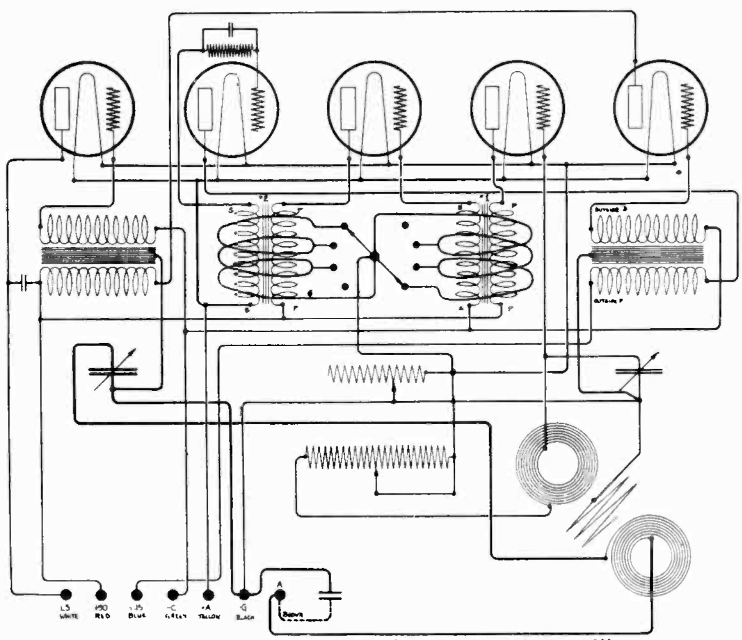


FIG. 6—SCHEMATIC WIRING DIAGRAM OF RADIOLA IX

Radiola X

INTRODUCTION

The Radiola X Receiver using four WD-11 Radiotrons is a complete radio receiving set with self-contained loud speaker and provision for internal batteries, mounted in an attractive mahogany cabinet. It contains everything necessary for operation, except the antenna and ground connections and the necessary batteries. It has been designed especially for broadcast reception and will tune to all wave frequencies between 1400 and 540 kilocycles (220 to 550 meters).

The circuit employed is the newly developed REGENOFLEX circuit, designed to eliminate radiation, that is, interference with a neighboring radio set, and also to give selectivity (or the ability to select the station desired) to a degree unapproached by the usual antenna type of receiver.

The Radiola X Receiver embodies the following features:

1. Ease of operation.
2. High selectivity.
3. Freedom from radiation.
4. Radio frequency amplification.
5. Regeneration.
6. Audio frequency amplification with improved transformers, using a special alloy for the cores.
7. Use of negative grid bias or "C" battery.
8. A loud speaker (electro-accoustic unit) giving vastiy improved tonal quality of reproduction, and covering a wide range in frequency.
9. A lock to prevent unauthorized use of receiver, or removal of Radiotrons.
10. An unusually pleasing cabinet.
11. Dry cell operated, no storage battery required.
12. Batteries and loud speaker self-contained.
13. High sensitiveness, permitting loud speaker reception from distant stations.
14. The loud speaker is built into the cabinet with its opening at the front above the panel.
15. The panel contains all necessary controls. It can be tipped forward to give access to the interior for insertion or replacement of Radiotrons.
16. All necessary batteries are located in the space provided at the back of the cabinet. The entire back of the cabinet is removable permitting free access to the interior. On the inside of the back is a card showing the proper location of the batteries. The antenna and ground connections are made by binding posts at the back of the cabinet near the bottom.
17. The appearance of Radiola X is such that it is an article of furniture welcome in any living room, and its capabilities as a musical instrument make it a never ending source of entertainment.

EQUIPMENT

Radiola X is supplied complete ready for operation with the exception of the antenna, ground connection and batteries. Four WD-11 Radiotrons are supplied which, with reasonable care, should last for approximately a year when used several hours per day.

In addition there are required a suitable antenna and ground, and "A", "B" and "C" batteries as follows:

"A" Battery (for filament heating)

Six 1½ volt dry cells, connected in PARALLEL, of any of the following:

Burgess Radio "A" Dry Cell #6.
Eveready Radio "A" Dry Cell #7111.
Manhattan Red Seal Dry Cell #2445.
Ray-O-Vac Radio "A" Dry Cell #1211.

or any other make of good dry cell having a diameter of 2½ inches and a height not exceeding 6½ inches and having screw and thumb nut terminals.

"B" Battery (for plate supply)

Four 22½ volt Plate Batteries, connected in series of any of the following:

Burgess # 5156 B P Plate Battery.
Eveready # 768 Plate Battery.
Ray-O-Vac # 5151 B P Plate Battery.

or any other make of good radio "B" battery whose base dimensions do not exceed 4⅛ by 2¾ inches. Leads are arranged for intermediate size batteries with lead and binding post as listed above. Other intermediate size batteries may be used or some of the new vertical types such as Eveready # 764 and Burgess # 5158.

"C" Battery (for grid bias)

One 4½ volt Grid Battery of any of the following:

Eveready # 771 Grid Battery.
Ray-O-Vac # 231-R Grid Battery.
Burgess # 2370 Grid Battery.

or any other make of good three cell battery, whose dimensions do not exceed 4 by 1⅜ inches.

INSTALLATION

Location—The Radiola X should be placed as near as possible to the incoming lead from the antenna. A good ground such as a water pipe should be not far away.

If possible, place the Radiola X in a fairly large room and one which does not have bare walls, as draperies, hangings, etc., will prevent accoustic reflections and help to make the entertainment more pleasing.

ANTENNA

Outdoor Type—In general, best results will be obtained with an outdoor antenna, from 100 feet to 200 feet long, including the lead-in wire, and 20 or more feet above the ground. If the suggested length and height cannot be secured, approach them as nearly as possible. So far as possible, the antenna should be located in a space above the tops of surrounding buildings and trees. It should not be touched by any object except the antenna insulators. The same precautions apply to the lead-in wire which should be a continuation of the antenna wire without any joints, and should run as directly as possible to the receiver. The antenna should be at right angles to electric light, traction, power and other wire lines which may cause objectionable noises. If practicable, the antenna should be at least 15 feet distant from such wire lines and other antennae.

When an outdoor antenna is used a protective device of a type approved and in accordance with the National Electric Code, should be installed to remove all danger from lightning or power wires.

Outdoor aerials having a length up to 200 feet should be used since louder signals and greater distances can thus be secured. Proper volume control and selectivity will be obtained by adjustment of the "Volume Control" knob, regardless of the size of the antenna, provided the length does not exceed 200 feet approximately.

If an antenna is available, it may be used provided that it is not more than 200 feet long. If a new antenna is to be erected, all necessary material and full directions will be found in the Antenna Package of the Radio Corporation of America, Type AG-788.

Indoor Type—For local reception, satisfactory results may be secured by using only 20 to 30 feet of ordinary double cotton covered bell wire (# 18 B & S) strung around the picture moulding. It may also be run the length of an attic. Such an antenna will not be satisfactory in a building with metal lath under the plaster.

Loop Type—A loop aerial can be used for nearby local reception.

GROUND

A good ground is as necessary as a good antenna. Perhaps the best ground is a good electrical connection to a water pipe. If this is not convenient, a connection to the steam or hot water heating system will serve unless there is a bad joint in the piping. Connections to gas pipes should not be used. If nothing of this nature is available, a pipe or metal rod may be driven into the ground to a depth of several feet, preferably where the soil is moist. The ground connection should be made with a ground clamp, the wire being soldered or held by clamping under a screw or nut. Be sure to scrape and clean the pipe thoroughly before attaching the ground clamp. Usually, connecting to more than one ground, for instance to both water and steam pipes, will improve reception.

CONNECTIONS

There are two binding posts at the bottom part of the cabinet near the middle of the back. One of these has a small plate with the letters "ANT." Connect the lead from the antenna to this binding post. The other has a small plate with the letters "GND." Connect a wire from the ground clamp to this binding post. Make both leads as short as possible.

All batteries fit into compartments at the back of the cabinet. Turn the cabinet so that easy access and good lighting may be had. Remove the back panel entirely by pulling outward at the top. The card on the inside of the back panel shows the proper arrangement of the batteries and the connections to them.

The "A" battery of six cells is arranged in two tiers of three cells each, connected in parallel, in the space between the horn and the left side of the cabinet viewed from the back. Only the round type of cell may be used and these must have terminals of the screw and thumb nut type. Remove all the thumb nuts. Place three cells in the lower tray with the binding posts on the edge toward the center of the group. Find the black wire with the brass disc attached to it. This disc has three holes which will slip over the three edge binding posts at the center of the group. Find the loop of yellow wire near the top of the cells with three lugs soldered to it and slip the lugs onto the center terminals of the cells nearest to each. After the first lug has been placed on a cell terminal, do not allow the others to touch any metal parts. Now replace the thumb nuts on the three cells and screw them down as tightly as possible. The same process is then to be applied to the other three cells in the upper tier. The result will be six cells in parallel.

The "B" battery is placed upon the bottom of the cabinet. Metal curbs are provided to keep the blocks in place. The battery should consist of four blocks of radio "B" battery, each giving normally 22½ volts. These blocks are to be connected in series according to the diagram. The battery space is designed primarily for the intermediate size plate batteries equipped with a lead at the positive end and a binding post at the negative end. These blocks are particularly easy to connect. Arrange them as shown in the diagram Fig. (2.) Connect the black lead from the set marked "—B" to the binding post of block number (1). Connect the battery lead from block number (1) to the binding post of block number (2) and to this same binding post connect the orange lead from the set marked " + 20 B." Then connect the lead from block number (2) to the binding post of block number (3) and the lead from block number (3) to the binding post on block number (4). The lead from block number (4) goes to the post on the side of the cabinet to which is attached a red lead from the set marked "+ 80 B." In case another type of battery is used, proceed as follows after placing blocks in the curbs. First find the black lead from the set which is marked "—B" on a small metal tag. Connect this lead to the negative terminal, which may be marked either "—" or "NEG", of one of the blocks which we shall now call number (1). Then find the orange lead from the set, this being marked "+ 20 B" and connect it to the positive terminal, which may be marked either "+", "+ 22½" or "POS", of block number (1). At the same time connect a short piece of wire to the same POSITIVE terminal of block number (1) and connect its other end to the NEGATIVE terminal of block number (2). In the same way connect the POSITIVE terminal of block number (2) to the NEGATIVE of number (3) and the POSITIVE of number (3) to the NEGATIVE of number (4). This leaves the positive of number (4) with no connection to it. Now connect a wire from this positive terminal to the binding post on the side of the cabinet to which is attached a red lead and a tag marked "+ 80 B."

The "C" battery is located in a small compartment just back of the horn. It should have three cells, giving voltages of 3 and 4½. The usual types have three terminals. Connect the lead having the tag marked " +C" to the terminal on the "C" battery marked "+" or "POS". Connect the other lead having the tag marked "—C" to the terminal marked "—3" or "—4½" as desired.

NOTE—3 volt connection will give greater volume. 4½ volt connection will better conserve the "B" batteries.

When all of the battery connections have been made, replace the back of the cabinet. Make sure that it is solidly in place. Note that the antenna and ground connections are tight or if they have been removed to facilitate the battery connection replace them according to directions.

To place the Radiotrons in the set, it is necessary to tip forward the operating panel. In the upper right corner of the panel is a combination lock and switch. This in the locked position opens the filament battery circuit and prevents the panel from being tipped forward. Insert the key and turn it to the right. In the upper left corner there is also a small catch. Turn this also to the right, and then pull. The panel will tip forward leaving a clear space of about three inches at the top. Remove four Radiotrons from their cartons and insert them in the sockets provided in the tube mounting board directly in back of the panel. **Push the Radiotrons straight down until the bases touch the socket panel.** The sockets are arranged so that the large pin in the base of the radiotron will be toward the panel. Be sure that the control marked "Battery Setting" has been turned as far to the left as possible before the Radiotrons are inserted. Then while the panel is still in the forward position, turn the "Battery Setting" to the right until the pointer reaches the mark diagonally upward to the right. Look down into each of the Radiotrons and make sure that all the filaments glow with a dull red color. Then tip the panel back into normal position and turn up the catch at the left.

A jack is provided at the extreme right of the panel a little above the center. This jack is in parallel with the loud speaker and is so connected that when a plug is inserted, the loud speaker in the cabinet is disconnected. It is intended for connection to a separate loud speaker or, under very exceptional circumstances, to a telephone headset.

OPERATION

Control

Volume Control—The control so marked serves to regulate the transfer of energy between the two tuning circuits. Thus it regulates the strength of the signal. It also governs the selectivity of the set, that is, the further the "Volume Control" is turned toward the left, the more easily can various stations be separated.

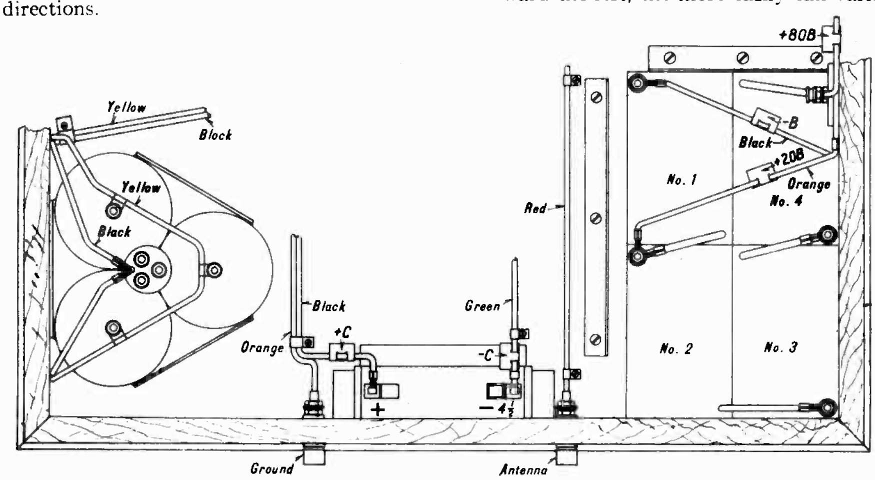


Fig. 2—Diagram of Battery Connections

Battery Setting—The control so marked serves to turn on and regulate the current to the filaments of the Radiotrons. When the set is not in use, either the lock directly above this control should be in the locked position with the key vertical or else the pointer of the "Battery Setting" should be turned as far to the left as possible. When it is desired to operate the set, unlock it and then turn the "Battery Setting" pointer until it rests on the mark diagonally upward to the right. With new dry cells in the "A" battery, this adjustment will give the proper current through the filaments. As the cells become old, it will be necessary to turn the "Battery Setting" still further to the right. The filaments should always glow at a dull red color, and should never be burned brighter than necessary to obtain signals. They may be examined at any time by tipping the panel forward.

Station Selector I—The control so marked serves to adjust the antenna tuning circuit so that it will respond to the desired wavelength.

Amplification—The control so marked adjusts the regeneration, and thereby regulates the sensitivity and the selectivity of the set.

Station Selector II—The control so marked adjusts the secondary tuning circuit so that it will respond to the desired wave length.

FINDING SIGNALS

Turn the "Volume Control" pointer to the right as far as it will go.

Turn the "Battery Setting" until the pointer rests on the mark, previously described, which shows proper position when batteries are new.

Turn "Amplification" until a breathing sound is heard. This should occur when the pointer reaches "2.5" or a little before. If it does not disconnect the lead marked "+20 B" from the positive terminal of the first block of the "B" battery and connect it to the positive terminal of the second block.

Turn both "Station Selector I" and "Station Selector II" from one end of the scale to the other keeping them at approximately the same reading all the time. GO SLOWLY and listen carefully. A squeal or whistle will be heard when the set is tuned to a station that is operating. When the whistle is heard, turn "Station Selector II" until the whistle assumes a very low pitch. Then turn "Station Selector I" until the whistle becomes loudest. Finally turn "Amplification" to the left just enough to stop the whistle when the speech or music should be heard clearly. A slight readjustment of "Station Selector II" may be necessary for best results. Of course it may happen that a station is found between numbers of its program. Therefore, if nothing is heard at the conclusion of the above process, wait a minute or so. Do not wait too long before adjusting "Station Selector II". A whistle may also be produced by an improperly operated receiving set nearby but such a whistle seldom remains constant.

A little experience in making the adjustments will be necessary before stations can be found easily and quickly but once this experience is had, the operation of picking up signals and tuning the receiver is very simple.

It will be found that there is a definite relation between the two "Station Selectors", for example, when "Station Selector II" is set on "3", "Station Selector I" should be nearly "3" when both are tuned to the same wavelength. It may happen that this agreement will not be very close in which case "Station Selector I" will reach one end or the other of the scale before "Station Selector II", thus making it impossible to tune both selectors accurately over the whole wavelength range. To improve this condition, tip the panel forward. At the extreme left is a coil wound on a micarta tube. At the top of the coil are four terminals, to one of which is attached a lead from the antenna. Remove this lead and attach it to one of the other terminals. With any ordinary antenna a terminal can be found where the agreement between the "Station Selectors" will be close. Ordinarily the lead should be left on this terminal as it facilitates tuning. More sound volume may be obtained when listening to stations which operate at frequencies less than approximately 860 kilocycles (greater than approximately 350 meters) by moving this lead to the terminal nearest the panel. This will cause "Station Selector I" to reach the lower end of its scale before "Station Selector II" and will destroy the agreement between them and make it impossible to tune to stations operating at high frequencies (low wave lengths.)

It is often convenient to have a record of the adjustments when tuned to various stations. The setting of "Station Selector I" and "Station Selector II" should be recorded for each station heard. Then when it is desired to hear that particular station, set the "Station Selectors" at the right points, adjust the "Amplification" and the station should be heard if it is operating.

When receiving from nearby stations, it may happen that the volume will be greater than is desired. Do not attempt to decrease the volume by turning back the "Battery Setting" as that will spoil the quality. Turn back the "Volume Control" until the signal strength has been reduced as much as is desired. Selectivity or the ability to pick a desired station out of interference, depends upon the setting of "Volume Control." The receiver is much more selective when this control is turned to the left so that it is often desirable to operate with this control almost to the left limit. This weakens the signals somewhat, but they can be brought up to desired loudness by further adjustment of the "Amplification Control."

The loud speaker is adjustable and is properly set before it leaves the factory. In case the adjustment has been disturbed and it does not operate satisfactorily, proceed as follows: Adjust the set to give a fairly loud signal from a nearby station. Remove the panel at the back of the set and the loud speaking element will be found in the upper right (from the back) corner. Reach in and find the knurled edge. Turn it to the right, i.e., so that the top moves away from you, until a rattling sound is produced. Then turn it back until the rattling sound ceases. This is the most sensitive adjustment and the loud speaker should ordinarily be left this way. When the signals are especially loud, it may be necessary to turn the knurled part back still further to prevent rattling. On the other hand, when the signals are extremely weak and it is desired to make the utmost of them, the knurled part may be turned still further to the right. In any case, the adjustment must be such that a rattling sound is not produced.

It is not recommended that the loud speaking element be adjusted frequently as this involves needless trouble. It should be adjusted as described at first and so long as it does not rattle, should be left alone.

MAINTENANCE

Radiotrons—When not mistreated, the Radiotrons will last for many months. Occasionally one will become inoperative on account of a broken filament or otherwise. It should be replaced by a new one of the same type.

Filament or "A" Battery—When the dry cells used for this purpose become discharged to the point where they will no longer heat the filaments to the proper brilliancy, they should be replaced by new ones.

Plate or "B" Battery—The "B" Battery should last for several months. When signals become weak with the filaments burning properly or operation becomes noisy, the "B" batteries should be replaced by new ones. If a voltmeter (preferably of the high resistance type) is available, the batteries may be tested. They should be discarded when the voltage has dropped to 17.

Bias or "C" Battery—It is difficult to tell when this battery is exhausted except by measurement of its voltage with a voltmeter. The safe plan is to renew it whenever the "B" battery is replaced.

SPECIFICATIONS

Cabinet—The cabinet is a fine example of the cabinet making art. It is made of mahogany, finished in dark brown and given a high polish.

Panel—The panel is moulded from a phenolic condensation product.

Variable Condensers—The variable condensers are especially smooth running. They are driven by a friction disc giving a slower motion to permit accurate tuning.

Fixed Condensers—The fixed condensers are of two types both especially designed for their uses.

Antenna Circuit Coils—The antenna circuit coils are wound on micarta tubing and are carefully impregnated and baked. They will retain their high efficiency indefinitely.

Secondary Circuit Coils—The secondary circuit coils are of an improved design and are so arranged as to require only a very small space.

Radiotron Sockets—The Radiotron sockets are of the well known sliding contact type and insure a positive connection to the Radiotrons. The Radiotron board is flexibly mounted on rubber to eliminate mechanical noises.

Transformers—The audio transformers use a special alloy material for the cores. This produces much better amplification at low frequencies than has been had in any previously used transformers.

Jack—The jack is of special design to keep all metallic parts from the front of the panel.

Radiotrons—The Radiotrons are type WD-11. They have been redesigned with small bulbs and moulded bases to occupy less space.

Loud Speaker—The loud speaker is the latest development in electro-accoustics and has a very wide frequency range. The quality of reproduction is unusually faithful and pleasing.

Circuit—The circuit employed is the newly developed "REGENOFLEX" circuit which eliminates radiation and gives excellent sensitivity and selectivity. The REGENOFLEX circuit combines radio frequency amplification, regeneration, audio amplification and freedom from radiation.

Of course, all Radiotrons are properly biased by the use of suitable grid or "C" battery, which is an essential to good quality reproduction and which greatly increases the life of Radiotrons and plate batteries.

The stage of radio frequency amplification is balanced so that it cannot oscillate and therefore this set cannot radiate and cause interference to other nearby receivers. Radio frequency amplification and regeneration make this set especially sensitive while the two tuned circuits plus regeneration make it selective.

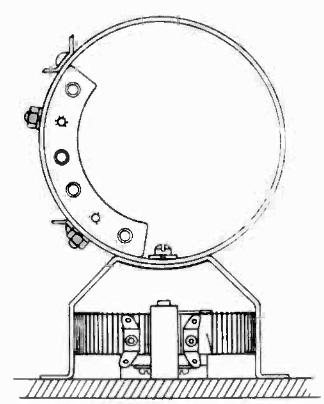


Fig. 3—View Showing Top of Antenna Coil

Radiola Regenoflex

INTRODUCTION

The Radiola Regenoflex Receiver, using four WD-11 Radiotrons, is a complete radio receiving set with self-contained batteries mounted in an attractive mahogany cabinet and contains everything necessary for operation, except the loud speaker, antenna and ground connections and the necessary batteries. It is designed especially for broadcast reception and will tune to all frequencies between 1400 and 540 kilocycles (220 to 550 meters).

The circuit employed is the newly developed Regenoflex circuit, designed to eliminate radiation, that is, interference with a neighboring radio set, and also to give selectivity (the ability to select the station desired) unapproached by the usual antenna type of receiver.

The Radiola Regenoflex receiver embodies the following features:

1. Super selectivity.
2. Freedom from radiation.
3. Greater sensitivity so that distant stations may be heard.
4. Radio frequency amplification.
5. Sufficient amplification so that a loud speaker may be operated on signals from distant stations.
6. "Dual amplification" whereby one tube is made to amplify at both Radio and Audio frequencies.
7. Audio frequency amplification using the balanced or push-pull method with improved transformers, using a special alloy for the cores.
8. Regeneration.
9. Use of negative grid bias or "C" battery.
10. A lock to prevent unauthorized use of receiver.
11. All batteries self-contained.
12. The panel contains all necessary controls.
13. An unusually pleasing cabinet.
14. Dry cell operation, no storage battery required.
15. Improved quality of speech and musical reproduction (when a good loud speaker is used).
16. The panel may be tipped forward to give access to the Radiotrons or to adjust the antenna tap.

The appearance of the Radiola Regenoflex is such that it will be an article of furniture welcome in any living room and its capabilities as a musical instrument will prove it to be a never ending source of entertainment.

EQUIPMENT

The Radiola Regenoflex is supplied complete ready for operation with the exception of the loud speaker, antenna and batteries. Four WD-11 Radiotrons are required which, with reasonable care should last for approximately one year's use.

In addition there are required a suitable antenna, ground connection and "A", "B" and "C" batteries as follows:

(A) refers to Filament lighting or "A" battery.
(B) refers to Plate or "B" battery.
(C) refers to Negative grid bias or "C" battery.

(A) **Six 1½ Volt Dry Cells, connected in Parallel, such as:**

6 Burgess Radio "A" dry cells ✱6 (2½ x 6) or,
6 Eveready dry cell radio "A" batteries ✱7111 (without Fahnstock clips), (2½ x 6) or,
6 Manhattan Red Seal Dry Cells ✱2445 (2½ x 6½) or,
6 Ray-O-Vac Radio "A" Dry Cells ✱1211 (2½ x 6½) or,
6 Columbia Ignitor ✱6 Dry Cells (2½ x 6½) or,
6 Ace Radio "A" Dry Cells ✱61 (2½ x 6) or,

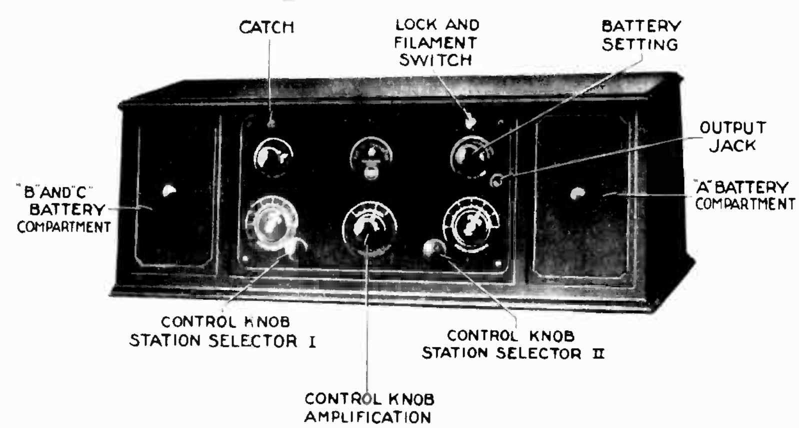


Fig. 1 Radiola Regenoflex

6 Du-al Radio "A" Dry Cells (General Duty) #6 ($2\frac{1}{2}$ x 6), or equivalent.

(B) **Four $22\frac{1}{2}$ Volt Plate Batteries, connected in series, such as:**
4 Burgess #5156 Plate Batteries ($4\frac{1}{8}$ x $2\frac{9}{16}$ x $2\frac{3}{4}$) or,
4 Eveready #768 Plate Batteries ($4\frac{1}{16}$ x $2\frac{9}{16}$ x $2\frac{3}{4}$) or,
4 French Ray-O-Vac #5151 Plate Batteries ($4\frac{1}{4}$ x $2\frac{9}{16}$ x $2\frac{3}{4}$), or equivalent.

(C) **One $4\frac{1}{2}$ Volt Negative Grid Bias Battery, such as:**
1 Eveready # 771 Negative Grid Bias Battery (4 x 3 x $1\frac{3}{8}$) or,
1 Ray-O-Vac # 231-R Negative Grid Bias Battery (4 x 3 x $1\frac{7}{16}$) or,
1 Burgess #2370 Negative Grid Bias Battery (4 x 3 x $1\frac{3}{8}$) or,
1 Yale #312 Negative Grid Bias Battery (4 x 3 x $1\frac{3}{8}$) or,
1 Bright Star B-34-17 Grid Bias Battery (4 x 3 x $1\frac{3}{8}$) or,
1 Novo #288 Grid Bias Battery (4 x 3 x $1\frac{3}{8}$), or equivalent.

INSTALLATION

Location—The Radiola Regenoflex should be placed as near as possible to the incoming lead from the aerial wire. A good ground such as a water pipe should be not far away.

If possible, place the Radiola Regenoflex in a fairly large room—one which does not have bare walls, as draperies, hangings, etc., will prevent accoustic reflections and help to make the entertainment more pleasing.

ANTENNA

Outdoor Type—In general, best results will be obtained with an outdoor antenna, from 75 to 150 feet long, including the lead-in wire and from 20 to 35 feet above the ground. If the suggested length and height cannot be secured, approach them as nearly as possible. So far as possible, it should be located in a space above the tops of surrounding buildings and trees. It should not be touched by any object except the antenna insulators. The same precautions apply to the lead-in wire which preferably should be a continuation of the antenna wire without any joints, and should run as directly as possible to the receiver. The antenna should be at right angles to all electric light, traction, power, telephone and telegraph wires and, if practicable, at least 15 feet distant from them.

Where an outdoor antenna is used, it should be protected from lightning by a suitable approved type of lightning arrester and the installation made in accordance with the National Electric Code Standards.

Outdoor aerials having a length up to 150 or 175 feet may be used since louder signals and greater distances can thus be covered. Proper volume control and selectivity will be obtained by adjustment of the "Volume Control" knob, regardless of the size of the antenna, provided the length does not exceed 175 feet (approximately).

Any normal antenna already installed may be used. If a new antenna is to be erected all necessary material and full directions will be found in the Radio Corporation of America Type AG-788 antenna package.

Indoor Type—For local reception, satisfactory results may be secured by using only 20 to 30 feet of ordinary double cotton covered bell wire (#18 B & S) strung around the picture moulding. It may also be run the length of the attic.

Loop Type—A loop aerial connected across the antenna and ground binding posts can be used for nearby local reception.

Ground—A good ground is as necessary as a good antenna. Perhaps the best ground is a good electrical connection to a water pipe. If this is not convenient, a connection to the steam or hot water heating system will usually serve almost as well. Connections to gas pipes are not always successful and should be avoided. If nothing of this nature is available, a pipe or metal rod may be driven into the ground to a depth of several feet, perferably where the soil is moist.

The ground connection should be made with a ground clamp, the wire being soldered or held by clamping under a screw or nut. Be sure to scrape and clean the pipe thoroughly before attaching the ground clamp. Usually, connecting to more than one ground, for instance to both water and steam pipes, will improve reception.

CONNECTIONS

There are two binding posts at the bottom part of the cabinet near the middle of the back. One of these has a small plate with the letters "ANT". Connect the lead from the antenna side of the lightning arrestor to the binding post. The other has a small plate with the letters "GND". Connect a wire from the ground clamp to this binding post. Make both leads as short as possible.

All batteries fit into compartments at either end of the cabinet. The compartment at the left is designed to hold the "B" and "C" batteries while the one at the right is intended to hold six dry cells. The little panels on the front of the cabinet may be easily removed by lifting upward and then pulling outward.

The "A" battery of six dry cells will fit into the compartment at the right as shown in figure 3. The cells should be placed in such a position that the outside or negative terminals form a vertical line. Remove all the thumb nuts. Find the black wire carrying the metal tag marked "—A" and with six lugs soldered to it. Place one lug over each of the outside binding posts, replace the thumb nuts on these posts and screw them down tightly. Then find the long yellow wire carrying the metal tag marked "+A" and with the six lugs soldered to it. Place one lug over each of the center binding posts beginning at the lower right cell and running up and over and down the left column as shown in figure 5. Replace the remaining thumb nuts and screw them down tightly. Replace the panel.

The "B" battery of four blocks is to be placed in the left compartment near the back. The blocks are to be laid on their sides in two rows as shown in figure 4. It will be necessary to make connections before the batteries are placed in the compartment. All four blocks are to be connected in series, that is, the positive of one to the negative of the next. Assuming that the intermediate size "B" batteries with lead and binding post are to be used, proceed as follows: Arrange four blocks as shown in figure 4. The one at the upper right we shall designate as #1. Among the leads coming from the center compartment will be found one with a brown braid and carrying a metal tag marked "−B". Connect this to the negative or "−" terminal of block #1. Then connect the positive or "+" lead from block #1 to the negative terminal of block #2. To this same binding post connect the orange lead carrying a metal tag marked "+20 B". Then connect the positive lead from block #2 to the negative terminal of block #3 and the positive lead of block #3 to the negative terminal of block #4. Finally connect the red cable lead to the positive lead of block #4. Now place the blocks in the compartment. #3 goes at the bottom at the back with #4 on top of it, the blocks lying on their sides. The other two blocks go in front with #2 on the bottom and #1 on top. If the batteries used are not of the type described, use short pieces of insulated wire to make the connections between blocks. When the wire is clamped under terminals, see that the copper conductor is clean and bright. All connections must be clean and tight or there will be noises.

The "C" battery is to be placed directly in front of the "B" batteries in the compartment at the left. Find the black cable lead with the tag marked "+C" and connect it to the battery terminal marked "+". Then connect the green cable lead with tag marked "−C" to the terminal marked "−4-½".

To place the Radiotrons in the set, tip the operating panel forward. In the upper right corner of the panel is a combination lock and switch. This in the locked position opens the filament battery circuit and prevents the panel from being tipped forward. Insert the key and turn it to the right. In the upper left corner there is also a small catch with a gold knob. Turn this also to the right, and then pull. The panel will tip forward leaving a clear space of about three inches at the top. Remove four new WD-11 Radiotrons from their cartons and insert them in the sockets provided in the tube mounting board directly in back of the panel. The sockets are arranged so that the large pin in the base of the Radiotron will be toward the panel. Be sure that the control marked "Battery Setting" has been turned as far to the left as possible before the Radiotrons are inserted. Then while the panel is still in the forward position turn the "Battery Setting" to the right until the pointer reaches the mark diagonally upward to the right. Look down into each of the Radiotrons and make sure that the filaments of all four glow at a dull red color. Then tip the panel back into normal position and turn up the catch at the left.

A jack is provided at the extreme right of the panel a little above the center. The loud speaker must be equipped with a telephone plug which is to be inserted in the jack when the loud speaker is to be used. In a few instances, it may be desirable to use a telephone headset plugged into the same place, but ordinarily, the signals will be uncomfortably loud.

OPERATION

Controls

Volume Control—The control so marked serves to regulate the transfer of energy between the two tuning circuits. Thus it regulates the strength of the signal. It also governs the selectivity of the set, that is, the farther the "Volume Control" is turned toward the left, the more easily can various stations be separated.

Battery Setting—The control so marked serves to turn on and regulates the current to the filaments of the Radiotrons. When the set is not in use, either the lock directly above this control should be in the locked position with the key vertical, or else the pointer of the "Battery Setting" should be turned as far to the left as possible. When it is desired to operate the set, unlock it and then turn the "Battery Setting" pointer until it rests on the mark diagonally upward to the right. With new dry cells in the "A" battery, this adjustment will give the proper current through the filaments. As the cells become old, it will be necessary to turn the "Battery Setting" still further to the right. The filaments should always glow at a dull red color, and should never be burned brighter than necessary to obtain signals. They may be examined at any time by tipping the panel forward.

Station Selector I—The control so marked serves to adjust the antenna tuning circuit so that it will respond to the desired wave length.

Amplification—The control so marked adjusts the regeneration, and thereby regulates the sensitivity and the selectivity of the set.

Station Selector II—The control so marked adjusts the secondary tuning circuit so that it will respond to the desired wave length.

Finding Signals

Turn the "Volume Control" until the pointer extends horizontally to the right.

Turn "Battery Setting" until the pointer rests on the mark previously described, which shows proper position when batteries are new.

Turn "Amplification" until a breathing sound is heard. This should occur when the pointer reaches "2.5" or a little before.

Turn both "Station Selector I" and "Station Selector II" from one end of the scale to the other keeping them at approximately the same reading all the time. GO SLOWLY and listen carefully. A squeal or whistle will be heard when the set is tuned to a station that is operating. When the whistle is heard, turn "Station Selector II" until the whistle assumes a very low pitch. Then turn "Station Selector I" until the whistle becomes loudest. Finally turn "Amplification" to the left just enough to stop the whistle when the speech or music should be heard clearly. A slight readjustment of "Station Selector II" may be necessary for best results. Of course, it may happen that a station is found between numbers of its program. Therefore, if nothing is heard at the conclusion of the above process, wait a minute or so. Do not wait too long before adjusting "Station Selector II". A whistle may also be produced by an improperly operated receiving set nearby but such a whistle seldom remains constant.

A little experience in making the adjustments will be necessary before stations can be found easily and quickly. This receiver is capable of receiving over great distances, and such operation will be secured if the controls are properly manipulated. Care in adjustment of "Station Selector II" and "Amplification" is particularly important.

It will be found that there is a definite relation between the two station selectors, for example, when "Station Selector II" is set on "3.0", "Station Selector I" should be nearly "3.0" when both are tuned to the same wavelength. It may happen that this agreement will not be very good in which case "Station Selector I" will reach one end or the other of the scale before "Station Selector II" thus making it impossible to tune both selectors accurately over the whole wavelength range. To remedy this trouble, tip the panel forward. At the extreme left is a coil wound on a micarta tube. At the top of the tube are four socket contacts, in one of which is inserted a lead from the antenna. Remove this and attach it to one of the other binding posts. One can be found where the agreement between the two station selectors will be quite close. In short, this adjustment is a means for adjusting the receiver to fit any antenna closely.

It is often convenient to have a record of the adjustments for various stations. The setting of "Station Selector I" and "Station Selector II" should be recorded for each station heard. Then when it is desired to hear that particular station. set the "Station Selectors" at the right points, adjust the "Amplification" and the station should be heard if it is operating.

When receiving from nearby stations, it may happen that the volume will be greater than is desired. Do not attempt to decrease the volume by turning back the " Battery Setting" as that will spoil the quality. Turn back the "Volume Control" until the signal strength has been reduced as much as is desired. Selectivity or the ability to pick a desired station out of interference, depends to a degree upon the setting of "Volume Control". The receiver is much more selective when this control is turned to the left. It is often desirable to operate with this control almost to the left limit. Careful adjustment will give almost as loud signals as when the "Volume Control" is at the extreme right.

MAINTENANCE

Radiotrons—When not mistreated, the Radiotrons will last for many months. Occasionally one will become inoperative on account of a broken filament or otherwise. It should be replaced by a new one of the same type.

If it becomes necessary to operate with only three Radiotrons, it may be done by leaving the socket at the extreme right empty.

Filament or "A" Battery—When the dry cells used for this purpose become discharged to the point where they will no longer heat the filaments to the proper brilliancy, they should be replaced by new ones.

Plate or "B" Battery—The "B" battery should last for several months. When signals become weak with the filaments burning properly or operation becomes noisy, the "B" batteries should be replaced by new ones. If a voltmeter (preferably of the high resistance type) is available, the batteries may be tested. They should be discarded when the voltage has dropped to 17.

Bias or "C" Battery—It is difficult to tell when this battery is exhausted except by measurement of its voltage with a voltmeter. The safe plan is to renew it whenever the "B" battery is replaced.

SPECIFICATIONS

Cabinet—The cabinet is finely made of solid mahogany. It is finished in dark brown mahogany and given a high polish.

Panel—The panel is moulded from a phenolic condensation product. The divisions and lettering are filled with a gold-colored material.

Variable Condensers—The variable condensers are especially smooth running. They are driven by a friction disc giving a slower motion to permit accurate tuning.

Fixed Condensers—The fixed condensers are of two types both specially designed for their uses.

Antenna Circuit Coils—The antenna circuit coils are wound on micarta tubing and are carefully impregnated and baked. They will retain their high efficiency indefinitely.

Secondary Circuit Coils—The secondary circuit coils are of an improved design which is so arranged as to require only very small space.

Radiotron Sockets—The Radiotron sockets are of the well-known sliding contact type that insure a positive connection to the Radiotrons. The Radiotron board is flexibly mounted on rubber to eliminate mechanical noises.

Transformers—The audio transformers use a special alloy material for the cores. This produces much better amplification at low frequencies than has been had in any previously used transformers.

Jack—The jack is of special design to keep all metallic parts from the front of the panel.

Radiotrons—The radiotrons are type WD-11. They have been redesigned with small bulbs and moulded bases to occupy less space, but their operating characteristics are identical with former types.

Circuit—The circuit employed is the newly developed "REGENOFLEX" circuit which eliminates radiation and gives excellent selectivity.

The REGENOFLEX circuit combines radio frequency amplification, regeneration, dual amplification and freedom from radiation. Also the last stage of audio amplification is of the balanced, or push-pull type, which improves the quality of reproduction and permits the use of greater loudness of signals.

A total of four Radiotrons are used therefore, which are equivalent in performance to the usual five tube set.

All Radiotrons are properly biased by the use of suitable grid or "C" Battery, which is an essential to good quality reproduction and which greatly increases the life of Radiotrons and plate batteries.

The stage of radio frequency amplification is balanced so that it can not oscillate and therefore this set can not radiate and cause interference to other nearby receivers. Radio frequency amplification and regeneration make this set especially sensitive while the two tuned circuits plus regeneration make it selective.

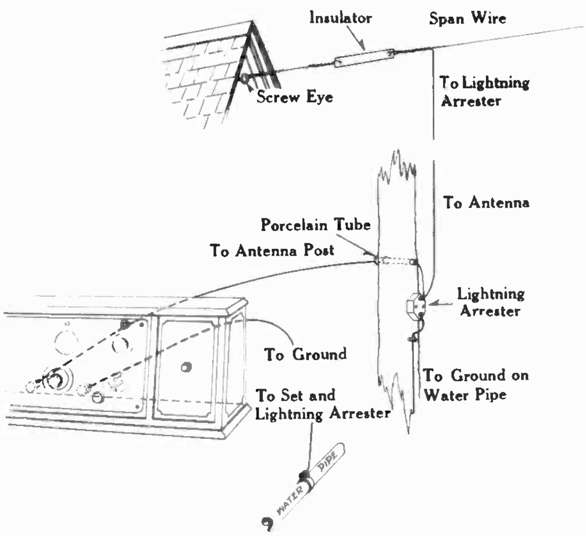


Fig. 2—Showing Connections to Antenna, Ground and Lightning Arrester

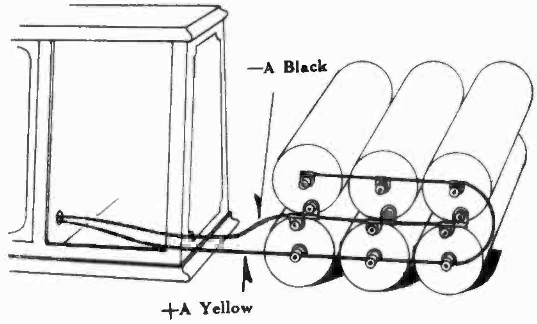


Fig. 3—Showing Method of Connecting A Batteries

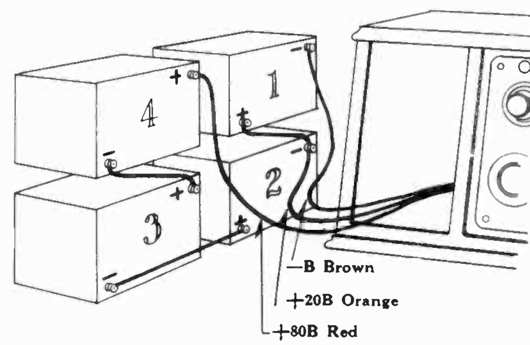


Fig. 4—Showing Method of Connecting B Batteries

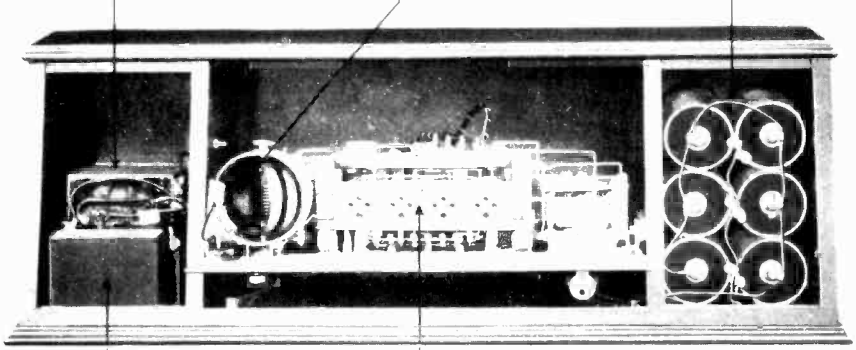
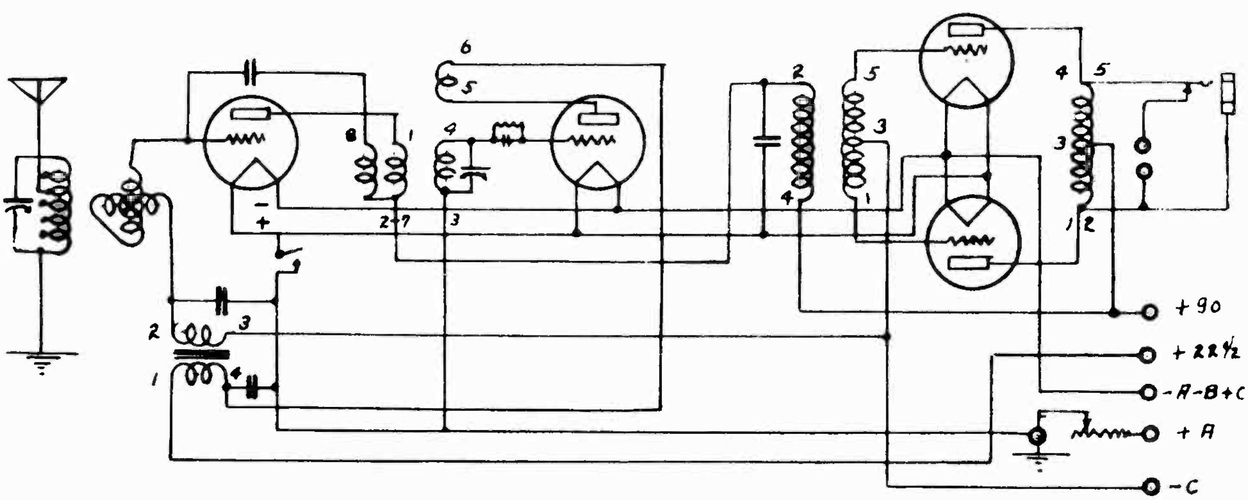
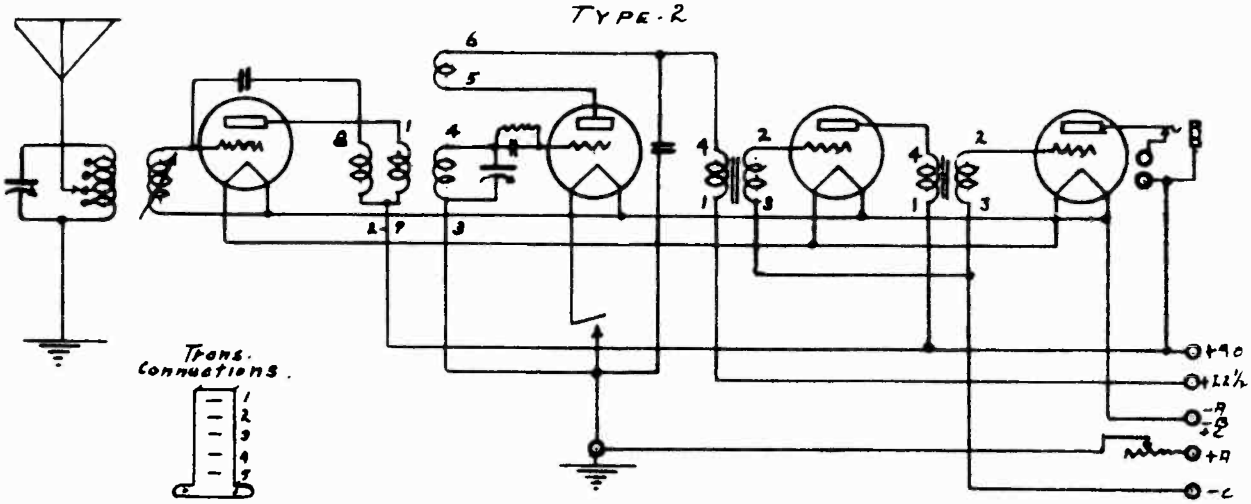


Fig. 5 Internal View of Radiola Regenoflex

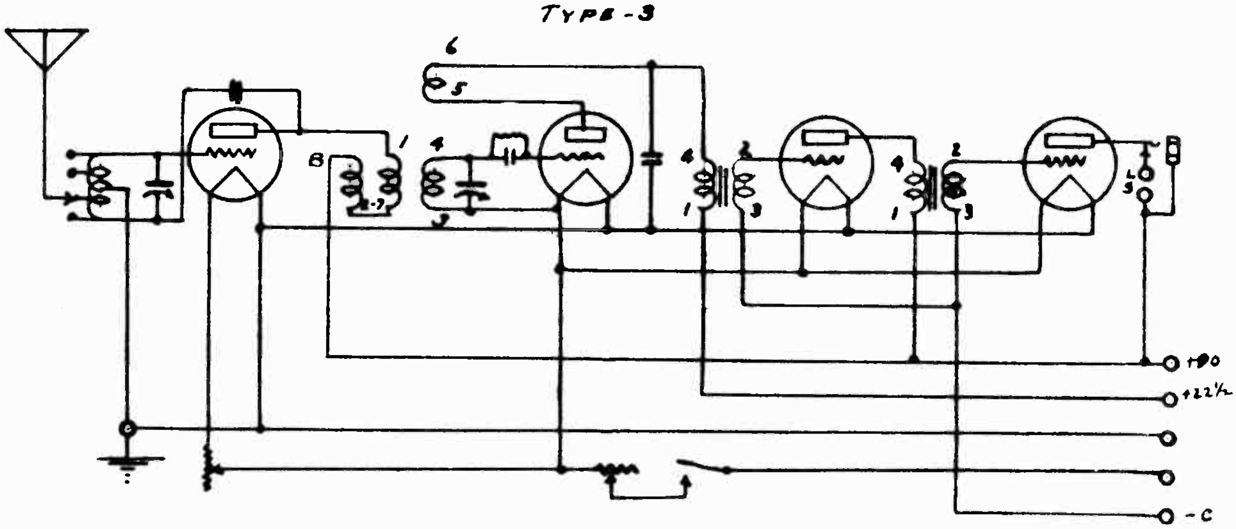
TYPE-1



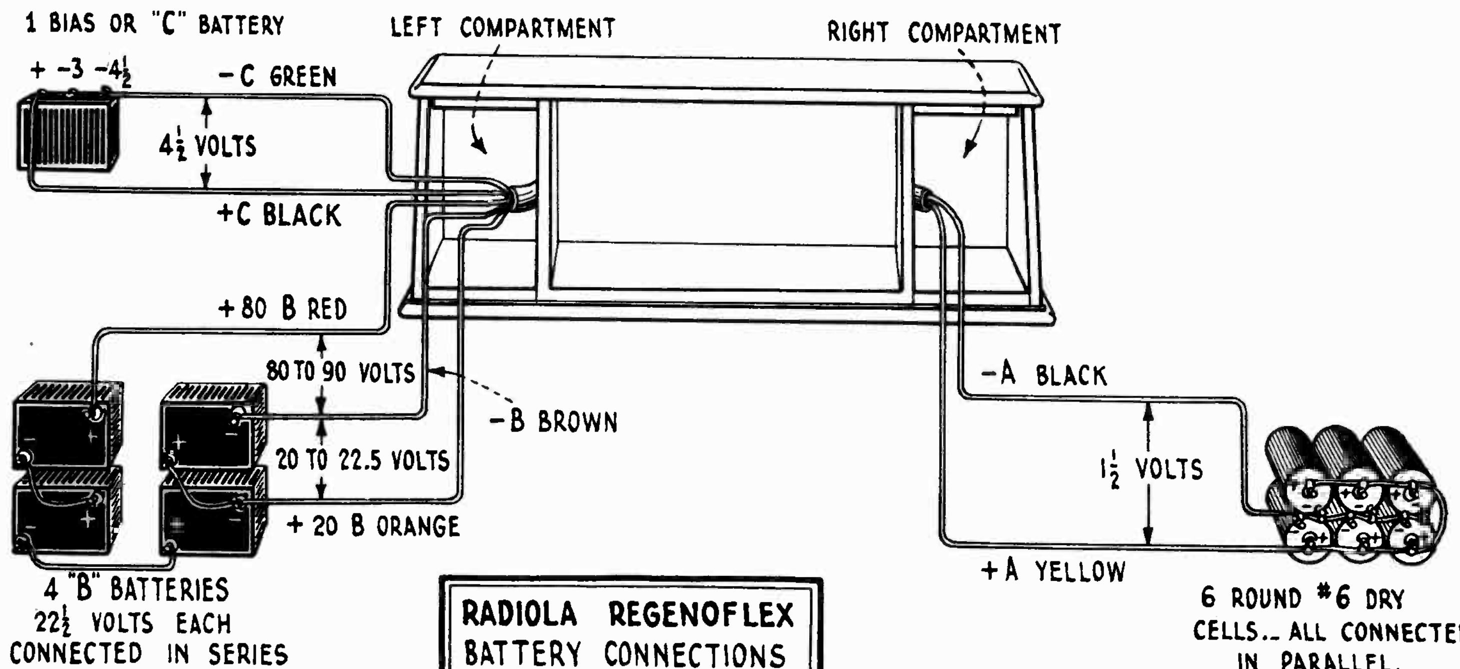
TYPE-2



TYPE-3

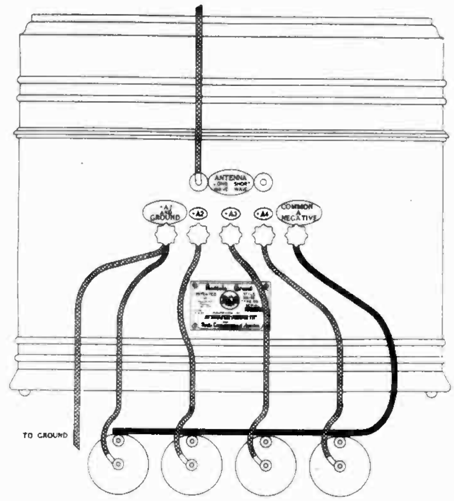


SCHEMATIC DIAGRAMS FOR R-X AND REGENOFLEX

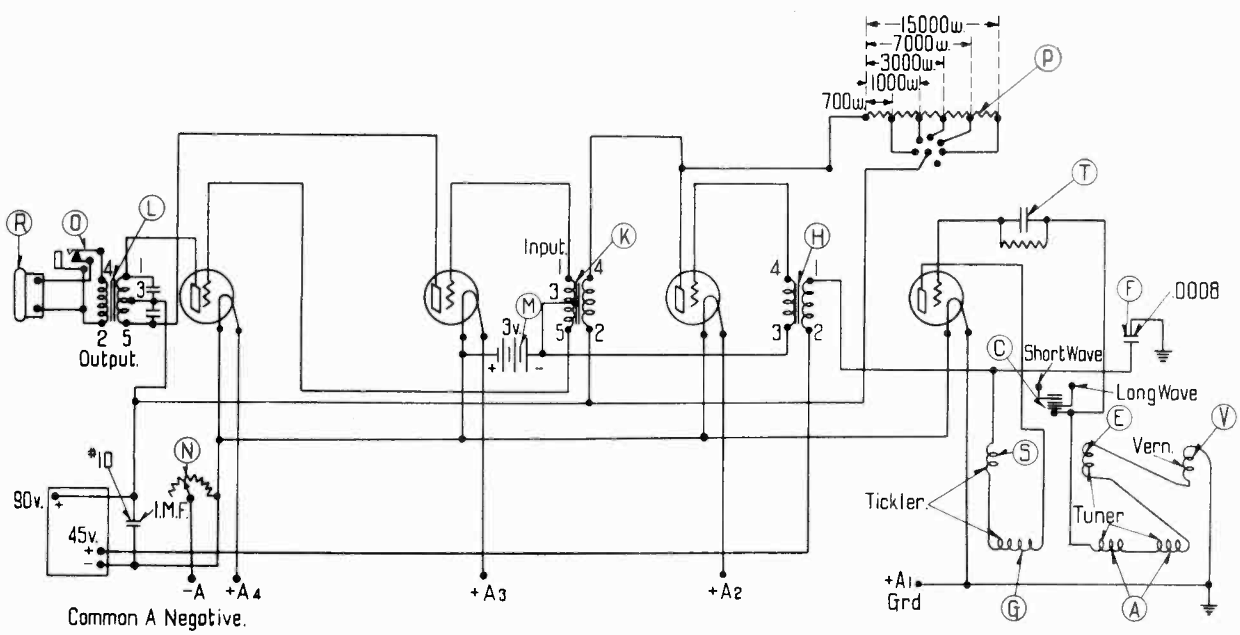


RADIOLA REGENOFLEX
BATTERY CONNECTIONS

Radiola Grand



Diagrammatic Connection of Dry Cells



BATTERY CONNECTIONS

RADIOLA SUPER-HETERODYNE

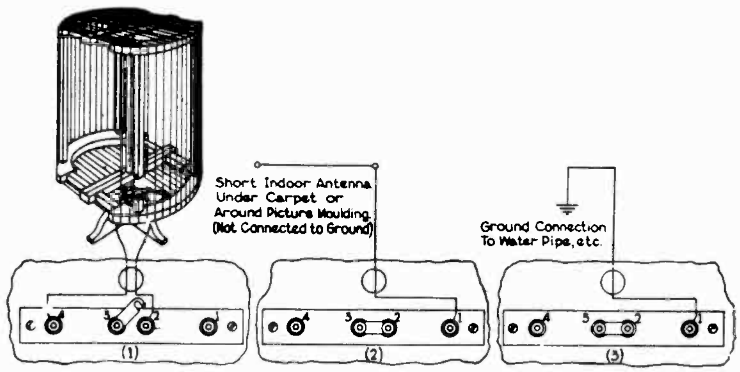


Fig. 5. Connection of Exterior Loop, Indoor Antenna, etc.

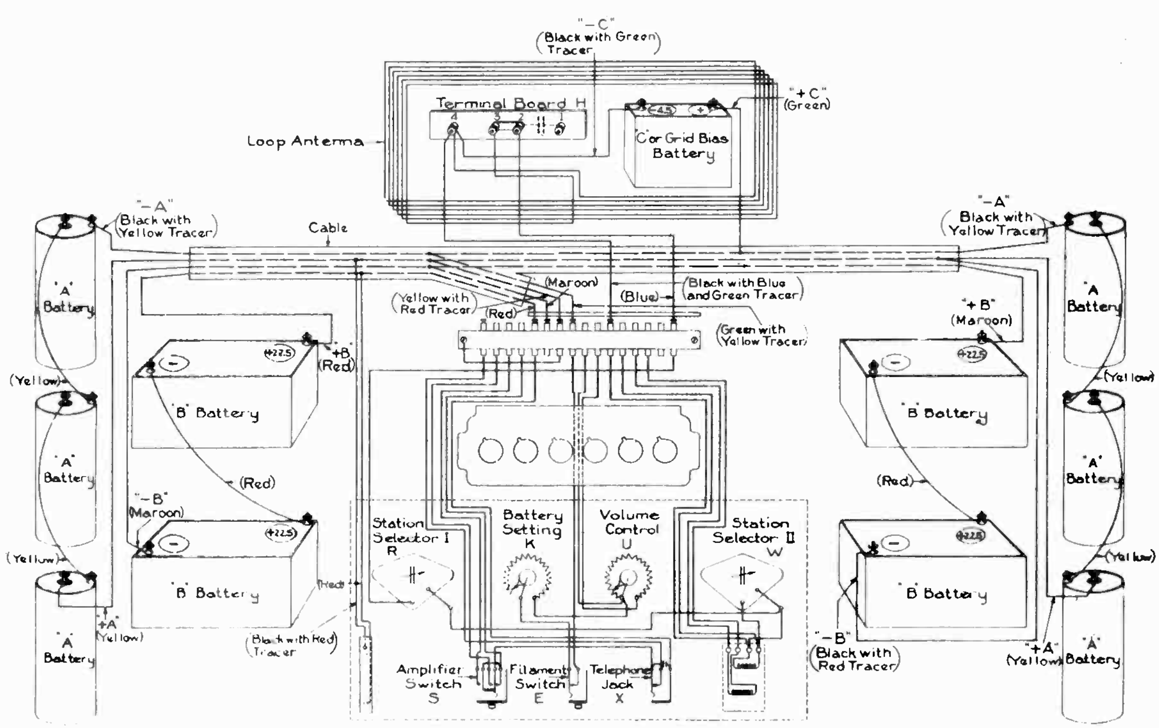
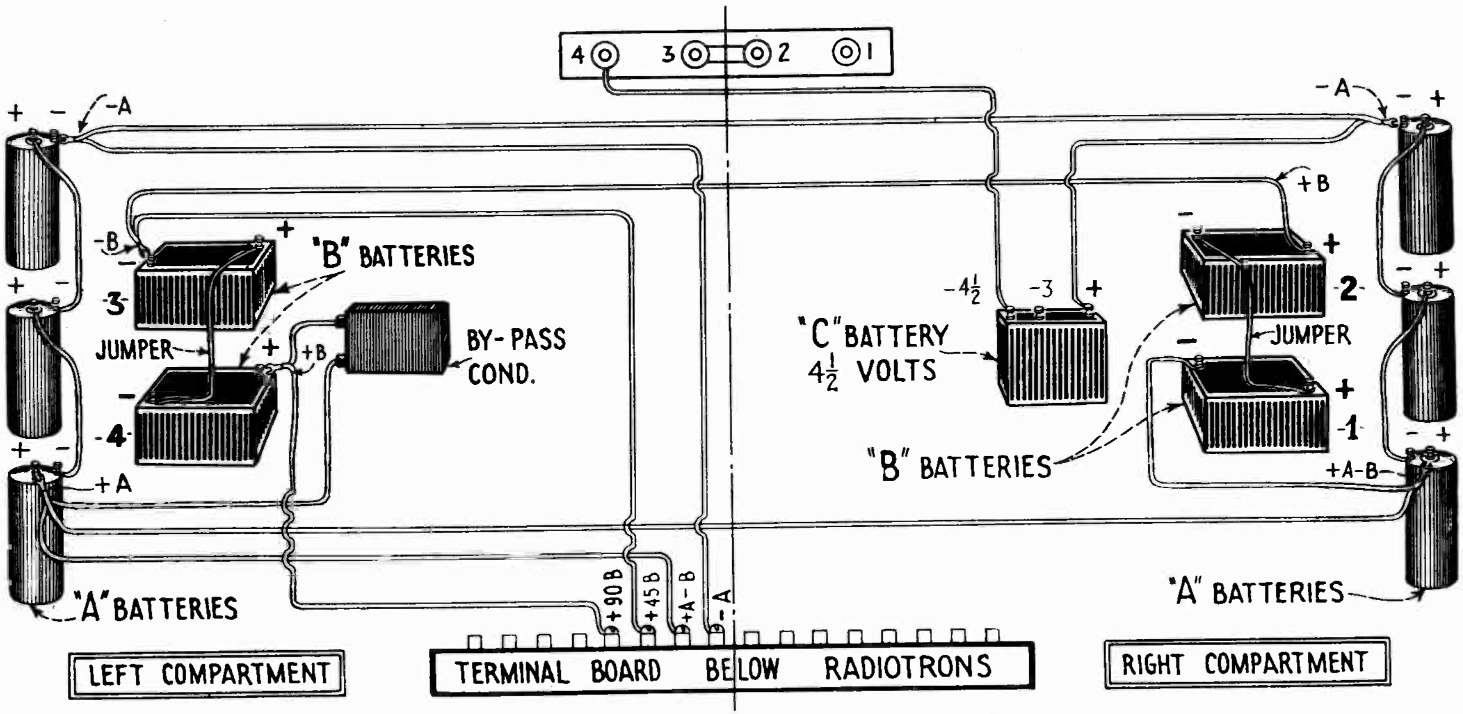


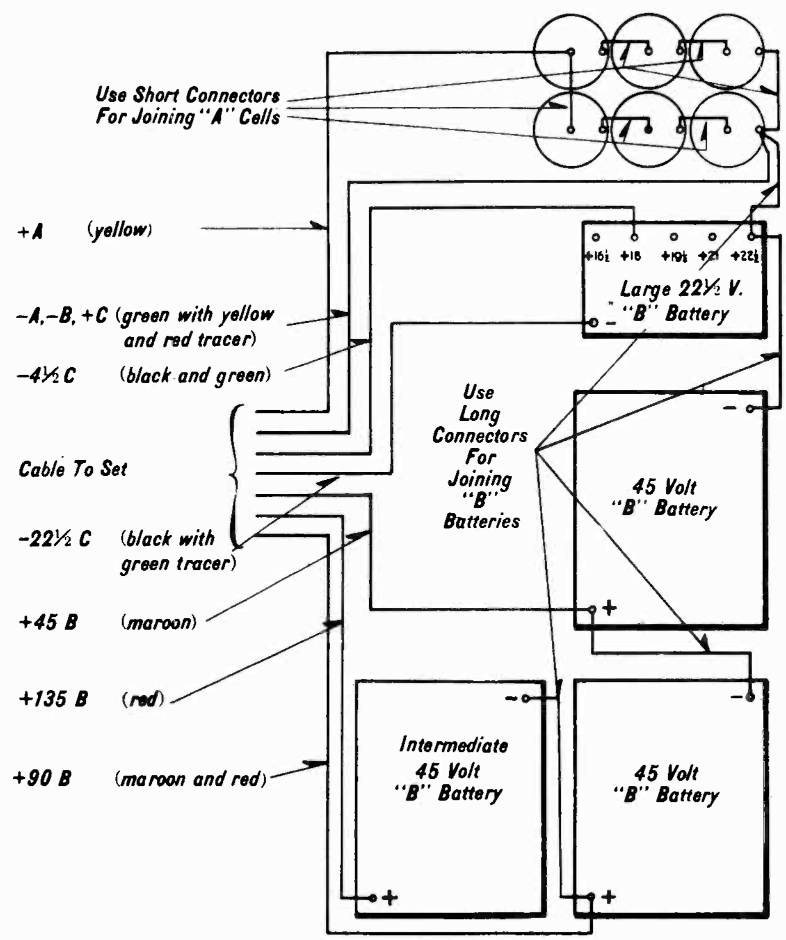
Fig. 6. Connection Diagram of Radiola Super-Heterodyne



BATTERY CONNECTIONS
FOR
Radiola Super-Heterodyne
(SECOND HARMONIC)

BATTERY CONNECTIONS

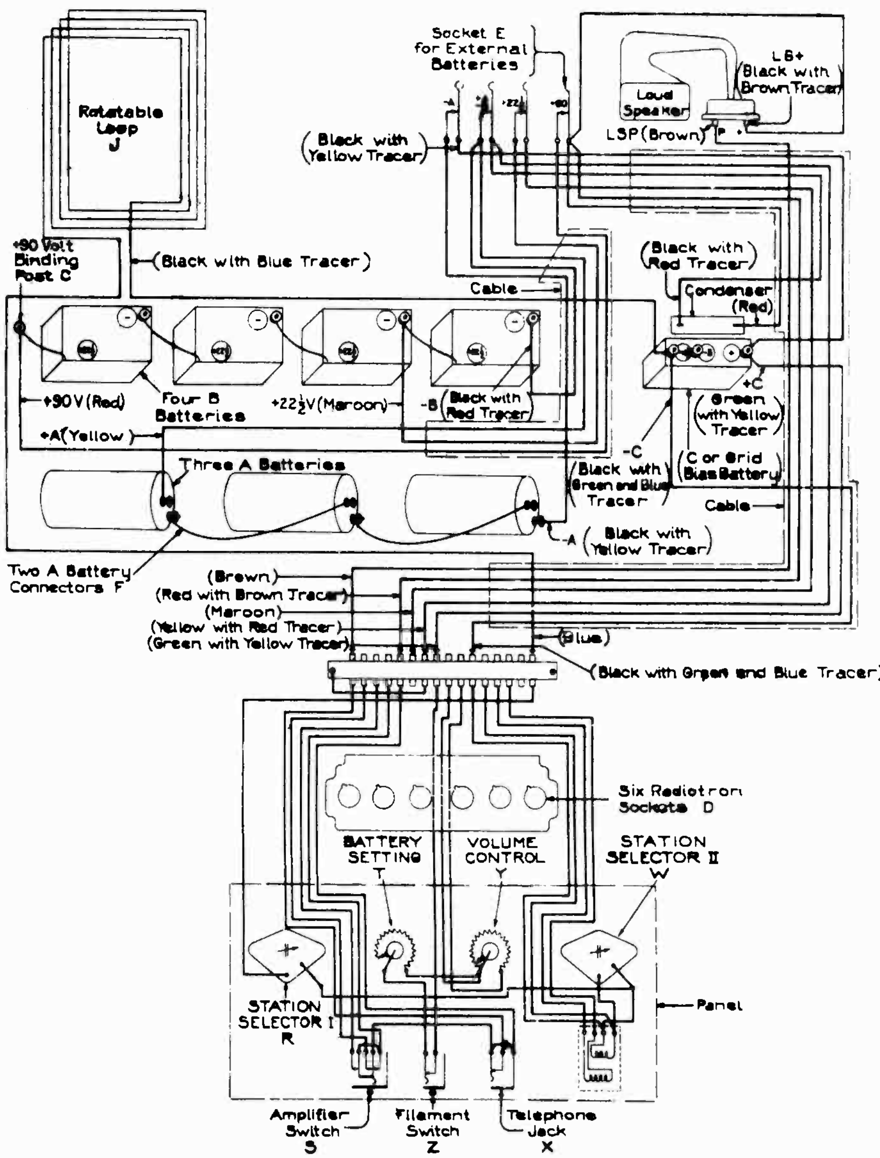
RADIOLA 20



RADIOLA 20.- BATTERY CONNECTIONS.

BATTERY CONNECTIONS

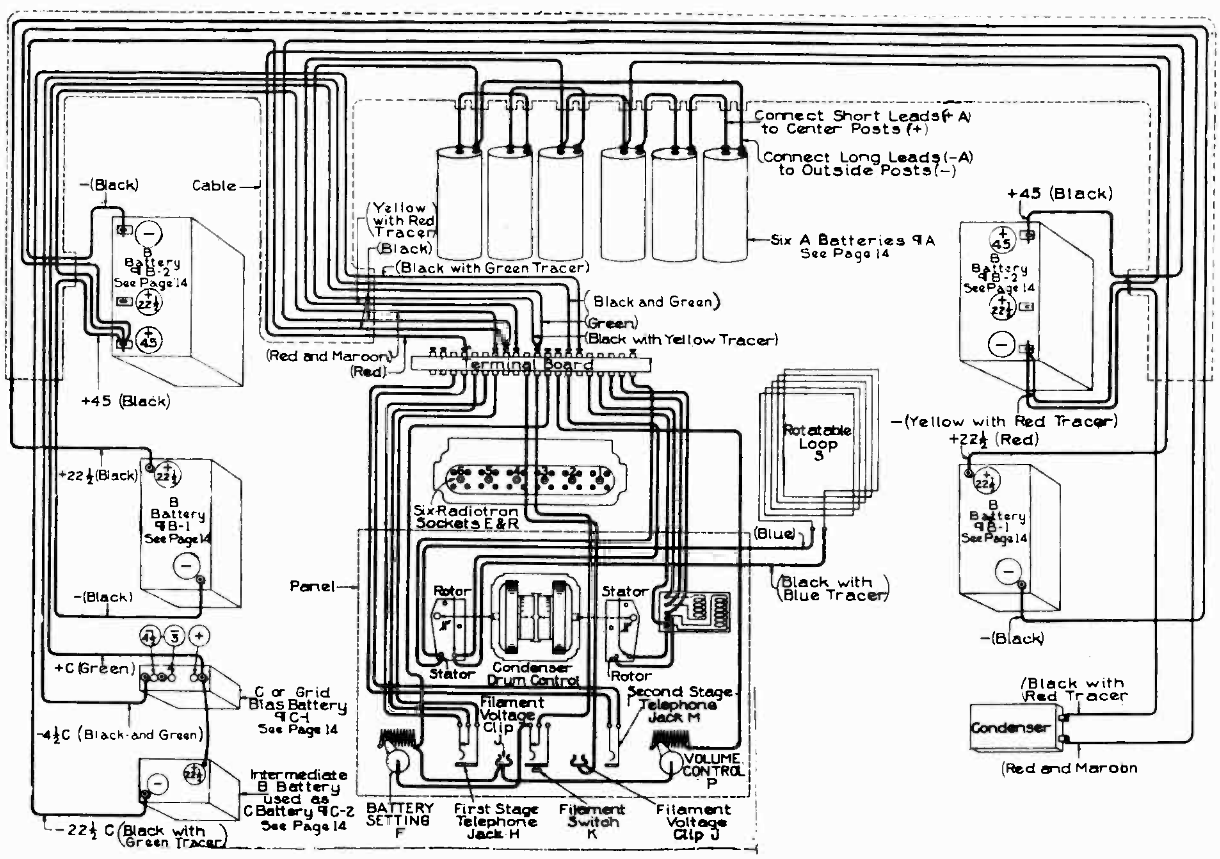
Radiola 24



BATTERY CONNECTIONS

Radiola 25

REG. U.S. PAT. OFF.



BATTERY CONNECTIONS

Radiola 26

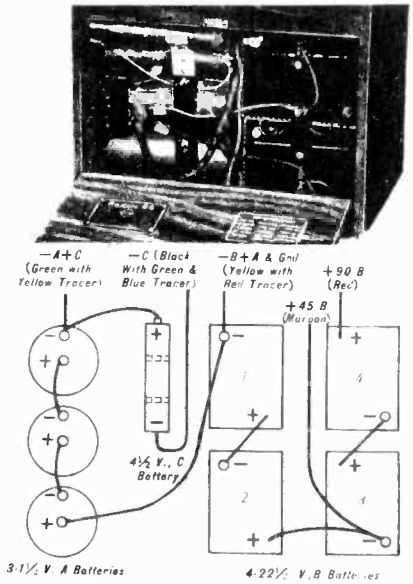
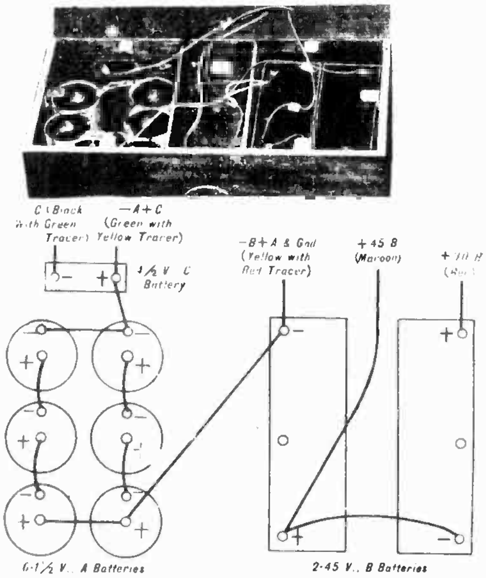
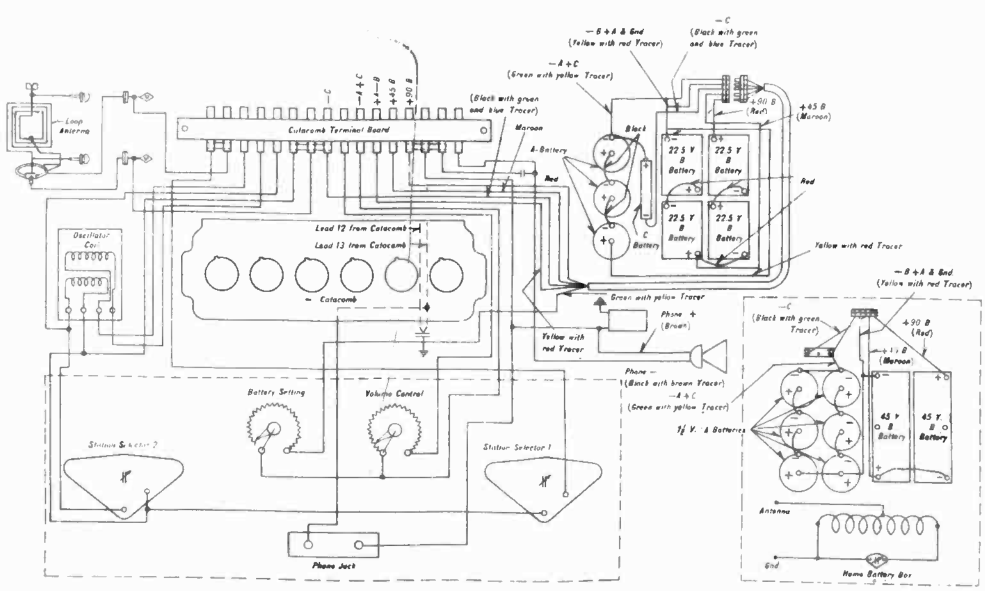


Diagram of Battery Connections for Portable Unit



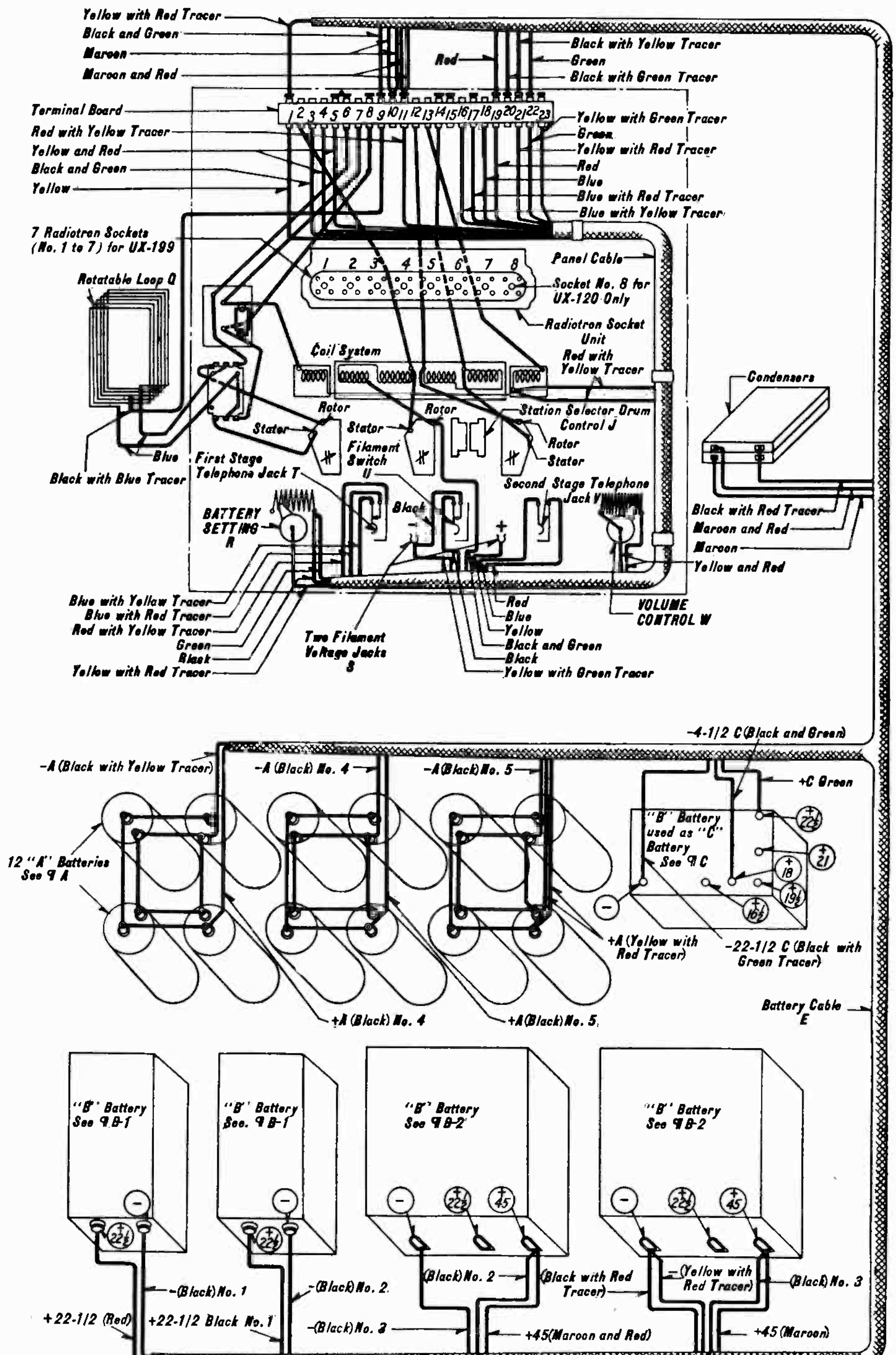
—Diagram of Battery Connections When Using Home Battery Box



BATTERY CONNECTIONS

Radiola 28

REG. U.S. PAT. OFF.

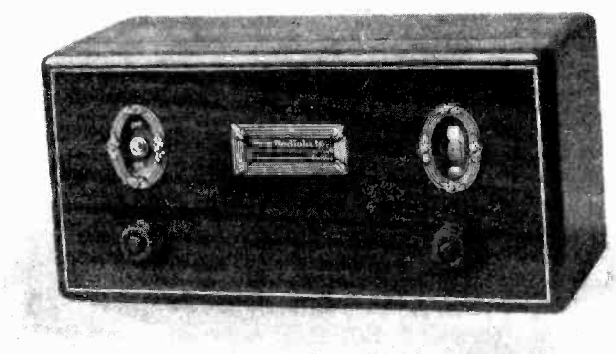


WIRING DIAGRAM FOR RADIOLA 28

In this wiring diagram, two or more leads of a like color contained in the same cable may be distinguished by the numeral following the color designation at each end of a given lead.

RCA
Radiola 16

SERVICE NOTES



RCA Radiola 16

Third Edition—10M—January, 1929

Radio Corporation of America

233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

BROOKLYN, N. Y.
Bld. No. 19—168 - 39th St.

CHICAGO, ILL.
2001 West Pershing Road

SAN FRANCISCO, CAL.
274 Brannan St.

DALLAS, TEX.
Santa Fe Bldg., Unit No. 2

ATLANTA, GA.
Monroe Bonded Warehouse, Spring and Peters Sts.

A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well-informed RCA Authorized Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that RCA Loudspeaker and Radiola owners may be entirely satisfied.

Obviously, this service can best be rendered by properly equipped service organizations having a thoroughly trained personnel with a knowledge of the design and operation of RCA Loudspeakers and Radiolas.

Such service organizations have been established by RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

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

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

In addition to supplying the Service Notes, the RCA Service Division maintains a corps of engineers who are qualified to render valuable help in solving service problems. These engineers call upon the trade at frequent intervals to advise and assist RCA Distributors in the performance of service work.

CONTENTS

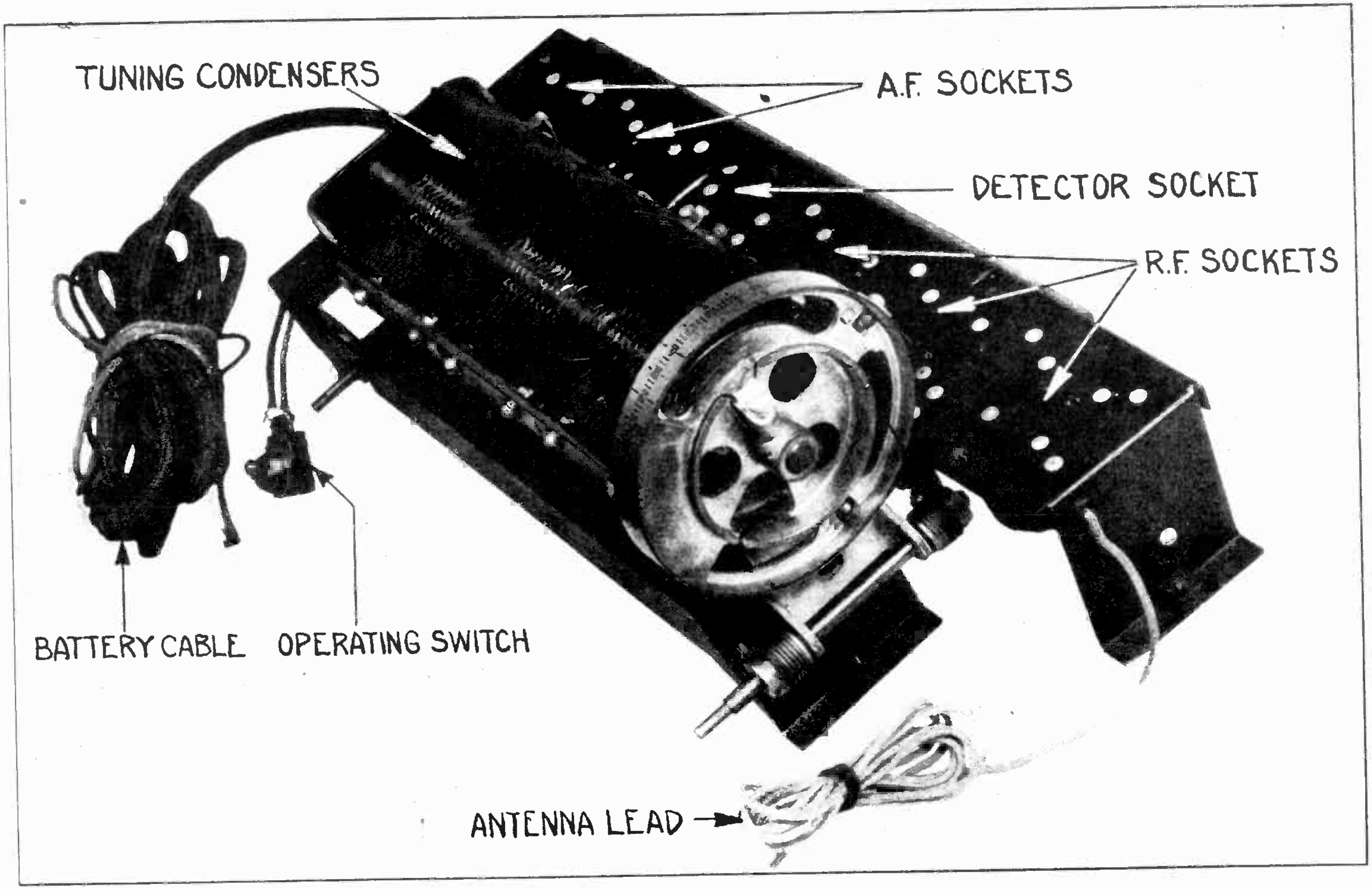


Figure 1—Top view of chassis showing the simple arrangement and rugged construction of the three-gang condensers, gang sockets and tuning control

RCA RADIOLA 16

SERVICE NOTES

Prepared by

RCA SERVICE DIVISION

INTRODUCTION

RCA Radiola 16 is a tuned radio frequency receiver employing five Radiotrons UX-201A and one Radiotron UX-112A. The tuning range of Radiola 16 extends from 550 to 1400 Kilocycles or 546 to 214 meters approximately. This amply covers the broadcast band of wavelengths. The utmost in simplified tuning is provided by having but two controls, one for the selection of stations and one for the adjustment of volume. Radiola 16 is designed to operate without the use of vernier tuning condensers or adjustable rheostats. Excellent quality of reproduction is obtained by the use of properly designed audio transformers and a power amplifier Radiotron easily capable of handling the signal delivered to the last audio amplifier.

Service work in conjunction with RCA Radiola 16 should be small, since all construction is of a simple character (See Figure 1) and of fool-proof design. However, for the guidance of those called upon to locate and remedy any trouble that may occur the following notes are presented.

PART I—SERVICE DATA

(1) RADIOTRON SEQUENCE

Figure 2 illustrates the sequence of the Radiotrons as applied to the path of the incoming signal. From right to left when facing the front of the Radiola, the Radiotron sequence is as follows:

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground and is not tuned in any way.

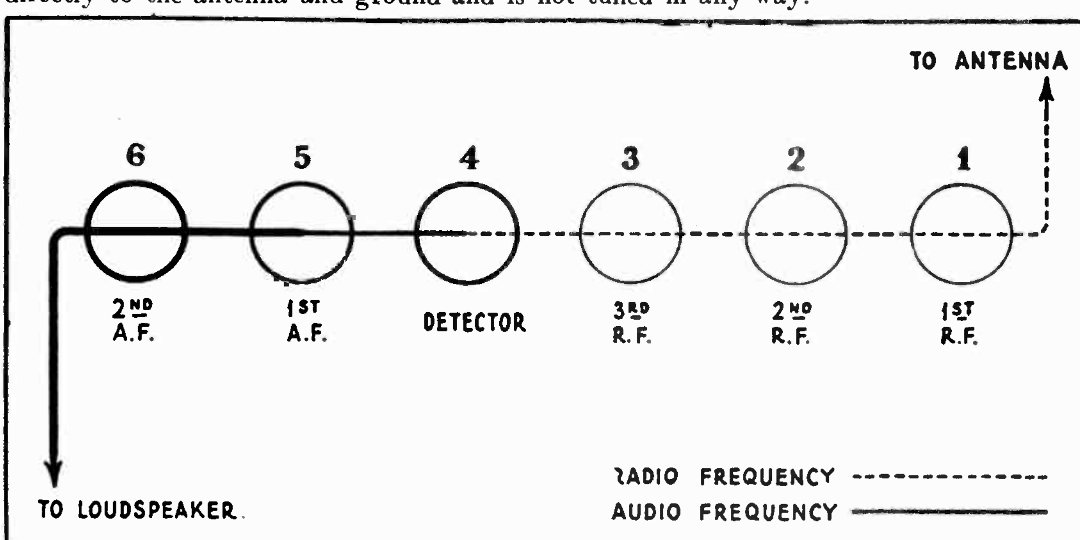


Figure 2—Radiotron sequence in RCA Radiola 16

Radiotron No. 2 is a stage of tuned R. F. amplification employing a grid resistance to prevent oscillation. It is tuned by means of the first of the three-gang condensers.

Radiotron No. 3 is the second stage of tuned R. F. amplification. It also employs a grid resistance for the purpose of stabilizing or preventing self oscillation in the circuit. It is tuned by the second of the main tuning condensers.

Radiotron No. 4 is the tuned detector. This circuit employs a tapped resistance across the filament leads for the purpose of improving tone quality.

Radiotrons No. 5 and No. 6 are respectively the first and second stages of audio frequency amplification. The last stage, Radiotron No. 6, employs power amplifier Radiotron UX-112A.

(2) CIRCUIT CHARACTERISTICS

The following principles are incorporated in the circuit design of Radiola 16.

1. A three-gang condenser, employed to tune two radio frequency and the detector circuits, provides one tuning control.

2. An aperiodic antenna circuit, or 1st R. F. circuit, eliminates the necessity for a separate antenna tuning control or a vernier across the antenna tuning condenser.

3. A plate voltage of 67 volts is used on all radio frequency stages without a "C" battery. This provides simplicity in battery circuits without any loss of sensitivity or tone quality.

4. The volume control regulates the filament voltage of the three radio frequency amplifiers. This gives a smooth control of volume with minimum distortion.

5. No neutralizing condensers are employed. Grid resistances in the radio frequency amplifier circuit effectively prevent any self oscillation that might occur. This is a simple and effective method of overcoming any oscillating tendency of the radio frequency amplifiers.

6. A fixed resistor is used in the filament circuit instead of a variable rheostat. This eliminates an extra control on the panel and safeguards the filaments of the Radiotrons against excessive voltage.

7. A plate voltage of 135 volts is used on both audio stages in conjunction with a negative grid bias of 9 volts. This simplifies battery connections and provides a more uniform drain on the "B" batteries. Also more amplification is obtained in the first audio frequency stage, which, when used with power amplifier Radiotron UX-112A in the second stage, results in greater volume with minimum distortion delivered to the loudspeaker.

These various circuit characteristics of Radiola 16 are all of a nature that provides the utmost in simplicity consistent with good performance and tone quality. The appearance of the set is in line with its internal mechanism.

(3) ANTENNA INSTALLATION (Outdoor Type)

The most efficient antenna system for Radiola 16 is one of 25 to 75 feet in length—depending upon local conditions—measured from the far end of the 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 which 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 oxidation 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 not cross either over or under any electric light, traction or power line and should be at right angles to these lines and other antenna. 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 arrestor, in accordance with the requirements of the National Fire Underwriters' Code.

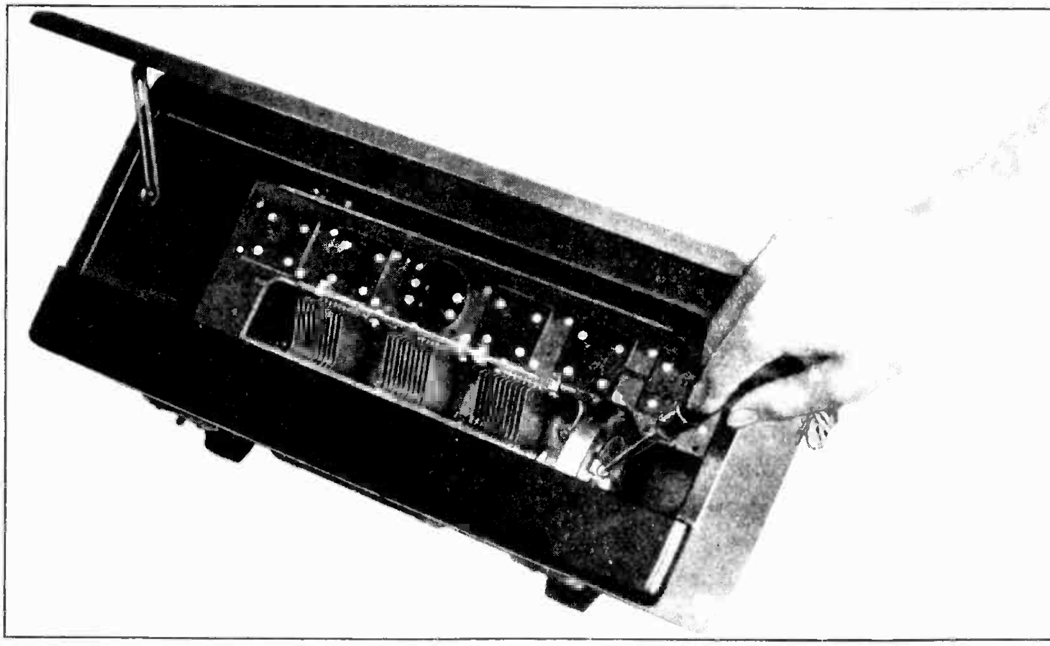


Figure 3—Turning the cable adjusting screw to take up slack in condenser control cable

(4) ANTENNA INSTALLATION (Indoor Type)

Where the installation of an outdoor antenna is not practical, satisfactory results may be had by using an indoor antenna consisting of 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 to secure satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

(5) GROUND

A good ground 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 16 is capable of receiving over good distances 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 factor in distant reception and it may also cause oscillation.

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 about six feet above ground, well insulated, of the same dimensions as the antenna and located directly under it. The counterpoise is connected to the Radiola in place of the ground connection.

(6) ANTENNA SYSTEM FAILURES

Complaints of swinging signals, or of intermittent reception with probable grating noises, as distinguished from fading effects, 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 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 16 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.

(7) RADIOTRON SOCKETS

The sockets in Radiola 16 are of the standard gang UX type. The three-gang socket is for the radio frequency amplifiers; the single socket is a cushioned socket for the detector and the two-gang socket is for the audio frequency amplifiers. Care must be exercised when inserting Radiotrons in the sockets. A socket contact may not be in its correct position and forced insertion of a tube will bend or break it. If care is exercised and the Radiotron inserted gently, little trouble will be experienced with socket contacts. A bent one will be noticeable on inspection and may be corrected by inserting a narrow instrument in the socket hole and pushing the contact into its correct position. A badly bent or broken socket contact must be replaced.

(8) RADIOTRON PRONGS

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

In placing Radiotrons in the gang sockets care should be exercised to make certain that the two large pins and two small pins of the Radiotrons match the socket holes. 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. These sockets are so designed that the prongs of the Radiotrons will fit in snugly without force being applied. If sufficient force is applied it might be possible to insert the prongs in the wrong holes, resulting in a filament burnout.

(9) LOOSE VOLUME CONTROL CONTACT

A loose volume control contact may cause noisy or intermittent operation and should be remedied. If the contact arm is loose, the remedy is to bend it slightly so that it makes firm contact against the resistance strip. In order to do this it is necessary to remove the chassis from the cabinet as described in Part II, Sec. 1. The volume control is then readily accessible. By removing the two screws that hold it to the metal frame it may be completely removed. After adjusting the contact, replace the mounting screws and return the chassis to the cabinet. Replace screws and control knobs.

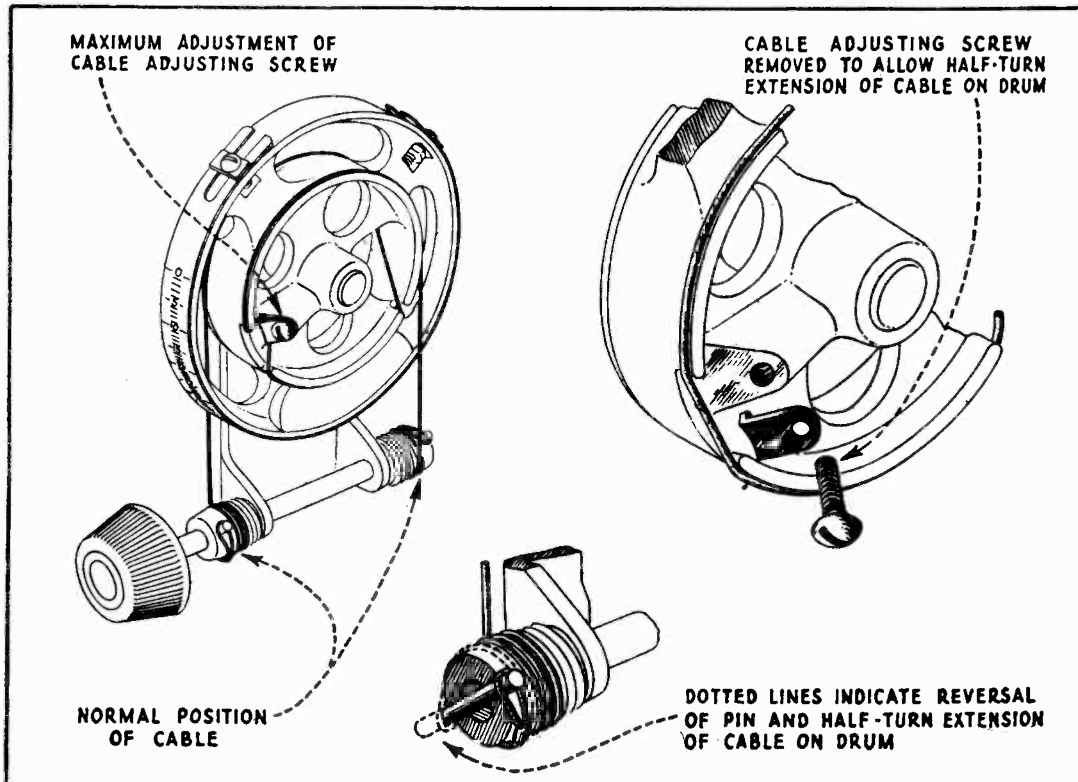


Figure 4—Three-gang condenser cable and drum operating mechanism

(10) ADJUSTMENT FOR SLACK DRUM CABLE

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash. See Figure 1.

After considerable wear, or extreme changes of temperature the cable may become slack. To take up this slack open lid of cabinet and turn the cable adjusting screw with clamp until the cable is taut—See Figure 3. In extreme cases as might occur after considerable use and several adjustments this screw may become seated thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part II Section 1. Remove the cable adjusting screw and clamp—See Figure 4. The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one-inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. Figure 4 illustrates this operation. It will be noted that the tapered pin in the new position cannot be inserted as far as originally. However it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and a half turn slipped on the drum which will provide for taking up all slack. Sufficient grooves are provided on the drum for this purpose.

(11) TUNING KNOB LOOSE

If the panel control knob becomes loose on the shaft, tighten the small set screw that holds the knob to the shaft or if its threads are defective, replace the knob.

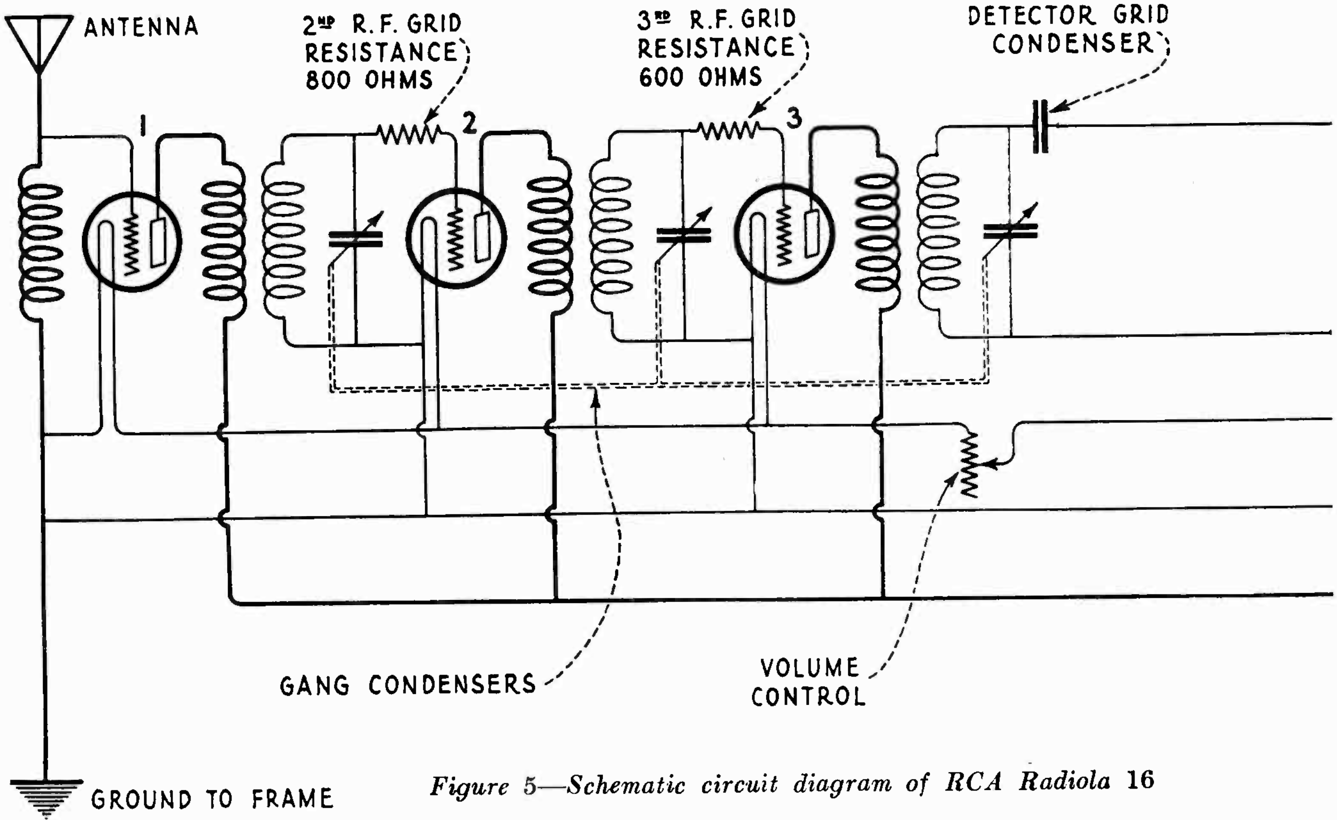


Figure 5—Schematic circuit diagram of RCA Radiola 16

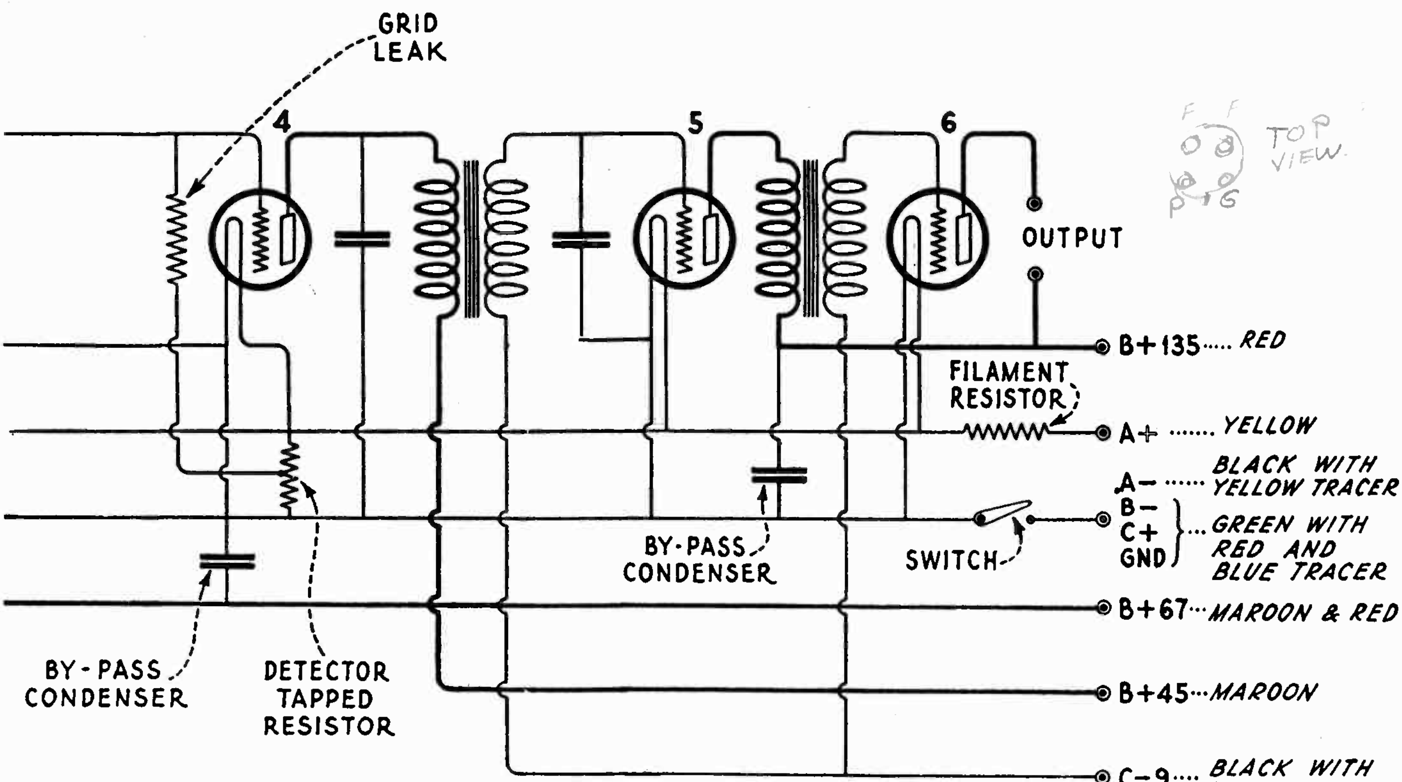
(12) BROKEN CABLE

Should a cable become broken due to considerable use or excessive tightening, the proper remedy is to replace the cable. The procedure for making this replacement is described in Part II, Section 7. However if a new cable is not immediately available a temporary repair may be made in the following manner provided the break in the cable is not in that section that passes over the small grooved drums.

The two ends should be spliced together and then soldered. Splicing consists of interweaving the strands as with rope and not just twisting the cable ends together as in an electrical wiring splice. Splicing gives greater strength and results in a smaller body being formed on the cable. When soldering, use plenty of flux and a small amount of solder. Heat sufficiently long for the solder to adhere to all the small strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows any excess solder to drip away. It is to be understood that this is but a temporary repair and should be used only until a new cable can be procured and installed.

(13) USING RADIOLA 16 WITH RCA "B" BATTERY ELIMINATOR OR SIMILAR DEVICES NOT SUPPLYING 67 VOLTS PLATE VOLTAGE

Radiola 16 uses a plate voltage of 67 volts for the radio frequency amplifiers and it is important that this voltage is not exceeded. (See Figure 5). A higher voltage may cause it to oscillate and in all cases seriously affect its tone quality. It is imperative that, when using "B" battery eliminators having fixed 90-volt taps, provision be made for



and wiring color scheme for making battery connections

reducing them to 67 volts. Off hand it would seem that a series resistance could be used to drop the voltage, but when we realize the plate voltage varies in practically all of these devices except in the case of the RCA "B" Eliminator (Duo-Rectron) and similar devices a fixed resistor would give a varying voltage depending on the device.

A potentiometer having sufficiently high resistance (at least 18,000 ohms) shunted across the +45V and +90V taps with the contact arm connected to the 67-volt lead from the receiver will give a variable voltage between 45 and 90 volts for this lead. By taking a high resistance voltmeter and connecting from —B to this arm, it may be adjusted for 67 volts. A drop of solder will make a permanent connection between the arm and resistance element and prevent a possible change in voltage. The General Radio Potentiometer No. 371 (18,000 ohms) is recommended for this purpose.

(14) LOUDSPEAKER POLARITY

In Radiolas employing Radiotron UX-112A in the last audio amplification stage it is very important to have the loudspeaker 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 loudspeakers of the horn type the solid brown lead should be connected to the left jack when facing the front of Radiola 16 and the black lead with brown tracer to the right jack. If 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, loudspeakers 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, 100A, 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) UNCONTROLLED OSCILLATIONS

Should Radiola 16 oscillate or regenerate at any point in the tuning range the trouble is probably caused by—

1. Excessive plate voltage on the R. F. or detector tubes.
2. Excessive filament voltage.
3. Defective grid resistor in 2nd R. F. or 3rd R. F. (Figure 5).

The remedy in the case of No. 1 or No. 2 is to reduce the plate or filament voltages to their correct value. Excessive voltage on the radio frequency amplifying tubes will also cause distorted reproduction from the Radiola.

In the case of No. 3 the various grid resistances in Radiola 16 may be checked by means of a resistance bridge. If a resistance bridge is not available the voltmeter-ammeter method gives accurate results provided the meters used are calibrated accurately. This method makes use of a milliammeter with a scale of 0-25 and a voltmeter of 0-7 volts. A voltage is then applied that will give a substantial reading. A circuit diagram of this method is shown in Figure 6.

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

$$R = \frac{E}{I} \text{ (Where R equals ohms, E equals volts and I equals amperes)}$$

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

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 values of the various resistances are shown in the schematic diagram Figure 5.

In some cases with certain antennas, the Radiola may oscillate even though everything is O. K. The remedy in this case is to interchange the Radiotrons or to reduce the volume control a slight amount.

(16) AUDIO HOWL

An audio howl is generally caused by some defect in the audio amplifying system. One of the following defects may be the cause of this howl.

1. Defective Radiotron.
2. Defective "B" battery.
3. Open audio by-pass condensers.
4. Defective grid leak or open grid of any tube in the Radiola.
5. Open R. F. grid resistor.
6. Open by-pass condenser across secondary of first audio transformer.

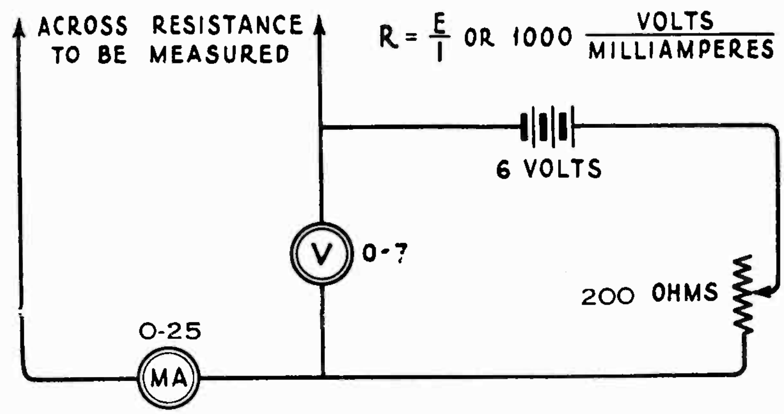


Figure 6—Schematic circuit for resistance measurement

(17) DISTORTED REPRODUCTION

Under normal conditions Radiola 16 will deliver a strong signal of good quality to the loudspeaker. If the loudspeaker production is poor, test the loudspeaker input from the receiver. A pair of phones or a loudspeaker of known quality may be used for this purpose. If the output of the Radiola is of poor quality the distortion may be due to any of the following causes:

1. Excessive voltage on R. F. amplifiers.
2. Excessive filament voltage.
3. Defective Radiotrons. The Radiola may be operating properly, but a poor tube in the detector or audio stages will cause distortion.
4. An open audio transformer may cause distortion.

(18) ACOUSTIC HOWL

This is caused by a microphonic Radiotron, or the Loudspeaker being too close to the Radiola. The sound waves from the loudspeaker striking a Radiotron may cause the Radiotron elements to vibrate, which in turn, produces an amplified howl in the output of the loudspeaker.

The remedy lies in interchanging the Radiotrons. Counting from left to right the third Radiotron is the most susceptible to this microphonic condition. Interchanging it, with one of the R. F. amplifiers or placing the Loudspeaker at a greater distance from the receiver will generally remedy this condition. In some cases both may be necessary.

(19) BATTERY CABLE

Radiola 16 has one battery cable consisting of six conductors and a separate cord for the antenna connection (See Figure 1). The color scheme for the connections is shown on a small card attached to the cable. This color scheme is as follows:

Antenna	Blue (Separate from the main cable)
+A 6V	Yellow
—A	Black with yellow tracer
—B+C Gnd.	Green with red and blue tracers
+B 45V	Maroon
+B 67V	Maroon and Red
+B 135V	Red
—C 9V	Black with green tracer

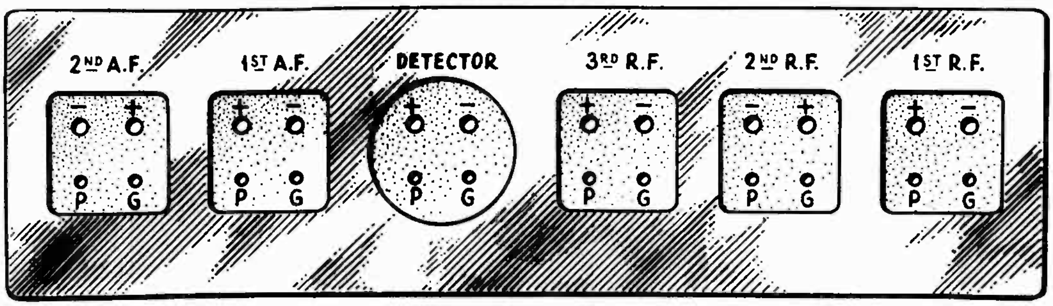


Figure 7—The correct filament polarity of the various Radiotron sockets in RCA Radiola 16

(20) REFINISHING MARRED SURFACES

The chassis assembly of Radiola 16 is finished in a dark bronze color that gives it a pleasing appearance and protection against rust or corrosion. When service work is being performed this surface is likely to become scratched, making a poor appearing job.

The RCA will supply to dealers and distributors through its service stations, small bottles or cans of refinishing paint, which together with a camel's hair brush should be a part of the service man's kit when servicing Radiola 16.

This bronze paint can also be used on the RCA 100A Loudspeaker.

(21) CONTINUITY TESTS

The following tests will show complete continuity for the circuits of Radiola 16.

The volume control should be adjusted so that half its resistance is in the circuit, the antenna lead disconnected and the battery cable disconnected from all batteries and placed so that none of its leads will make contact with any other lead. Close operating switch.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient voltage to give a 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 or leads indicated in the following test table under the column marked "Terminals." 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 second column indicates the correct effect.

The designation "P" and "G" refer to the plate and grid contacts of the socket indicated by the number following. For example G2 would indicate the grid contact of the second socket, P6 would indicate the plate contact of the sixth tube socket.

Polarity of the various Radiotron sockets are not alike. Figure 7 illustrates the correct polarity of the filament terminals for each socket in addition to the location of the plate and grid terminals.

CONTINUITY TEST CHART

Terminals	*Correct Effect*	*Incorrect Effect Caused By*
+A to +F1, 2, and 3	Closed	Open volume control, filament resistor, or wiring
+A to +F4, 5 and 6	Closed	Open filament resistor or wiring
—A to —F1, 2, 3, 4, 5 and 6	Closed	Open switch, defective cable or wiring
—A to —F6 (Open and close switch while making test)	Open or closed according to position of switch	Defective switch or connections
—F4 to +F4	Closed	Open detector grid resistance
—B to +135B	Open	Defective 1 mfd. by-pass condenser
—B to +67½	Open	Defective ½ mfd. by-pass condenser
—B to frame	Closed (Switch closed)	Open ground connection to chassis frame
—B to G1, G2 or G3	Closed	Open secondary of radio-frequency transformers or grid resistances
—B to P4	Open	Defective A. F. by-pass condenser
—B to G4	Closed (very weak)	Defective grid leak or detector grid resistance
+F4 to +F3	Closed	Open volume control
+F6 to +A	Closed	Open filament resistor
+67½ to P1	Closed	Open primary 1st R. F. Transformer
+67½ to P2	Closed	Open primary 2nd R. F. Transformer
+67½ to P3	Closed	Open primary 3rd R. F. Transformer
+45 to P4	Closed	Open primary 1st A. F. Transformer
+135 to P5	Closed	Open primary 2nd A. F. Transformer
+135 to Output	Closed	Open Connection
P6 to Output	Closed	Open Connection
—9C to G5	Closed	Open secondary of first audio trans.
—9C to G6	Closed	Open secondary of second audio trans.
Antenna to frame	Closed	Open antenna inductance or connections
G1 to frame	Closed	Open antenna inductance or connections
Stator condenser No. 1 to G2	Closed	Open grid resistance No. 1
Stator condenser No. 2 to G3	Closed	Open grid resistance No. 2

(22) IMPORTANT PRECAUTIONS

1. As a fixed resistor is used in the filament circuit, it is important that all the Radiotrons be in place before turning on the operating switch. This is to protect the Radiotrons from excessive filament voltage when the total load is not in the circuit.

2. The main tuning condensers are electrically and mechanically aligned at the factory. Tampering with or handling of any kind that may affect the alignment of these condensers is to be avoided. The screws on the side of the assembly should not be touched because any movement, even though slight, may seriously affect the overall efficiency of the Radiola. This would be especially noticeable on weak signals.

PART II—MAKING REPLACEMENTS

(1) REPLACING ANTENNA COIL

The following procedure should be used when replacing the antenna coil:

(a) Remove five screws holding wooden back panel to cabinet.

(b) Remove knobs on "Station Selector" and "Volume control."

(c) Unscrew threaded round collar from front of battery switch.

(d) Remove four screws holding chassis in place to bottom of cabinet.

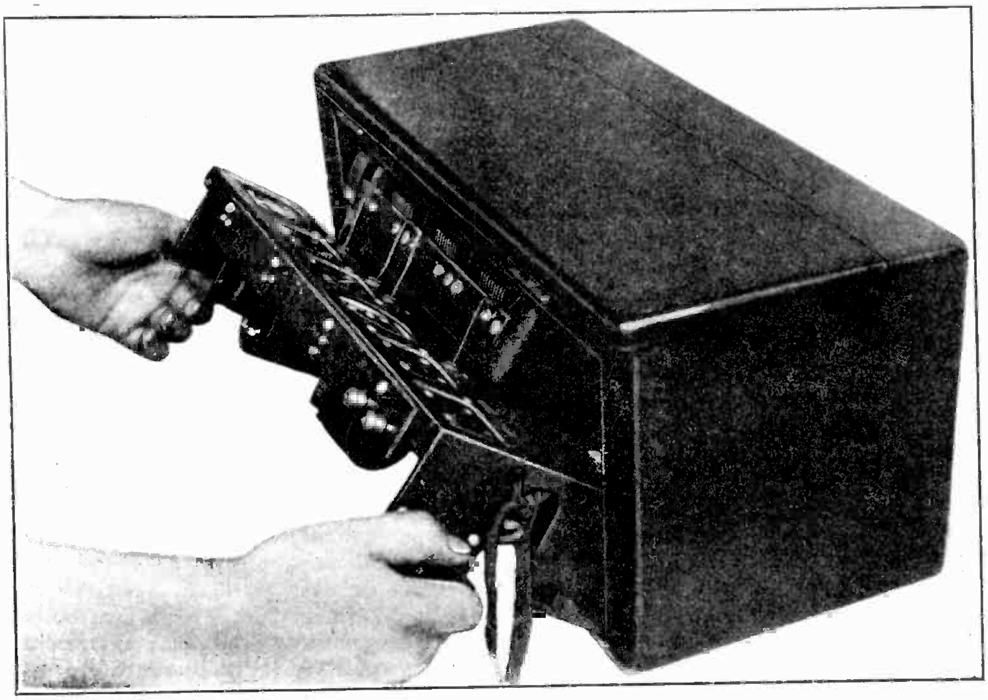


Figure 8—Removing chassis assembly from cabinet

The chassis assembly may now be removed by slightly rocking it in the cabinet and slipping it out of the rear opening. See Figure 8. This brings the complete chassis into view, allowing an easy examination of all parts.

The antenna coil is located at the left end viewed from the rear of the cabinet—the end that has the condenser drum and scale. See Figure 9. To remove the coil unsolder the two leads and remove screw and nut that passes through center of coil. The new coil is then placed in the position occupied by the old one. The nut and screw are replaced and the Radiola is reassembled in the reverse of the foregoing order. Before being replaced in the cabinet it should be given an operating test.

(2) REPLACING RADIO FREQUENCY COILS

The three radio frequency transformers together with a mounting strip and two pin jacks are stocked as one complete unit.

A step by step procedure for replacing this assembly is as follows:

1. Remove chassis from cabinet as described in Part II, Section 1.
2. Unsolder and carefully tag all connections to the three transformers and the two pin jacks.

3. Remove four screws that hold mounting strip to metal chassis. The entire assembly can now be released. The new assembly should be placed in the same position occupied by the one just removed.
4. Replace the four screws that hold mounting strip to metal chassis.
5. Replace and resolder all leads to the three transformers and two pin jacks as indicated by the tags previously attached to them.

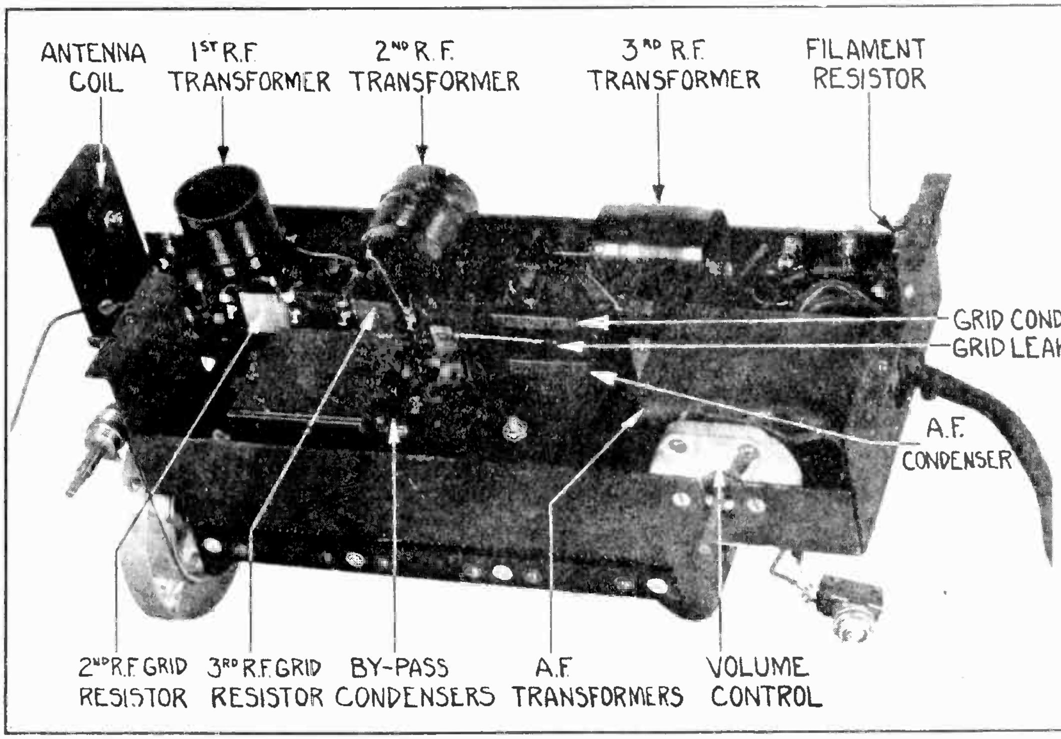


Figure 9—Sub-chassis assembly showing antenna coil, radio frequency coils, by-pass condensers, resistances and audio frequency transformers

6. Give Radiola an operating test before replacing in cabinet to determine that replacement has been properly made.
7. Return chassis assembly to cabinet and replace all screws and control knobs.

(3) REPLACING GANG SOCKETS

The sockets of Radiola 16 are of the gang variety, using one detector socket, a two-gang A. F. socket strip, and one three-gang socket strip for the radio frequency amplifier tubes.

These sockets are riveted to the metal chassis. To replace these sockets drill out the old rivets and use screws, nuts and lock washers for securing the new sockets. A step by step procedure for making replacements of this kind is as follows:

1. Remove chassis assembly from cabinet as described in Part II, Sec. 1.
2. Remove and tag all leads to the terminals of the sockets being removed.
3. Drill out rivets holding sockets to metal chassis frame.
4. The socket assembly may now be removed and the new one placed in the position occupied by the old one.

5. Fasten new socket in place by using small round head machine screws, nuts and lock washers in place of the rivets previously drilled out.
6. Resolder all connections to terminals of new sockets.
7. Test Radiola and replace in cabinet.

(4) REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers are replaced as one complete unit. A step by step procedure is as follows:

1. Remove chassis assembly from housing as described in Part II, Sec. 1.
2. Unsolder four connections to condenser.
3. Remove three screws from under side of chassis that holds condenser assembly.
4. The assembly may now be removed and the new assembly placed in position.
5. Replace three screws that hold assembly in place and resolder the four leads.
6. Replace chassis assembly in cabinet.

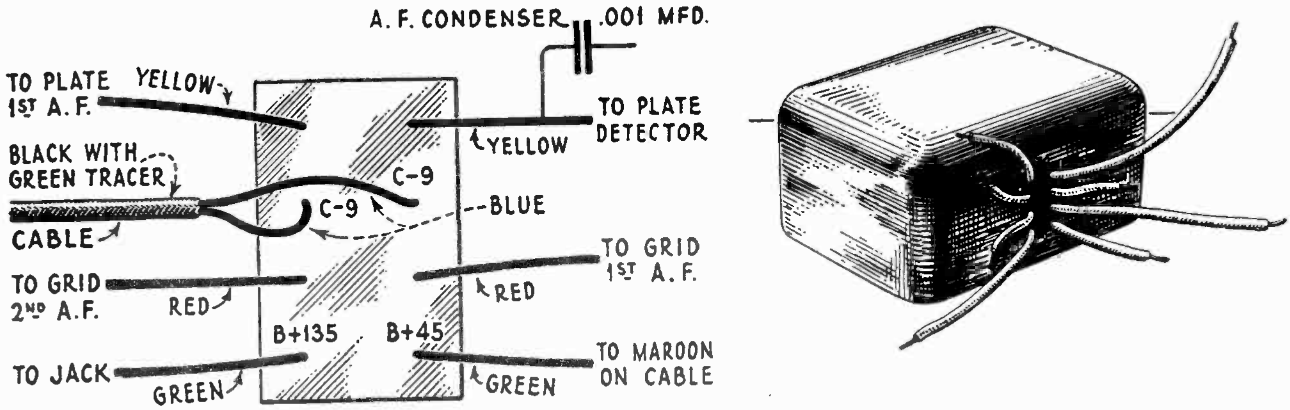


Figure 10—*Audio frequency transformers and color scheme of connections*

(5) REPLACING LARGE BY-PASS CONDENSERS

These condensers, located on the under side of the chassis frame, are held together by means of clamps that form part of the condenser case fastened to the frame. A step by step procedure when making replacement is as follows:

1. Remove chassis from cabinet as described in Part II, Sec. 1.
2. Remove condenser assembly as described in Part II, Sec. 4.
3. The tabs of the condensers may now be bent up, by using a screw driver.
4. The two condensers are released as a unit from the chassis frame. Separate them by turning up the tab that holds them together.
5. Unsolder the leads of the condenser that is to be replaced. Insert the new condenser in the place occupied by the old one and resolder the leads to it.
6. Fasten the condensers together as a unit by binding over the tabs provided for that purpose. Fasten to frame by inserting the tabs of the condenser into their respective slots and bending the tabs over on the top side of the frame.
7. Replace condenser assembly as described in Part II, Section 4, and then replace chassis assembly in cabinet as described in Part II, Section 1.

(6) REPLACING AUDIO TRANSFORMERS

The audio transformers of Radiola 16 are built together as a unit. In making a replacement the following procedure should be used.

1. Remove chassis from cabinet as described in Part II, Section 1.
2. The audio transformer case is held by metal tabs, bent over on the upper side of the chassis. Turn these up to release the transformer assembly.
3. Tag and unsolder all leads.
4. Place the new transformer assembly in position occupied by the old and fasten to frame by bending over metal tabs that hold it in place.
5. Solder all leads in place as indicated by tags attached. The color scheme of these connections is shown in Figure 10.
6. Replace chassis assembly in cabinet.

(7) REPLACING CONDENSER DRIVE CABLE

The condenser drive cable of Radiola 16 is made of phosphor bronze and is very rugged. If replacement becomes necessary the following procedure should be used.

1. Remove chassis from cabinet as described in Part II, Section 1. Place chassis on table in normal position with controls to the front.
2. Release the cable adjusting screw and clamp, and remove old cable from large drum and grooved drums completely.
3. Starting from the rear grooved drum place eye of cable over pin, wind on three complete turns, and then bring cable up to large drum. The pin in the grooved drum should be nearly horizontal and on the right side of the drum.
4. Now bring cable over the large drum. Turn drum so that cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing cable to the other side of drum to the other track.
5. Follow on around other track in same direction until point is reached where cable is directly above front grooved drum.
6. Starting on the third groove back from the front of the grooved drum wind on two and a half turns and slip eye over pin.

The cable is now in the correct position, although probably slack.

The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the groove are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of the controls. Care should be taken not to take up too much as the cable may be stretched or possibly broken.

(8) REPLACING DIAL SCALE

After considerable use a dial scale may become dirty or illegible and a new scale desired. A step by step procedure of making replacement follows:

1. Open lid of cabinet of Radiola.
2. Turn dial so that the two screws that hold the dial in place are on top.
3. Remove screws, washer and nuts that hold dial in place.
4. Replace old dial with new one and replace screws, but do not tighten.
5. Examine new dial from front of Radiola to see that numbers on dial are not upside down and the maximum and minimum figures are in their correct places.
6. Tighten screws holding dial in place and close lid of cabinet.

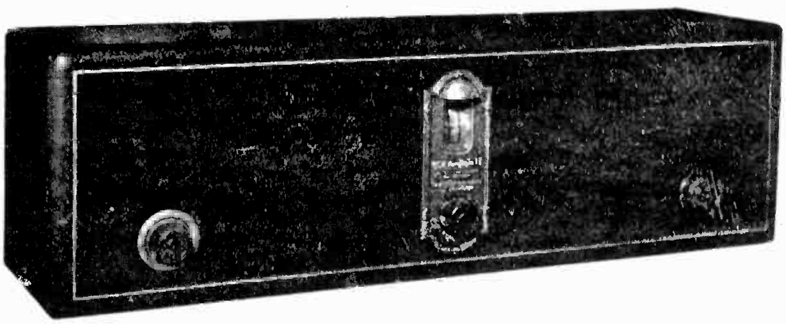
SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes. defective batteries, wrong battery connections and a poor antenna system. If imperfect operation is not due to the above causes the "Service Data Chart" should be consulted for further detailed causes.

Indication	*Cause*	*Remedy*	See Service Notes	
			Part I	*Part II*
No Signals	Defective operating switch	Replace switch	—	—
	Loose volume control arm	Tighten volume control arm	Sec. 9	—
	Defective battery cable	Replace battery cable	Sec. 19	—
	Defective antenna coil	Replace antenna coil	—	Sec. 1
	Defective R. F. transformer	Replace R. F. transformer assembly	—	Sec. 2
	Defective A. F. transformer	Replace A. F. transformer assembly	—	Sec. 6
	Defective By-pass condenser	Replace By-pass condenser	—	Sec. 5
Weak Signals	Defective cable	Replace cable	Sec. 19	—
	Defective antenna coil	Replace antenna coil	—	Sec. 1
	Defective R. F. transformer	Replace R. F. transformer assembly	—	Sec. 2
	Defective A. F. transformer	Replace A. F. transformer assembly	—	Sec. 6
	Dirty prongs of Radiotrons	Clean Radiotron prongs	Sec. 8	—
	Defective By-pass condenser	Replace defective By-pass condensers	—	Sec. 5
	Defective main tuning condenser	Replace main tuning condenser assembly	—	Sec. 4
Poor Quality	High plate voltage on R. F. amplifiers	Reduce plate voltage to 67 on R. F. amplifiers	Sec. 13	—
	Defective A. F. transformer	Replace A. F. transformer assembly	—	Sec. 6
	Defective By-pass condenser	Replace defective condenser	—	Sec. 5
Noisy or Intermittent Reception	Dirty Radiotron prongs	Clean Radiotron prongs with fine sand paper	Sec. 8	—
	Loose volume control arm	Tighten volume control arm	Sec. 9	—
	Socket contacts bent or broken	Repair or replace defective contact	Sec. 7	—
Howling	High plate voltage on R. F. amplifiers	Reduce plate voltage on R. F. amplifiers to 67	Sec. 13	—
	Open grid resistors	Check and replace grid resistors	Sec. 21	—
	Defect in audio system	Check and repair defect in audio system	Sec. 16	—
	Acoustic howl caused by microphonic Radiotrons or loudspeaker too close to Radiola	Interchange Radiotrons or increase distance of loudspeaker from Radiola	Sec. 18	—
	Open grid circuit in any stage	Check circuits and repair defect	Sec. 21	—
Radiotrons fail to light	Operating switch not "On"	Turn switch "On"	—	—
	Defective operating switch	Replace operating switch	—	—
	Defective volume control	Correct defect or replace volume control	Sec. 9	—
	Defective cable	Repair or replace cable	Sec. 19	—
Play in station selector	Loose knob	Tighten or replace knob	Sec. 11	—
	Slack cable	Take up on cable at adjusting screw	Sec. 10	—

RCA
Radiola 17

SERVICE NOTES



RCA Radiola 17

Third Edition—2M—Jan. 1931

RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well informed RCA Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that 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 Dealer's 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 RCA Dealers' service problems, and presents the best practice in dealing with them. A careful reading of these Service Notes will establish their value to Dealer and Distributor, and it is suggested they be preserved for ready reference.

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

CONTENTS

PART I—SERVICE DATA

PART II—MAKING REPLACEMENTS

ILLUSTRATIONS

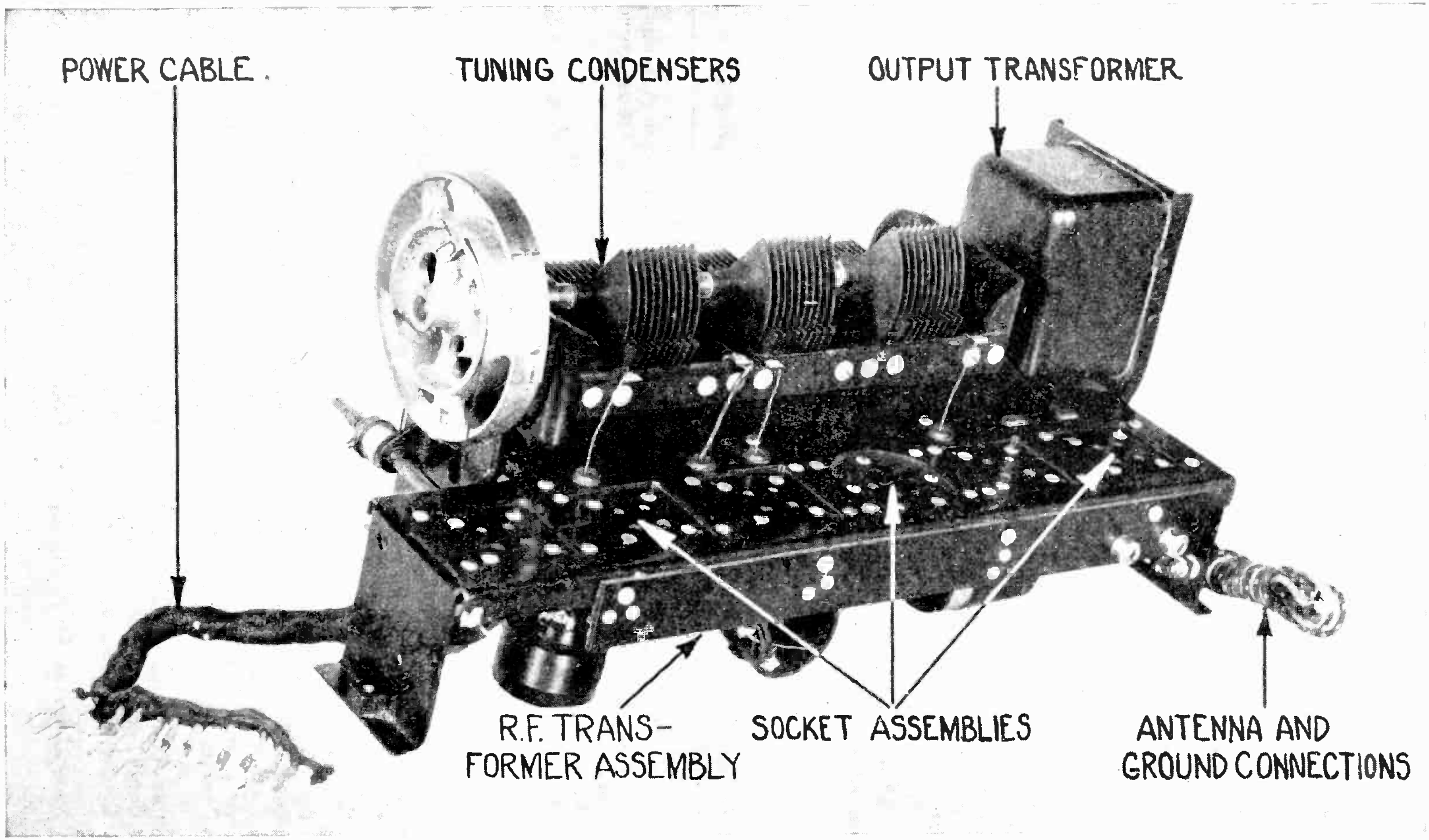


Figure 1—Top view of receiver assembly showing the principal parts.

RCA RADIOLA 17

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

RCA Radiola 17 is a six-tube tuned radio frequency receiver (Figure 1), utilizing RCA Radiotrons UX-226, UY-227, UX-171A and the Radiotron full wave rectifier UX-280 in the socket power unit (Figure 2). The use of Radiotrons UX-226, UY-227, and UX-171A, using raw alternating current for filament sup-

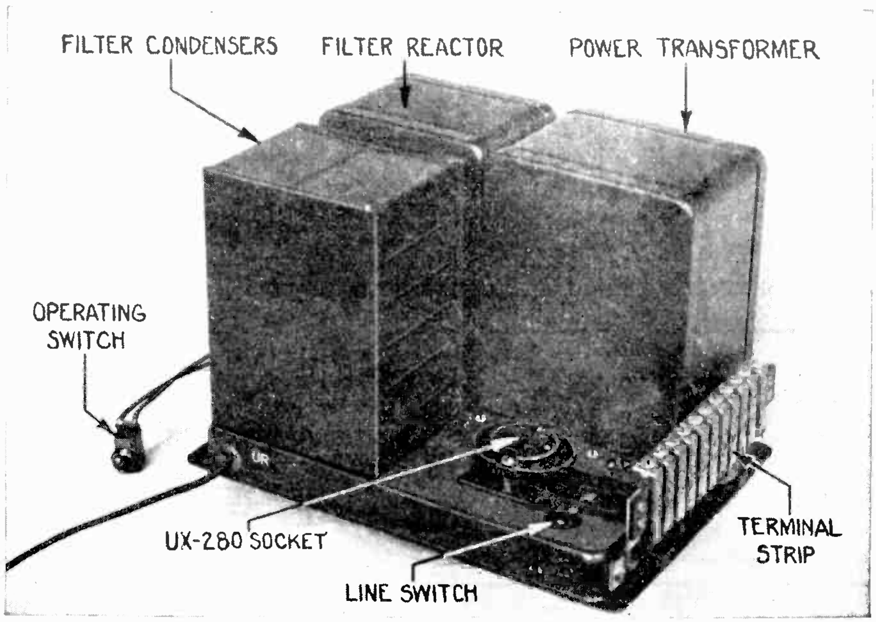


Figure 2—Socket Power Unit showing various parts.

ply, and Radiotron UX-280 in a plate and grid supply unit makes Radiola 17 a complete socket power receiver operating on 105-125 volts, 50 to 60 cycle A. C.

Very little service work should be required on Radiola 17. However, the following notes are published for the guidance of those called upon to locate and remedy any trouble that may occur.

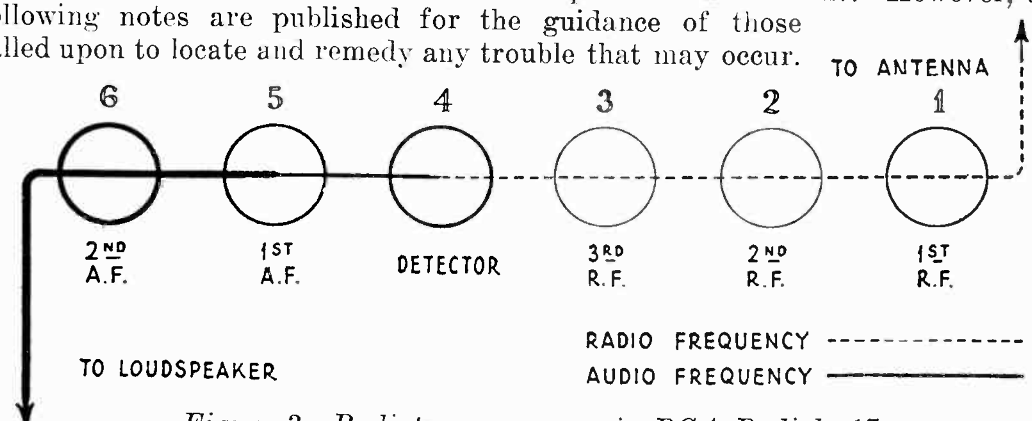


Figure 3—Radiotron sequence in RCA Radiola 17

PART I—SERVICE DATA

(1) RADIOTRON SEQUENCE

Figure 3 illustrates the sequence of the Radiotrons in the receiver proper, omitting Radiotron UX-280 in the socket power unit. From right to left, when facing the front of the Radiola, the Radiotron sequence is as follows:

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground and is not tuned in any way.

Radiotron No. 2 is a stage of tuned R. F. amplification employing a grid resistance to prevent oscillation. It is tuned by the first gang condenser.

Radiotron No. 3 is the second stage of tuned R. F. amplification. It also

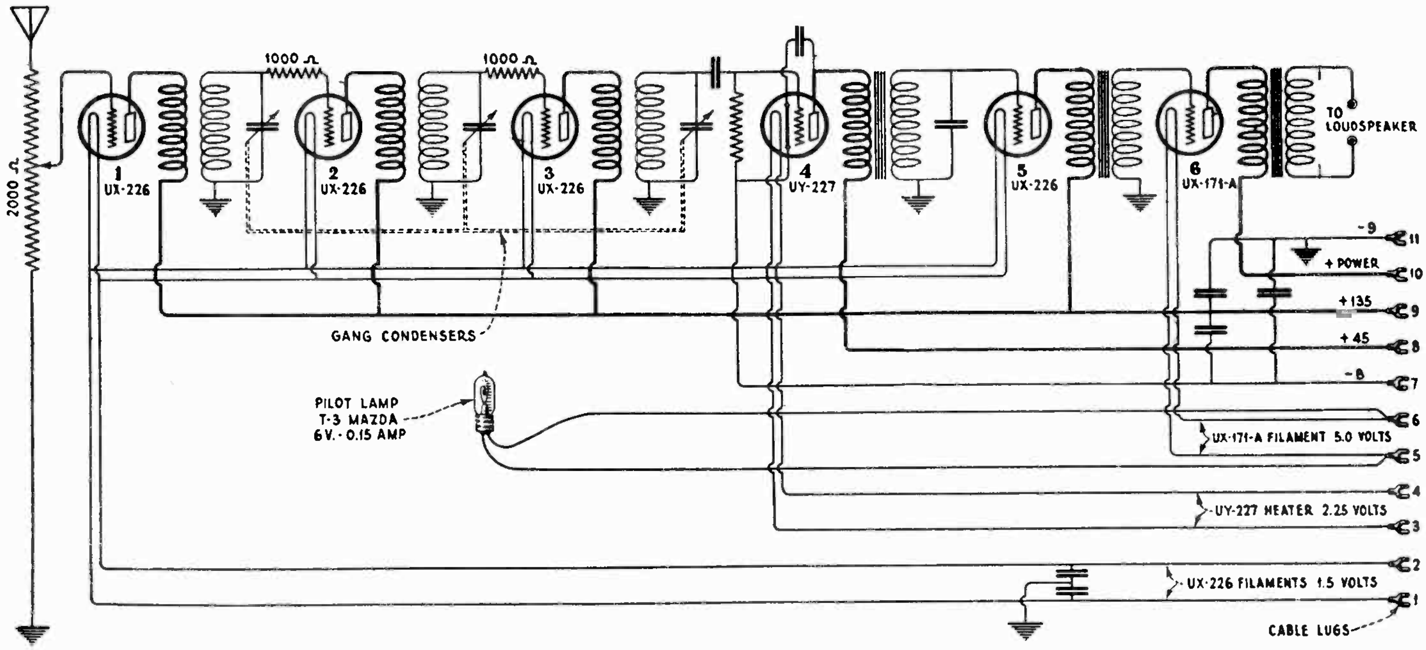


Figure 4—Schematic circuit diagram of receiver assembly.

employs a grid resistance for the purpose of stabilizing or preventing self oscillation in the circuit. It is tuned by the second of the main tuning condensers.

Radiotron No. 4 is the detector tuned by the third-gang condenser.

Radiotrons No. 5 and No. 6 are respectively the first and second stages of audio frequency amplification. The last stage, Radiotron No. 6, employs power amplifier Radiotron UX-171A.

(2) CIRCUIT CHARACTERISTICS

The following principles are incorporated in the circuit design of Radiola 17 (Figure 4 and 4A.)

1. A three-gang condenser, employed to tune two of the radio frequency circuits and the detector circuit, provides one tuning control.

2. An aperiodic antenna, or first R. F. circuit, eliminates the necessity for a separate antenna tuning control.

3. The volume control regulates the input grid voltage to the first R. F. amplifier stage. This is the most practical method of volume control for use

with A. C. Radiotrons and gives a smooth control of volume without distortion.

4. No neutralizing condensers are employed. Grid resistances in the two tuned radio frequency stages effectively prevent any tendency to self oscillation.

5. Raw A. C. of the correct voltage is used for filament heating of all Radiotrons. This eliminates the use of "A" batteries.

6. The three R. F. stages and the first audio stage receive a plate voltage of 135 volts in conjunction with a negative grid bias of 9 volts. The detector receives 45 volts plate supply without grid bias. The last audio stage receives a plate supply sufficient to provide ample loudspeaker output. The plate and grid voltages are supplied by means of a built-in "B" and "C" supply using Radiotron UX-280 as the rectifying device.

7. Radiotron UX-171A in the last audio stage provides ample volume without distortion in loudspeaker reproduction.

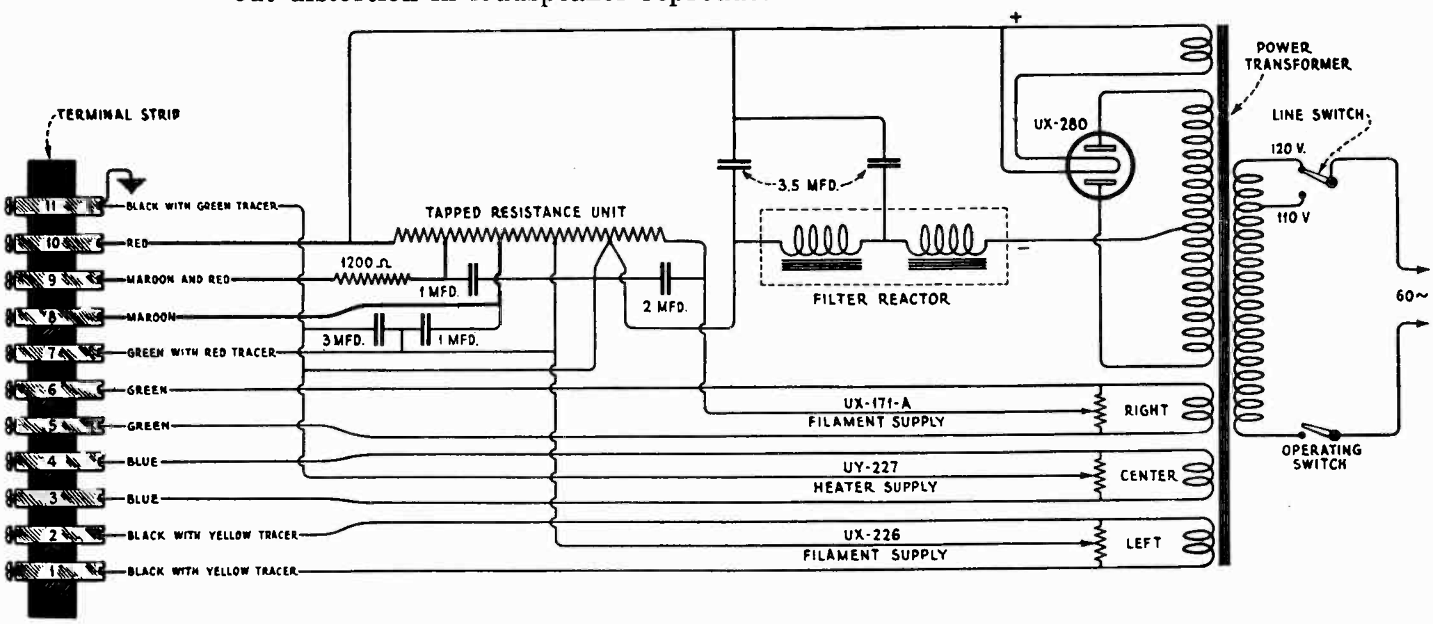


Figure 4A—Schematic circuit diagram of socket power unit.

The various circuit characteristics of Radiola 17 provide for easy installation and simple operation coupled with quality reproduction delivered to the loudspeaker.

(3) RADIOTRONS

Radiotrons UX-226 are used in all radio frequency amplifying stages and in the first audio amplifying stage. It has an oxide coated filament consuming 1.05 amperes at 1.5 volts.

Radiotron UY-227 is used for the detector. It operates on raw A. C. for filament supply, making use of an indirectly heated cathode. This Radiotron has five prongs, the extra prong being connected to the oxide coated cathode. Under normal conditions Radiotron UY-227 should give little trouble. However, in some cases a slight howl may develop in the detector circuit which will necessitate substituting another UY-227 Radiotron. Although a howl may develop in a receiver with one UY-227, in another the same tube may prove O. K. On examining a Radiotron UY-227 in operation, a slight flickering of the heater element, incased in its insulating material, may be noticed. This condition in no way affects the normal operation of the Radiotron. The lag in the transference of heat from the heater element to the cathode, as evidenced when starting and stopping the operation of the tube, takes care of any variations indicated by this flicker, which supposedly might affect the normal operation of Radiotron UY-227. In Radiola 17 there is a positive potential of 9 volts applied to the cathode of Radiotron UY-227 with the negative side of this potential connected to the center connection of the potentiometer across the heater winding for this Radiotron. This prevents a possibility of the cathode emitting any electrons back to the heater instead of to the plate. An output transformer protects the loudspeaker windings from the high plate voltage used in conjunction with Radiotron UX-171A.

Radiotron UX-280 is a full wave rectifying Radiotron used to rectify the alternating current into pulsating direct current, which is smoothed out by means of a filtering system, and used to provide all plate and biasing voltages.

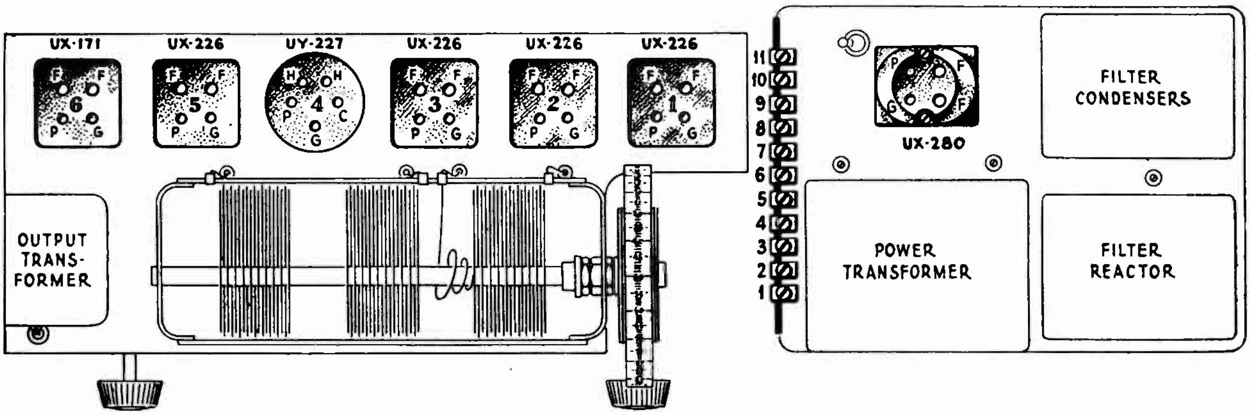


Figure 5—Radiotron socket contacts.

(4) ANTENNA INSTALLATION (Outdoor Type)

Due to the high sensitivity of Radiola 17 the most efficient antenna system is one of approximately 25 feet in length—depending upon local conditions—measured from the far end of the 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 which 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 there from by a porcelain tube.

The antenna should not cross either over or under any electric light, traction or power line and should be at right angles to these lines and other antenna. 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.

(5) ANTENNA INSTALLATION (Indoor Type)

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna consisting of about 25 feet of insulated wire strung around the picture moulding or placed under a rug. 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 to secure satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

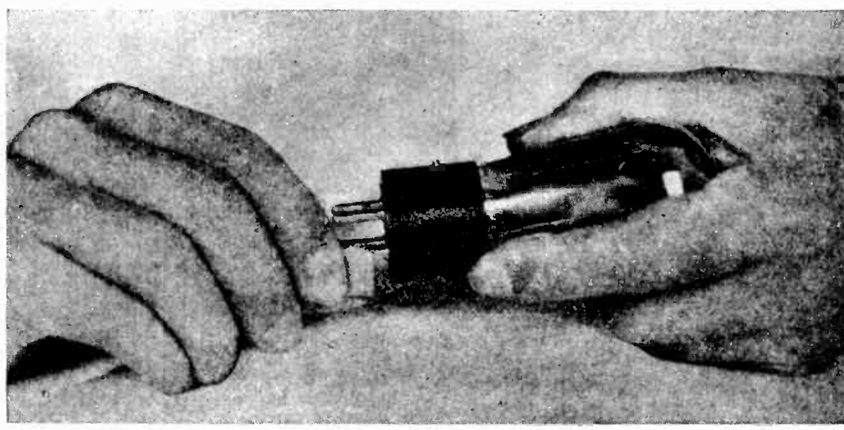


Figure 6—Method used to clean Radiotron prongs.

(6) GROUND

A good ground 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.

In some instances the sensitivity of a particular set may be improved by leaving off the ground connection. The receiver, however, does not operate entirely without a ground as there is a small capacity ground through the A. C. power supply line. On the other hand, the absence of a ground connection may cause oscillation depending upon the particular set and the antenna system installed. It is recommended that the service man experiment with grounds, and employ the arrangement giving the best results.

(7) ANTENNA SYSTEM FAILURES

Complaints of swinging signals, or of intermittent reception with probable grating noises, as distinguished from fading effects, 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 lead-in connection to the antenna, or antenna touching some metallic surface, such as the edge of tin roof, drain pipe, etc. By disconnecting the antenna and ground leads from Radiola 17 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.

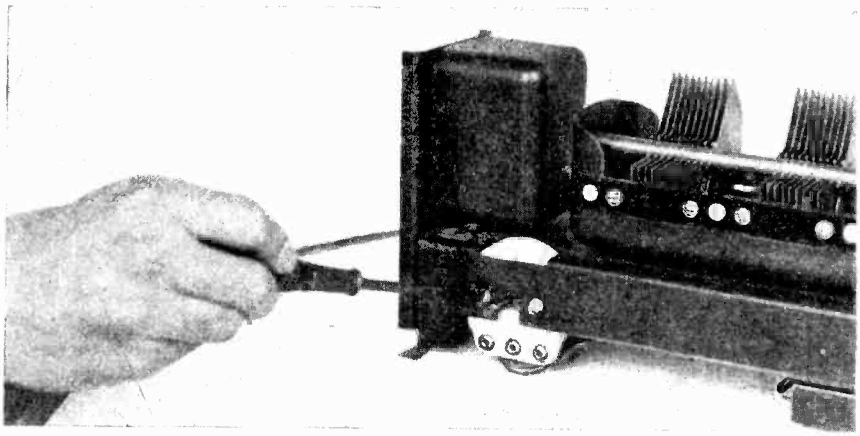


Figure 7—Releasing mounting screws holding volume control.

(8) RADIOTRON SOCKETS

The socket in Radiola 17 are of the standard gang UX and UY type (Figure 5). The three-gang socket is for the radio frequency amplifiers; the single socket—a five-prong detector socket is for Radiotron UY-227 and the two-gang socket is for the audio frequency amplifiers. Care must be exercised when inserting Radiotrons in the sockets. A socket contact may not be in its correct position and forced insertion of a tube will bend or break it. If care is exercised and the Radiotron inserted gently, little trouble will be experienced with socket contacts. A bent one will be noticeable on inspection and may be corrected by inserting a narrow instrument in the socket hole and pushing the contact into its correct position. A badly bent or broken socket contact must be replaced.

(9) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuit sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned periodically to insure good contact.

The potentiometers (Part I, Section 19) should be readjusted for the position of minimum hum whenever the Radiotron prongs are cleaned.

The prongs should be cleaned by using a piece of fine sandpaper (Figure 6). The use of emery cloth or steel wool is not recommended. Before re-inserting Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

In placing Radiotrons in the UX sockets care should be exercised to make certain that the two large pins and two small pins of the Radiotrons match the socket holes. The UY-227 Radiotron has five prongs all of the same size and will fit in the socket only one way. If a Radiotron will not fit into a socket without considerable pressure being applied, look for excessive solder on one or more of the prongs. Excessive solder on prongs may be removed with a file or knife.

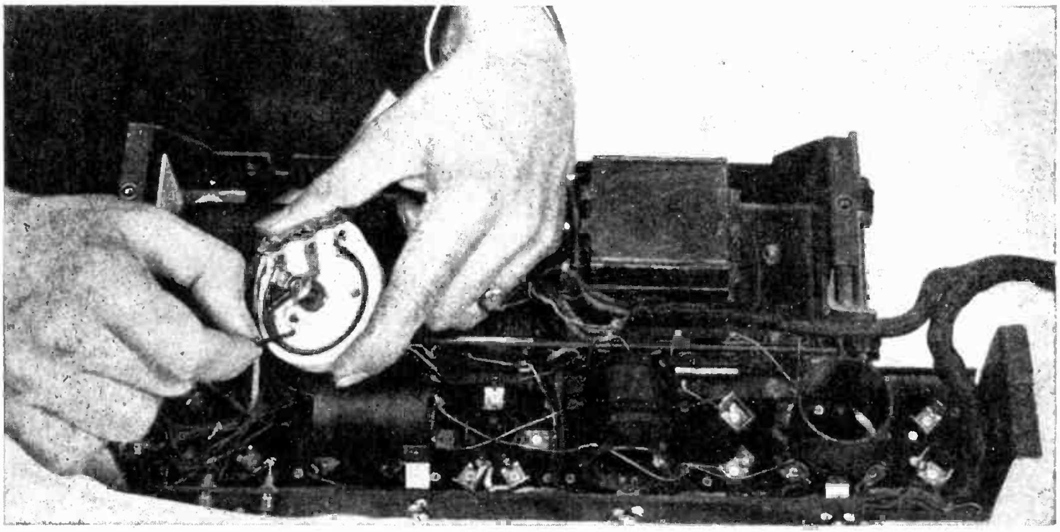


Figure 8—Adjusting the contact arm to secure improved contact with resistor strip.

(10) LOOSE VOLUME CONTROL CONTACT ARM

A loose volume control contact may cause noisy or intermittent operation and should be remedied. If the contact arm is loose, the remedy is to bend it slightly so that it makes firm contact against the resistance strip. In order to do this it is necessary to remove the chassis from the cabinet as described in Part II, Section 1. The volume control is then readily accessible. By removing the two screws (Figure 7), that hold it to the metal frame it may be completely removed. The small U-shaped washer is removed from the shaft and the spring contact arm is pulled out to clear the resistor strip. The spring contact arm may now be bent sufficiently to make a good contact. Figure 8 illustrates the bending of this contact arm. After adjusting the spring contact arm, replace the mounting screws and return the chassis to the cabinet and replace screws and control knobs.

(11) ADJUSTMENT FOR SLACK DRUM CONTROL

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash. (See Figure 10.)

After considerable wear, or extreme changes of temperature the cable may become slack. To take up this slack open lid of cabinet and turn the cable adjusting screw with clamp until the cable is taut. (See Figure 9.) In extreme cases as might occur after considerable use and several adjustments this screw may become seated thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part II, Section 1. Remove the cable adjusting screw and clamp (see Figure 10). The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one-inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. Figure 10 illustrates this operation. It will be noted that the tapered pin in the

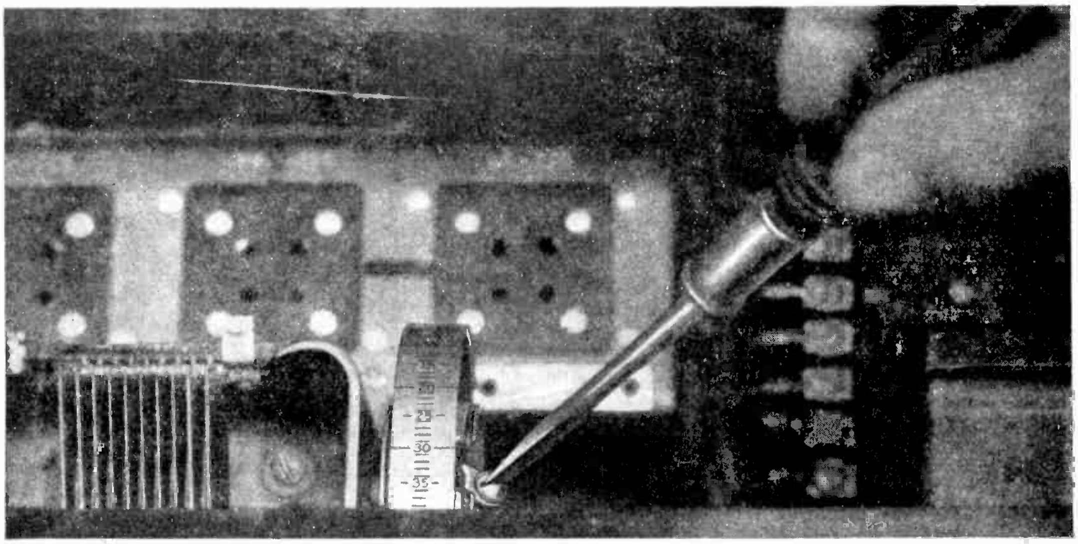


Figure 9—Turning cable adjusting screw to take up slack in tuning drum cable.

new position cannot be inserted as far as originally. However, it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and a half turn slipped on the drum which will provide for taking up all slack. Sufficient grooves are provided on the drum for this purpose.

(12) MECHANICAL HUM

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S. P. U. as described in Part II, Section 12, and heating it in a slow oven. The open end of the transformer should be kept up and the wax heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S. P. U.

(13) BROKEN CONDENSER DRIVE CABLE

Should a cable become broken, due to considerable use or excessive tightening, the proper remedy is to replace the cable. The procedure for making this replacement is described in Part II, Section 8. However if a new cable is not immediately available a temporary repair may be made in the following manner provided the break in the cable is not in that section that passes over the small grooved drums.

The two ends should be spliced together and then soldered. Splicing consists of interweaving the strands as with rope and not just twisting the cable

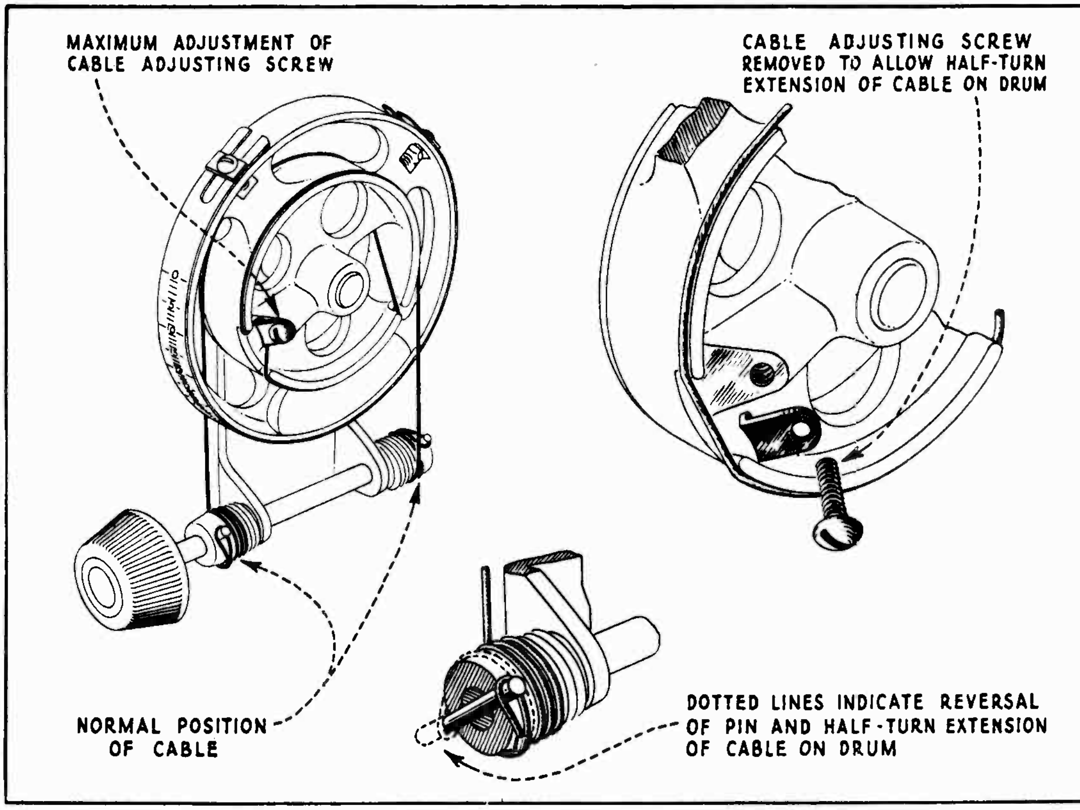


Figure 10—Radiola 17 three-gang condenser cable and drum operating mechanism.

ends together as in an electrical wiring splice. Splicing gives greater strength and results in a smaller body being formed on the cable. When soldering, use plenty of flux and a small amount of solder. Heat sufficiently long for the solder to adhere to all the small strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows any excess solder to drip away. It is to be understood that this is but a temporary repair and should be used only until a new cable can be procured and installed.

(14) LOUDSPEAKER POLARITY

Due to Radiola 17 using an output transformer, there is no polarity to the output current of the receiver. Consequently, when connecting any type of loudspeaker (either horn type or cone type) the speaker should be connected in the manner that gives the most pleasing reproduction.

(15) UNCONTROLLED OSCILLATION

Should Radiola 17 oscillate or regenerate at any point in the tuning range the trouble is probably caused by:

(1) Defective grid resistor in second or third R. F. stages. The resistors may be checked by means of a resistance bridge, or the voltmeter ammeter method described below. Figure 4 shows the correct value of these resistors.

(2) Excessive filament voltage. Adjust line switch to high position.

(3) Excessive plate voltage. This may be caused by a defective 1200-ohm resistor in UX-226 plate supply line.

(4) Antenna lead not in proper position. The correct position is between the A. F. transformer assembly and the frame.

(5) Open ground connection. Make repair.

(6) High resistance ground. Connect the ground lead to a cold water pipe, a hot water or steam radiator or both. If these are not available connect to several other grounds until a fairly low resistance ground is obtained.

(7) Open—9 volt bias lead (black with green tracer). Make repair.

(8) Open ground lead in set. Any of the several grounding leads in the Receiver and S. P. U. Assembly being open may cause oscillation. Test for open connections and make repair.

(9) Antenna and ground leads reversed, either at their point of connection to the volume control or outside of the set. Connect properly.

In the case of No. 1 the grid resistance of Radiola 17 may be checked by means of a resistance bridge. If a resistance bridge is not avaliable the voltmeter-ammeter method gives accurate results provided the meters used are calibrated accurately. This method makes use of a milliammeter with a scale of 0-25 and a voltmeter of 0-7. A voltage is then applied that will give a substantial reading. A circuit diagram of this method is shown in Figure 12.

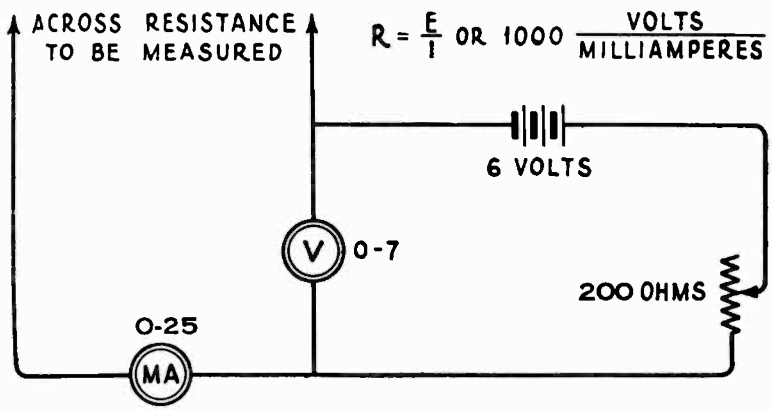


Figure 12—Schematic circuit for resistance measurement.

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

$$R = \frac{E}{I} \left(\begin{array}{l}\text{Where R equals ohms} \\ \text{E equals volts and I equals amperes}\end{array}\right) \text{ or } 1000\,\frac{\text{Volts}}{\text{Milliamperes}}$$

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.

A detector tube may cause oscillation or a howl, very similar to a microphonic howl. The remedy in this case is to interchange the detector Radiotron with another UY-227 Radiotron. A tube may howl in one Radiola 17 and perform normally in another.

In some cases with certain antennas, the Radiola may oscillate even though everything is O. K. The remedy is to change the antenna length or interchange the UX-226 Radiotrons in the R. F. stages.

(16) DISTORTED REPRODUCTION

Under normal conditions Radiola 17 will deliver a strong signal of good quality to the loudspeaker. If the loudspeaker production is poor test the loudspeaker output from the receiver. A pair of phones or a loudspeaker of known quality may be used for this purpose. Poor quality or distortion may be due to any of the following causes:

1. High or low plate and grid voltages from socket power unit. This may be due to a defective Radiotron UX-280 or tapped resistance unit. The remedy is to replace the Radiotron UX-280 with one of known quality or check the various resistances of the tapped resistor for a possible short or open.

2. Defective Radiotrons. Though the Radiola may be in operating condition a defective Radiotron in any stage will cause distortion. This is especially true of the detector, 1st and 2nd audio stages and the rectifier tube.

3. Potentiometers not properly adjusted. Unless the potentiometers are correctly adjusted sufficient hum may be present to cause distortion. The correct adjustment of these potentiometers is described in Part I, Section 19.

Should Radiola 17 become noisy in operation or signals come in and die out abruptly with periods of hum or no reception, test in the following manner:

(a) Disconnect antenna and ground leads. If the Radiola becomes quiet and signals from local stations, though weak, are received it would be an indication that the trouble is either in the antenna system or is caused by nearby interfering electrical apparatus. The remedy in the first case is to repair the antenna system and in the second place Radio Frequency chokes on any offending nearby apparatus. The location of interfering electrical machinery and the cure will require patience, skill and experimenting.

(b) If disconnecting the antenna and ground system does not eliminate the noise the trouble is in the Radiola. A defective tube, one having poorly welded elements would cause a disturbance of this kind and this point should be checked by interchanging the Radiotrons in the Radiola with others of the same type. If it is definitely established that the Radiotrons are O. K. then the contact between the Radiotron prongs and the socket contacts should be examined for a dirty or poor contact. The three potentiometers in the Socket Power Unit and the Volume Control should be examined for a dirty or poor contact between the contact arm and the resistor strip.

(17) AUDIO HOWL

Radiola 17 may have a tendency to howl when first installed. This can usually be remedied by interchanging the detector Radiotron with another UY-227 Radiotron. If this does not remedy the trouble try the following:

(a) Put the line control switch in the position that gives the least light at the pilot lamp. This reduces the filament voltage on all the Radiotrons which may be high, causing oscillation on the part of the R. F. amplifiers.

(b) Place antenna lead between the A. F. transformer and frame.

If the Radiola has been in operation for a considerable time and a howl develops, the following points should be checked for possible defect:

(a) Defective Radiotrons. A Radiotron after considerable use may cause a howl. Substituting a Radiotron of known condition will isolate the defective one.

(b) Open audio by-pass condensers.

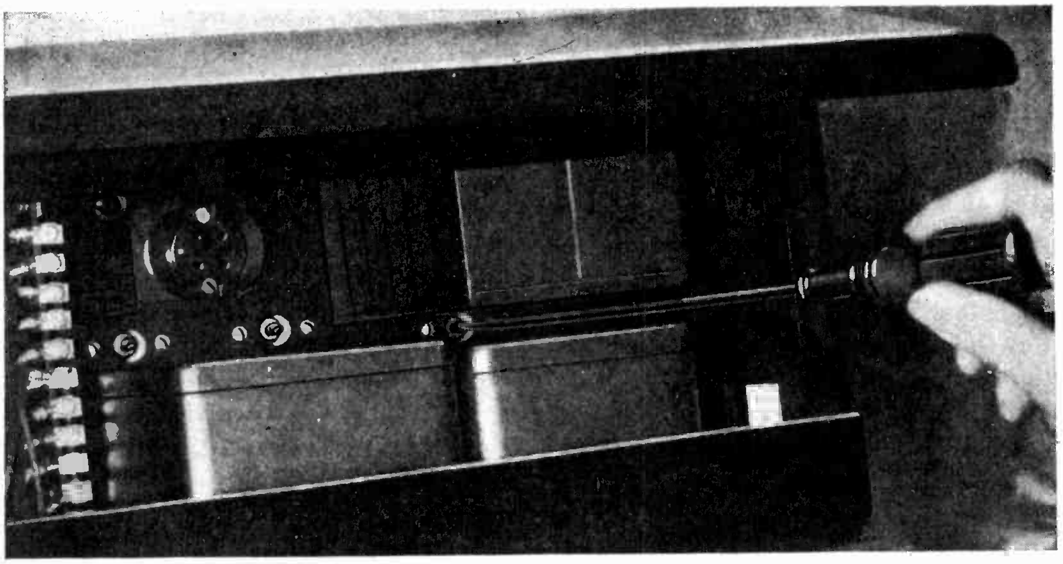


Figure 13—Using a long screwdriver in adjusting the potentiometer for minimum hum.

(c) Defective grid leak or open grid connection of any tube in the Radiola except Radiotron UX-280.

(d) Open R. F. grid resistor.

Any part found defective should be replaced and any open or poor connection should be repaired.

(18) ACOUSTIC HOWL

Generally speaking, Radiola 17 is much less susceptible to acoustic howling due to microphonic tubes than receiving sets using other than A. C. tubes. However, on some occasions acoustic howling may be experienced and the loudspeaker location must be chosen with care. This howl is somewhat different from the usual microphonic howl in that it disappears when a station is tuned in, but still causes some distortion in the received signal. The remedy is to interchange the UY-227 detector tube with another of a similar type or change the position of the loudspeaker. In extreme cases both remedies may be necessary.

(19) HUM

Three potentiometers are provided in Radiola 17 for the suppression of any A. C. hum. These potentiometers are adjusted for the correct electrical center of the filaments of Radiotrons UX-226, UY-227 and UX-171A. The following procedure should be used in eliminating hum:

(a) Place set in normal operation with loudspeaker connected.

(b) Remove Radiotrons 2 and 3, counting from left to right (first audio and detector stages facing front of Radiola).

(c) Locate position of three potentiometers in power unit.

(d) Adjust potentiometer, located at extreme right when facing front of Radiola (Figure 13), for position of minimum hum.

(e) Now replace Radiotron No. 2 (UX-226), previously removed, and

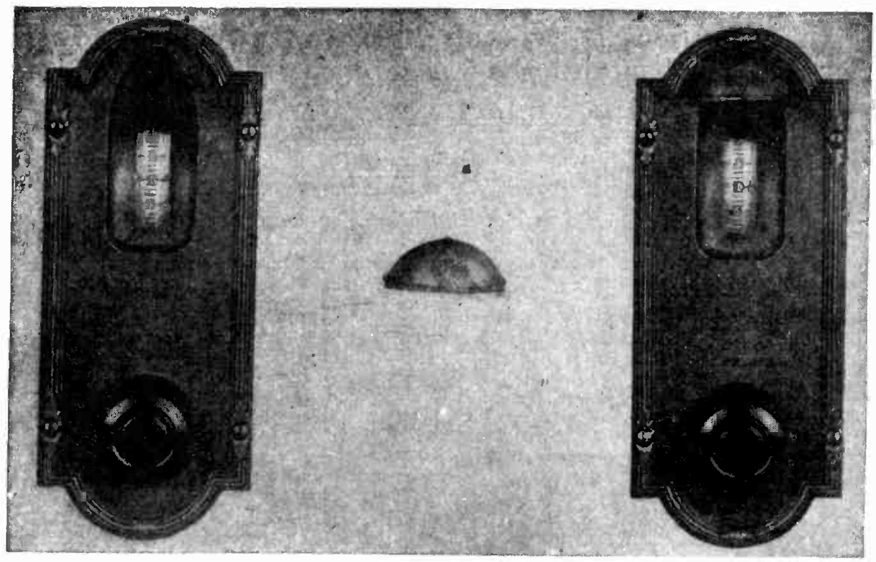


Figure 14—Detailed view of the pilot light socket and canopy.

adjust the potentiometer located at the extreme left (facing the front of the Radiola) for position of minimum hum.

(f) Replace Radiotron UY-227 and with the Radiotron in normal operation adjust the center potentiometer for minimum hum.

Under normal conditions these three adjustments will suppress any noticeable hum in the loudspeaker.

If the foregoing procedure does not reduce hum, try the following:

(a) In some cases when adjusting the potentiometers there may be no apparent point of minimum hum. This is due to low line voltage and may be remedied by throwing the line switch to the position that gives maximum brilliancy of the pilot lamp. If this does not remedy the trouble, try changing the position of the line switch to each location several times. There may be a dirty contact in this switch, making a high resistance connection which may cause the filaments to glow below normal brilliancy. When this condition is present, it will be impossible to adjust the potentiometers for minimum hum until the filament temperature of all Radiotrons is normal.

(b) When adjusting the UX-226 potentiometer (at the left) it may be noted that the position of minimum hum is at one extreme of the potentiometer. When this is encountered the potentiometer should be arbitrarily placed at its center position and then the UY-227 Radiotron placed in its socket and the center potentiometer adjusted for minimum hum. The left potentiometer may now be re-adjusted for a further minimum value, which will not now be located at one of the extreme positions.

(c) After making any potentiometer adjustment, further reduction of hum may be attempted by reversing the input plug.

When adjusting the potentiometer at the extreme right with a metallic screw driver a flash will occur from the screw driver to any part of the frame that the screw driver may touch. This is normal and does no harm. If it is desired to avoid this condition, an insulated shaft screw driver or a metallic screw driver wrapped with insulating tape should be used.

(d) If these various adjustments suppress the A. C. hum correctly, but after a short time the hum reappers it is a good indication that some of the

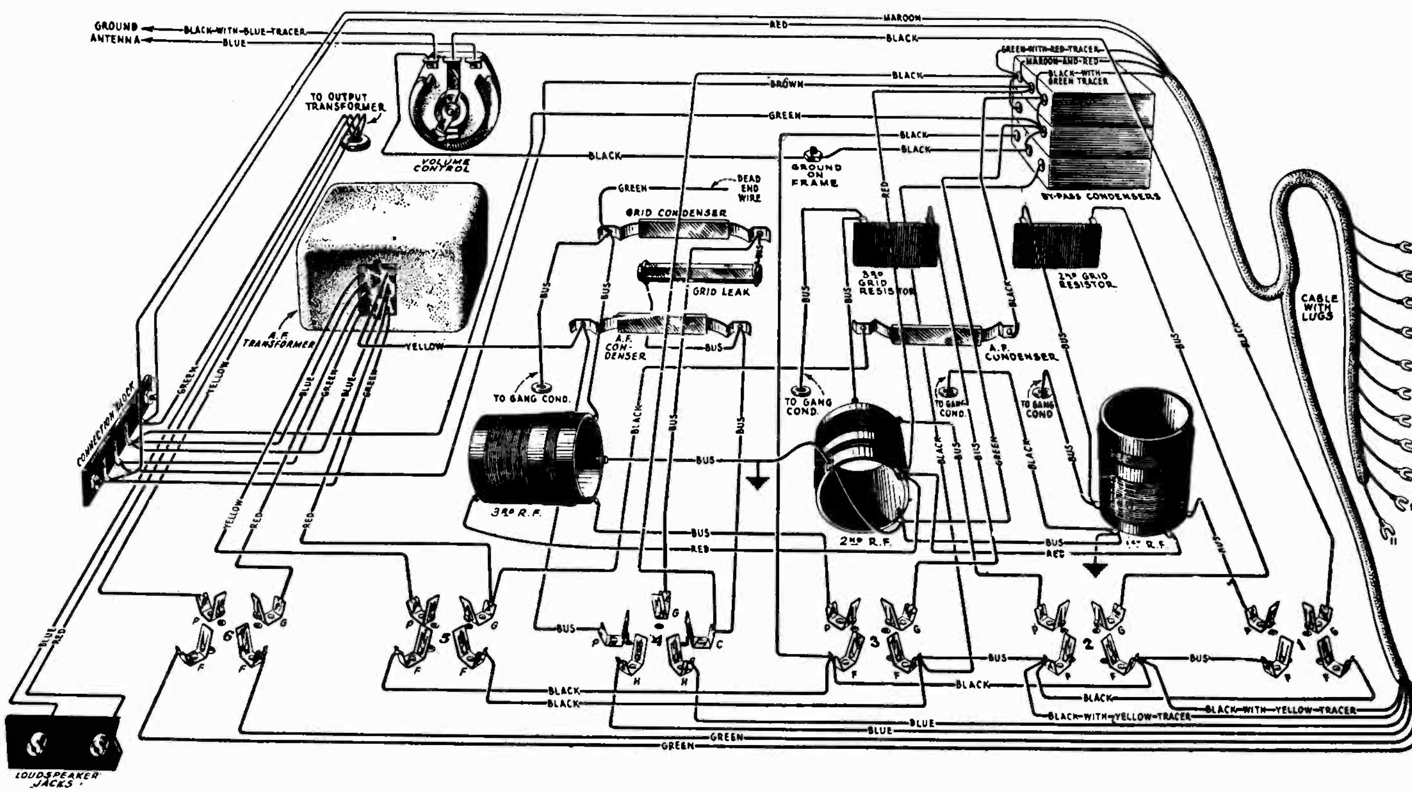


Figure 15—Wiring diagram of receiver assembly showing color scheme and connections with relative location of parts.

Radiotrons are making poor socket contacts, thus destroying the electrical center of the filament potentiometers. These prongs should be cleaned as described in Part I, Section 9.

If at any time the Radiola is changed from one electrical outlet to another outlet or Radiotrons are interchanged or replaced with others it may be necessary to readjust one or more of the potentiometers.

(20) LINE CONTROL SWITCH

A two-way switch is provided in the S. P. U. for adjustment to line voltages. Unless it is definitely known that the line is *always* below 115 volts the switch should be placed at the 120-volt position. It is a good plan to leave this switch at the 120-volt position on all lines unless unsatisfactory operation is experienced. If the switch is set at the 110-volt position on supply lines exceeding 115 volts the Radiotrons in the receiver will be damaged.

(21) WIRING CABLE

On examination of the chassis wiring in some models of Radiola 17 there will be noticed a green dead end wire, about 6 inches long, connected to the third

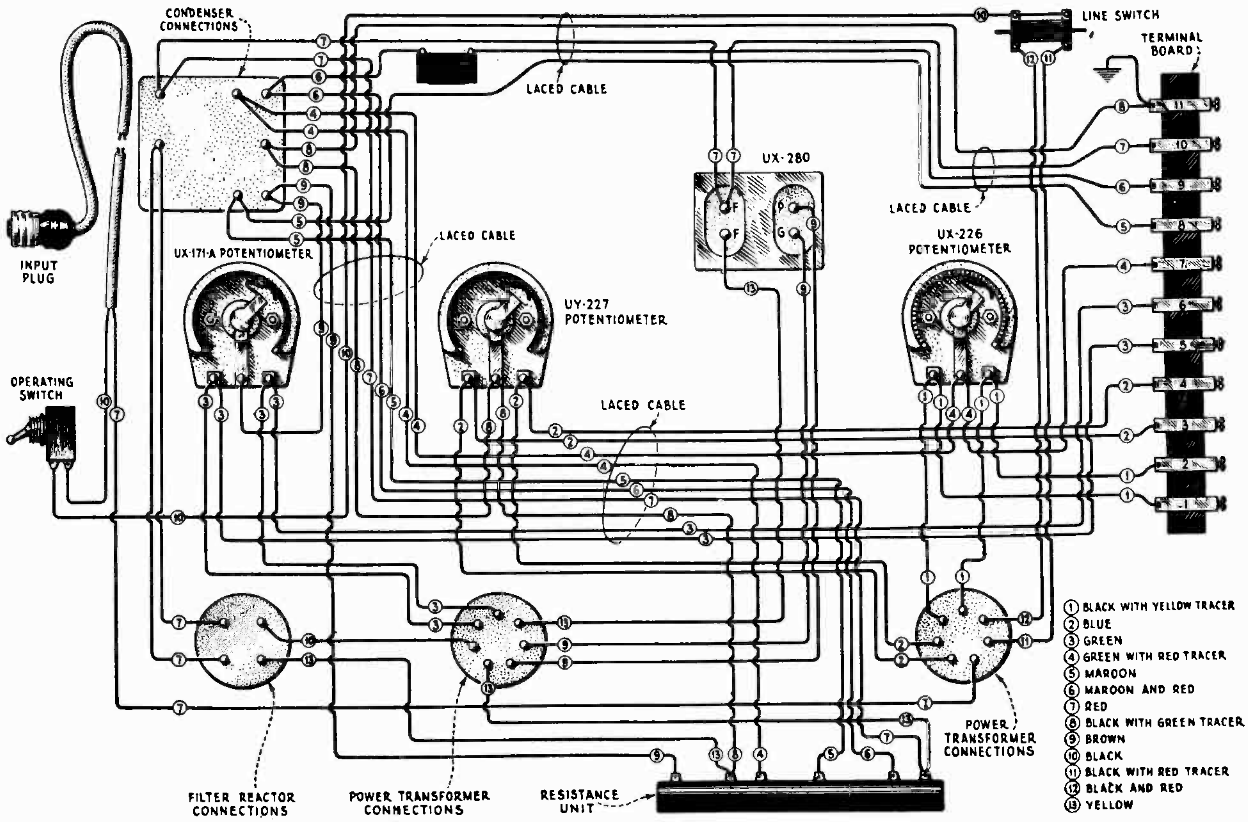


Figure 16—Continuity wiring diagram of socket power unit and color scheme of wiring.

R. F. coil. This is normal and no attention should be paid to the presence of this lead.

(22) PILOT LAMP AND CANOPY

Radiola 17 is equipped with a small pilot lamp (Figure 14), operating from the UX-171A filament winding for illuminating the dial and indicating that the Radiola is in operation. The latter use is quite important because when starting Radiola 17 approximately 30 seconds are required to bring the detector UY-227 into operating condition. The lamp and canopy are packed separately and must be installed when the Radiola is first placed in operation. The pilot lamp is a standard T-3 Mazda, miniature base, 6 volt, 0.15 ampere light and is screwed into its base directly over the tuning dial. The canopy has three projections which fit three holes directly over this light. Should this lamp be damaged or burn out a new one can be obtained on the open market.

(23) FILTER CONDENSERS

In general a defective filter condenser will be indicated by the plates of Radiotron UX-280 heating excessively, with the set giving weak, distorted or no reproduction and a loud hum. When this condition is experienced, the condenser bank should be disconnected from the circuit and the condensers tested with a reasonably high voltage, not over 200 volts. The correct way to test filter condensers is to charge and discharge them, being careful not to come in contact with the terminals. Figure 17 illustrates filter condenser connections.

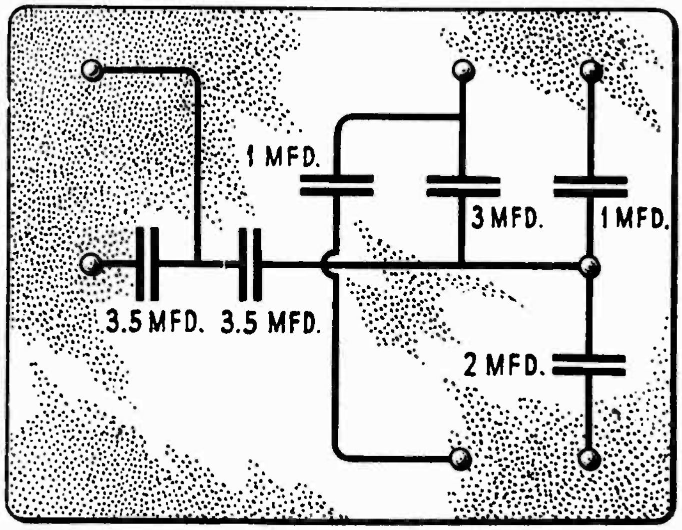


Figure 17—Internal connections of filter condensers.

(24) VOLTAGE READINGS

When checking a Radiola 17 for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man will need both an A. C. and a D. C. voltmeter, the D. C. meter to be of at least 600 ohms per volt in resistance. The following voltages should be obtained at the terminal strip when the set is in operation with full load on the socket power unit (Figure 4A). The terminal strip numbers are from front to rear, No. 1 being closest to the front of the Radiola and No. 11 closest to the rear.

Terminals	*Correct Voltage*
1 to 2	1.5 A. C.
3 to 4	2.25 A. C.
5 to 6	5.0 A. C.
7 to 8	45 D. C.
7 to 9	135 D. C.
Gnd. to 10	165 D. C. (Approx.)
7 to 11	9 D. C.
11 to adjusting screw of UX-171A potentiometer	30 D. C.

Any serious variation from these voltages indicates a defective resistance strip or power transformer. An easy method to determine whether the defect is in the power transformer or the resistance strip follows:

Defective power transformer.

(a) Any A. C. voltages off the correct value.

(b) All D. C. voltages, high or low, their differences remaining constant.

Defective resistance unit.

(a) Any D. C. voltages being either high or low, but not all consistently high or low with all A. C. voltages correct.

(25) GRID AND PLATE VOLTAGES

In order to intelligently service Radiola 17 it is well to have a good understanding of how the various circuits function. The plate supply and filament

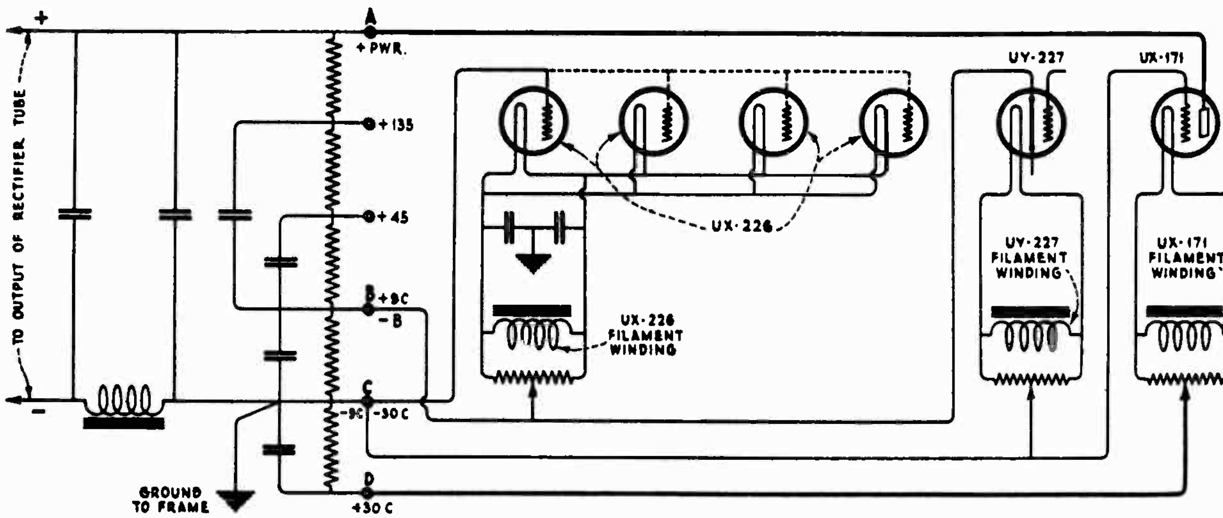


Figure 18—*Schematic circuit for securing grid biasing voltages.*

supply systems present no special features not used in similar circuits. However, the grid biasing voltages are obtained in a slightly different manner from that usually employed to obtain "C" bias voltage. Also the —9 volt "C" used to bias the Radiotron UX-226 is also used to keep the heater element of the detector Radiotron at a negative potential.

Figure 18 illustrates the grid and plate supply circuit.

(a) The three plate voltages and the —9 volt "C" potential are obtained from a series resistance unit in the regular manner, using the drop of voltage through the resistance unit to obtain the desired voltage. The —9 volt "C" supply is used as a bias voltage for all Radiotrons UX-226 and is also impressed on the UY-227 heater through the center connection to the UY-227 potentiometer. The +9 volt "C" is connected to the cathode of this Radiotron. The net result of such an arrangement is to keep the heater element of the detector tube at a sufficiently high negative potential to eliminate any tendency of the cathode to emit electrons back to the heater rather than to the plate of the tube.

(b) Referring to Figure 18 we note that the —9 "C" is also marked —30 "C" and connected to the grid of Radiotron UX-171A. Also a series resistance is placed in the grid return from this resistance and connected to the center tap of

Radiotron UX-171A potentiometer. This connection is marked +30 "C" The action of this arrangement is somewhat different from the method used for obtaining the —9 volts "C" for the UX-226 Radiotrons.

In obtaining the —9 volt "C" potential for the Radiotron UX-226, the voltage drop across a portion of the resistance strip (see A to C, Figure 18) is used for this potential. Any point on the strip from any other point is either positive or negative, depending on whether the other point is toward the positive side "A" or the negative side "C". For example point "B" would be negative in regards to point "A" and positive in regards to point "C". Now using this same principle, but taking the current flow from "A" to "C" through the plate and filament of Radiotron UX-171A and the resistance in series with the center connection to the potentiometer we may find either a positive or negative drop depend-

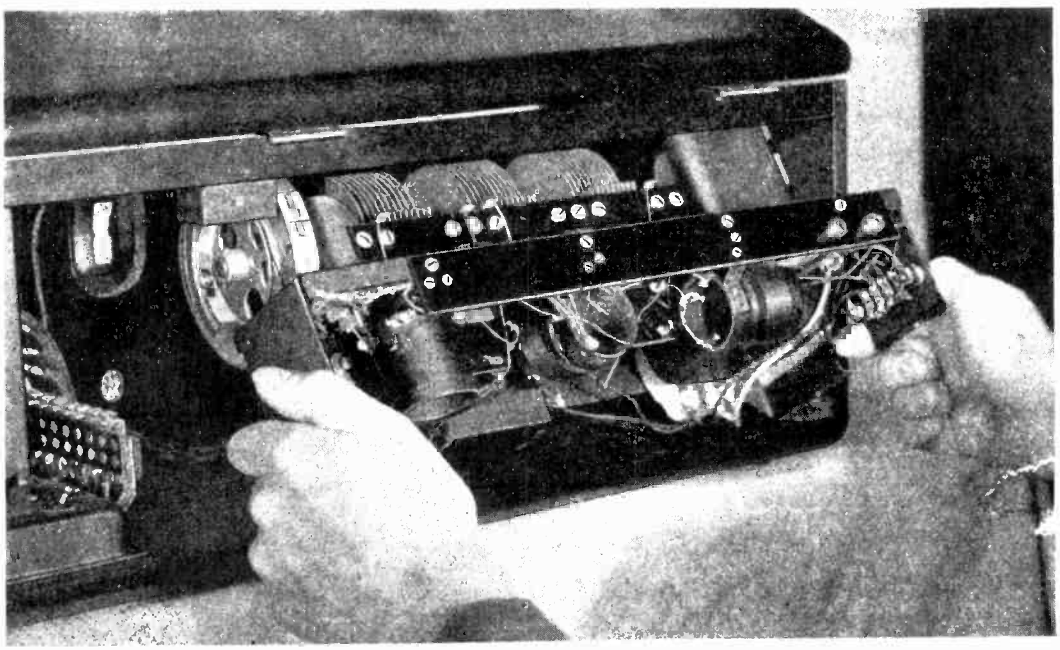


Figure 19—*Removing the receiver assembly from the cabinet.*

ing on where the point of connection is made. By connecting point "D" (Figure 18), as a source of positive potential any point toward "C" will have an increasingly negative potential. The value of this negative potential will depend on the resistance connected between "C" and "D". In Radiola 17 this negative potential is 30 volts and, as shown, gives the proper bias for Radiotron UX-171A.

This parallel circuit across the resistance isolates the "C" potential for Radiotron UX-171A from the plate and "C" voltages for the other Radiotrons. Doing this keeps fluctuations in the various plate supplies from varying the "C" potential on this tube. More stable operation and less distortion is the net result.

(26) HEATING OF CABINET

Under normal conditions when the lid of Radiola 17 is closed the interior parts in the vicinity of Radiotron UX-280 will become quite warm. This is a normal condition. It keeps all the mechanism dry and maintains maximum operating efficiency even under severe climatic conditions.

(27) RADIOLA 17 CONTINUITY TESTS

The following tests will show complete continuity for the Receiver Assembly (Figure 15) and the S. P. U. (Figure 16). Disconnect the antenna and ground leads, the cable connecting the S. P. U. to the receiver assembly, and the A. C. supply cord at its outlet. Do not tamper with the main tuning condensers.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient voltage to give a full scale deflection when connected directly across the battery terminals should be used in making this test.

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove All Radiotrons and Disconnect Cable at Terminal Strip

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Lug No. 1 to ground	Open	Shorted by-pass condenser
Lug No. 2 to ground	Open	Shorted by-pass condenser
Lug No. 1 to Lug No. 2	Open	Shorted UX-226 socket
Lug No. 3 to Lug No. 4	Open	Shorted UY-227 socket
Lug No. 5 to Lug No. 6	Open	Shorted UX-171A socket
Lug No. 1 to one side of filament contact of sockets Nos. 1, 2, 3 and 5	Closed	Open connection
Lug No. 2 to other filament contact of sockets Nos. 1, 2, 3 and 5	Closed	Open connection
Lug No. 3 to one side of heater contacts of socket No. 4	Closed	Open connection
Lug No. 4 to other side of heater contacts of socket No. 4	Closed	Open connection
Lug No. 5 to one side of filament contact of socket No. 6	Closed	Open connection
Lug No. 6 to other side of filament contact of socket No. 6	Closed	Open connection
Lug No. 7 to cathode contact of socket No. 4	Closed	Open connection
Lug No. 8 to plate contact of socket No. 4	Closed	Open primary of first audio transformer or connection
Lug No. 9 to plate contact of sockets Nos. 1, 2, 3 and 5	Closed	Open primary of 1st, 2nd or 3rd R.F. transformers or primary of 2nd A.F. transformer
Lug No. 10 to plate contact of socket No. 6	Closed	Open primary of output transformer
Across loudspeaker pin jacks	Closed	Open secondary of output transformer
Antenna lead to ground lead	Closed	Open volume control
Grid contact of socket No. 1 to ground	Closed	Open volume control or poor contact of volume control arm
Grid contact of socket No. 2 to ground	Closed	Open secondary of 1st R.F. transformer or grid resistance
Grid contact of socket No. 3 to ground	Closed	Open secondary of 2nd R.F. transformer or grid resistance
Stator of condenser No. 3 (nearest output transformer) to ground	Closed	Open secondary of 3rd R.F. transformer
Grid contact of socket No. 5 to ground	Closed	Open secondary of 1st A.F. transformer
Grid contact of socket No. 6 to ground	Closed	Open secondary of 2nd A.F. transformer

SOCKET POWER UNIT CONTINUITY TESTS

Remove Radiotron UX-280 and Disconnect Cable at Terminal Strip

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across terminals 1 to 2	Closed	Open UX-226 filament winding and potentiometer
Across terminals 3 to 4	Closed	Open UY-227 filament winding and potentiometer
Across terminals 5 to 6	Closed	Open UX-171A filament winding and potentiometer
Across filament contacts of UX-280 socket	Closed	Open UX-280 filament winding
Grid contact to plate contact of UX-280 socket	Closed	Open high voltage winding of power transformer
UX-171A potentiometer adjusting screw to terminal No. 10	Closed	Open resistance strip
Terminal No. 11 to plate contact of UX-280 socket	Closed	Open high voltage winding of power transformer or filter reactor
Across input plug	Closed	Open primary of power transformer or line switch. If open throw switch to other position and test. If both open test switch separately.

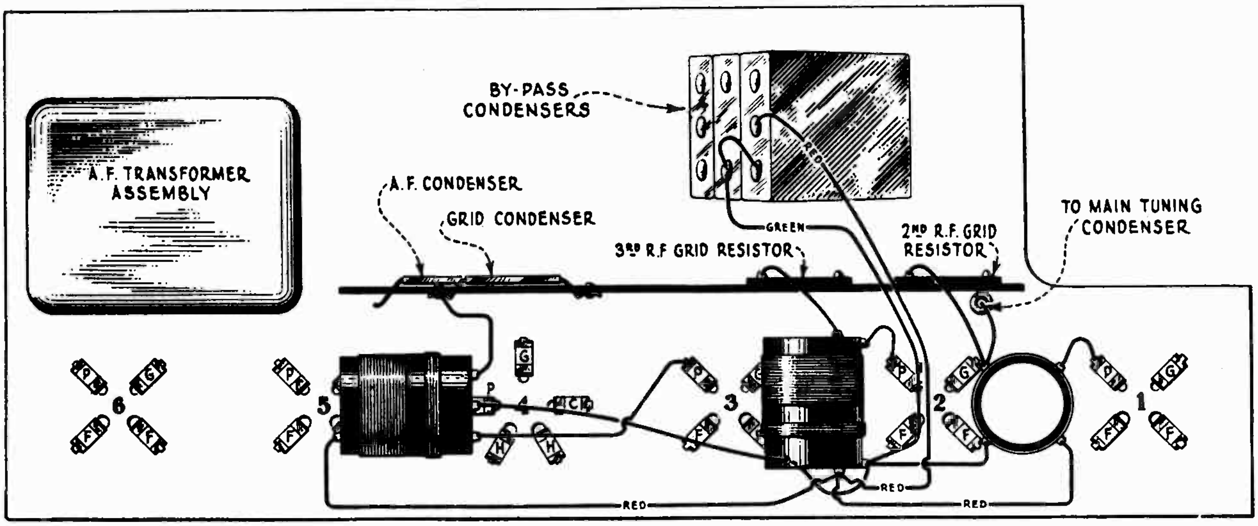


Figure 20—*R. F. transformer connections and color scheme of wiring.*

PART II — MAKING REPLACEMENTS

(1) REPLACING VOLUME CONTROL

The following procedure should be used when replacing the volume control.

1. Remove the seven screws holding the wooden back to the cabinet.
2. Remove knobs on "Station Selector" and "Volume Control."
3. Release the cable connecting the socket power unit to the receiver assembly and the two leads to the pilot lamp. This is done by loosening the screws holding them to the terminal strip of the socket power unit.
4. Remove four screws holding chassis in place to bottom of cabinet. The chassis may now be removed by rocking it in the cabinet and slipping it out of

the back opening. See Figure 19. This will allow an examination of the parts and provide access to those requiring replacement.

5. Remove the two screws that hold the volume control to the metal chassis. (Figure 7.)

6. Tag and unsolder all leads to the volume control. The volume control may now be removed and the new one placed in position occupied by the old one. The connections should be placed on the new volume control as indicated on the tags attached to the wires or refer to Figure 15.

7. The volume control should now be fastened to the chassis and the Radiola reassembled in the reverse order of that already given.

(2) REPLACING RADIO FREQUENCY COILS

The three radio frequency transformers together with a mounting strip and two pin jacks are stocked as one complete unit.

A step by step procedure for replacing this assembly is as follows:

1. Remove chassis from cabinet as described in Part II, Section 1.

2. Unsolder and tag all connections to the three transformers and the two pin jacks.

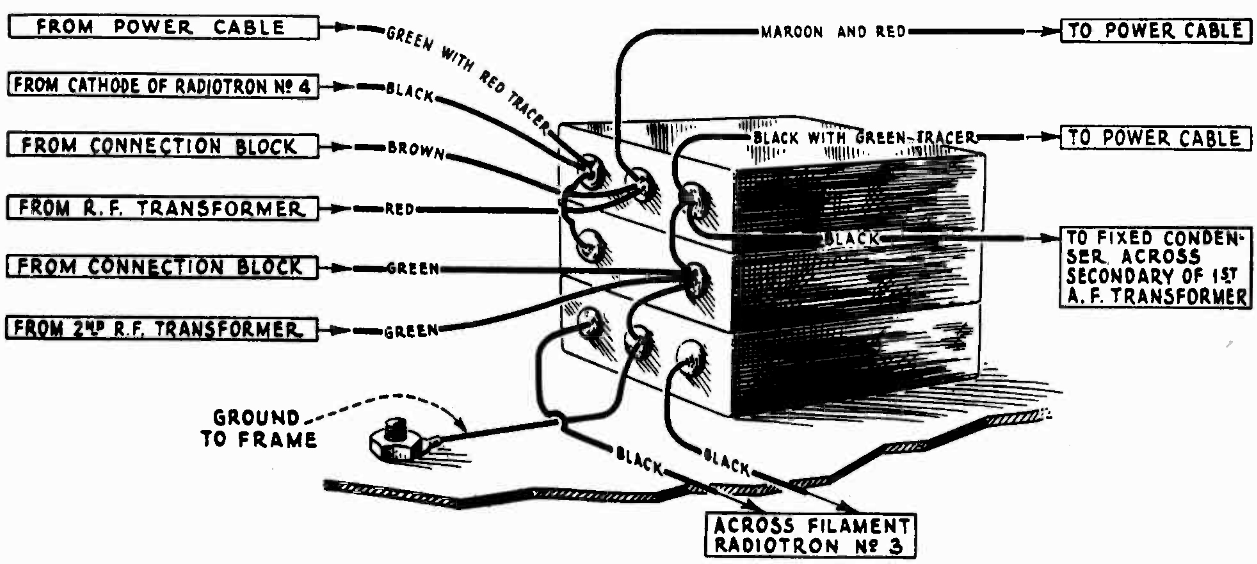


Figure 21—Connections and color scheme of wiring to by-pass condensers

3. Remove four screws that hold mounting strip to metal chassis. The entire assembly is now released and may be removed. The new assembly should be placed in the same position occupied by the one just removed.

4. Replace the four screws that hold the mounting strip to the metal chassis.

5. Replace and resolder all leads to the three transformers and two pin jacks as indicated by the tags previously attached to them. The connections to the transformer are shown in Figure 20 and those to the pin jacks in Figure 15. These figures should be referred to when making these connections. After finishing the connections, they should be carefully checked before reassembling the Radiola.

6. Connect power cable to chassis assembly and give Radiola an operating test before fastening to the cabinet to determine that replacement has been properly made.

7. Fasten chassis assembly to cabinet and replace all screws.

(3) REPLACING RADIOTRON GANG SOCKETS

The Radiotron sockets of Radiola 17 are of the gang variety, using one detector socket, a two-gang A.F. socket strip and one three-gang socket strip for the radio frequency amplifier tubes.

These sockets are riveted to the metal chassis. To replace them drill out the old rivets and use screws, nuts and lock washers for securing the new sockets. A step by step procedure follows for making a replacement:

1. Remove chassis assembly from cabinet as described in Part II, Section 1.
2. Remove and tag all leads to the terminals of the sockets.

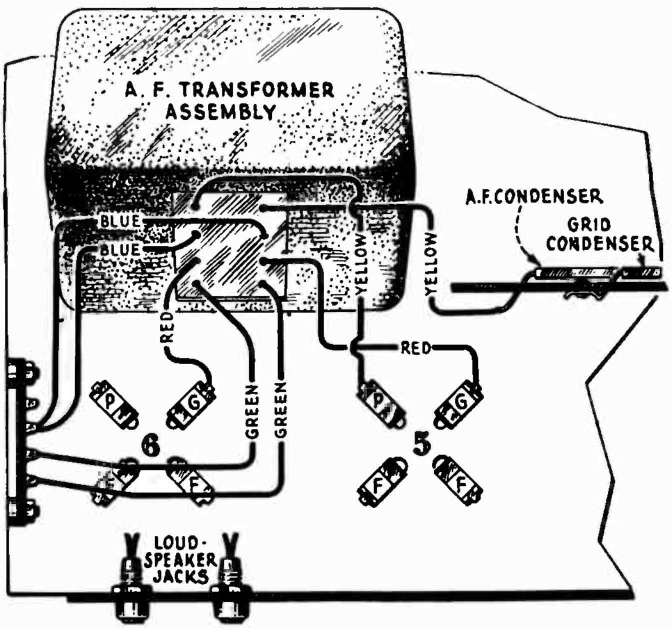


Figure 22—Detail of A. F. transformer connections and color scheme of wiring.

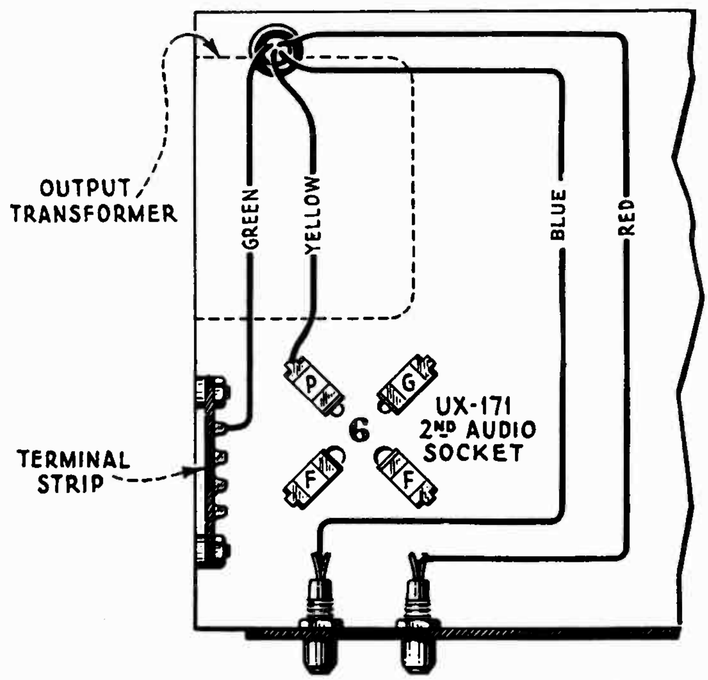


Figure 23—Output transformer connections.

3. Drill out rivets holding sockets to metal chassis frame.
4. The socket assembly may now be removed and the new one placed in the position occupied by the old one.
5. Fasten new socket in place by using small head machine screws, nuts and lock washers in place of the rivets previously drilled out.
6. Replace connections as indicated on tags attached or refer to Figure 15 for the correct socket connections.
7. Return chassis to cabinet.

(4) REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and the driving mechanism is replaced as one complete unit. The step by step procedure follows:

1. Remove chassis assembly from housing. See Part II, Section 1.

2. Unsolder four connections to consdenser.

3. Remove three screws from under side of chassis that holds condenser assembly.

4. The assembly may now be removed and the new assembly placed in the position occupied by the old assembly.

5. Replace three screws that hold assembly in place and resolder leads.

6. Replace chassis assembly in cabinet.

(5) REPLACING LARGE BY-PASS CONDENSERS

These condensers, located on the under side of the chassis frame, are held together by means of clamps that form part of the condenser case fastened to the frame. To replace proceed as follows:

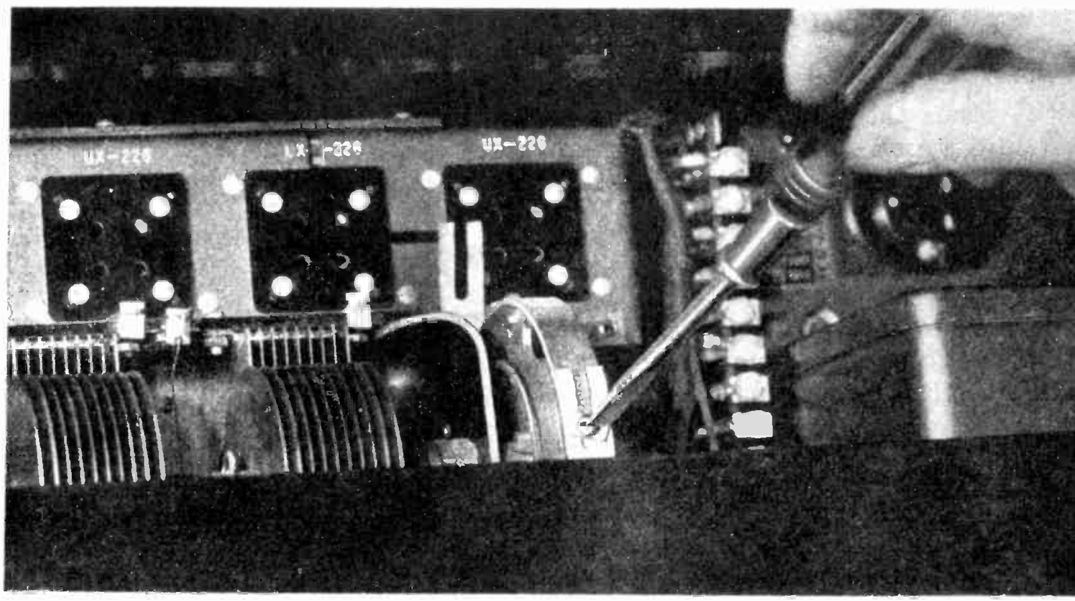


Figure 24—Method used in replacing dial scales.

1. Remove chassis from cabinet as described in Part II, Section 1.

2. Remove condenser assembly as described in Part II, Section 4.

3. The tabs holding the condensers to the chassis may now be bent up by using a screw driver.

4. The three fixed condensers are now released as a unit from the chassis frame. The defective condenser may be released by bending the tabs that hold it to the other condensers.

5. Unsolder the leads of the condenser that are to be replaced. Insert the new condenser in the place occupied by the old one and fasten it to the adjacent condenser. The condensers are now fastened together as a unit and are fastened to the frame by insetting the tabs of the condenser into their respective slots and bending the tabs on the top side of the frame.

6. Replace condenser assembly as described in Part II, Section 4.

7. Reconnect all wire leads removed from the large fixed condensers. The correct connections are shown in Figure 21.

8. Connect power cable to Socket Power Unit and test Radiola. If Radiola is in correct operating condition fasten chassis assembly to cabinet in reverse order of that used to remove it.

(6) REPLACING AUDIO TRANSFORMERS

The audio transformers of Radiola 17 are built together as a unit. In making a replacement the following procedure should be used:

1. Remove receiver chassis from cabinet as described in Part II, Section 1.
2. Remove output transformer from chassis by removing four screws holding it in place.
3. Unsolder and tag all leads.
4. Remove transformer assembly by turning up tabs holding it to chassis frame with screw driver.
5. Under the old transformer, between the chassis frame and the transformer, is located a piece of insulating paper. This must be replaced to its normal position, as there is a possibility of grounding the core of the transformers to the frame of the chassis unless it is in place.
6. Place the new transformer assembly in position occupied by the old and fasten to frame by bending over metal tabs that hold it in place.
7. Solder all leads in place as indicated by tags attached. The correct connections are shown in Figure 22.
8. Replace receiver chassis assembly in cabinet in the reverse order of that used to remove it.

(7) REPLACING OUTPUT TRANSFORMER

The output transformer of Radiola 17 is held in place by means of four tabs which hold the output transformer to the vertical part of the chassis frame. A step by step procedure for replacing this unit is as follows:

1. Remove receiver chassis assembly from cabinet as described in Part II, Section 1.
2. Unsolder and tag the connecting points to the four leads of the output transformer.
3. Remove four screws, nuts and lock washers used to fasten bracket to chassis.
4. The transformer may now be removed and the new one placed in the position occupied by the old one.
5. Push the four leads from the transformer through the frame. Fasten bracket to chassis with screws previously removed. Connect leads as indicated by tags, previously attached to proper connection. These connections are shown in Figure 23.
6. Return receiver assembly to cabinet in reverse order of that used to remove it.

(8) REPLACING CONDENSER DRIVE CABLE

The condenser drive cable of Radiola 17 is made of phosphor bronze and is very rugged. If replacement becomes necessary proceed as follows:

1. Remove receiver chassis assembly from cabinet as described in Part II, Section 1. Place chassis on table in normal position with controls to the front.
2. Release the cable adjusting screw and clamp, and remove old cable from large drum and grooved drums completely.

3. Starting from the rear grooved drum place eye of cable over pin, which should be in a horizontal position facing the socket power unit, and wind on three complete turns, and then bring cable up to large drum.

4. Now bring cable over the large drum. Turn drum so that cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing cable to the track on other side of drum.

5. Follow on around other track in same direction until point is reached where cable is directly above front grooved drum.

6. Starting on the third groove back from the front of the grooved drum wind on two and a half turns and slip eye over pin. The cable is now in the correct position, although probably slack.

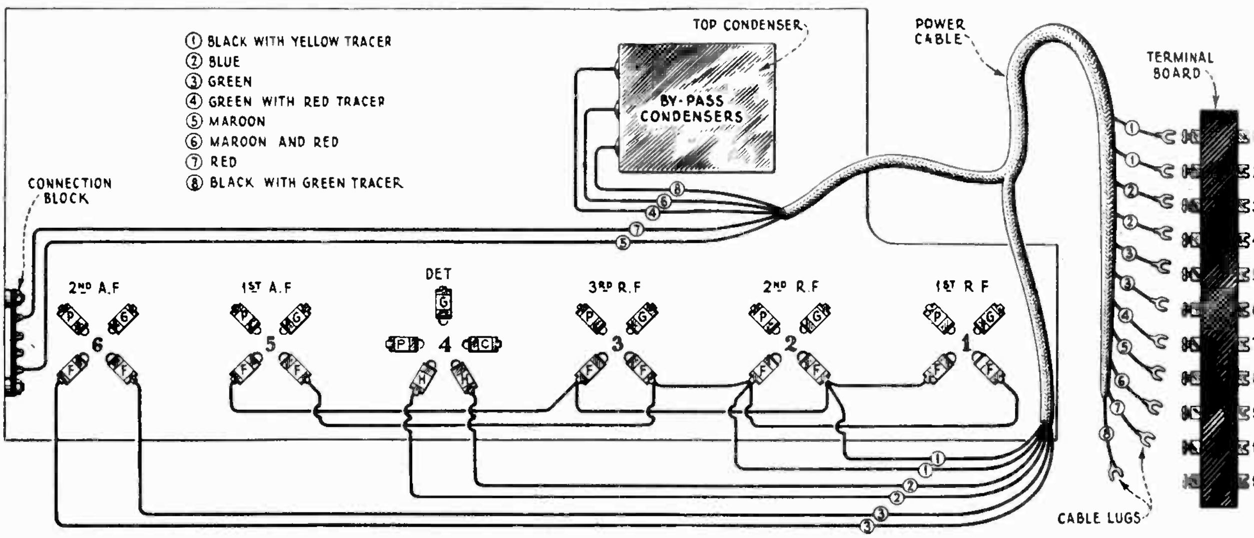


Figure 25—Color scheme of power cable connections.

7. The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the groove are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of the controls. Care should be taken not to take up too much, as the cable may be stretched or possibly broken.

8. Return receiver assembly to cabinet in the reverse order used to remove it.

(9) REPLACING DIAL SCALES

After considerable use a dial scale may become dirty or illegible and a new scale desired. A step by step procedure for making replacement follows:

1. Open lid of cabinet of Radiola.
2. Turn dial so that the two screws that hold the dial in place are on top.
3. Remove screws, washer and nuts that hold dial in place. (Figure 24.)
4. Replace old dial with new one and replace screws, but do not tighten.
5. Examine new dial from front of Radiola to see that numbers on dial are in the correct position.
6. Tighten screws holding dial in place and close lid of cabinet.

(10) REPLACING POWER CABLE

Attached to the receiver assembly is a heavy cable, connecting all A, B and C voltage supplies for this assembly. If this cable requires replacement the following procedure should be used.

1. Remove receiver chassis assembly from cabinet as described in Part II, Section 1.

2. Turn assembly so that bottom side is exposed and unsolder all the connections to the cable. Attach tags to points of connection.

3. Remove old cable from chassis and replace with new cable. Solder the connections of the new cable as indicated on tags attached to connection points. The correct connections for the power cable are shown in Figure 25.

4. After connecting power cable attach it to the Socket Power Unit and test Radiola. If O. K. fasten receiver chassis assembly to cabinet in reverse order of that used to remove it.

(11) REPLACING FILTER CONDENSER ASSEMBLY

The following procedure should be used when replacing the filter condensers of Radiola 17:

1. Remove the seven screws holding the wooden back to the cabinet.

2. Remove collar on operating switch at front of Radiola.

3. Release the cable connecting the socket power unit to the chassis assembly and the two leads to the pilot lamp. This is done by loosening the screws holding them to the terminal strip on the socket power unit.

4. Remove four screws at bottom of cabinet holding Socket Power Unit in place. The Socket Power Unit may now be removed by slipping it out of the back opening. This will allow an examination of the parts and provide access to the ones necessary to replace.

5. Unsolder and tag the connections to the seven terminals on the under side of the condenser bank.

6. Now turn up the six tabs that hold the unit to the S. P. U. base. The entire assembly may now be removed.

7. The new condenser should be placed in the position occupied by the old, taking care that the terminal connections are in the same position.

8. Clamp the assembly in place by turning the tabs over the under side of the base.

9. Solder the connections to the assembly as indicated on the tags attached. These connections are shown in Figure 16.

The S. P. U. should be tested by connecting the cable on the receiver unit to the terminal strip and if found O. K. fastened to the cabinet in the reverse order of that used to remove it.

(12) REPLACING EITHER POWER TRANSFORMER OR FILTER REACTOR

The power transformer and the filter reactor are each encased in a metal container. Either unit may be replaced in the following manner:

1. Remove S. P. U. from cabinet as described in Part II, Section 11.

2. Unsolder the leads of the unit being replaced and tag connection points.

3. Bend up tabs that hold unit to base. It may be necessary to remove the resistance unit in order to bend all the tabs. The particular assembly being replaced may now be removed and the new assembly placed in the position occupied by the old one.

4. The tabs on the new assembly should be bent so as to properly fasten the unit to the S. P. U. base.

5. Connect all leads from the assembly to the points of connection as indicated by tags previously attached. These connections are shown in Figure 16, which should be followed exactly when any S. P. U. part is replaced.

6. Connect cable from receiver assembly to terminal strip of Socket Power Unit. If found O. K. fasten unit to cabinet in the reverse order.

(13) REPLACING TERMINAL STRIP

The following procedure should be used in replacing a terminal strip on the Socket Power Unit.

1. Remove S. P. U. from cabinet as described in Part II, Section 11.

2. Unsolder and tag all leads soldered to terminal strip.

3. Release two screws holding strip to S. P. U. base.

4. The strip may now be removed and replaced by a new one.

5. Fasten new strip in position occupied by old strip by means of two machine screws, lock washers and nuts previously removed.

6. Solder all leads to terminal strip as indicated on tags attached. The color scheme and correct connections are shown in Figure 16.

7. Connect cable from receiver assembly and test Radiola. If found operating properly fasten S. P. U. to cabinet in the reverse order.

(14) REPLACING MISCELLANEOUS PARTS IN S. P. U.

The potentiometers, line switch, UX-280 socket and resistance unit in Radiola 17 may become defective and require replacement. They are all attached to the base by means of machine screws and nuts and replacement is very simple. The following general outline will apply to all of these units:

1. Remove S. P. U. from cabinet as described in Part II, Section 11.

2. Unsolder leads from defective unit and tag each lead.

3. Remove defective unit from base and replace with new unit.

4. Solder leads to new unit as indicated on tags or see Figure 16.

5. Connect cable to S. P. U. from receiver assembly. Test and if found O. K. fasten S. P. U. to cabinet in reverse order of that used to remove it.

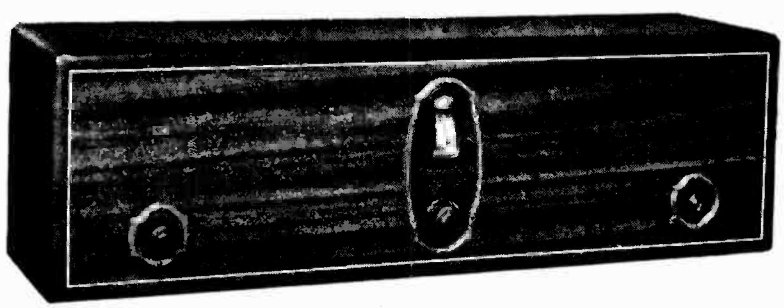
SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, or a poor antenna system. If imperfect operation is not due to these causes the "Service Data Chart" should be consulted for further detailed causes.

Indication	*Cause*	*Remedy*
No signals	Defective operating switch	Repair or replace switch
	Loose volume control arm	Tighten volume control arm
	Defective power cable	Replace power cable
	Defective R.F. transformer	Replace R.F. transformer assembly
	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective By-pass condenser	Replace By-pass condenser
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary
Weak Signals	Defective power cable	Repair or replace cable
	Defective line switch	Clean contacts or replace line switch
	Defective R.F. transformer	Replace R.F. transformer assembly
	Defective A.F. transformer	Replace A.F. transformer assembly
	Dirty Radiotron prongs	Clean prongs with fine sandpaper
	Defective By-pass condenser	Replace defective By-pass condenser
	Defective main tuning condensers	Replace defective tuning condensers
	Defective output transformer	Replace defective transformer
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary
Poor Quality	Defective A.F. transformer	Replace A.F. transformer assembly
	Defective output transformer	Replace output transformer
	Defective By-pass condenser	Replace defective By-pass condenser
	Dirty contact arm of volume control	Clean contact arm on volume control
	Potentiometers not property adjusted	Adjust potentiometers correctly
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper
Howling	Open grid resistor	Check by means of continuity and replace any defective grid resistor
	Radiotron UY-227 howl	Interchange Radiotron UY-227 with another
	Defect in audio system	Check and repair any defect
	Detector tube oscillating	Place antenna lead between A.F. transformer and chassis frame
	Open grid circuit in any stage	Check circuits and repair defect
Excessive Hum	Potentiometers not properly adjusted	Adjust potentiometers correctly
	Socket plug position	Reverse socket plug
	Line voltage low	Set line switch for low line voltage
	Dirty or defective line switch	Clean or replace line switch
Radiotrons fail to light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer
	No A.C. line voltage	Turn A.C. line voltage "On"
Play in Station Selector	Loose knob	Tighten or replace knob
	Slack cable	Take up on cable adjusting screw

RCA
Radiola 18

SERVICE NOTES



RCA Radiola 18

Third Edition—2M—Jan. 1931

RCA Victor Company, Inc.
RADIOLA DIVISION
Camden, New Jersey
REPRESENTATIVES IN PRINCIPAL CITIES

A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well-informed RCA Authorized Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that RCA Loudspeaker and Radiola owners may be entirely satisfied.

Obviously, this service can best be rendered by properly equipped service organizations having a thoroughly trained personnel with a knowledge of the design and operation of RCA Loudspeakers and Radiolas.

Such service organizations have been established by RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

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

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

In addition to supplying the Service Notes, the RCA Service Division maintains a corps of engineers who are qualified to render valuable help in solving service problems. These engineers call upon the trade at frequent intervals to advise and assist RCA Distributors in the performance of service work.

CONTENTS

PART I—INSTALLATION

PART II—SERVICE DATA

PART III—MAKING REPLACEMENTS

ILLUSTRATIONS

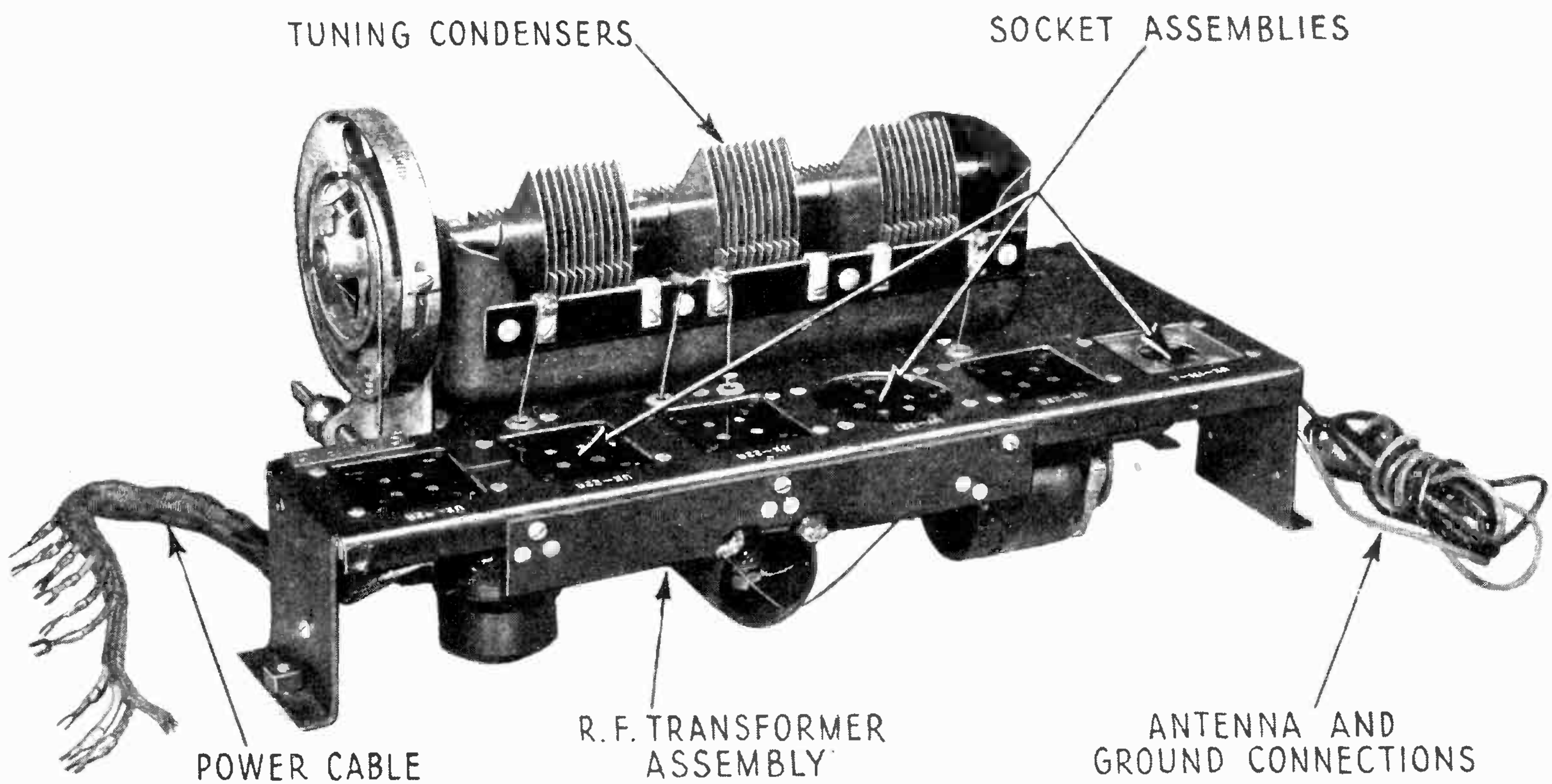


Figure 1—Top view of chassis assembly showing principal parts.

RCA RADIOLA 18

(105-125 Volts, 50-60 Cycle A.C.)

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

INTRODUCTION

RCA Radiola 18 is a socket powered six-tube, tuned radio frequency receiver utilizing RCA Radiotrons UX-226, UY-227, UX-171A and the full wave rectifier Radiotron UX-280 in the Socket Power Unit. It operates on 105-125 volts, 50 to 60 cycle A.C. lines. Figure 1 illustrates the various units of the receiver assembly and Figure 2 the main parts of the Socket Power Unit.

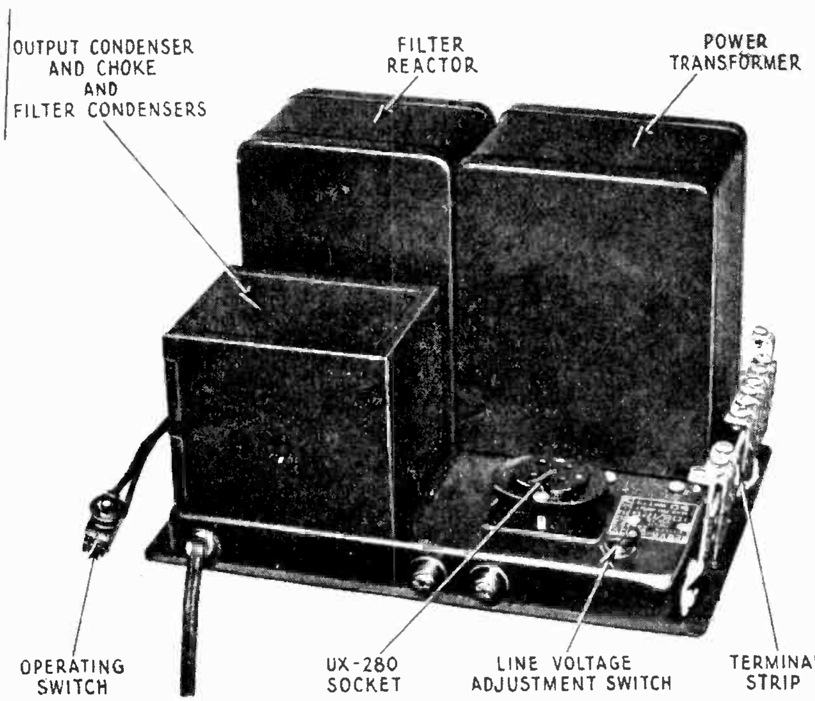


Figure 2—Socket power unit showing various parts.

The following principles are incorporated in the circuit design. (See Fig. 3.)

(1) A single control, three-gang condenser is employed to tune two of the radio frequency circuits and the detector circuit.

(2) An aperiodic antenna or first R.F. circuit, eliminates the necessity for a separate antenna tuning control.

(3) The volume control regulates the input grid voltage to the first R.F. amplifier stage. This is the most practical method of volume control for use with A.C. Radiotrons and gives a smooth control of volume without distortion.

(4) Raw A.C. of the correct voltage is used for filament heating of all Radiotrons. This eliminates the use of "A" batteries.

(5) The three R.F. stages and the first audio stage receive a plate voltage of 135 volts in conjunction with a negative grid bias of 9 volts. The detector receives 45 volts

plate supply. The last audio stage receives a plate voltage sufficient to provide ample loudspeaker output. The plate and grid voltages are supplied by means of a built-in "B" and "C" power supply unit using Radiotron UX-280 as the rectifying device.

(6) A new method of stabilizing the tuned R.F. circuit gives improved sensitivity and selectivity.

The following notes are published for the guidance of those called upon to locate and remedy any trouble that may occur. The text is divided into three parts, Part I—Installation; Part II—Service Data, and Part III—Making Replacements.

PART I—INSTALLATION

(1) ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiola 18 the antenna length need only be approximately 25 feet. It should be erected as high as possible and be removed from all obstructions. The lead-in should be a continuation of the antenna itself, thus avoiding all splices which might introduce additional resistance and in time corrode sufficiently to seriously affect reception. If it is absolutely necessary to splice the lead-in to the antenna the joint must be carefully soldered to insure a good electrical contact. Clean off all excess flux and tape the connection to protect it from the oxidation effects of the atmosphere.

High grade glass or porcelain insulator supports are required and at no point should the antenna or lead-in wire come in contact with any part of the building. Bring the lead-in wire through a porcelain tube penetrating the wall or window frame.

The antenna should not cross either over or under any electric light, traction or power line and should be at right angles to these lines and other antennas. An outdoor antenna should be protected by means of an approved lightning arrester, in accordance with the requirements of the National Fire Underwriters' Code.

(2) ANTENNA (Indoor Type)

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna of about 25 feet of insulated wire strung around the picture moulding or placed under a rug. 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 to secure satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

(3) GROUND

A good ground 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. The service man should experiment with various grounds, and employ the one giving the best results.

(4) RADIOTRONS

Four Radiotrons UX-226, one UY-227, one UX-171A and one UX-280 are used. The locations of these Radiotrons are plainly designated on each socket. Be careful not to insert a Radiotron UX-226 in the UX-171A socket, as immediate filament burn-out will result when the current is turned "ON".

Connect the loudspeaker to the output pin terminals and insert the input plug into a socket outlet of correct voltage and frequency, namely 105-125 volts, 50-60 cycles A.C. supply. Turn "ON" the operating switch. After about 30 seconds the Radiotron UY-227 will glow dimly, indicating that the receiver is in operating condition. If no signals are heard when tuning to a station known to be broadcasting examine the

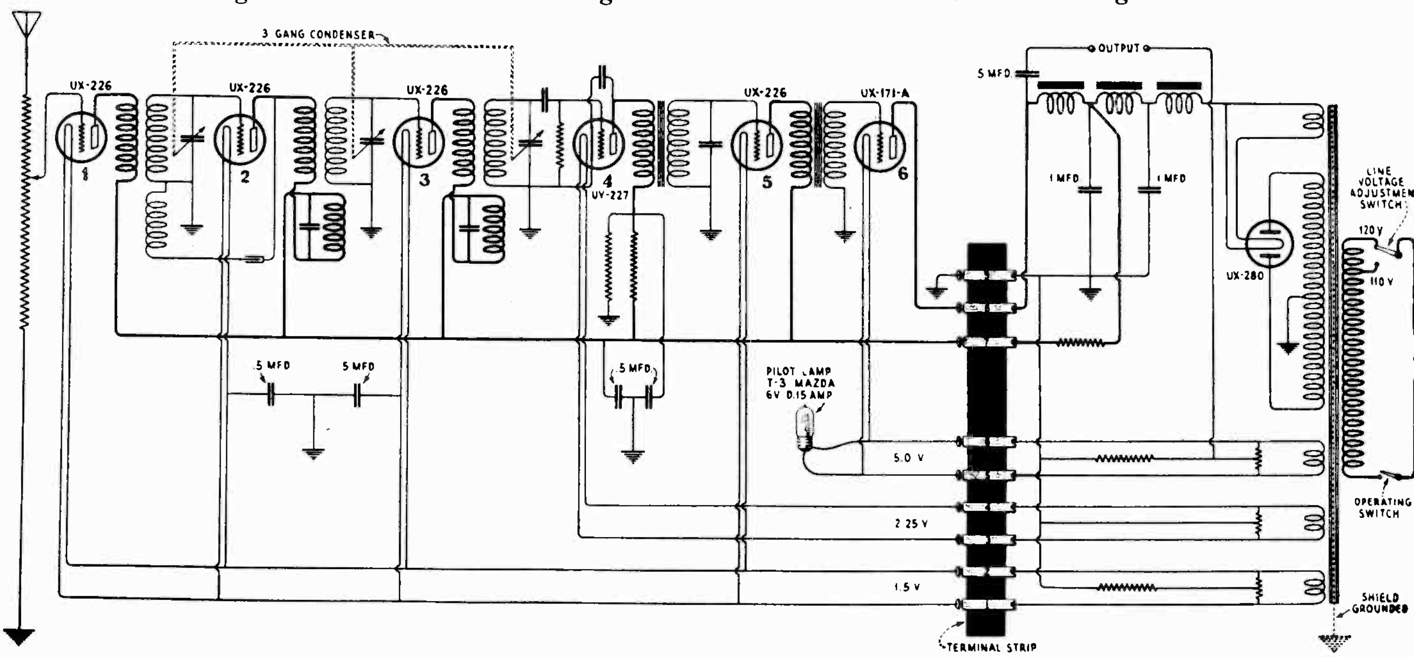


Figure 3—Schematic diagram of receiver and socket power unit.

Radiotrons. Possibly one Radiotron has been damaged in transit. Interchanging with one or more known to be in operating condition will isolate the damaged one.

If there is an excessive hum present during operation:

(a) Reverse the A.C. input plug at the socket outlet.

(b) Interchange the Radiotrons UX-226 in the R.F. stages with the one in the first A.F. stage, and use the combination that gives least hum. Then interchange the three in the R.F. stages for the best results while tuned to a broadcast station.

(5) LINE SWITCH

A two-way switch is provided in the S.P.U. for adjustment to line voltages. A shield over the terminal strip holds this switch in the 120-volt position. Unless it is definitely known that the line is *always* below 115 volts the switch should be left in its original position. It is a good plan to leave this switch at the 120-volt position on all lines unless unsatisfactory operation is experienced. If the switch is set at the 110-volt position on supply lines exceeding 115 volts the Radiotrons in the receiver will be damaged.

(6) SUB-CHASSIS WIRING

The sub-chassis wiring of Radiola 18 consists of a combination of bus-bar and flexible braid covered wire utilizing a color scheme of connections. It is placed in a very definite position in the sub-chassis assembly. When testing and making replacements this wiring is apt to become displaced, which in some instances, may seriously affect the operation of the Radiola. It is important that any displaced wiring be returned to its original position. The sub-chassis assembly should be examined for this condition as a preliminary to any test made to check on poor operation.

(7) HOWL

A slight tendency to howl on local stations when the volume control is adjusted to the extreme "loud" position may be remedied by interchanging the detector tube, Radiotron UY-227, with another one. In some cases a howl of this kind is caused by incorrect adjustment of the compensating condenser. The correct method of adjusting this condenser is described in Part II, Section 10.

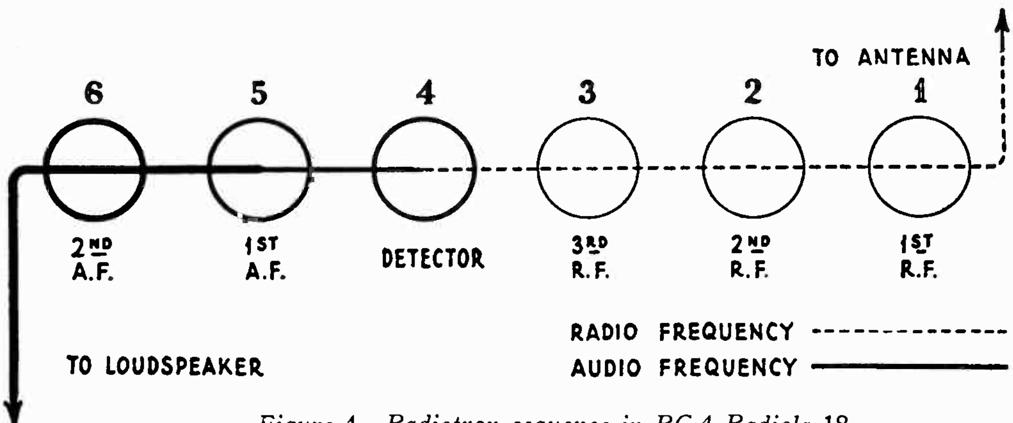


Figure 4—Radiotron sequence in RCA Radiola 18.

(8) RADIOTRON SEQUENCE

Figure 4 illustrates the sequence of the Radiotrons in the receiver, omitting Radiotron UX-280 in the socket power unit. From right to left, when facing the front of the Radiola, the Radiotron sequence is as follows:

Radiotron No. 1 is an untuned stage of radio frequency amplification. It is coupled directly to the antenna and ground and is not tuned in any way.

Radiotron No. 2 is a stage of tuned radio frequency amplification, and is tuned by the first of the gang condensers.

Radiotron No. 3 is the second stage of tuned radio frequency amplification. It is tuned by the second of the gang condensers.

Radiotron No. 4 is the detector and is tuned by the third of the gang condensers.

Radiotrons Nos. 5 and 6 are respectively, the first and second stages of audio frequency amplification. The last stage, Radiotron No. 6, employs power amplifier Radiotron UX-171A. An output filter protects the loudspeaker windings from excessive D.C. current.

PART II—SERVICE DATA

(1) ANTENNA SYSTEM FAILURES

A grating noise may be caused by a poor lead-in connection to the antenna or the antenna touching some metallic surface, such as the edge of a tin roof, drain pipe, etc. By disconnecting the antenna and ground leads the service man can soon determine whether the cause of complaint is within or external to the receiver and plan his service work accordingly.

(2) RADIOTRON SOCKETS

The sockets in Radiola 18 are the standard gang UX and UY type (See Figure 5). Care must be exercised when inserting Radiotrons in their sockets. A socket contact may not be in its correct position and forced insertion of a tube will bend or break it. If care is exercised and the Radiotron inserted gently, little trouble will be experienced with socket contacts. A bent one will be noticeable on inspection and may be corrected by inserting a narrow instrument in the socket hole and pushing the contact into its correct position. A badly bent or broken socket contact should be replaced.

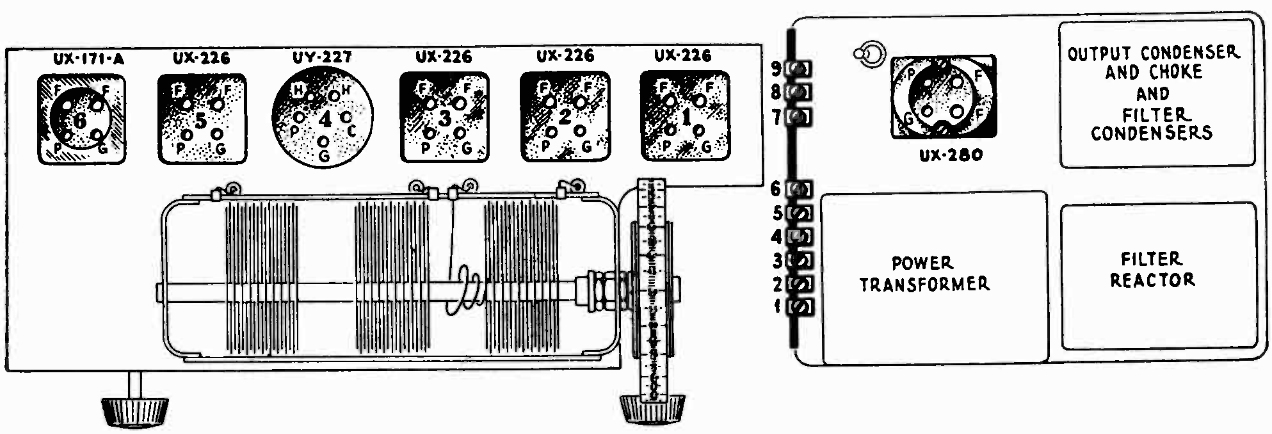


Figure 5—Radiotron socket contacts.

(3) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation or change the resistance of the filament circuit sufficiently to cause a hum in the loudspeaker. They should therefore be cleaned with fine sandpaper periodically to insure good contact.

The use of emery cloth or steel wool is not recommended. Before reinserting Radiotrons in their sockets wipe the prongs and base carefully to make certain that all particles of sand are removed.

Care should be exercised to see that the two large pins and two small pins of the Radiotrons match the socket holes. The UY-227 Radiotron has five prongs, all of the same size, and will fit in the socket only one way. If a Radiotron will not fit into a socket without considerable pressure look for excessive solder on one or more of the prongs. Excessive solder on the prongs may be removed with a file or knife.

(4) LOOSE VOLUME CONTROL AND LOW VOLUME

A loose volume control contact arm may cause noisy or intermittent operation. It should be bent slightly so that it makes firm contact against the resistance strip. To do this it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. The volume control is then accessible. It can be released by removing the two screws that hold it to the metal frame.

Low volume even on local stations may be due to one of the following causes:

(a) Defective antenna and ground system. A poor antenna and ground system or one in a shielded locality may cause weak signals. The suggestions given in Part I, Sections 1, 2 and 3 should be followed if trouble of this kind is experienced.

(b) Compensating condenser out of adjustment. If this condenser is badly out of adjustment it will have the effect of making the Radiola very insensitive. To adjust correctly refer to Part II, Section 10.

(c) Defective R.F. transformers. Should the R.F. transformers become damaged so that they do not properly match, weak signals may be the result.

(d) Defective A.F. transformer. An open or short in the A.F. transformers may cause weak signals and distorted reproduction.

(5) ADJUSTMENT FOR SLACK DRUM CONTROL

The main tuning condensers are controlled by a cable and drum arrangement giving a smoothly acting vernier movement that has no back lash.

After considerable wear, or extreme changes of temperature the cable may become slack. To take up this slack open lid of cabinet and turn the cable adjusting screw with clamp until the cable is taut. This screw may become seated after several adjustments are made thus allowing no further tightening of the cable. When this condition occurs it will be necessary to slip the cable a half turn on the grooved drum. To make this adjustment it is necessary to remove the chassis from the cabinet as described in Part III, Section 1. Remove the cable adjusting screw and clamp. The cable will then have approximately one inch slack. By removing the tapered pin holding the front grooved drum to its shaft and replacing it on the opposite side (180 degrees) the one-inch slack in the cable can be taken up by using the new position of the pin for anchoring the cable. It will be noted that the tapered pin in the new position cannot be inserted as far as originally. However, it can be inserted far enough to lock the grooved drum to the control shaft and clear the metal housing. If the cable again is stretched to the maximum adjustment of the cable adjusting screw the tapered pin can be returned to its original position and an additional half turn slipped on the drum which will provide for taking up all slack. Sufficient grooves are provided on the drum for this purpose.

(6) HUM

Part I, Section 4, describes the method to eliminate ordinary hum in Radiola 18 when making an installation. If a pronounced hum develops during operation check the following:

(a) Low emission Radiotron UX-280. A low emission rectifying tube will cause excessive hum and unsatisfactory operation.

(b) Shorted filament condenser. There are two ½ mfd. condensers hooked in series across the UX-226 filaments with the center tap grounded. A short of either of these condensers will cause loud hum and imperfect operation of the Radiola.

(c) Defective center tapped resistance. A short or open in any of the center tapped resistances connected across the various filament supplies will cause a loud hum.

(d) Any open of the several grounding connections in the Radiola or defective voltage supply resistances may cause a certain amount of hum. These defects will have a pronounced effect on the general operation of the Radiola which will be more noticeable than the additional hum. Check by means of the continuity test given in Part II, Section 16.

A mechanical hum caused by vibration of loose laminations in the power transformer may be corrected by removing the power transformer from the S.P.U. as described in Part III, Section 11, and heating it in a slow oven. The open end should be kept up and the compound heated sufficiently to allow it to adhere to the laminations of the transformer. After heating, the transformer should be allowed to cool for at least 24 hours and then returned to the S.P.U.

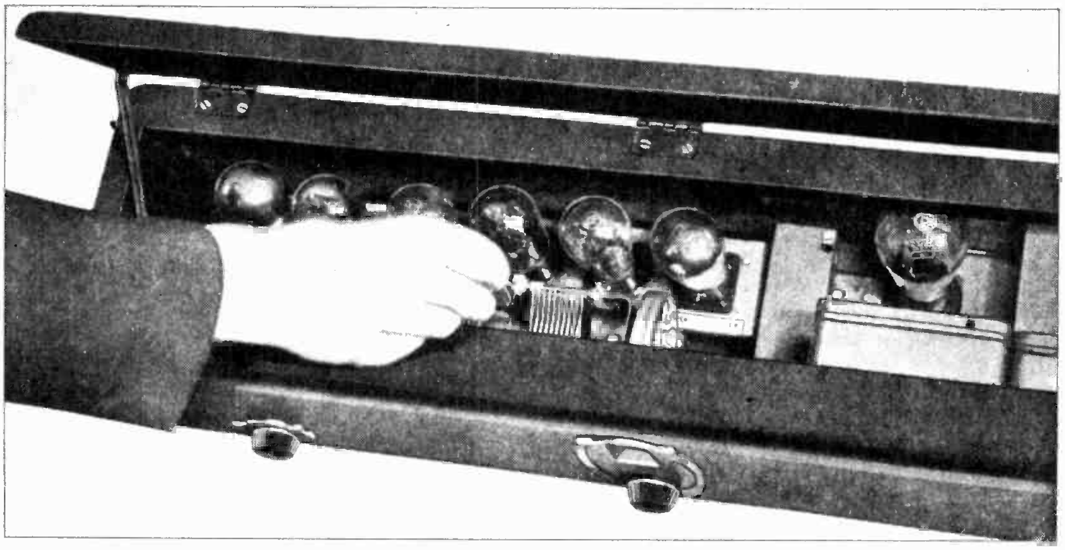


Figure 6—Adjusting the compensating condenser.

(7) BROKEN CONDENSER DRIVE CABLE

A broken condenser drive cable can be replaced in the manner described in Part III, Section 4. However, if a new cable is not immediately available a temporary repair can be made in the following manner, provided the break in the cable is not in that section that passes over the small grooved drums.

Splice and solder the two ends together. Splicing consists of interweaving the strands, as with rope, and not just twisting the cable ends together as in an electrical wiring splice. Splicing gives greater strength and forms a smaller body on the cable. When soldering use plenty of flux and a small amount of solder. Heat sufficiently so the solder adheres to all the strands of the cable. Placing the splice in an alcohol or bunsen flame affords sufficient heat and allows excess solder to drip away. This is but a temporary repair to be used only until a new cable can be procured.

(8) LOUDSPEAKER POLARITY

The use of an output filter in Radiola 18 makes unnecessary any adjustment for polarity of the output current. Any type of loudspeaker (either horn or cone) can be connected in the manner that gives the most pleasing reproduction.

(9) AUDIO HOWL

Audio howl may be caused by:—

(1) Incorrect adjustment of compensating condenser. The correct procedure for adjusting the compensating condenser is given in Part II, Section 10.

(2) Open A.F. condenser connections. An open connection to either of the A.F. condensers may cause a howl.

(3) Open by-pass condensers. An open by-pass condenser connection may cause a howl.

(4) Vibrating elements in receiver Radiotrons. A gradually developed howl is probably due to the loudspeaker causing the receiver Radiotron elements to vibrate. To overcome this condition, interchange the Radiotrons in the receiver or change the relative angle between the loudspeaker and the Radiola. In extreme cases it will be necessary to increase the distance between the Radiola and the loudspeaker.

(5) Poor ground. Install ground system as indicated in Part I, Section 3.

(6) An open connection in any of the several ground leads in the Radiola.

(7) A defect in the R.F. coil system. A short in any of the concentrated primary coils or the condenser shunted around them may cause a howl.

(8) Poorly soldered or corroded joints. Any high resistance joint throughout the Radiola may cause howl.

(9) Defective resistance in Socket Power Unit. A short in any section of the plate and grid resistance unit may cause howl.

(10) COMPENSATING CONDENSER OUT OF ADJUSTMENT

The compensating condenser should not be touched until it is definitely ascertained that no other defect exists. If the condenser needs adjustment observe the following procedure: Obtain a small non-metallic screw-driver (either bakelite or wood will do) having a shaft less than ¼″ in diameter.

(a) Put Radiola in operation in usual manner and tune in some station preferably at the lower wavelengths.

(b) To reach the adjusting screw of the compensating condenser, break the brown paper seal and insert the screw-driver through the hole at the bottom of the tuning condenser assembly. (See Figure 6.)

(c) With the volume control at maximum intensity, turn this screw to the right until the Radiola goes into oscillation. Then turn the screw to the left until all oscillation and any howl is eliminated, with the volume control at maximum. In some cases it will be necessary to interchange the Radiotrons UX-226 in the R.F. stages before the proper adjustment is found. This is the correct adjustment to obtain maximum sensitivity and tone quality in the operation of Radiola 18.

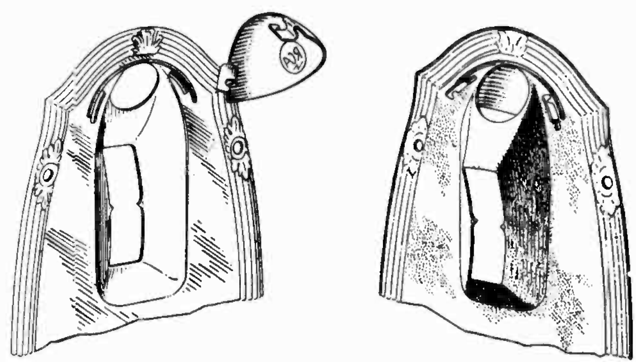
(d) The brown paper seal should be replaced by another seal dated and initialed to prevent tampering with the adjustment.

(11) DISTORTED REPRODUCTION

Under normal conditions Radiola 18 will deliver a strong signal of good quality to the loudspeaker. The high sensitivity of Radiola 18 makes it undesirable to operate the set at full volume when receiving from a nearby broadcasting station. The volume control should be adjusted to secure maximum quality, for the volume will be found ample for all requirements. If the loudspeaker production is poor test the loudspeaker output from the receiver. A pair of phones or loudspeaker of known quality may be used for this purpose. Poor quality or distortion may be due to any of the following causes:

(1) Defective Radiotrons. Though the Radiola may be in operating condition a defective Radiotron in any stage will cause distortion. This is especially true of the detector, 1st and 2nd audio stages and the rectifier tube.

(2) High or low plate and grid voltages from the Socket Power Unit. The cause may be a defective Radiotron UX-280 or resistance unit. Replace the Radiotron UX-280 with one of known quality and check the various resistances for a possible short or open.



FRONT VIEW OF ESCUTCHEON PLATE WITH CANOPY REMOVED

REAR VIEW WITH CANOPY HOOKED IN PLACE

Figure 7—Method of fitting canopy into escutcheon plate.

The cause of noisy operation and intermittent signals with periods of hum or no reception may be traced in the following manner:

(1) Disconnect the antenna and ground leads. If the Radiola becomes quiet and signals from local stations, though weak, are received the trouble is in the antenna system, or is caused by nearby interfering electrical apparatus. In the first case repair the antenna system and in the second case place radio frequency chokes on any offending nearby apparatus. The location of interfering electrical machinery will require patience, skill and experimenting.

(2) If disconnecting the antenna and ground does not eliminate the noise the trouble is in the Radiola. A defective tube, one having poorly welded elements will cause a disturbance of this kind, and this point should be checked by interchanging the Radiotrons in the Radiola with others of the same type. If it is definitely established that the Radiotrons are O. K. the Radiotron prongs and the socket contacts should be examined for dirt or poor contact. The volume control should be examined for poor contact between the contact arm and the resistor strip.

(12) PILOT LAMP AND CANOPY

Radiola 18 is equipped with a small pilot lamp operating from the Radiotron UX-171A filament winding. Its purpose is to illuminate the tuning dial and act as a current supply indicator. The latter use is quite important because the time required for Radiotron UY-227 to develop normal operation, which is approximately 30 seconds, can be checked.

The lamp and canopy are packed separately and must be installed when the Radiola is first placed in operation. The pilot lamp is a standard T-3 Mazda miniature base, 6 volt, 0.15 ampere lamp which can be procured on the open market if replacement becomes necessary. It is screwed into its base directly over the tuning dial. The projections on the canopy fit into the holes in the escutcheon plate directly over the light. A slight side shift locks it securely in place. (See Figure 7.)

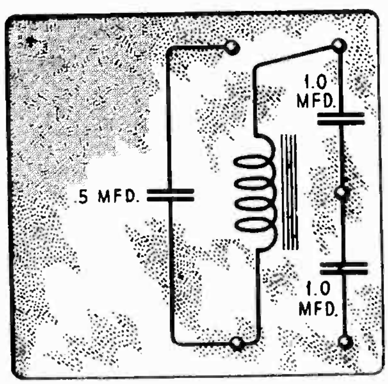


Figure 8—Internal connections of condensers.

(13) FILTER CONDENSER AND OUTPUT CONDENSER AND CHOKE

The output choke and condenser and the two filtering condensers are located in one container in the S.P.U. Figure 8 shows the internal connections. The procedure for testing this unit is to "click test" the choke for an open, and charge and discharge the condensers individually by shorting their terminals with a screw-driver. A condenser that will not retain its charge is defective. Approximately 200 volts D.C. should be used when making this test.

An open output condenser or an open or shorted choke will cause weak and distorted reproduction. A defective filter condenser is indicated by excessively hot plates, possibly showing color, in Radiotron UX-280.

(14) VOLTAGE SUPPLY SYSTEM

It is well to understand the various voltage supply systems incorporated in Radiola 18 as they differ somewhat from the systems normally used. Generally speaking, Radiola 18 uses what is known as the series resistance method of obtaining its various voltages. This series arrangement makes it possible to use small filter condensers. Figure 9 shows the connections. The grid bias voltages are obtained by using the drop across a resistance connected in the plate return lead.

With this arrangement the correct grid or plate voltage is dependent on the Radiotrons being in good condition. A low emission tube will cause the voltage to rise on all tubes. It is important to note that when interchanging Radiotrons all tubes should be in their respective sockets before turning "on" the current supply.

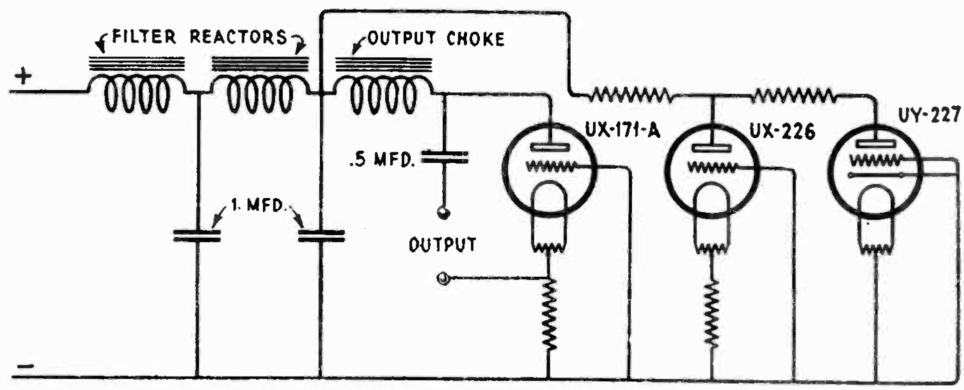


Figure 9—Schematic circuit illustrating method of obtaining grid and plate voltages.

(15) VOLTAGE READINGS

When checking a Radiola 18 for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man will need both an A.C. and a D.C. voltmeter, the D.C. meter being 600 ohms per volt or higher in resistance. The following voltages at the terminal strip of the S.P.U. are correct with all tubes in place and a normal load on the S.P.U. The tubes used must be in good condition, otherwise the D.C. voltages may be excessively high. The shield over the terminal strip will have to be removed before any readings can be made. Keep the line adjustment switch in the normal position for the particular line to which the set is connected.

The terminal strip numbers are read from front to rear of the Radiola, No. 1 being toward the front and No. 9 toward the rear.

TERMINALS	CORRECT VOLTAGE
1 to 2	1.5 A.C.
3 to 4	2.25 A.C.
5 to 6	5.0 A.C.
7 to 9	145 D.C.
8 to 9	165 D.C.

Any serious variations from these voltages, not caused by defective Radiotrons, indicates a defective resistance unit, condenser or power transformer.

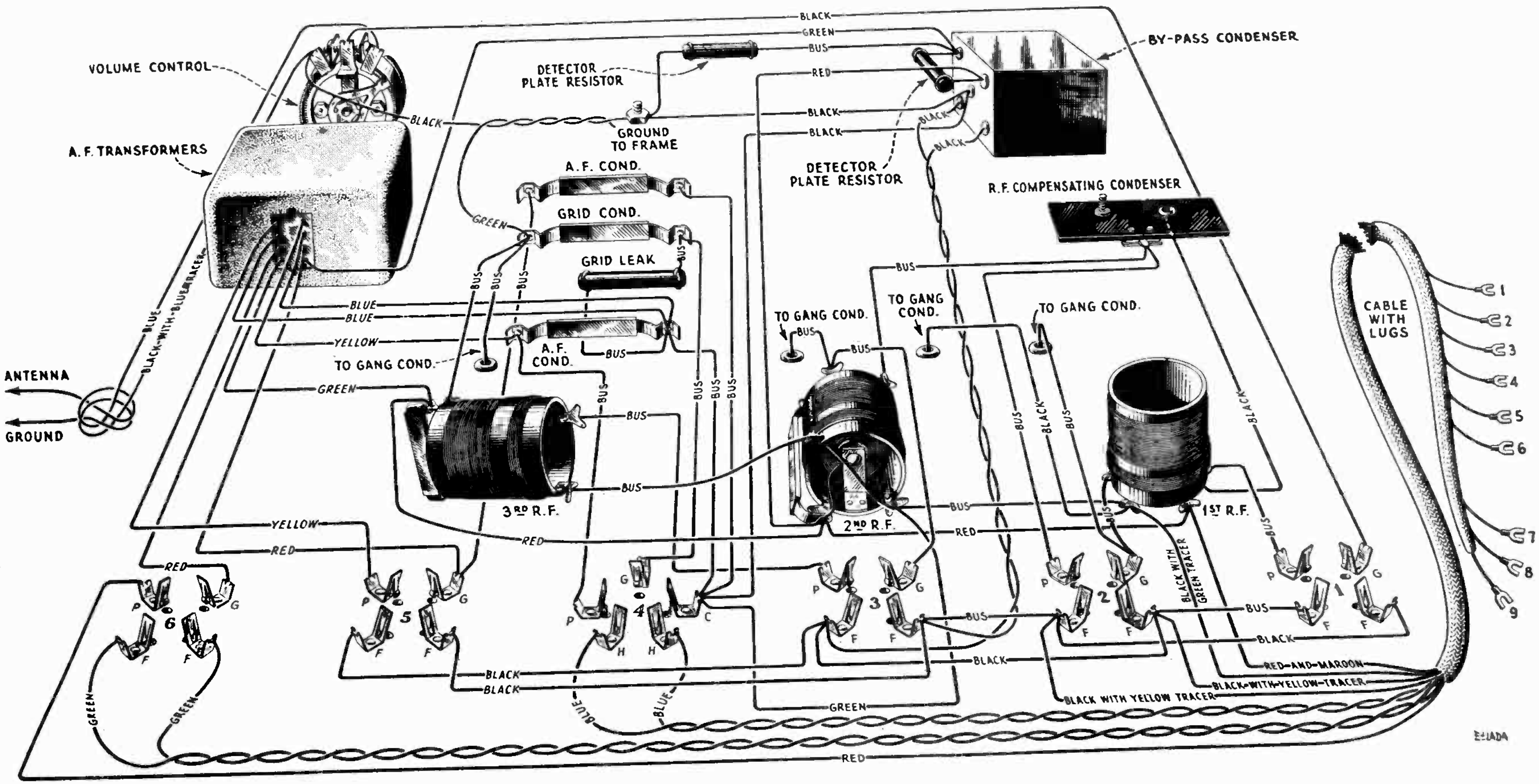


Figure 10—Wiring diagram of receiver sub-chassis assembly showing location of parts and color scheme of connections.

(16) RADIOLA 18 CONTINUITY TESTS

The following tests will show complete continuity for the receiver assembly (Figure 10) and the Socket Power Unit (Figure 11). Disconnect the antenna and ground leads; the cable connecting the S.P.U. to the receiver assembly, and the A.C. supply cord at its outlet.

A pair of headphones with at least 4½ volts in series or a voltmeter with sufficient voltage to give a full scale deflection when connected directly across the battery terminals should be used in making these tests. The receiver sockets, numbers and lugs used in these tests are shown in Figure 10. The S.P.U. terminals are shown in Figure 11.

RECEIVER ASSEMBLY CONTINUITY TESTS

Remove All Radiotrons and Disconnect Cable at Terminal Strip

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna lead to G1	Closed	Open volume control or loose contact arm
	G2 to Lug No. 9	Closed	Open secondary of first R.F. transformer
	G3 to Lug No. 9	Closed	Open secondary of second R.F. transformer
	Stator plates of third condenser to Lug No. 9	Closed	Open secondary of third R.F. transformer
	G4 to Lug No. 9	Open or very weak	If closed, shorted grid condenser or grid leak
	G5 to Lug No. 9	Closed	Open secondary of first A.F. transformer
	G6 to Lug No. 9	Closed	Open secondary of second A.F. transformer
Plate	P1 to Lug No. 7	Closed	Open primary of first R.F. transformer
	P2 to Lug No. 7	Closed	Open primary of second R.F. transformer or concentrated coil
	P3 to Lug No. 7	Closed	Open primary of third R.F. transformer or concentrated coil
	P4 to Lug No. 7	Closed (Weak)	Open primary of first A.F. transformer or detector plate resistance
	P5 to Lug No. 7	Closed	Open primary of second A.F. transformer
	P6 to Lug No. 8	Closed	Open connection
Filament	One filament contact of sockets Nos. 1, 2, 3 and 5 to Lug No. 1	Closed	Open filament connection
	Other filament contact of sockets Nos. 1, 2, 3 and 5 to Lug No. 2	Closed	Open filament connection
	Lug No. 1 to Lug No. 9	Open	Shorted by-pass condenser
	Lug No. 2 to Lug No. 9	Open	Shorted by-pass condenser
	Lug No. 3 to one filament contact of socket No. 4	Closed	Open filament connection
	Lug No. 4 to other filament contact of socket No. 4	Closed	Open filament connection
	Lug No. 5 to one filament contact of socket No. 6	Closed	Open filament connection
	Lug No. 6 to other filament contact of socket No. 6	Closed	Open filament connection

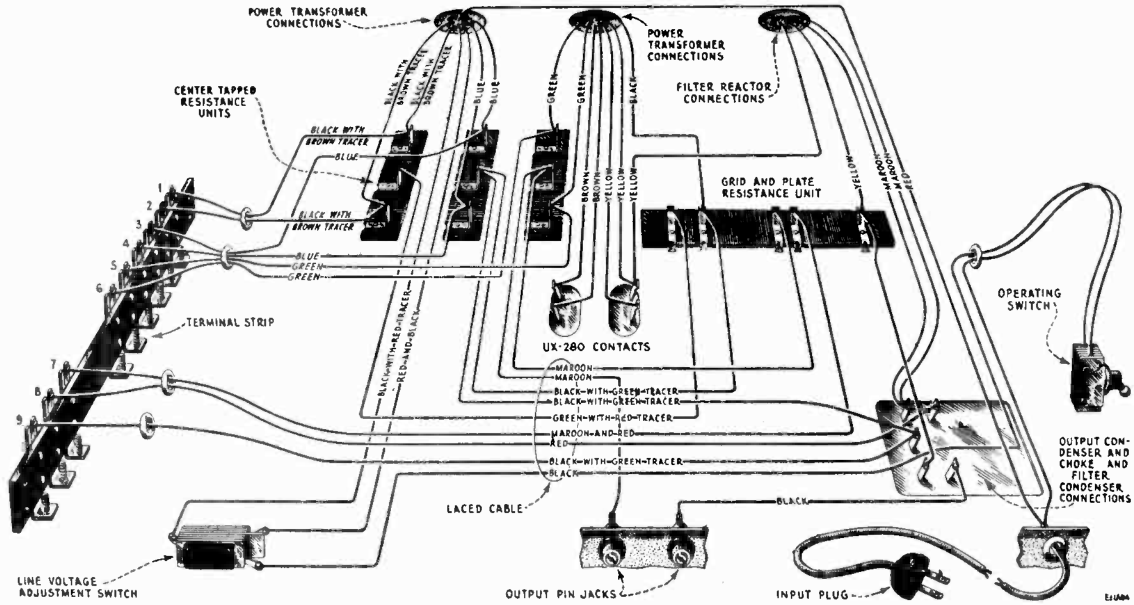


Figure 11—Wiring diagram of socket power unit showing location of parts and color scheme of connections.

SOCKET POWER UNIT CONTINUITY TESTS

Remove Radiotron UX-280 and Disconnect Cable at Terminal Strip

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
S.P.U.	Terminal No. 9 to terminals Nos. 1 or 2	Closed	Open UX-226 grid bias resistance
	Terminal No. 9 to terminals Nos. 5 or 6	Closed	Open UX-171A grid bias resistance
	P to G of UX-280 socket	Closed	Open high voltage winding of power transformer
	Across UX-280 filament contacts	Closed	Open UX-280 filament winding
	Across terminals 1 and 2	Closed	Open UX-226 filament winding and center tapped resistance
	Across terminals 3 and 4	Closed	Open UY-227 filament winding and center tapped resistance
	Across terminals 5 and 6	Closed	Open UX-171A filament winding and center tapped resistance
	Terminal No. 8 to either filament contact UX-280 socket	Closed	Open output choke or filter reactor
	Terminal No. 7 to terminal No. 8	Closed	Open output choke or resistance unit
	Terminal No. 8 to terminal No. 9	Open	Shorted filter condensers
	One output pin jack to terminal No. 8	Open	Shorted output condenser
	Other output pin jack to terminal 5 or 6	Closed	Open center tapped resistance unit or connection

PART III — MAKING REPLACEMENTS

The various assemblies and parts of Radiola 18 are easy of access and replacements can be made quickly.

(1) REPLACING VOLUME CONTROL

The following procedure should be used when replacing the volume control:

(1) Remove the seven screws that hold the wooden back to the cabinet.

(2) Remove knobs on "Station Selector" and "Volume Control."

(3) Remove the shield located on the terminal strip by loosening the screws at each end and slipping the screw heads through the larger openings.

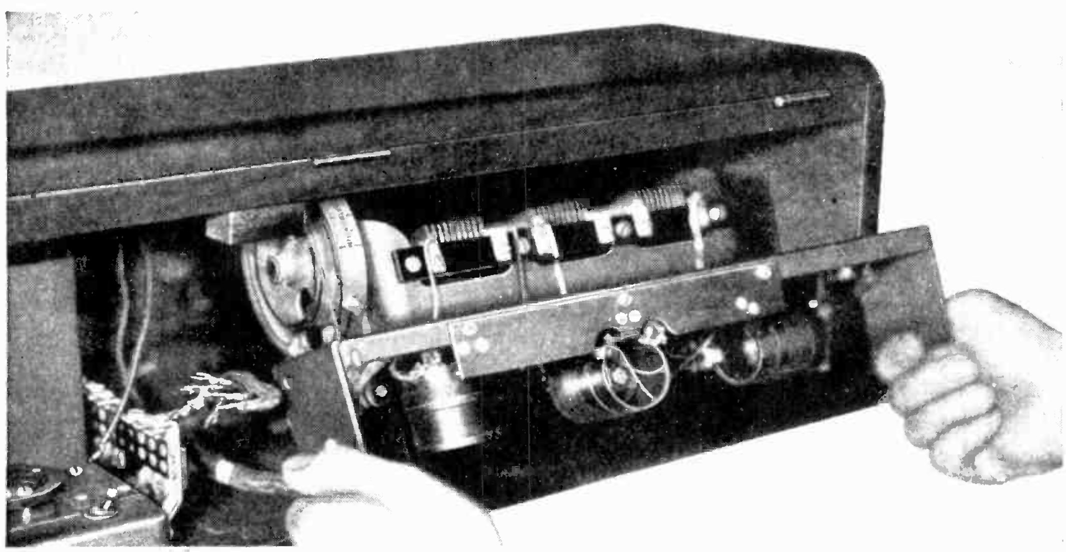


Figure 12—Removing receiver chassis assembly from cabinet.

(4) Release the cable connecting the socket power unit to the chassis assembly and the two leads to the pilot lamp. This is done by loosening the screws holding them to the terminal strip of the socket power unit.

(5) Remove the four screws holding chassis in place to bottom of cabinet. The chassis may now be removed by rocking it in the cabinet and slipping it out of the back opening. (See Figure 12.)

(6) Unsolder and tag the leads to the volume control.

(7) Remove the two screws that hold the volume control to the metal chassis. The volume control may now be removed and the new one fastened in place. The connections to the new volume control should be made as indicated on the tags attached to the wires, or refer to Figure 10.

(8) The Radiola is reassembled in the reverse order of that already given.

(2) REPLACING RADIO FREQUENCY COILS

The three radio frequency transformers together with small fixed condensers across the concentrated primary coils are mounted on one strip and must be replaced as a unit. The following procedure is used:

(1) Remove the chassis assembly from the cabinet as described in Part III, Section 1.

(2) Unsolder and tag all connections to the three transformers.

(3) Remove the three screws that hold the mounting strip to the metal chassis. The entire assembly can now be removed. The new assembly is placed in the position occupied by the old one.

(4) Replace the screws that hold the mounting strip to the metal chassis.

(5) Replace and resolder all leads to the three transformers as indicated on tags previously attached to them. These connections are shown in Figure 10. When making this replacement be careful not to disturb the two condensers connected across the concentrated coils. Placing these condensers closer to the coils than their normal position will affect the inductance of the coil with a resulting decrease of sensitivity.

(6) Return chassis assembly to cabinet and replace all screws and knobs. Now adjust the compensating condenser to the correct position as indicated in Part II, Section 10.

(3) REPLACING RADIOTRON GANG SOCKETS

The Radiotron sockets of Radiola 18 are of the gang variety, using one detector socket; two A.F. socket strips, and one three-gang socket strip for the radio frequency amplifying tubes. There is a small bakelite shield placed over the rivets of the UX-171A socket which is used to identify the socket. This shield is supplied separately and does not come with the socket. The sockets are riveted to the metal chassis. To replace them, drill out the old rivets and use screws, nuts and lock washers for securing the new sockets. A step by step procedure follows:

(1) Remove chassis assembly from cabinet as described in Part III, Section 1.

(2) Remove and tag all leads to the terminals of the sockets.

(3) Drill out the rivets holding the sockets to the metal chassis frame. In some cases it may be necessary to loosen the R.F. transformer assembly in order to slip the socket strips out.

(4) The socket assembly is now removed and the new one placed in the position occupied by the old one.

(5) Fasten new socket in place by using small head machine screws, nuts and lock washers in place of the rivets previously removed.

(6) Replace connections as indicated on tags attached, or refer to Figure 10 for the correct socket connections.

(7) Return chassis to cabinet.

(4) REPLACING MAIN TUNING CONDENSERS AND DRIVE

The main tuning condensers and the driving mechanism are replaced as one complete unit. The step by step procedure follows:

(1) Remove chassis assembly from housing as described in Part III, Section 1.

(2) Unsolder four connections to condensers.

(3) Remove three screws, nuts and lock washers that hold the assembly to the frame.

(4) The assembly may now be removed and the new assembly placed in the position occupied by the old one.

(5) Replace the three screws, nuts and lock washers and resolder the leads.

(6) Replace chassis assembly in cabinet.

(5) REPLACING BY-PASS CONDENSER

This condenser, located on the under side of the chassis frame is held in place by four metal tabs that are a part of the condenser case and are bent over on the upper side of the metal chassis. A step by step procedure for making this replacement follows:

(1) Remove chassis from cabinet as described in Part III, Section 1.

(2) Remove tuning condenser assembly from chassis as described in Part III, Section 4.

(3) Unsolder the leads connected to the defective condensers.

(4) The four tabs holding the condenser to the chassis may now be bent up with a screw-driver and the old condenser replaced by the new one. Insert the tabs in the holes and bend them over on the upper side of the chassis assembly. Resolder the leads to their correct terminals. The connections are shown in Figure 10.

(5) Replace the tuning condenser assembly as described in Part III, Section 4.

(6) Return chassis assembly to cabinet in reverse order of that used to remove it.

(6) REPLACING AUDIO TRANSFORMERS

The audio transformers of Radiola 18 are built together in one unit. In making a replacement the following procedure should be used:

(1) Remove receiver chassis from cabinet as described in Part III, Section 1.

(2) Unsolder and tag all leads to the audio transformers.

(3) Use a screw-driver to turn up the tabs that hold the transformer assembly to the chassis frame and remove it.

(4) Place the new transformer in the position occupied by the old one, bend over the tabs and resolder all connections. The correct connections are shown in Figure 10.

(5) Replace chassis in cabinet in the reverse order of that used to remove it.

(7) REPLACING CONDENSER DRIVE CABLE

The condenser drive cable of Radiola 18 is very rugged and should give good service. If replacement becomes necessary proceed as follows:

(1) Remove the receiver assembly from the cabinet as described in Part III, Section 1. Place chassis on table with controls to the front.

(2) Release the cable adjusting screw and clamp, and remove old cable from large drum and grooved drums completely.

(3) Starting from the rear grooved drum place eye of cable over pin, which should be in a horizontal position facing the socket power unit, and wind on three complete turns, and then bring cable up to large drum.

(4) Now bring cable over the large drum. Turn drum so that cable adjusting screw is on top. Pass cable over groove until point is reached where there is a slot in the drum for passing cable to the track on other side of drum.

(5) Follow on around other track in same direction until point is reached where cable is directly above front grooved drum.

(6) Starting on the third groove back from the front of the grooved drum wind on two and a half turns and slip eye over pin. The cable is now in the correct position, although probably slack.

(7) The cable adjusting screw and clamp that were previously removed to allow the cable to pass along the groove are replaced. By slipping the clamp over the cable and gradually turning up on the cable adjusting screw, the cable may be tightened until there is no lost motion in any of the controls. Care should be taken not to take up too much as the cable may be stretched or possibly broken.
(8) Return receiver assembly to cabinet in the reverse order used to remove it.

(8) REPLACING DIAL SCALES

After considerable use a dial scale may become dirty or illegible and a new scale desired. A step by step procedure for making replacement follows:

(1) Open lid of cabinet of Radiola.
(2) Turn dial so that the two screws that hold the dial in place are on top.
(3) Remove screws. washer and nuts that hold dial in place.
(4) Replace old dial with new one and replace screws, but do not tighten.
(5) Examine new dial from front of Radiola to see that numbers on dial are in the correct position.
(6) Tighten screws holding dial in place and close lid of cabinet.

(9) REPLACING POWER CABLE

Attached to the receiver is a heavy cable used to conduct all current supplies from the S.P.U. Replacement is made as follows:

(1) Remove receiver assembly from cabinet as described in Part III, Section 1.
(2) Turn assembly so that bottom side is exposed and unsolder all connections to the cable. Attach tags to points of connection.
(3) Replace old cable with the new one. Solder the connections of the new cable as indicated on the attached tags, or as shown in Figure 10.
(4) Return receiver assembly to cabinet in reverse order of that used to remove it.

(10) REPLACING FILTER CONDENSER, OUTPUT CHOKE AND CONDENSER ASSEMBLY

The filter condensers, together with the output choke and condenser, are all contained in one metal container and must be replaced as a unit. The replacement procedure follows:

(1) Remove the seven screws holding the wooden back to the cabinet.
(2) Remove collar on operating switch at front of Radiola.
(3) Release the cable connecting the socket power unit to the receiver assembly and the two leads to the pilot lamp. This is done by first removing the metal shield placed over the terminal strip and then loosening the nine screws on the terminal strip.
(4) Remove four screws at the bottom of the cabinet holding S.P.U. in place. The Socket Power unit may now be removed by slipping it out of the back opening. This will allow an examination of parts and provide access to the units it is desired to replace.
(5) Unsolder and tag the connections to the filter condenser unit.
(6) Turn up the tabs that hold this unit to the S.P.U. base with a screw-driver. The entire assembly may now be removed and the new one placed in the position occupied by the old one.

(7) Clamp the assembly in place by turning the tabs over on the under side of the base. Solder the connections as indicated on tags attached, or as shown in Figure 11.

(8) Return the S.P.U. to the cabinet and reassemble in the reverse order of that used to remove it.

(11) REPLACING EITHER POWER TRANSFORMER OR FILTER REACTOR

The power transformer and the filter reactor are each encased in a metal container. Either unit may be replaced in the following manner:

(1) Remove S.P.U. from cabinet as described in Part III, Section 10.

(2) Unsolder the leads of the unit being replaced and tag connection points.

(3) Bend up the tabs holding unit to the base. It may be necessary to remove the resistance unit in order to bend all the tabs. The particular assembly being replaced may now be removed and the new assembly placed in the position occupied by the old one.

(4) The tabs on the new assembly should be bent so as to properly fasten the unit to the S.P.U. base.

(5) Connect all leads from the assembly to the points of connection as indicated by tags previously attached. These connections are shown in Figure 11, which should be followed exactly when any S.P.U. parts are replaced.

(6) Return to cabinet in the reverse order, and connect to receiver assembly.

(12) REPLACING TERMINAL STRIP

Should a terminal strip on the socket power unit require replacement use the following procedure:

(1) Remove S.P.U. from cabinet as described in Part III, Section 10.

(2) Unsolder and tag all leads to terminal strip.

(3) Release two screws holding strip to S.P.U. base.

(4) The strip may now be removed and replaced by a new one.

(5) Fasten new strip in position occupied by old strip by means of two machine screws, lock washers and nuts previously removed.

(6) Solder all leads to terminal strip as indicated on tags attached. The color scheme and correct connections are shown in Figure 11.

(7) Return S.P.U. to cabinet in the reverse order and connect to receiver assembly.

(13) REPLACING MISCELLANEOUS PARTS IN S.P.U.

The center tapped resistors, plate and grid supply resistors, line switch and UX-280 socket in Radiola 18 may become defective and require replacement. They are all attached to the base by means of machine screws and nuts, and replacement is very simple. The following general outline will apply to all these units:

(1) Remove S.P.U. from cabinet as described in Part III, Section 10.

(2) Unsolder leads from defective unit and tag each lead.

(3) Remove defective unit from base and replace with new unit.

(4) Solder leads to new unit as indicated on tags or see Figure 11.

(5) Return S.P.U. to cabinet in reverse order of that used to remove it.

SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, or a poor antenna system. If imperfect operation is not due to these causes the "Service Data Chart" should be consulted for further detailed causes. Reference to Part No. and Section No. in the "Service Notes" is also noted for further details.

Indication	*Cause*	*Remedy*
No Signals	Defective operating switch	Repair or replace switch
	Loose volume control arm	Tighten volume control arm, P. II, S. 4
	Defective power cable	Replace power cable, P. III, S. 9
	Defective R.F. transformer	Replace R.F. transformer assembly, P. III, S. 2
	Defective A.F. transformer	Replace A.F. transformer assembly, P. III, S. 6
	Defective By-pass condenser	Replace By-pass condenser, P. III, S. 5
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 16
Weak Signals	Compensating condenser out of adjustment	Adjust compensating condenser correctly, P. II, S. 10
	Defective power cable	Repair or replace cable, P. III, S. 9
	Defective line switch	Clean contacts or replace line switch
	Defective R.F. transformer	Replace R.F. transformer assembly, P. III, S. 2
	Defective A.F. transformer	Replace A.F. transformer assembly, P. III, S. 6
	Dirty prongs of Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
	Defective By-pass condenser	Replace defective By-pass condenser, P. III, S. 5
	Defective main tuning condensers	Replace defective tuning condensers, P. III, S. 4
	Low voltages from socket power unit	Check socket power unit voltages with high resistance D.C. voltmeter and A.C. voltmeter, P. II, S. 15
	Defective socket power unit	Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 16
Poor Quality	Defective A.F. transformer	Replace A.F. transformer assembly, P. III, S. 6
	Defective By-pass condenser	Replace defective By-pass condenser, P. III, S. 5
	Dirty contact arm of volume control	Clean contact arm of volume control, P. II, S. 4
	Dirty prongs on Radiotrons	Clean prongs with fine sandpaper, P. II, S. 3
Howling	Compensating condenser out of adjustment	Adjust compensating condenser correctly
	Radiotron UY-227 howl	Interchange Radiotron UY-227 with another. P. I, S. 7
	Defect in audio system	Check and repair any defect, P. II, S. 16
	Open grid circuit in any stage	Check circuit and repair defect
Excessive Hum	Defective center tapped resistance unit	Replace defective resistance unit, P. III, S. 13
	Socket plug position	Reverse socket plug, P. I, S. 4
	Line voltage low	Set line switch for low line voltage, P. I, S. 5
Radiotrons fail to light	Operating switch not "On"	Turn operating switch "On"
	Defective operating switch	Replace operating switch
	Defective input A.C. cord	Repair or replace A.C. input cord
	Defective power transformer	Replace power transformer, P. III, S. 11
	No A.C. line voltage	Turn A.C. line voltage "On"
Play in Station Selector	Loose knob	Tighten or replace knob
	Slack cable	Take up on cable adjusting screw, P. II, S. 5

RCA

Radiolas 18 D.C. and 51 D.C.

SERVICE NOTES

[First Edition 2½M

Radio Corporation of America
233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

Bld. No. 19—168 39th St.
Brooklyn, N. Y.

2001 West Pershing Road
Chicago, Ill.

274 Brannan St.
San Francisco, Cal.

Dallas, Texas
Santa Fe Bldg.
Unit No. 2

Atlanta, Ga.
Monroe Bonded Warehouse
Spring and Peters Sts.

PREFACE

Service goes hand in hand with sales. The well-informed RCA Authorized Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that RCA Loudspeaker and Radiola owners may be entirely satisfied.

Obviously, this service can best be rendered by properly equipped service organizations having a thoroughly trained personnel with a knowledge of the design and operation of RCA Loudspeakers and Radiolas.

Such service organizations have been established by RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

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

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

In addition to supplying the Service Notes, the RCA Service Division maintains a corps of engineers who are qualified to render valuable help in solving service problems. These engineers call upon the trade at frequent intervals to advise and assist RCA Distributors in the performance of service work.

CONTENTS

PART I—GENERAL SERVICE DATA

PART II—ELECTRICAL TESTS

ILLUSTRATIONS

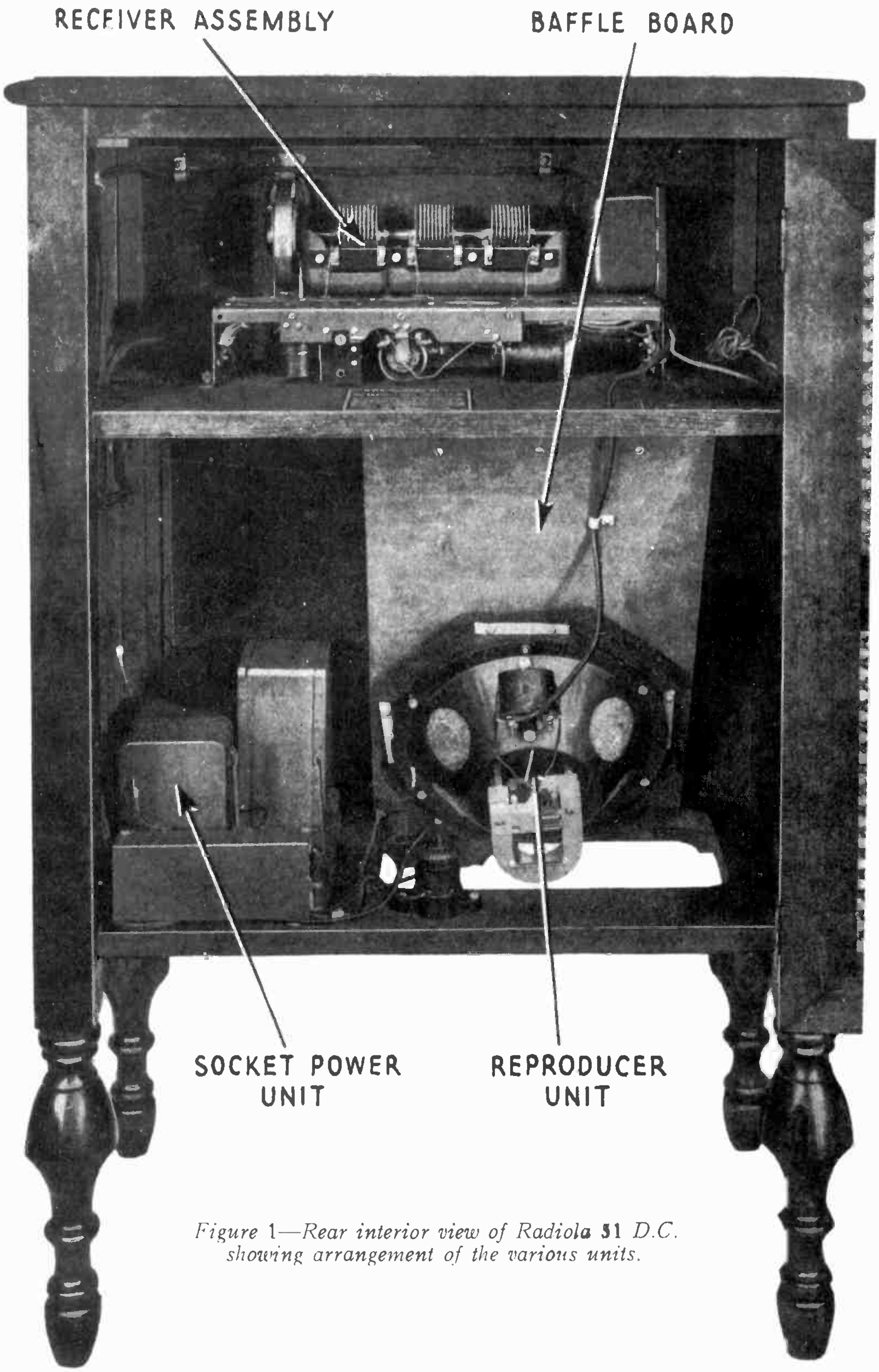


Figure 1—Rear interior view of Radiola **51** *D.C. showing arrangement of the various units.*

RADIOLAS 18 D.C. and 51 D.C.

107.5-127.5 Volts Direct Current

SERVICE NOTES

PREPARED BY RCA SERVICE DIVISION

RCA Radiola 18 and 51 are manufactured in models designed for direct current lighting circuit operation. While these models are similar to the A.C. models in appearance and performance, electrically they are considerably different. For this reason a special Service Note on these models is issued for the guidance of those called upon to locate and remedy any trouble that may develop.

RCA Radiola 51 D.C. is a cabinet model combination of the RCA Radiola 18 D.C. and Loudspeaker 100A. See rear interior view Figure 2 and top view of receiver Figure 3. Service work in connection with the loudspeaker is covered in the regular RCA Loudspeaker 100A Service Notes. Due to the location of the S.P.U., there is a slight mechanical difference in the location of wiring and arrangement of the terminal strip, as compared with Radiola 18 D.C. These various changes are shown in the circuit diagrams and also in the continuity tests. In other respects, both Radiolas are identical.

These notes are divided into two parts, namely: Part I—General Service Data; Part II—Radiola 18 D.C. and 51 D.C. Electrical Tests, and a Service Data Chart, applicable to both Radiolas. The general instructions given in the Radiola 18 A.C. Service Notes may be used when replacement is desired as the general arrangement of parts is the same.

PART 1—GENERAL SERVICE DATA

(1) CIRCUIT CHARACTERISTICS

The following characteristics are incorporated in the design of Radiolas 18 D.C. and 51 D.C.:

(a) Each is a six-tube tuned radio frequency receiver, utilizing five Radiotrons UX-112A and one Radiotron UX-171A.

(b) A single control, three-gang condenser is employed to tune two of the radio frequency amplifiers and the detector.

(c) The volume control regulates the input grid voltage to the first R.F. amplifier stage. This is a simple and effective method for controlling volume in this type of receiver.

(d) A series filament connection is used for all tubes. This is a simple and practical method for a direct current receiver as the input wattage is at a minimum. The current consumption of these Radiolas is no greater than the same type Radiolas designed for alternating current.

(e) The D.C. house circuit in addition to supplying filament current for the Radiola supplies all plate and grid voltages except the grid voltage used on the Radiotron UX-171A. This is supplied by an external "C" battery of 18 volts which must be supplied at the time of installation.

(f) Counting from right to left facing the front of the Radiola, the Radiotron sequence is as follows:

(1) Radiotrons Nos. 1, 2 and 3 are successively the first, second and third stages of radio frequency amplification.

(2) Radiotron No. 4 is the tuned detector.

(3) Radiotrons Nos. 5 and 6 are the first and second audio stages respectively.

Figure 4 shows the schematic circuit of Radiola 18 D.C. and Figure 5 shows the schematic circuit of Radiola 51 D.C.

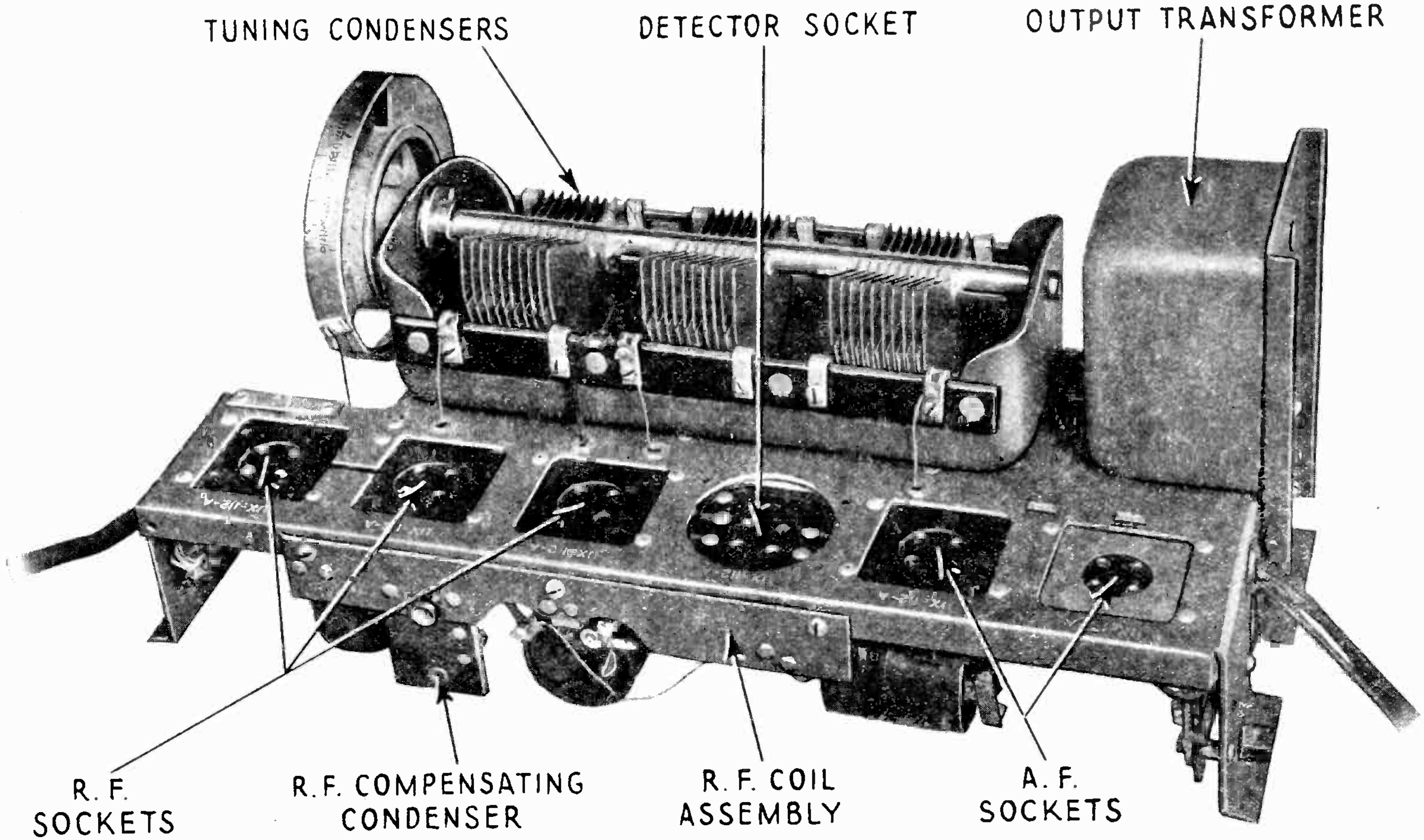


Figure 3—Top view of Radiola 51 D.C. receiver assembly, showing various parts

(2) ANTENNA (Outdoor Type)

Due to the high sensitivity of Radiolas 18 D.C. and 51 D.C. the antenna length need only be approximately 50 feet long. It should be erected as high as possible and be removed from all obstructions. The lead-in should be a continuation of the antenna itself, thus avoiding all splices which might introduce additional resistance and in time corrode sufficiently to seriously affect reception. If it is absolutely necessary to splice the lead-in to the antenna the joint must be carefully soldered to insure a good electrical contact. Clean off all excess flux and tape the connection to protect it from the oxidation effects of the atmosphere.

High-grade glass or porcelain insulator supports are required and at no point should the antenna or lead-in wire come in contact with any part of the building. Use a porcelain tube insulator where the lead-in wire enters the house.

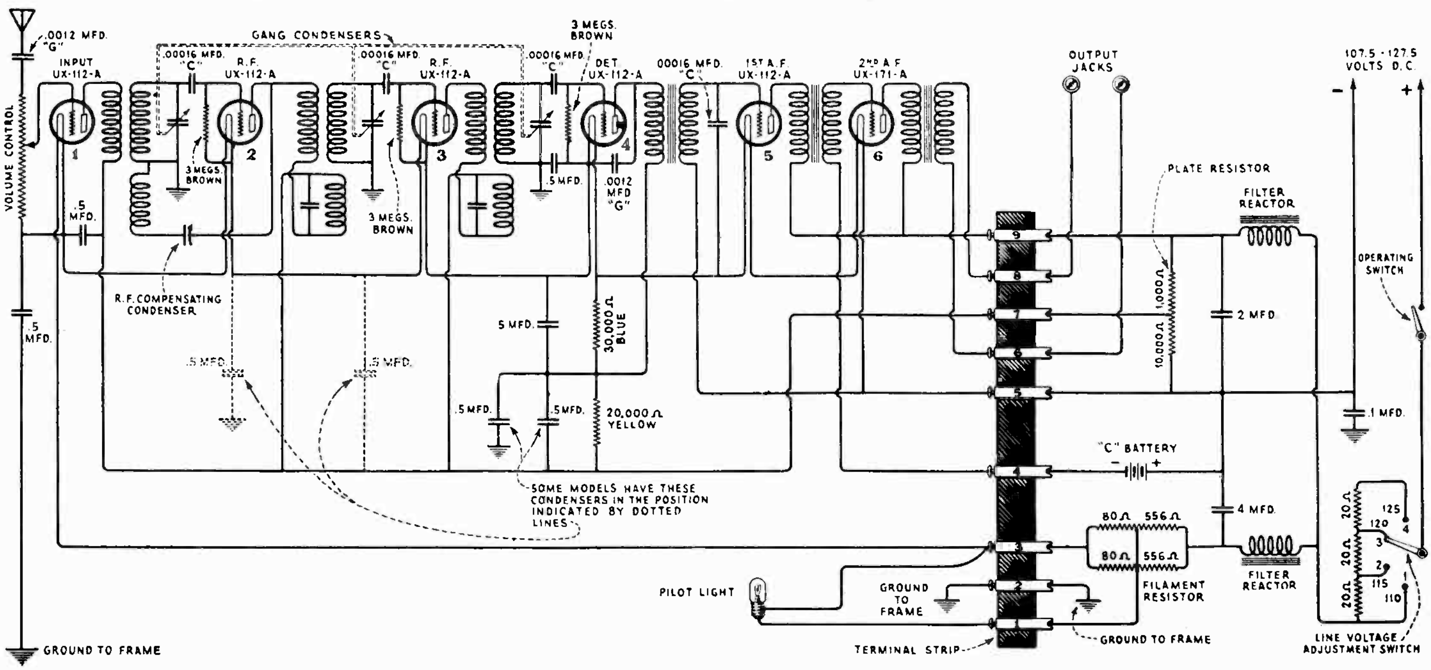


Figure 4—Schematic circuit diagram of Radiola 18 D.C.

The antenna should not cross either over or under any electric light, traction or power line and should be at right angles to these lines and other antennas. An outdoor antenna should be protected by means of an approved lightning arrester, in accordance with the requirements of the National Fire Underwriters' Code.

(3) ANTENNA (Indoor Type)

Where the installation of an outdoor antenna is not practical, satisfactory results may generally be obtained by using an indoor antenna of about 20 to 40 feet of insulated wire strung around the picture moulding or placed under a rug. 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 to secure satisfactory results. An indoor antenna is not as efficient as a properly installed outdoor antenna.

(4) RADIOTRONS

Five Radiotrons UX-112A and one Radiotron UX-171A are used. These should be placed in their correct sockets as indicated by the lettering at each socket before the current is turned "on." The current should never be turned "on" unless all Radiotrons are in place.

After placing the Radiola in operation it is well to interchange the Radiotrons in the R.F. stages for best performance. The most critical of these stages is the second (Radiotron No. 2, counting from right to left facing the front of the Radiola) and the Radiotron selected for this socket should be one giving the loudest signal on a weak station and it should not go into oscillation. If no tube is found satisfactory for this socket or the Radiola is insensitive, a readjustment of the R.F. compensating condenser may be necessary. The correct method for making this adjustment is described in Part I, Section 7.

(5) LINE SWITCH

A four-position switch is provided on the S.P.U. for adjusting the Radiola to various line voltages over a range of 107.5 to 127.5. The line voltage should be measured by an accurate D. C. voltmeter and the switch placed at the correct position for this voltage. The different positions of the switch are as follows:

POSITION	FOR LINE VOLTAGES OF
1	107.5 to 112.5
2	112.5 to 117.5
3	117.5 to 122.5
4	122.5 to 127.5

The line switch is accessible by removing the terminal strip cover. The operating switch should always be turned "off" when the terminal cover is removed.

(6) "C" BATTERY

An external "C" battery is used to bias the Radiotron UX-171A power amplifier in these Radiolas. The use of this battery allows the highest possible plate voltage on the tube which gives a maximum undistorted output. The black lead is connected to the negative side of the battery either minus or minus 22½ terminal on the battery. The green lead is connected to the positive side of the battery either + 18 or —4½. The result is that an 18-volt bias is applied to the grid of the Radiotron UX-171A. This battery should be replaced about once a year.

(7) ADJUSTMENT OF R. F. COMPENSATING CONDENSER

The R.F. compensating condenser in Radiolas 18 D.C. and 51 D.C. is provided to allow adjustment of the receiver to compensate for variations of tube characteristics and thereby allow the receiver to function in its most sensitive condition. Before readjusting this condenser, the Radiotrons should be interchanged and satisfactory operation secured by this means if possible. The interchanging of tubes should be made with the idea of getting a tube in socket No. 2 that will not go into oscillation and gives the loudest signal on a weak station. If satisfactory sensitivity cannot be secured by this means an adjustment of the compensating condenser may be made as follows:

(a) In Radiola 18 D.C. remove the rear cover from the cabinet. In Radiola 51 D.C. open the rear door.

(b) Put receiver in operation in usual manner and tune in a station preferably at the middle or upper wave lengths.

(c) Locate the position of the compensating condenser adjusting screw at the rear of the receiver assembly. (See Figure 2.)

(d) With the volume control at the position of maximum intensity, turn the screw to the right until the set goes into oscillation. Then turn the screw to the left until all oscillation and howl is eliminated with the volume control at maximum. In some cases interchanging the tubes in the R. F. stages will facilitate this adjustment.

(e) Tune in stations with maximum volume and note if the receiver goes into oscillation at any wavelength. If it does, turn the screw still further to the left.

(f) When the receiver does not oscillate at any wavelength the correct adjustment has been found for best sensitivity and tone quality.

(8) AUDIO GROWL OR HOWL

Either a low or high frequency howl originating in the receiver assembly may be caused by:

(a) Open by-pass condensers. An open by-pass condenser may cause an audio howl.

(b) Vibrating elements in the receiver Radiotrons. A gradually developed howl is probably due to the loudspeaker causing the receiver Radiotron elements to vibrate. To overcome this condition interchange the Radiotrons in the receiver or in the case of Radiola 18 D.C. change the relative angle between the set and speaker. In Radiola 51 D.C. examine the mounting of the loudspeaker and see that the speaker is entirely suspended from the baffle board by means of its felt ring.

(c) Defective resistance in S. P. U. A short or open in any section of the plate resistor may cause inoperation or howl.

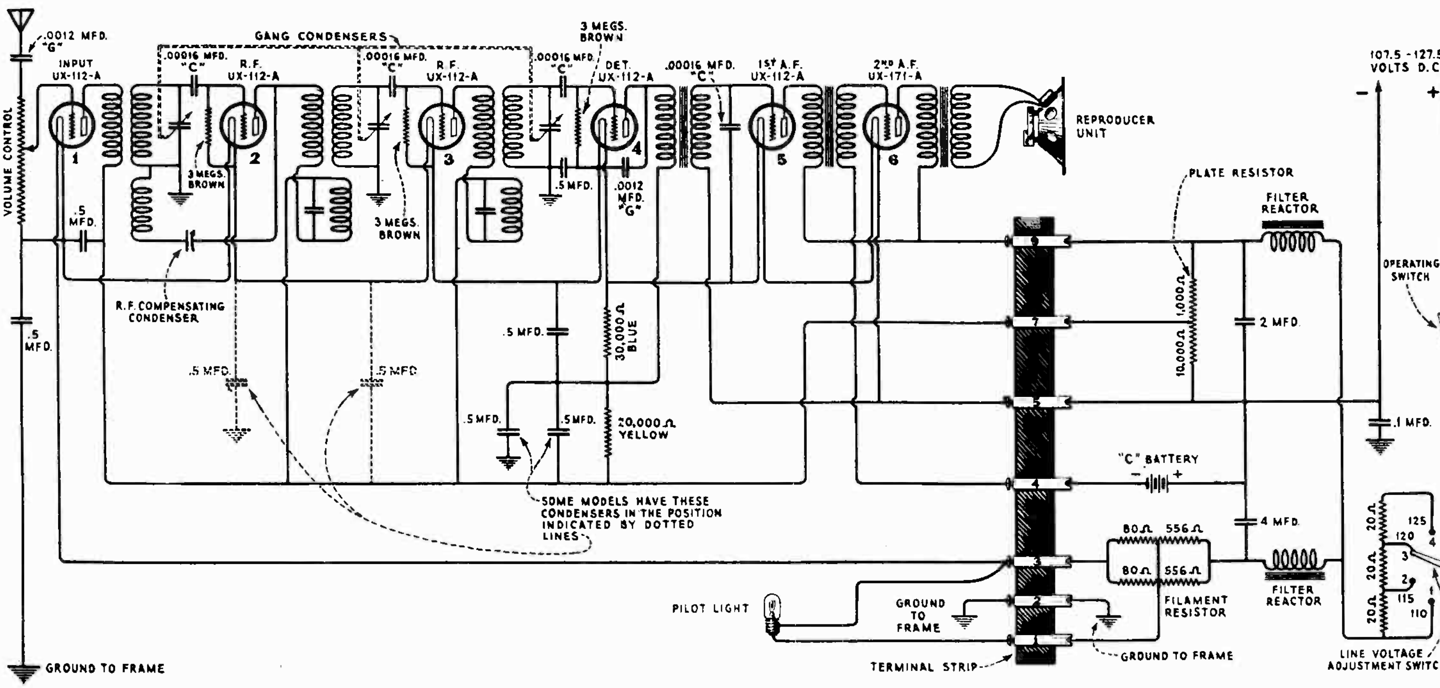


Figure 5—Schematic circuit diagram of Radiola 51 D.C.

(d) In some receivers, especially those connected to lines having the positive side grounded, an audio howl may be experienced even though everything is O.K. The remedy in this case is to shift the two condensers to the position indicated in Figure 4 so that a ½ mfd. condenser will be shunted across the 20,000 ohm resistor in the detector plate supply. Some receivers have this connection already made and it is very unlikely this audio howl trouble will be experienced.

(9) UNCONTROLLED OSCILLATION

Uncontrolled oscillations in Radiolas 18 D.C. and 51 D.C. may be caused by:

(a) Incorrect adjustment of the R.F. compensating condenser. Adjust compensating condenser as described in Part II, Section 7.

(b) An open of the several grounding leads in the receiver. Check all ground connections.

(c) Defective R.F. coil system. A short in the condensers connected across the concentrated primary coils may cause the receiver to go into oscillation.

(d) In some cases, even though everything is O.K., oscillation will occur. Should this condition exist one of the following remedies will prove effective.

(1) Bend the first R.F. coil in the direction of its free end closer to the end of the chassis. (Away from the other R.F. coils).
(2) Remove the ground lead which comes from the pigtail of the gang variable condenser from its normal position at the terminal of one of the R.F. coils to a point on the uninsulated ground bus bar approximately half way between the second and third R.F. coils.
(3) Addition of a .5 mfd. condenser from the positive terminal of the bias battery to an external ground connection such as a water pipe or steam radiator. This will also help reduce undesirable back ground noises that are present in some locations. This is most effective on installations that have the positive side of the 110-volt D.C. line grounded.

PART II—ELECTRICAL TESTS

(1) VOLTAGE READINGS

When checking Radiola 18 D.C. or 51 D.C. for possible defects it is good practice to check the voltage of the various sources of current. To do this a service man should have a good D.C. voltmeter, preferably of 600 ohms per volt or higher in resistance. The following voltages at the S.P.U. terminal strip are correct with the voltage adjustment switch set at the correct position for the particular line to which the Radiola is connected and all tubes in operating condition and in their correct positions. The terminal numbers are indicated in Figures 8 and 9.

TERMINALS	VOLTAGE
1 to 3	5 volts
3 to 5	30 volts
4 to 5	18 volts
5 to 7	75 volts
5 to 9	100 volts
7 to 9	25 volts

If it is desired to check the voltages at the individual sockets the following readings are correct. The readings are taken with a Weston Model 537 Type 2 test set or others giving similar readings.

Tube No.	Filament to Grid Volts	Filament to Plate Volts	Plate Current Milliamperes	Filament Voltage
1	5	45	4.5	4.7
2	4	50	5.0	4.8
3	4	55	5.5	5.0
4	4	21	1.0	5.1
5	10	90	3.5	5.2
6	22.5	90	10.0	5.3

(2) CONTINUITY TESTS

The following tabulated continuity tests cover the receiver assembly and S.P.U. of both Radiolas 18 D.C. and 51 D.C. Before making tests disconnect the antenna lead, the D.C. supply cord at the socket outlet, remove the terminal strip shield and all connections to the terminal strip. The terminal and lug numbers, socket contacts and socket numbers referred to are shown in the continuity diagrams, Figure 6, 7, 8, and 9.

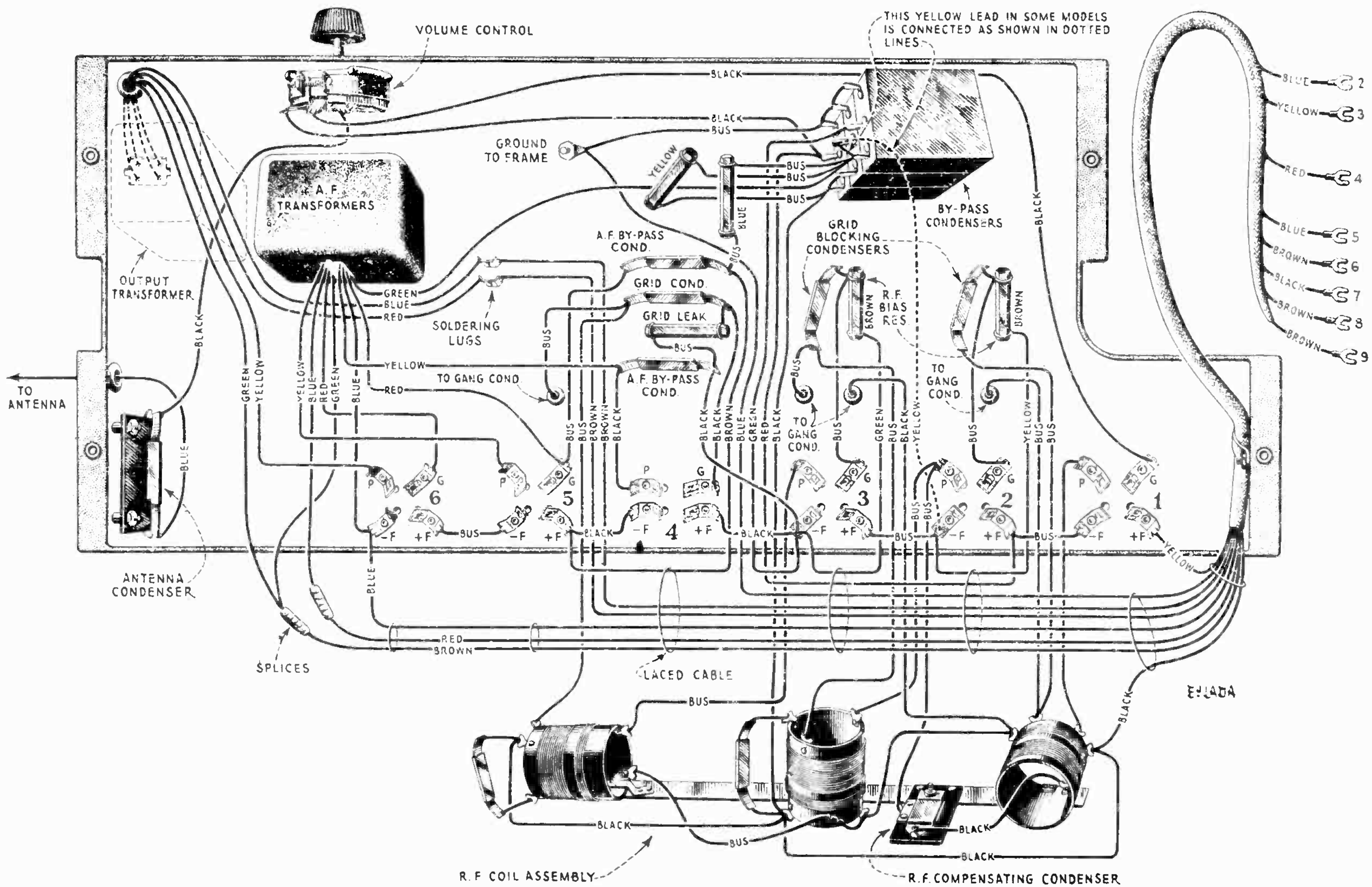


Figure 6—Wiring diagram of Radiola 18 D.C. receiver assembly.

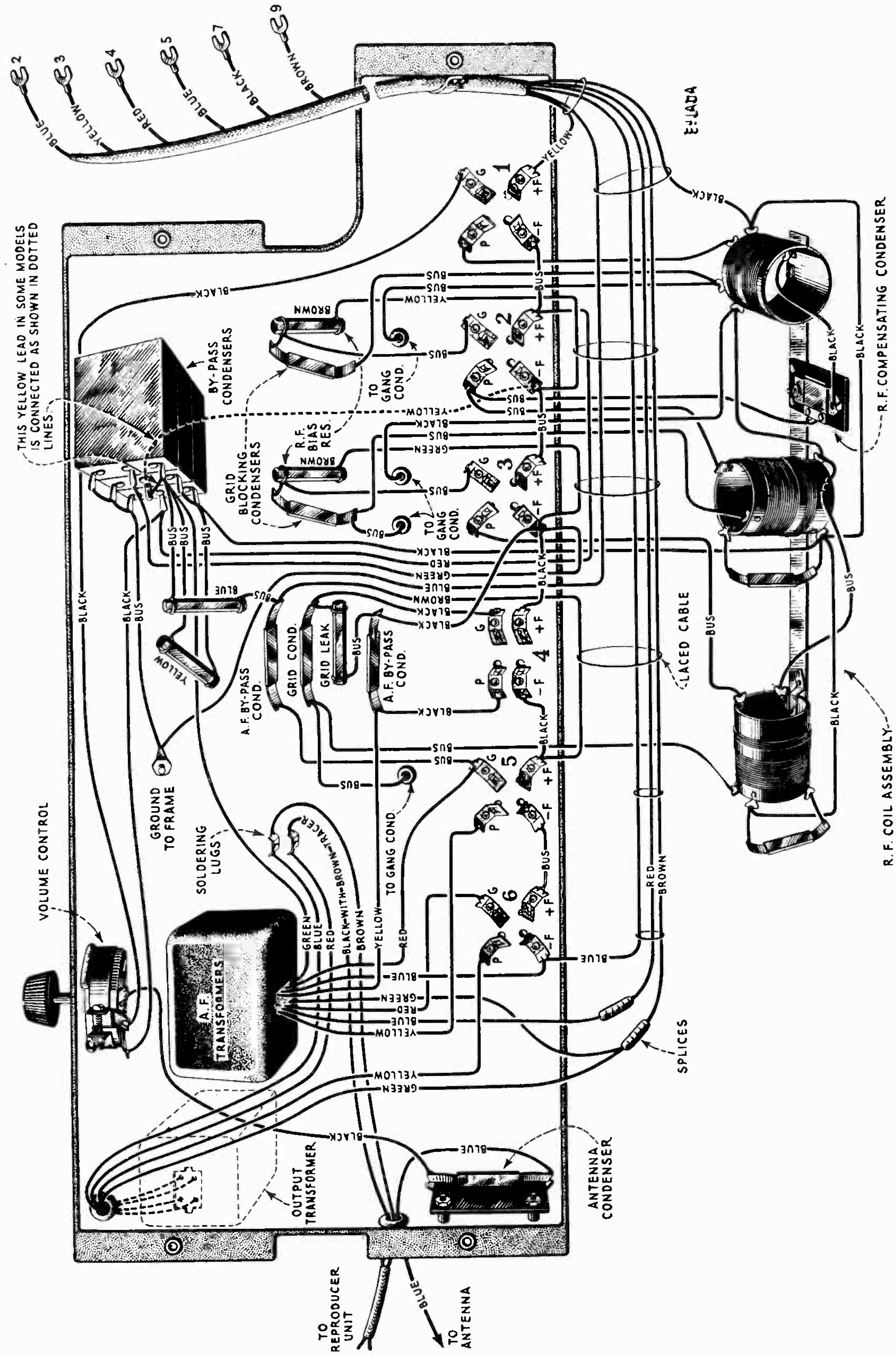


Figure 7—Wiring diagram of Radiola 51 D.C. receiver assembly.

RADIOLA 18 D.C. and 51 D.C. RECEIVER ASSEMBLY CONTINUITY TESTS

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by*
Grid	Antenna to G1	Open	Shorted antenna condenser
	—F1 to frame	Open	Shorted grounding condenser or wiring
	Stator condenser No. 1 to frame	Closed	Shorted secondary 1st R.F. transformer
	G2 to +F2	Closed (Very Weak)	Open grid bias resistance or if loud, shorted grid resistance
	Stator condenser No. 2 to frame	Closed	Open secondary of 2d R.F. transformer
	G3 to —F3	Closed (Very Weak)	Open grid resistance or if loud, shorted grid bias resistance
	Stator condenser No. 3 to frame	Closed	Open secondary of 3d R.F. transformer
	G4 to one F4	Closed (Very Weak)	Open grid leak or if loud, shorted grid leak
	G5 to Lug No. 5	Closed	Open secondary of 1st A.F. transformer
	G6 to Lug No. 4	Closed	Open secondary of 2d A.F. transformer
Plate	P1 to Lug No. 7	Closed	Open primary of 1st R.F. transformer
	P2 to Lug No. 7	Closed	Open primary or concentrated coil of 2d R.F. transformer
	P3 to Lug No. 7	Closed	Open primary or concentrated coil of 3d R.F. transformer
	P4 to Lug No. 7	Closed	Open primary of 1st A.F. transformer or detector plate resistor
	P5 to Lug No. 9	Closed	Open primary of second A.F. transformer
	P6 to Lug No. 9	Closed	Open primary of output transformer
Misc.	Lug No. 2 to frame	Closed	Open connection
	Lug No. 3 to +F1	Closed	Open connection
	Lug No. 6 to Lug No. 8 (R 18 D.C. only)	Closed	Open secondary of output transformer
	Disconnect cable on Loudspeaker and test across leads (R 51 D.C. only)	Closed	Open Secondary of output transformer
	—F1 to P1	Open	Shorted .5 mfd. condenser
	+F4 to frame	Open	Shorted .5 mfd. condenser
	Some Models { —F2 to frame	Open	Shorted .5 mfd. condenser
	Some Models { —F2 to Lug No. 7	Open	Shorted .5 mfd. condenser
	Some Models { —F3 to P4	Open	Shorted .5 mfd. condenser
	Some Models { P4 to frame	Open	Shorted .5 mfd. condenser
	+F4 to frame	Open	Shorted .5 mfd. condenser

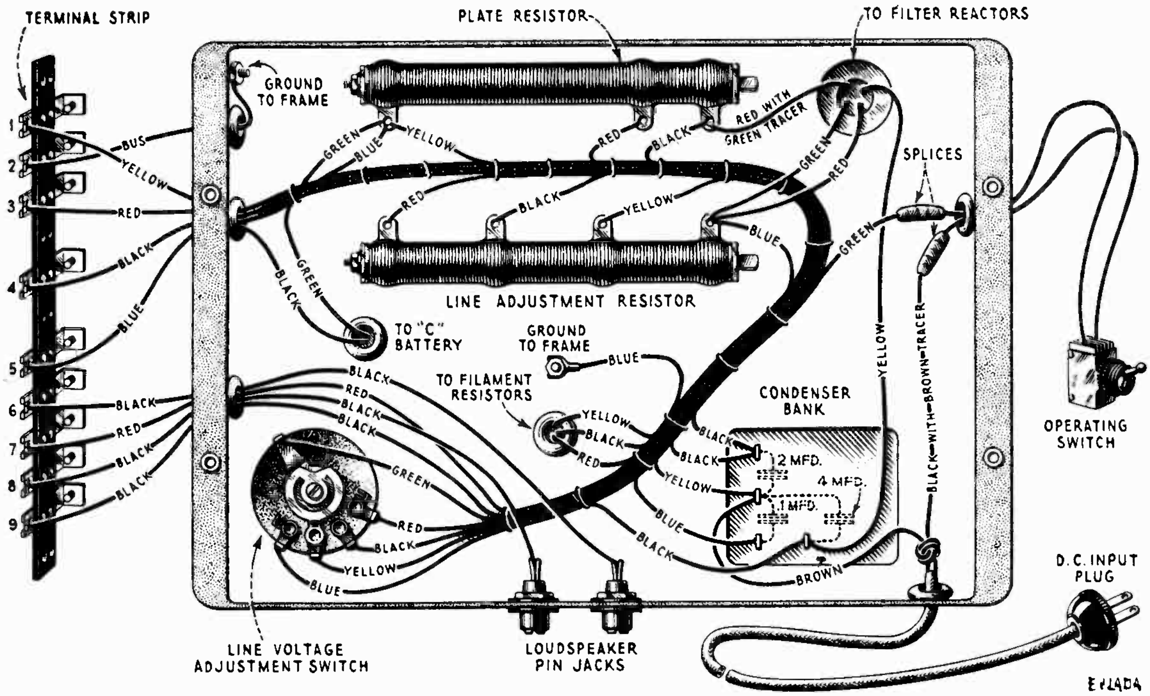


Figure 8—Wiring diagram of Radiola 18 D.C. socket power unit.

RADIOLA 18 D.C.—S. P. U. CONTINUITY TESTS

Remove terminal cover and lugs from all terminals. See Figure 8 for reference numbers. Close switch.

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across input supply plug (switch closed)	Closed	Open filter reactor or plate voltage dividing resistor or line adjustment resistor
Terminal No. 3 to one input plug connection	Closed	Open line adjusting resistor, filament filter reactor, or filament voltage resistance
Terminal No. 6 to one Loudspeaker jack	Closed	Open connection
Terminal No. 8 to other Loudspeaker jack	Closed	Open connection

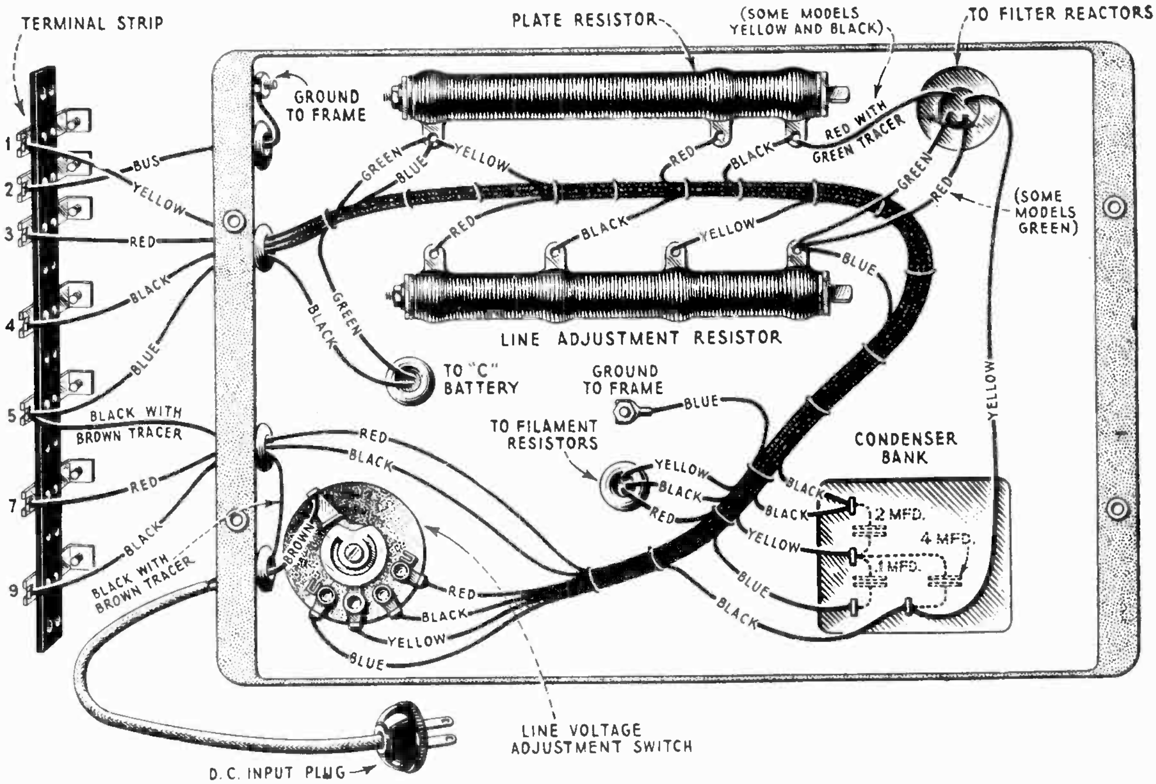


Figure 9—Wiring diagram of Radiola 51 D.C. socket power unit.

RADIOLA 51 D.C.—S. P. U. CONTINUITY TESTS

Remove terminal cover and lugs from all terminals. See Figure 9 for reference numbers. Close switch.

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
Across input supply plug (switch closed)	Closed	Open filter reactor or plate voltage dividing resistor or line adjustment resistor
Terminal No. 3 to one input plug connection	Closed	Open line adjusting resistor, filament filter reactor, or filament voltage resistance

SERVICE DATA CHART

Before using the following Service Data Chart, when experiencing no signals, weak signals, poor quality, noisy or intermittent reception, howling and fading, first look for defective tubes, or a poor antenna system. If imperfect operation is not due to these causes, the "Service Data Chart" should be consulted for further detailed causes. Reference to Part No. and Section No. in the "Service Notes" is also noted for further details.

Indication	*Cause*	*Remedy*
No signals	Defective operating switch Loose volume control arm Defective power cable Defective R.F. transformer Defective A.F. transformer Defective By-pass condenser Defective socket power unit Socket plug in reversed position	Repair or replace switch Tighten volume control arm Replace power cable Replace R.F. transformer assembly Replace A.F. transformer assembly Replace By-pass condenser Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 2 Reverse socket plug
Weak signals	Compensating condenser out of adjustment Defective power cable Defective R.F. transformer Defective A.F. transformer Defective By-pass condenser Defective main tuning condensers Low voltages from socket power unit Defective socket power unit	Adjust compensating condenser correctly, P. I, S. 7 Repair or replace cable Replace R.F. transformer assembly Replace A.F. transformer assembly Replace defective By-pass condenser Replace or align defective tuning condensers Check socket power unit voltages with high resistance D.C. voltmeter, P. II, S. 1 Check socket power unit by means of continuity test and make any repairs or replacements necessary, P. II, S. 2
Poor Quality	Defective A.F. transformer Defective By-pass condenser Defective output transformer	Replace A.F. transformer assembly Replace defective By-pass condenser Replace output transformer
Howling	Compensating condenser out of adjustment Defect in audio system Open grid circuit in any stage Receiver in oscillation	Adjust compensating condenser correctly, P. I, S. 7 Check and repair any defect Check circuit and repair defect Check and repair, P. I, S. 9
Radiotrons fail to light	Operating switch not "ON" Defective operating switch Defective input cord No. D.C. line voltage Defective resistor in SPU	Turn operating switch "On" Replace operating switch Repair or replace input cord Turn D.C. line voltage "On" Replace defective resistor
Play in Station Selector	Loose knob Slack cable	Tighten or replace knob Take up on cable adjusting screw

RCA
Radiola 20

SERVICE NOTES

Third Edition—5M—June, 1928

RCA Radiola 20

Radio Corporation of America

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

326 Broadway
New York City

2001 West Pershing Road
Chicago, Ill.

274 Brannan St.
San Francisco, Cal.

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.

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.

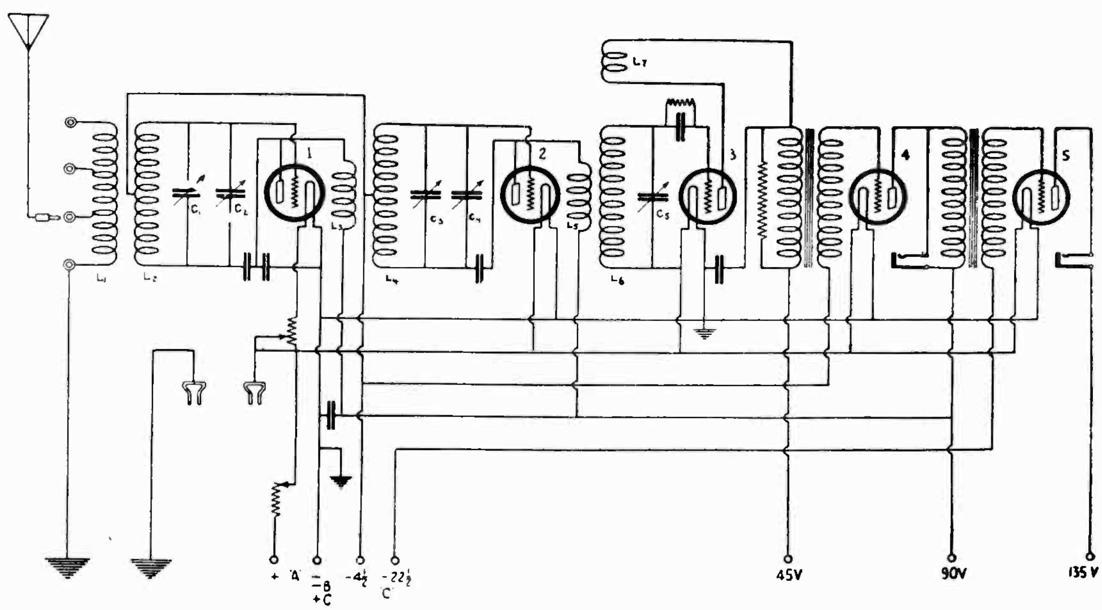


Figure 1—Schematic circuit of RCA Radiola 20

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.

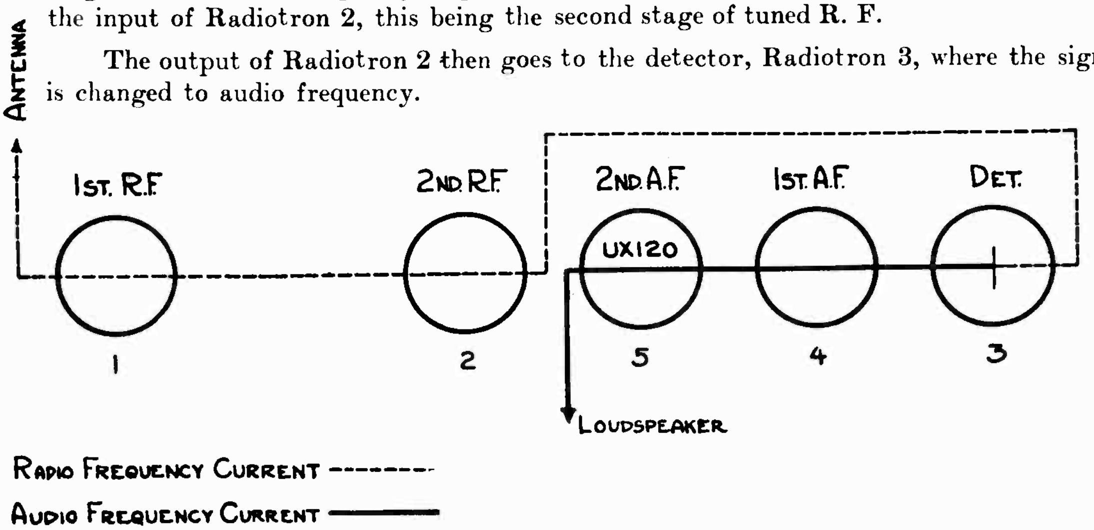


Figure 2—Radiotron sequence in RCA Radiola 20

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.

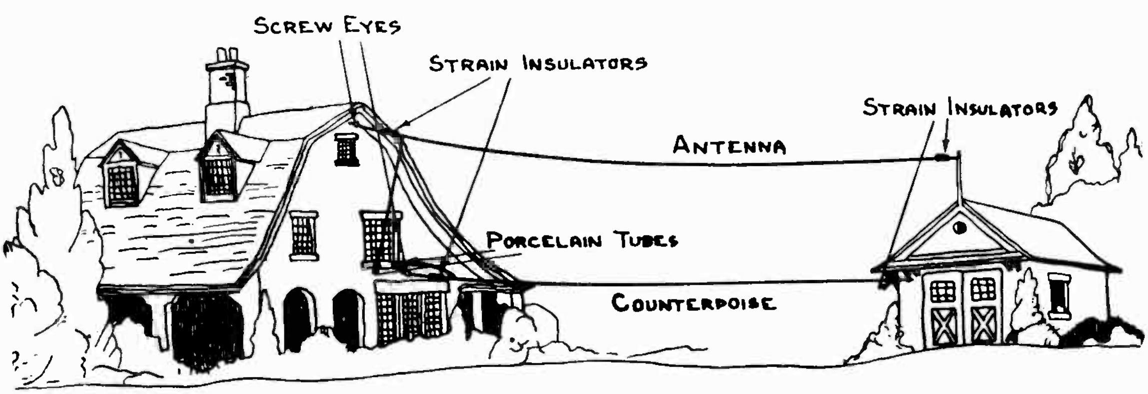


Figure 3—Typical Outdoor Antenna Installation
(Showing use of counterpoise where good ground is not available)

(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	
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").

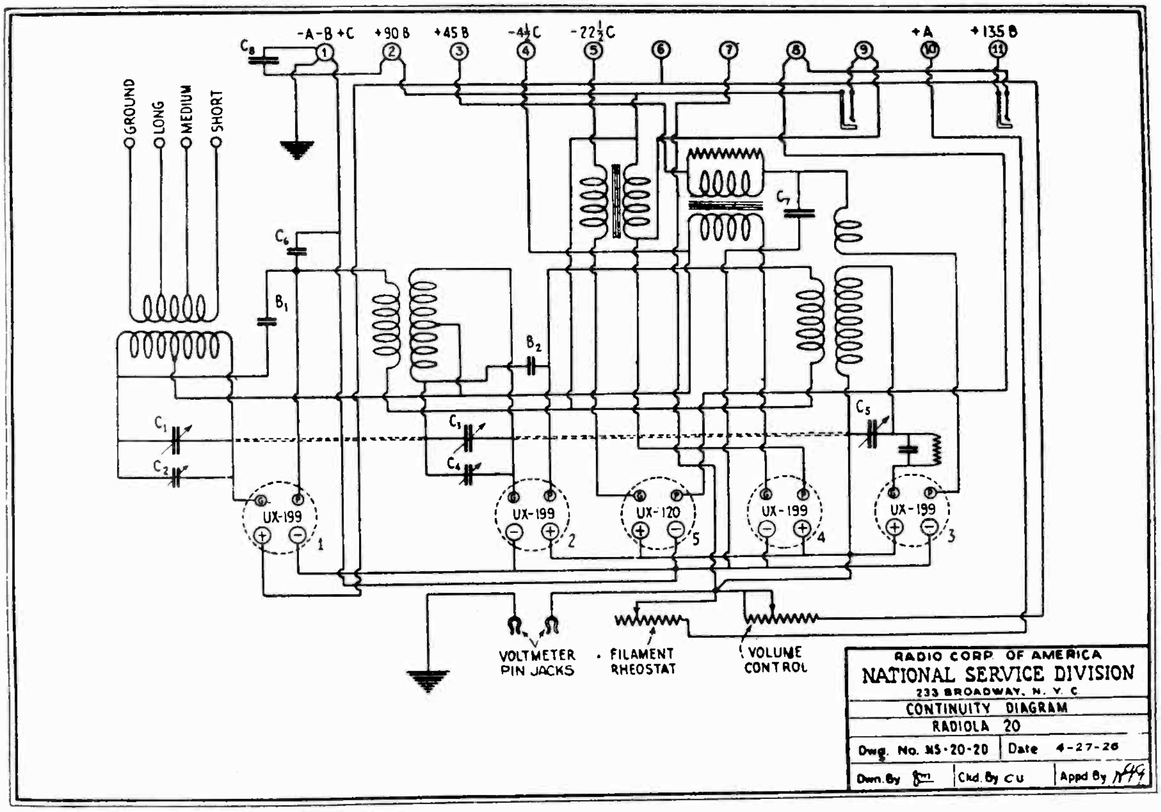


Figure 4—Continuity wiring diagram

(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

Terminals	*Correct Effect*	*Incorrect Effect Caused by*
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.

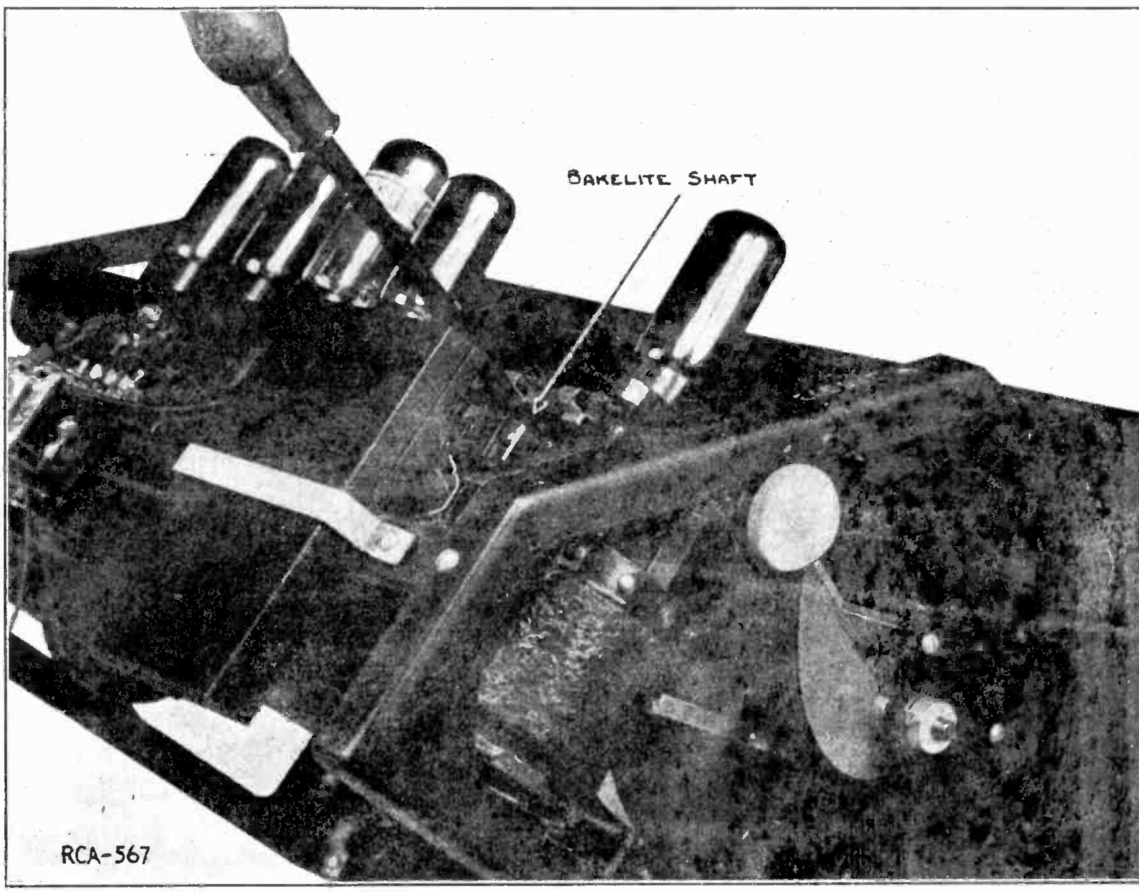


Figure 5

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.

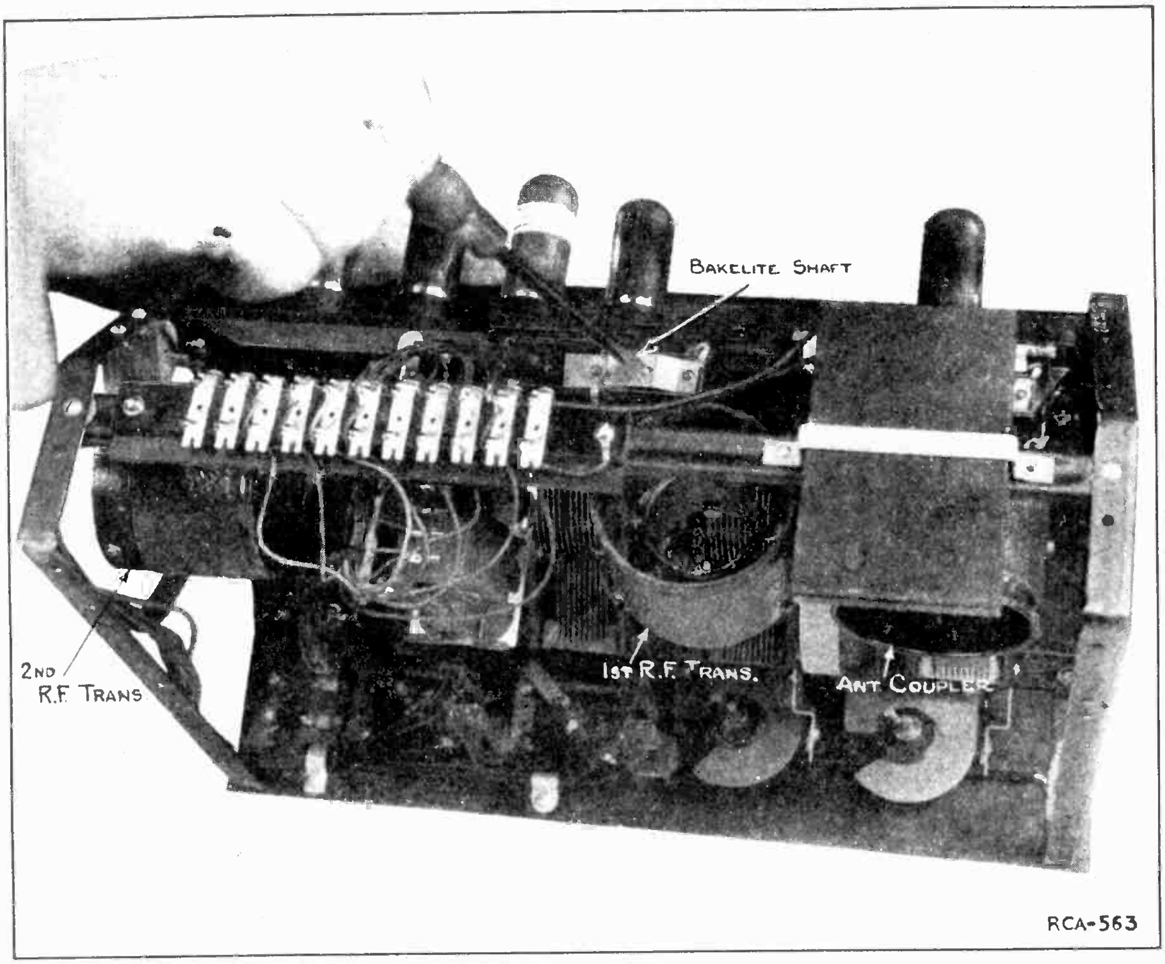


Figure 6

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.

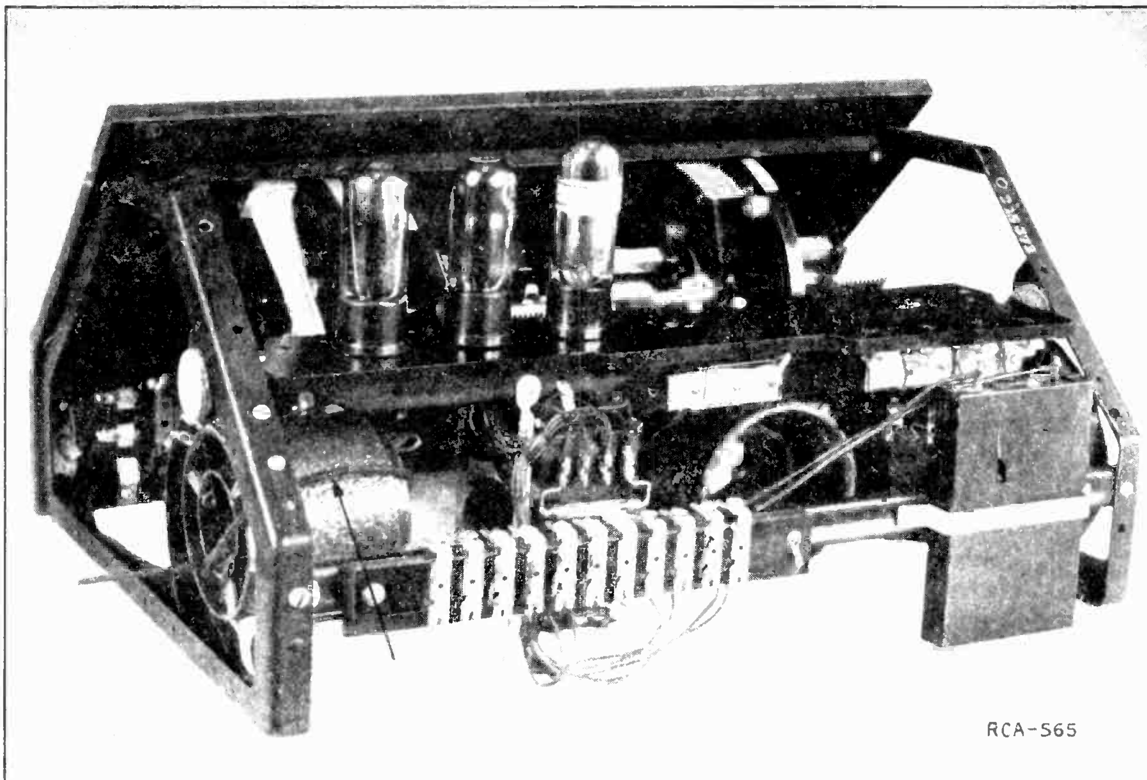


Figure 7
Location of "pick-up" wire with two Radiotrons removed for first step in lining up main tuning condensers

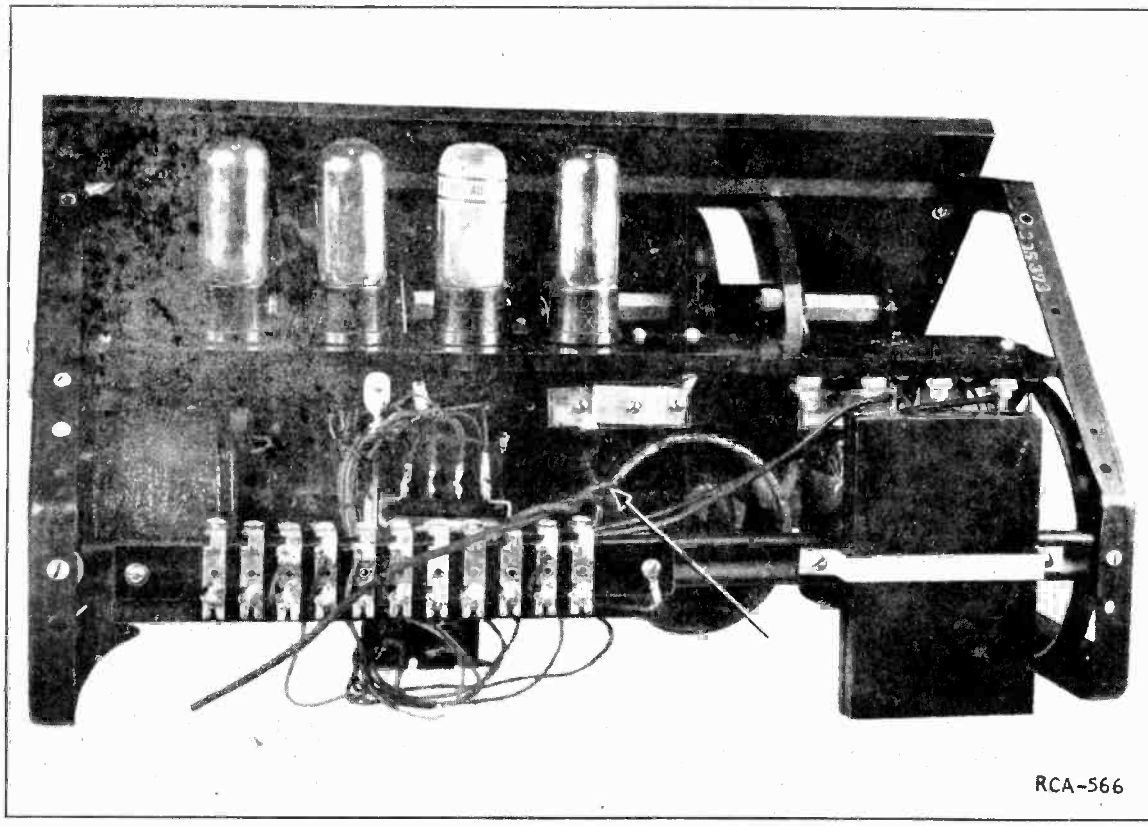


Figure 8

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

(21) 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.

(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.

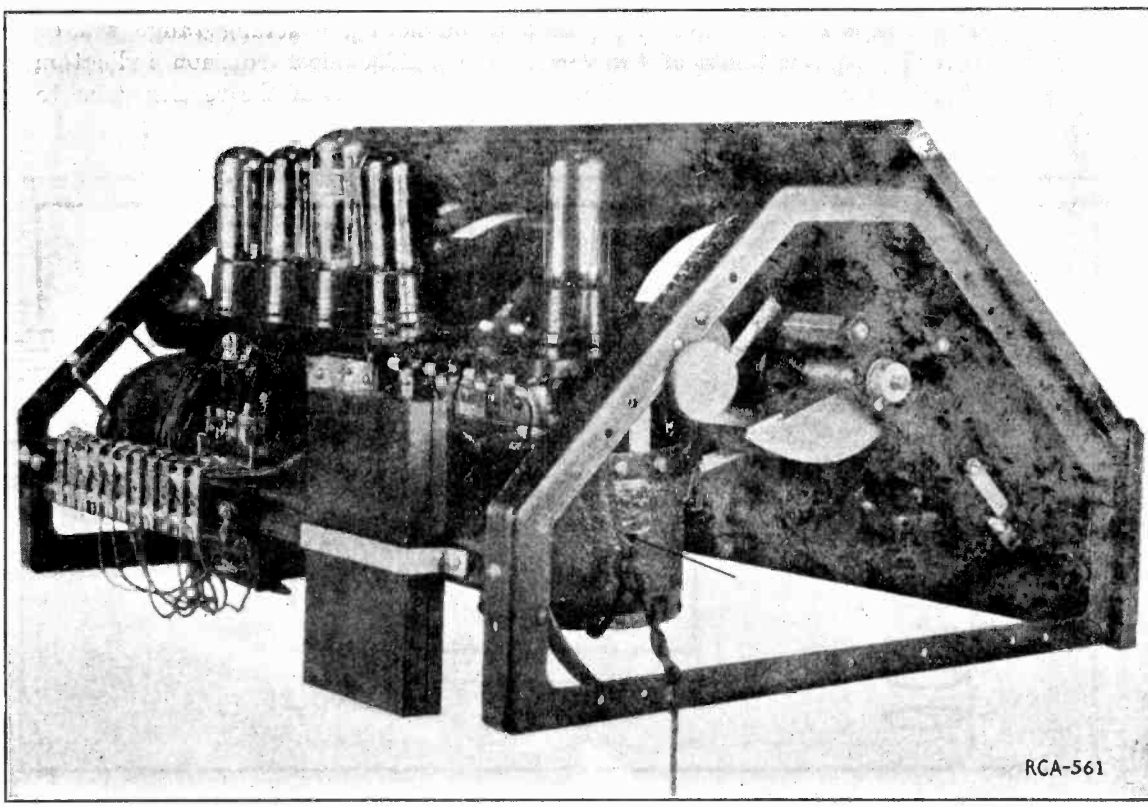


Figure 9

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

(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 slipped 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.

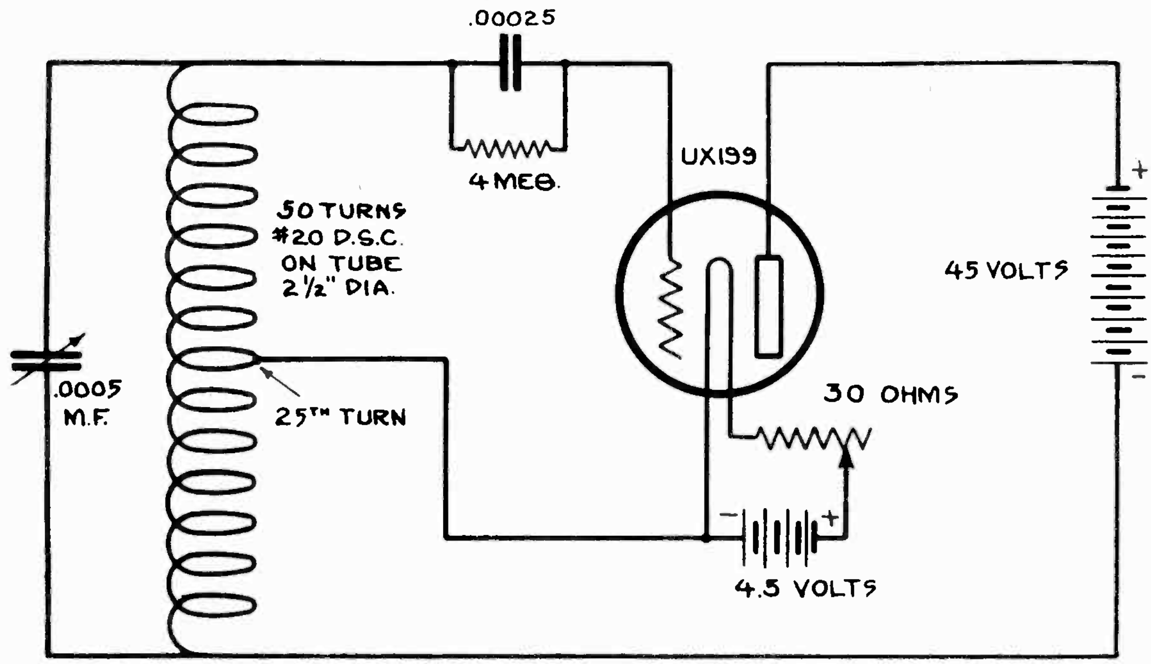


Figure 10

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 2½-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 UX-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.

RCA

Printed in U.S.A., 1928

RADIOLA 25

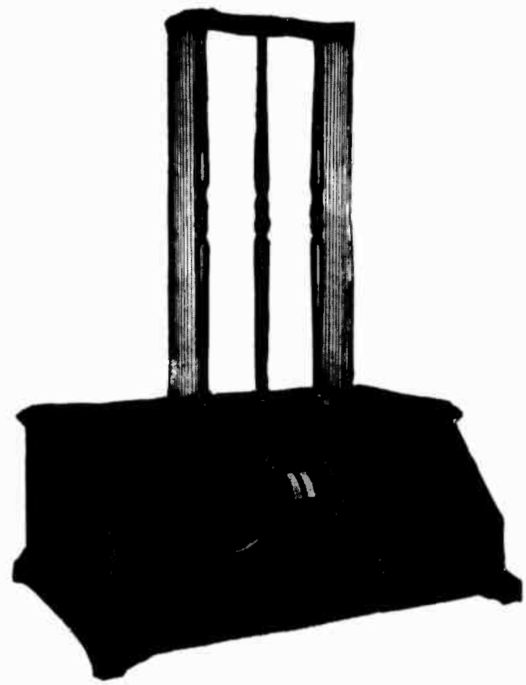
(Reg. U. S. Pat. Office)

(BATTERY OPERATED)

SERVICE NOTES

NS—25-2

Second Edition—November, 1926



RADIO CORPORATION OF AMERICA

Prepared by

NATIONAL SERVICE DIVISION

233 Broadway, New York City

DISTRICT SERVICE STATIONS

326 Broadway
New York City

10 South La Salle Street
Chicago, Ill.

3308 Fourteenth Street, N. W.
Washington, D. C.

28 Geary Street
San Francisco, Cal.

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 25 SERVICE NOTES

(Battery Operated)

Prepared by

RCA NATIONAL SERVICE DIVISION

NS—25-2

INTRODUCTION

Radiola 25 is a radio broadcast receiver of the super-heterodyne type employing the standard six-tube circuit. As used in Radiola 25 this proven circuit provides ease of tuning, selectivity, sensitivity and ample loudspeaker volume. Five Radiotrons UX-199 and one Radiotron UX-120 are used. Provision is made for all batteries to be placed in the compartment with the tuning apparatus, thus making a complete self-contained receiver.

Seals: The lead seals placed on the catacomb of Radiola 25 are for the protection of the dealer. 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 regular channels to the nearest RCA Service Station. 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.

(1) RADIOTRON SEQUENCE

Facing the panel and counting from right to left the input is brought into the first Radiotron, which is a stage of tuned radio frequency amplification.

The output of the first Radiotron then goes to the second tube from the right, which acts as a first detector and oscillator combined. At this stage the beat or intermediate signal frequency is formed which now is reflexed to Radiotron No. 1. This Radiotron, while acting as a stage of tuned R.F., also is the 1st intermediate frequency stage.

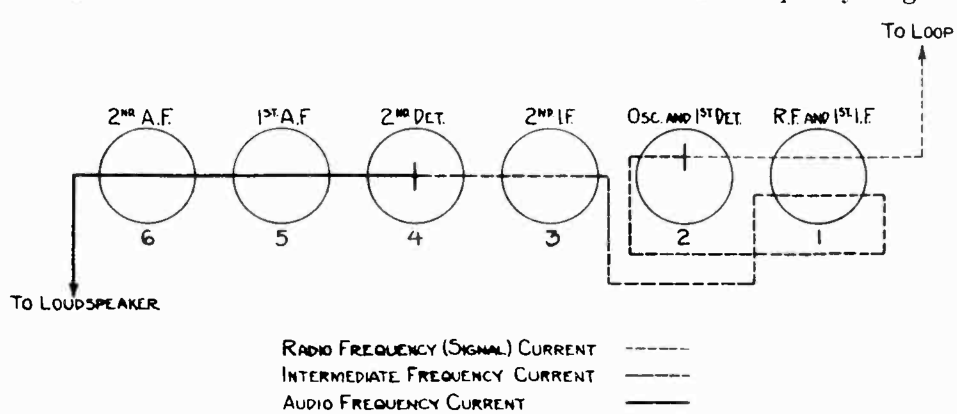


Figure 1—Radiotron Sequence

From Radiotron No. 1 the intermediate frequency signal now goes to Radiotron No. 3, which is the 2nd stage of intermediate amplification.

The signal is now fed into the second detector, or Radiotron No. 4, where it changes to audio frequency current. Radiotron No. 5 and No. 6 are the first and second stages of audio frequency amplification, respectively, and the signal is made available at either stage by connecting the speaker to the proper jack. Fig. 1 illustrates the Radiotron sequence and the path of the different currents through them.

(2) RADIOTRON SOCKETS

In placing Radiotrons in the gang 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 and two small holes respectively of the sockets. 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. These sockets are so designed that the prongs of the Radiotrons will fit in snugly without force being applied. If sufficient force is applied it might be possible to insert the prongs in the wrong holes, resulting in a filament burnout.

(3) LOOP SOCKET

Great care should be taken to see that the loop is firmly seated in its socket as under certain conditions the "A" and "C" batteries may become short circuited by the contact spring of the loop *plug* shorting the contact spring of the *socket* to the metal collar of the socket if the loop plug is not properly seated.

(4) LOOP NOT VERTICAL WHEN SEATED

The position of the loop may not be exactly vertical although properly 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, hold 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 center spindle. When a vertical position is thus attained, remove loop from the socket, taking great care not to move the socket assembly from its new position. The four screws may now be tightened and the loop will remain vertical providing the new position of the socket assembly was not altered when removing the loop.

(5) LOOP OPEN

When the left hand drum has no apparent effect on tuning, look for an open loop. In some instances the loop leads perhaps are not properly soldered to the prongs of the loop terminal, or have jarred off in shipment. Make usual battery test across the two outside prongs for continuity of loop. It must be recognized, however, that there is a possibility of the loop circuit being open below the lid (broken pig tail of loop tuning condenser, etc.), but the place mentioned is the most likely source of trouble.

(6) LOOSE RHEOSTAT CONTACTS

To get at this source of trouble, with the loop taken out, 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. Test "A" batteries to see that they are up to their proper rating. 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.

(7) OUTER EDGE OF DRUM 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. Replacing with a new wheel or a slight filing of the escutcheon plate will correct this trouble.

(2) *Condenser improperly aligned.* To correct this condition remove front panel 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 aluminum frame thus allowing a degree of play sufficient for adjustment purposes.

(8) SCRAPING DRUMS

Sometimes, due to warping of the control wheels, the metal drums of the Station Selectors will touch. This will cause a grating noise in the loudspeaker whenever the drums are adjusted. When this occurs the hex. nuts holding the drums to the condenser shaft should be loosened and the drums adjusted for clearance. The nuts should then be tightened. If this will not remedy the trouble, the points touching should be filed with a small file until ample clearance is provided.

(9) DRUMS FAIL TO HOLD POSITION

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

(a) Remove set from cabinet and readjust tension screw on the inside of the drum. Some models have only one counterweight, relying on a friction shoe to hold the other drum from slipping. Other models, however, are equipped with a counterweight on both condensers, the friction shoe only being used to hold the opposite condenser in relative position when one is moved. The tension screw referred to controls the pressure of this shoe against the opposite drum. If one drum turns too hard when the other is held, the tension screw should be slightly loosened.

(b) When the frequency range is 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 (maximum wave length) the rotor plates should be entirely inside the stator ones. Provision is made on some models to key the drum to the condenser plates, thus eliminating the possibility of incorrect frequency calibration due to slipping of the drum control.

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

The screws holding this bus bar must always be kept tight, otherwise intermittent reception or complete failure to operate may result. This bus bar is a vital part of the filament circuit, connecting the filaments in parallel for dry battery operation. Occasionally the screws holding it in place will work loose in shipment.

(11) OSCILLATION

Should Radiola 25 oscillate, causing squeals and howls, it is usually an indication of excessive filament voltage or a defective catacomb. The battery voltage should never exceed 3.3. This can best be checked by connecting a voltmeter at the pin jacks on the panel. The point where the filament voltage is 3.3 should be noted on the "Battery Setting" dial and this point used as a maximum point for operation.

If it is determined that the catacomb is defective it should be replaced. However, before it is changed, all other circuits should be checked to ascertain their operating condition.

(12) WEAK SIGNALS DUE TO HIGHLY SHIELDED LOCATION

There will be found an occasional location so badly shielded that an external pickup will be necessary. Installations in steel buildings are at times troubled with this shielding effect and make necessary the erection of a short antenna, not over 25 feet or so in length outside the building. Insulated wire should be used and may be conveniently hung out of a window, although it would 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 25 by winding a few turns of the lead-in (which should be a continuation of the antenna itself) to a diameter of about eight or nine inches and placing this coil standing up behind the set. It may conveniently be placed against the back of the set.

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 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 25 and transmitted to the set in the usual manner. The loop, of course, loses its directional effect, but the loop tuning condenser calibration remains unchanged.

(13) TEST FOR PROPER BATTERY CONNECTIONS

Disconnect battery connection strip from catacomb terminal board by loosening the screws holding it in place. Battery readings may then be taken directly across the various terminals by a high resistance type voltmeter. If the batteries are properly connected and in good condition the following voltmeter indications illustrated should be obtained with the correct polarity:

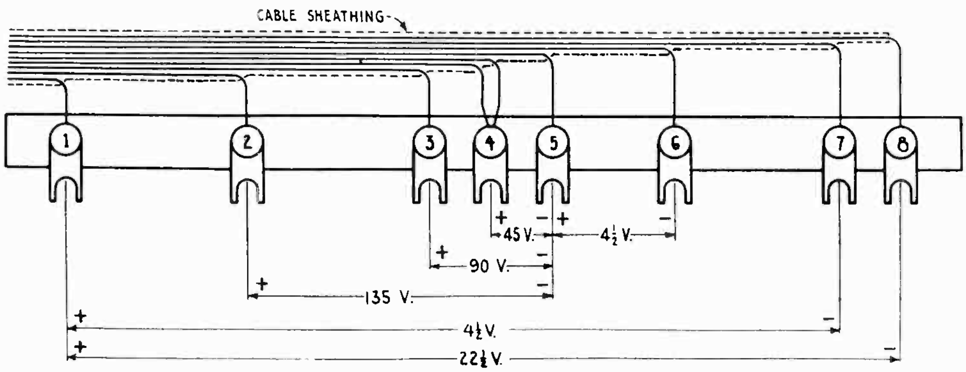


Figure 2—Radiola 25 Battery Terminal Strip

(14) INSTALLATION OF BATTERIES

Care must be taken to install the two 22½-volt batteries and 4½-volt battery at the left of the cabinet so that their terminals face *up* or *forward* towards the panel. There is a possibility of the metal frame shorting the batteries if they are faced in toward the frame.

(15) 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 jack 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 loose 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, loudspeakers 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 Radio 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.

(16) CATACOMB AND PANEL CONTINUITY TESTS

In making the tests for continuity of both 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 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 (See Figure 3) or a voltmeter with voltage sufficient to give full scale deflection when connected directly across battery terminals should be used in making these tests. This arrangement will be found to be very sensitive in checking voltage drop in various circuits.

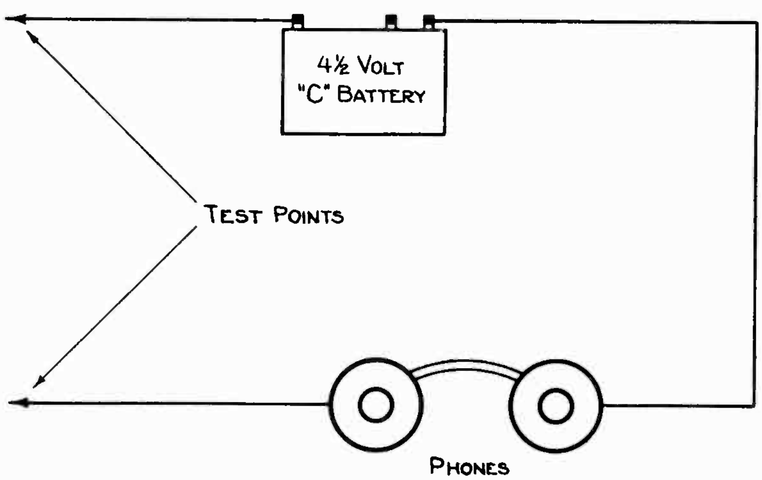


Figure 3—Click test circuit

The contacts of the test equipment should be placed across the terminals indicated under the column marked "Terminal" (see page 9) 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.

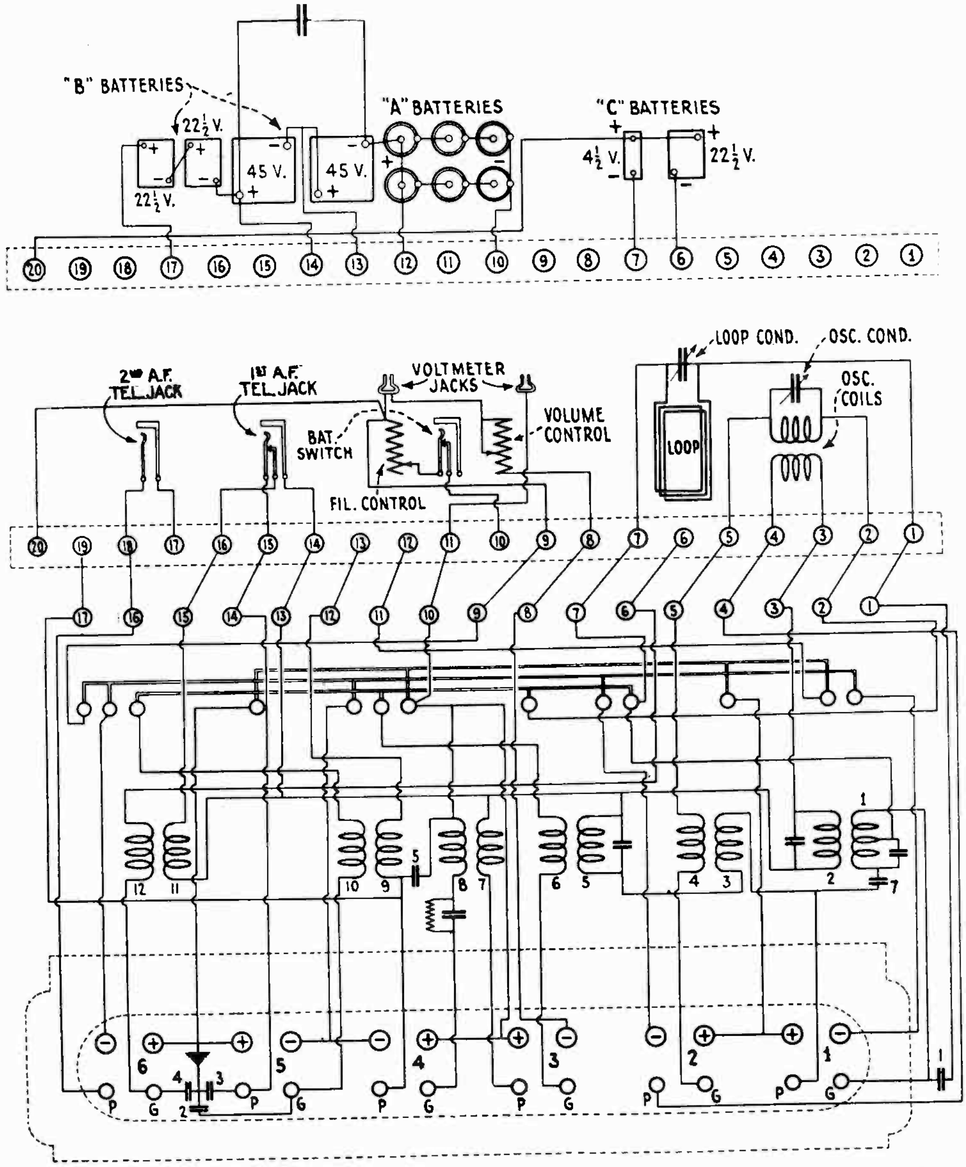
The numbers of the terminals referred to in these tests apply to the terminals on the connecting strip at the rear of the catacomb frame assembly. The designation "P" and "G" refer to plate and grid contacts of the socket indicated by the number following. For example G2 would indicate the grid contact of the second socket; P6 would indicate the plate contact of the sixth tube socket. The coil numbers referred to in the right hand column will be found in Figure 4.

Catacomb Test (Coils and Connections)

Circuits	*Terminals*	*Correct Effect*	*Defect*
Grid	G1 to 7	Closed	Open ½ coil No. 1
	G2 to 5	Closed	Open coil No. 4
	G3 to 7	Closed	Open coil No. 6
	G4 to 12	Closed through grid leak	Open grid leak or coil No. 8
	G5 to 7	Closed	Open coil No. 10
	G6 to 6	Closed	Open coil No. 12
Plate	P1 to 14	Closed	Open coil No. 3 or No. 5
	P2 to 4	Closed	Open connections
	P3 to 14	Closed	Open coil No. 7
	P4 to 13	Closed	Open coil No. 9
	P5 to 15	Closed	Open connections
	P6 to 18	Closed	Open coil No. 11
	14 to 3	Closed	Open coil No. 2
—Filament	—F1 to 9	Closed	Open connections
	—F2 to 9	Closed	Open connections
	—F4 to 9	Closed	Open connections
	—F5 to 9	Closed	Open connections
	—F6 to 9	Closed	Open connections
+Filament	+F1 to 12	Closed	Open connections
	+F2 to 12	Closed	Open connections
	+F3 to 12	Closed	Open connections
	+F4 to 12	Closed	Open connections
	+F5 to 12	Closed	Open connections
	+F6 to 12	Closed	Open connections

Catacomb Test (Condensers)

Circuit	*Terminals*	*Correct Effect*	*Defect*
Grid	G1 to 1	Open	Shorted condenser No. 1
	G1 to P1	Open	Shorted condenser No. 7
	G4 to 19	Open	Shorted condenser No. 5
	G5 to P5	Open	Shorted condensers Nos. 2 and 3
	G5 to G6	Open	Shorted condensers Nos. 2 and 4



VOLTAGE READINGS TAKEN AT CATACOMB TERMINAL STRIP

VOLTS	+ TERMINAL	− TERMINAL
135B	17	12
90B	14	12
45B	13	12
22½C	20	6
4½C	20	7
4½A	12	10

RADIO CORP. OF AMERICA
NATIONAL SERVICE DIVISION
233 BROADWAY, N. Y. C.

RADIOLA 25

CONTINUITY DIAGRAM

Dwg. No. NS-25-2 | Date 11-29-26

Dwn. By J.O.Q. | Ckd. By C.S.Q. | Appd. By [illegible] 12/11/25

Figure 4—Radiola 25 continuity diagram

Panel Test

Circuits	*Terminals*	*Correct Effect*	*Defect*
Loop	1 to 7	Closed	Open loop
Grid	2 to 5	Closed	Open grid coil of oscillator
Plate	4 to 3	Closed	Open plate coil of oscillator
Filaments	9 to 10	Closed	Open filament rheostat
	8 to 9	Closed	Open volume control

Panel Test (Condensers)
(Loop Removed)

Circuit	*Terminal*	*Correct Effect*	*Defect*
Loop	1 to 7	Open	Shorted loop tuning condenser

FILAMENT POLARITY OF SOCKETS

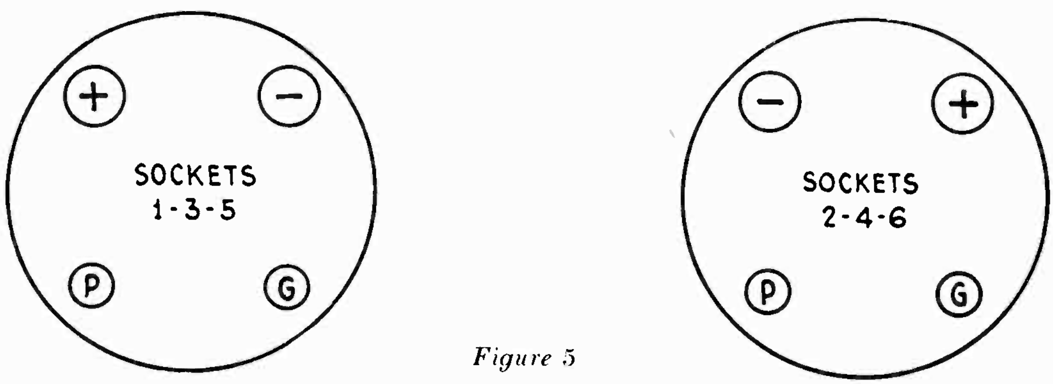


Figure 5

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.

RCA

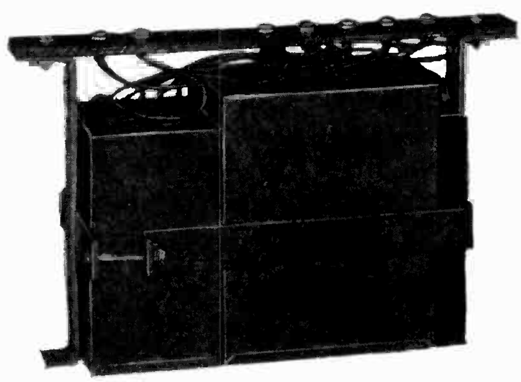
A.C. OPERATION OF RADIOLAS 25 AND 28

Using A.C. Packages Model UP-971 and Model UP-972

SERVICE NOTES

A C -25-28-1

First Edition—January, 1927



UP-972 Condenser Bank

RADIO CORPORATION OF AMERICA

Prepared by

SERVICE DIVISION of the PRODUCTION AND SERVICE DEPARTMENT

233 Broadway, New York City

DISTRICT SERVICE STATIONS

326 Broadway
New York City

2001 West Pershing Road
Chicago, Ill.

1412 Monróe Street, N. W.
Washington, D. C.

274 Brannan Street
San Francisco, Cal.

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 unkeep. 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 services of engineers who are qualified to render valuable help in solving service problems.

CONTENTS

ILLUSTRATIONS

PROTECTIVE SEALS AND THEIR USE

The lead seals placed on various units of Radiola 25 and 28 and RCA Loudspeaker Model 104 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 practical 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.

A service man may sometimes find it necessary to break a seal in the R. P. A. unit of the Model 104 Loudspeaker 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.

PROTECTIVE DEVICES

In RCA Loudspeaker Model 104 there will be found two protective devices, one a safety switch and the other an interlocking device. The safety switch is designed to break the A.C. input current when the rear door is removed and make it impossible to operate the Loudspeaker unless the door is in place. The interlocking device is a small sliding door so arranged that it is impossible to open the terminal door of the R.P.A. unit unless the A.C. input plug is first removed.

It should be understood that the electrical protective devices on RCA Loudspeaker Model 104 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.

SERVICE NOTES

A.C. OPERATION *of* RADIOLAS 25 *and* 28

Prepared by

RCA SERVICE DIVISION

A C -25-28-1

INTRODUCTION

The problems that arise in A.C. operation of Radiolas 25 and 28 driven by RCA Loudspeaker Model 104 are somewhat different from the problems encountered in battery operation of these Radiolas. The present Service Notes deal only with A.C. operation. For information on service problems encountered with battery operated Radiolas 25 and 28 consult the "Service Notes" issued on those models.

In A.C. operation with RCA Loudspeaker Model 104 A.C. Package UP-971 is used with Radiola 25 and A.C. Package UP-972 with Radiola 28. These A.C. Packages consist essentially of a special condenser bank, Catacomb resistance strip, "Volume Control" and "Battery Setting" resistances, connecting cables and other miscellaneous items. The instructions for installing the various parts are given in the "Instruction Book" accompanying the particular A.C. package.

The present notes are divided into three parts:

I. Problems Arising in A.C. Operation of Radiola 25.

II. Problems Arising in A.C. Operation of Radiola 28.

III. Problems Common to A.C. Operation of Radiolas 25 and 28.

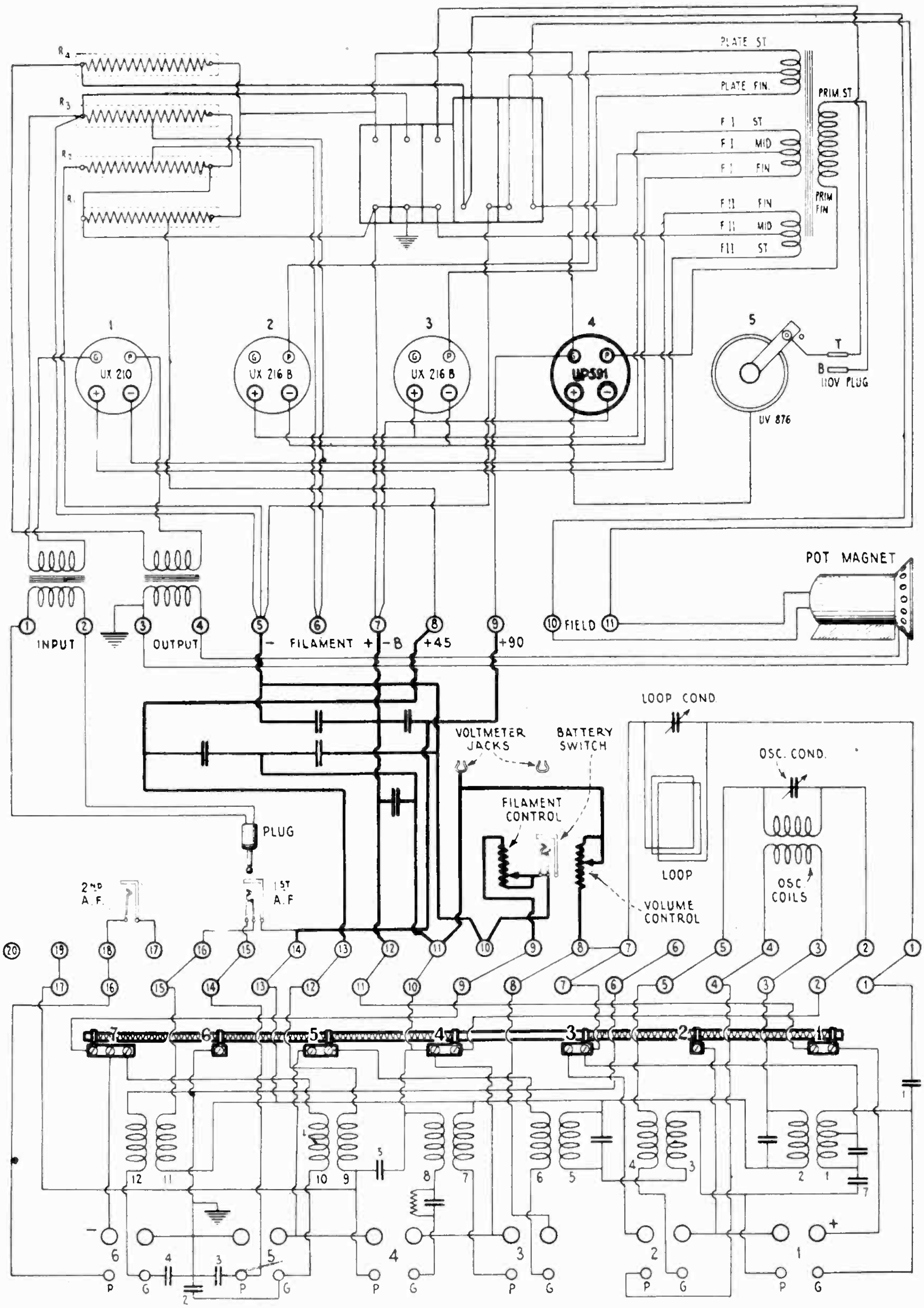
When isolating trouble each particular section should be consulted as conditions may warrant.

PART I

Problems Arising in A.C. Operation of Radiola 25

(1) VOLTAGE READINGS

The following are the correct voltages that should be obtained at the Catacomb terminal strip across the terminals indicated in the text test table, with the power turned on at the Loudspeaker. A voltmeter with at least 600 ohms resistance per volt or the no-current voltmeter described on pages 17 and 18 of these notes should be used if true readings are to be obtained. The allowable variation is approximately 5 volts in either direction.



A.C. PACKAGE CHANGES

Figure 1—Radiola 25 A.C. operated continuity circuit diagram

VOLTAGE READINGS OF RADIOLA 25

Taken at Catacomb Terminal Strip—Count Terminals from Right to Left When Facing the Front of Radiola 25

Terminals	*Correct Effect*
10 to 12	Should measure 31 volts with all Radiotrons lighted and battery setting near "Off." Positive terminal of voltmeter to be placed on No. 12.
12 to 13	Should measure 21.5 volts normally. Positive terminal of voltmeter should be placed on No. 13.
13 to 14	Should measure 41 volts normally. Positive terminal of voltmeter should be placed on No. 14.

(2) CATACOMB AND PANEL CONTINUITY TESTS

The following tests will show complete continuity for both external and internal connections of the catacomb. See page 8 for "Continuity Test Instructions."

CATACOMB TESTS (Coils and Connections)

The Radiotrons, Cable and Loop Are to Be Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
15 to P5	Closed	Open connection
14 to P1	Closed	Open coil No. 3 or No. 5
14 to Term. 3	Closed	Open coil No. 2
14 to P3	Closed	Open coil No. 7
14 to Term. 16	Closed	Open coil No. 11
13 to P4	Closed	Open coil No. 9
11 to G3	Closed	Open coil No. 6 or resistance strip
9 to G5	Closed	Open coil No. 10
7 to neutralizing cond. (Hole between sockets No. 1 and No. 2)	Closed	Open connection
7 to G1	Closed	Open ½ coil No. 1
6 to G6	Closed	Open coil No. 12
5 to G2	Closed	Open coil No. 4
4 to P2	Closed	Open connection

CATACOMB TESTS (Condensers)

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
15 to Terminal 9	Open	Shorted cond. No. 3
11 to P4	Open	Shorted cond. No. 5
11 to G4	Open or weak	Shorted grid condenser
9 to G6	Open	Shorted cond. No. 4
7 to P1	Open	Shorted cond. No. 7
1 to G1	Open	Shorted cond. No. 1

CONTINUITY TEST INSTRUCTIONS

Both filament control and volume control rheostats should be adjusted so that half the resistance is in the circuit, the loop removed 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. 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 indicated in the column titled "Terminal" in the text test table and the results should be as indicated in the column titled "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 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, counting from right to left when facing the front of Radiola 25. The designation "P" and "G" refer to plate and grid contacts of the socket indicated by the number following, counting from right to left when facing Radiola 25. For example G2 would indicate the grid contact of the second socket; P5 would indicate the plate contact of the fifth tube socket. The coil numbers referred to in the right hand column will be found in Figure 1.

If the catacomb fails to pass any of the 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 various panel parts are comprised in the following tests:

PANEL TESTS

With Radiotrons, Cable and Resistance Strip Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
16 to 15 (With no telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
11 to 8	Closed	Defective volume control
10 to 9	Closed	Defective filament control
4 to 3	Closed	Defective oscillator coil
5 to 2	Closed	Defective oscillator coil
1 to 7	Closed	Open loop

PANEL TESTS (Condensers)

Loop Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
7 to 1	Open	Shorted loop tuning condenser

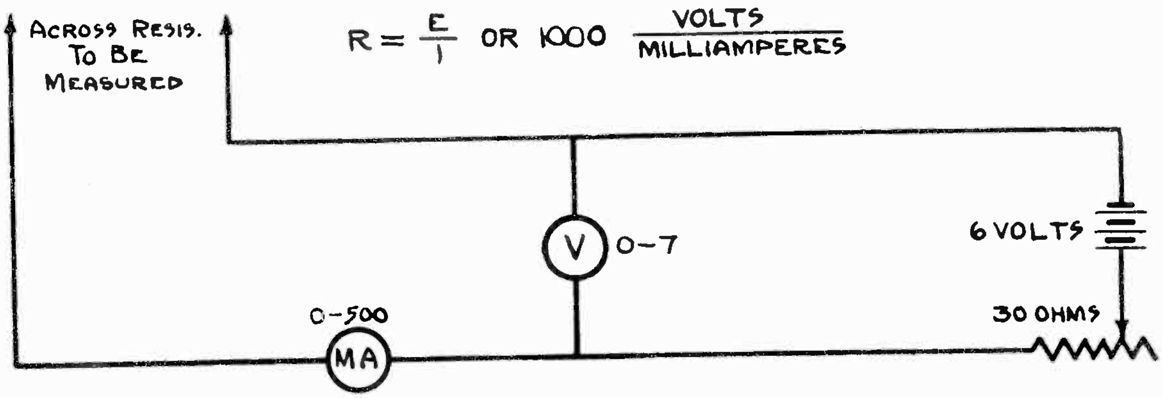


Figure 2—Wiring diagram for resistance measurement

(3) RESISTANCE STRIP TESTS

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 2.

The resistance may then be calculated by the use of Ohm's law.

$$R = \frac{E}{I} \text{ where R equals ohms, E equals volts and I equals amperes}$$

$$\text{or ohms} = 1000 \frac{\text{volts}}{\text{milliamperes}}$$

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 allowable values in ohms for the different sections of the resistance strip in Radiola 25 are tabulated below:

RADIOLA 25 A.C. RESISTANCES

Count Terminals from Right to Left When Facing Radiola 25

Resistance Terminals	*Lower Limit*	*Normal*	*Upper Limit*
1-2	218.5	230	241.5
2-3	192	201	208
3-4	Open	Open	Open
4-5	151.9	155	158.1
5-6	143	150	153
6-7	44.75	50	55.25

If the values obtained do not fall within the prescribed limits the strip should be replaced.

(4) INSTALLATION CHANGE IN A.C. PACKAGE UP-971

Some models of Radiola 25 have panel cabling instead of the regular black wire connections. When installing A.C. Package UP-971 on these models the following instructions should be observed. (See Figure 3.)

Remove the panel cable lead (yellow with green tracers) from the left voltmeter jack and resolder it to the right voltmeter jack.

To one side of the "Volume Control" rheostat are attached two panel cable leads (each yellow with green tracer.) Disconnect these two leads and determine which one

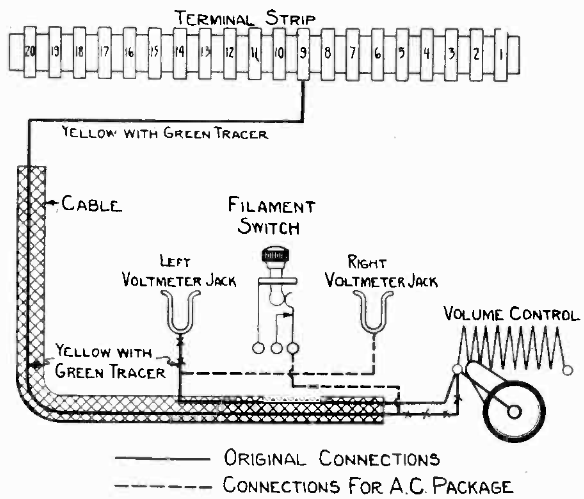


Figure 3—Panel wiring change required for installation of UP-971 in some models of Radiola 25

goes to terminal No. 9 on the terminal board. This may be done by means of a pair of telephones connected in series with a 4½ volt battery. One of the test points is placed on terminal No. 9 and the other tried on the two panel leads which were connected to the "Volume Control" rheostat. One of these will give a click when connection is made to the other test point. This is the one that goes to terminal No. 9.

Solder the lead which goes to terminal No. 9, as determined above, to the long prong of the filament switch. Resolder the other lead (yellow with green tracer) to the "Volume Control" rheostat, exactly as it was.

In Instruction Book No. 86997 "A" edition for A.C. Package UP-971, pages 5 and 6, the following two paragraphs are not applicable to this model of Radiola 25:

> "It will be noticed that one of the wires from the 'Volume Control' rheostat runs to the right-hand voltmeter clip. Unsolder it and resolder it to the left-hand clip, as shown in Fig. 4."
>
> "Unsolder either one of the two wires which go to the filament switch, and solder this wire so that it is on the same switch blade as the other wire, as shown in Fig. 4."

PART II

Problems Arising in A.C. Operation of Radiola 28

(1) VOLTAGE READINGS

The following are the voltages obtained at the Catacomb terminal strip, when tests are taken across the terminals indicated in the text test table. A high resistance voltmeter of at least 600 ohms resistance per volt or the No-Current Voltmeter described in Section 3, Part III, of these notes should be used. The allowable variation plus or minus is approximately 5 volts.

VOLTAGE READINGS OF RADIOLA 28

Taken at Catacomb Terminal Strip—Count Terminals from Left to Right When Facing Radiola 28

Terminals	*Correct Effect*
1 to 21	Should measure 31 volts, normally with all Radiotrons lit and battery setting near "Off." Positive terminal of voltmeter on No. 1.
1 to 10	Should measure 21.5 volts normally. Positive terminal of voltmeter to No. 10.
10 to 11	Should measure 41 volts normally. Positive terminal of voltmeter to No. 11.

(2) CATACOMB AND PANEL CONTINUITY TESTS

The following tests will show complete continuity for both external and internal connections of the catacomb. Terminal numbers refer to terminals on Catacomb terminal strip, counting from left to right when facing front of Radiola 28. (Figure 4.)

Both filament control and volume control rheostats should be adjusted so that half the resistance is in the circuit, the loop removed and the 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 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.

Any failure of a circuit to meet the above tests will indicate a defective catacomb which should be replaced with one of known operating condition.

CATACOMB TESTS (Condensers)

The Radiotrons, Cable and Loop Are to Be Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
P6 to +6	Open	Shorted cond. No. 3 or No. 4
9 to P2	Open	Shorted catacomb neutralizing condenser
9 to G6	Open or very faint	Shorted grid condenser
14 to 11	Open	Shorted cond. No. 1

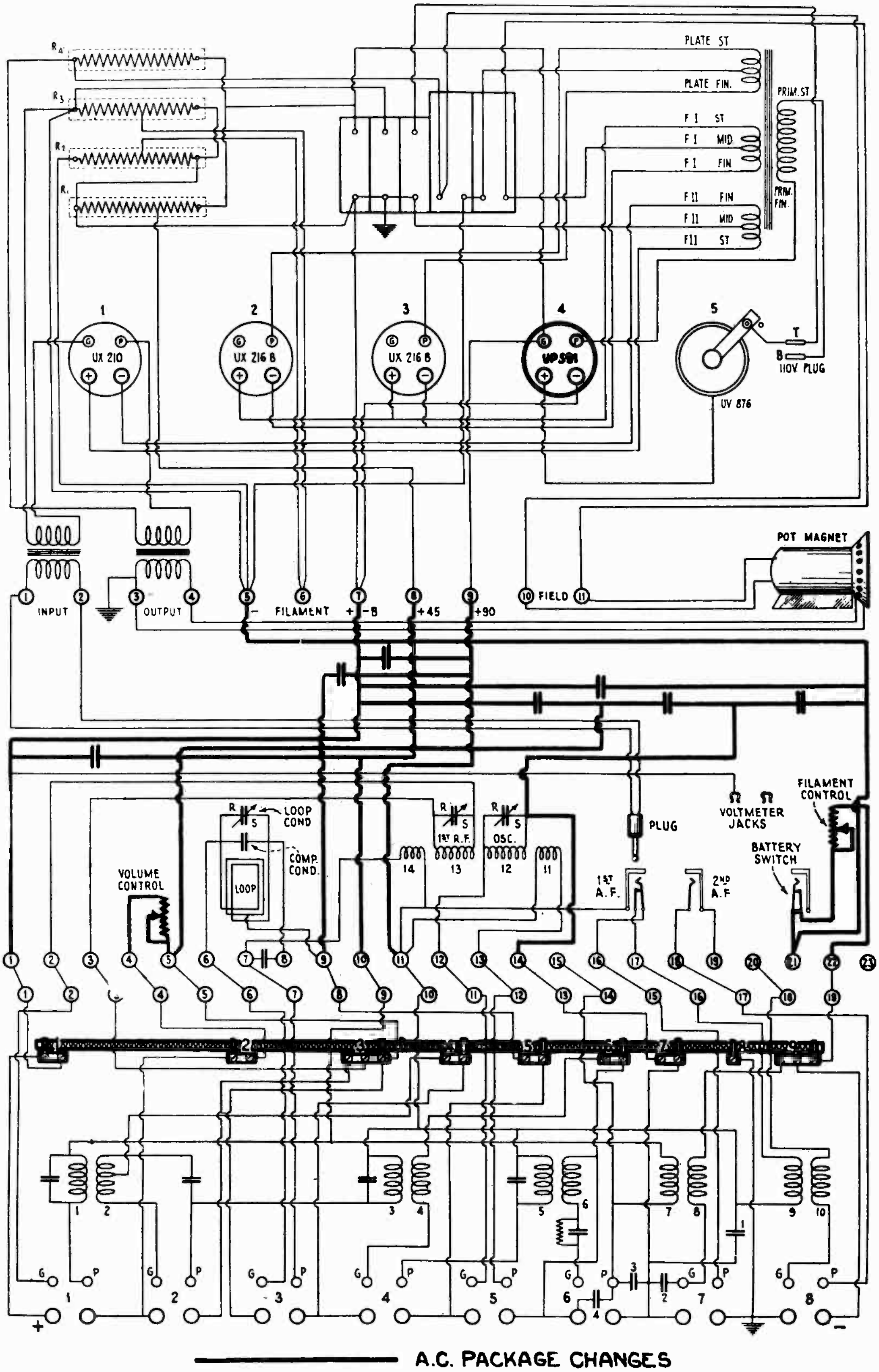


Figure 4—Radiola 28 A.C. operated continuity circuit diagram

CATACOMB TESTS (Coils and Connections)

The Radiotrons, Cable and Loop Are to Be Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
2 to G1	Closed	Open connection
6 to G3	Closed	Open connection
7 to P3	Closed	Open connection
9 to G2	Closed	Open ½ coil No. 2 or resistance strip
9 to G4	Closed	Open coil No. 4 or resistance strip
10 to P1	Closed	Open coil No. 1
10 to P6	Closed	Open coil No. 7
11 to P2	Closed	Open coil No. 3
11 to P4	Closed	Open coil No. 5
11 to Terminal No. 17	Closed	Open coil No. 9
12 to G5	Closed	Open connection
13 to P5	Closed	Open connection
16 to P7	Closed	Open connection
18 to P8	Closed	Open connection
20 to G8	Closed	Open coil No. 10
22 to G7	Closed	Open coil No. 8

PANEL TESTS

With Radiotrons, Cable, Loop and Resistance Strip Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
3 to 2	Closed	Open R.F. coil
5 to 4	Closed	Open volume control
11 to 7	Closed	Open R.F. coil
13 to 11	Closed	Open oscillator coil
14 to 12	Closed	Open oscillator coil
16 to 11 (With shorted telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
17 to 16 (With no telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
22 to 21	Closed	Open filament control

PANEL TESTS (Condensers)

Loop Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
8 to 6	Open	Shorted loop or compensating cond.
8 to 7	Open	Shorted neutralizing condenser

(3) RESISTANCE STRIP TESTS

listed below:

RADIOLA 28 A.C. RESISTANCES

The method described in Section 3, Part I, of these notes should be used in checking the value of the various resistances of the resistance strip.

The values in ohms of the various resistances in the Radiola 28 resistance strip are

Count Terminals from Left to Right When Facing Radiola 28

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

* On some models section No. 2 of the resistance strip has been left open. When this is done the volume control is of 187.5 ohms resistance instead of 375 ohms as used when the strip is not open.

Another series of resistance values with a 250-ohm Volume Control found in some models of Radiola 28 is given below:

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

All resistance strips are interchangeable, provided the volume control has the correct value for the strip used. This is of utmost importance as the Radiola will not function properly when the volume control and resistance strip are not correct.

(4) CHANGES IN FACTORY BUILT A.C. RADIOLA 28

The following changes in connections and parts apply to factory built A.C. Radiolas 28 as distinguished from battery operated Radiolas 28 converted to A.C. operation.

Whisker 16 is connected to terminal 19 instead of terminal 17.

The condenser cable has an additional connection.

The output of the Radiola is taken direct from the terminal strip at the rear of the catacomb and the plug is not used in the first stage jack.

The filament switch voltmeter pin jacks and second audio stage phone jack are also omitted.

The instruction book accompanying the receiver refers to these changes and should be consulted when servicing this particular model of Radiola 28.

PART III

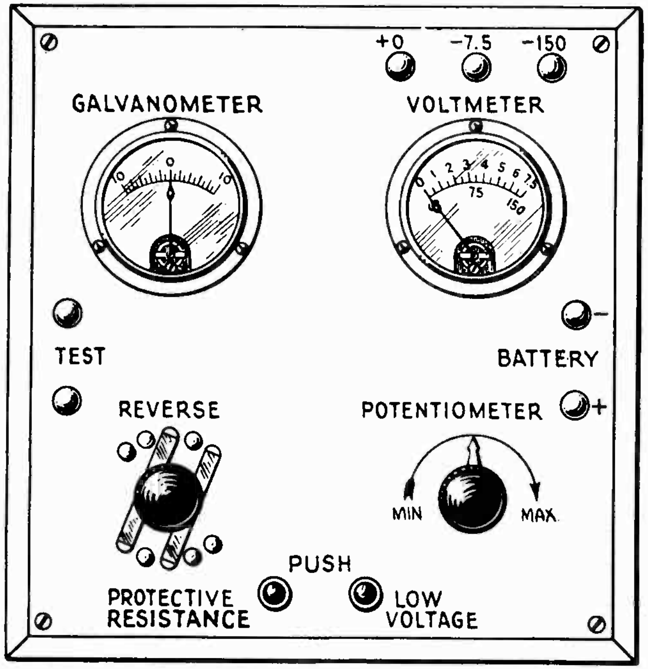
Problems Common to A.C. Operation of Radiolas 25 and 28

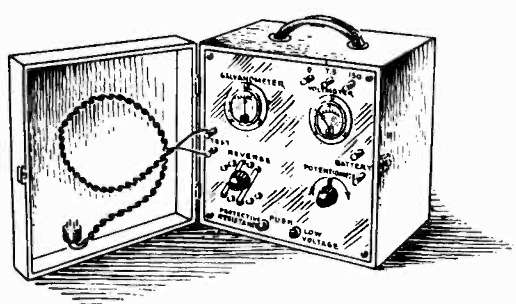
(1) A.C. PACKAGES AND CABLE

When tests are made, especially voltage readings, at the terminal strip of the catacomb and trouble is found, additional tests to check the preliminary test must be made. For example, the voltage readings should be taken at the condenser bank terminal strip and terminal board of the R.P.A. unit. This will prevent a possible defective cable or condenser bank from indicating trouble elsewhere. If the various tests check and the readings at the three points are the same it may be well to assume that the trouble is in the R.P.A. unit.

Figure 5—Installing condenser bank of A.C. Package UP-972

The small A.C. Package cable connecting the catacomb terminal strip of the Radiola to the A.C. package condenser bank and the 30-ft. cable joining the condenser bank to the R.P.A. unit of the Loudspeaker should be carefully examined to determine if the leads at the ends of each cable are worn or the terminals soldered to each lead are corroded or loose. Worn leads should be repaired or replaced. Corroded or loose terminals should be cleaned and resoldered.





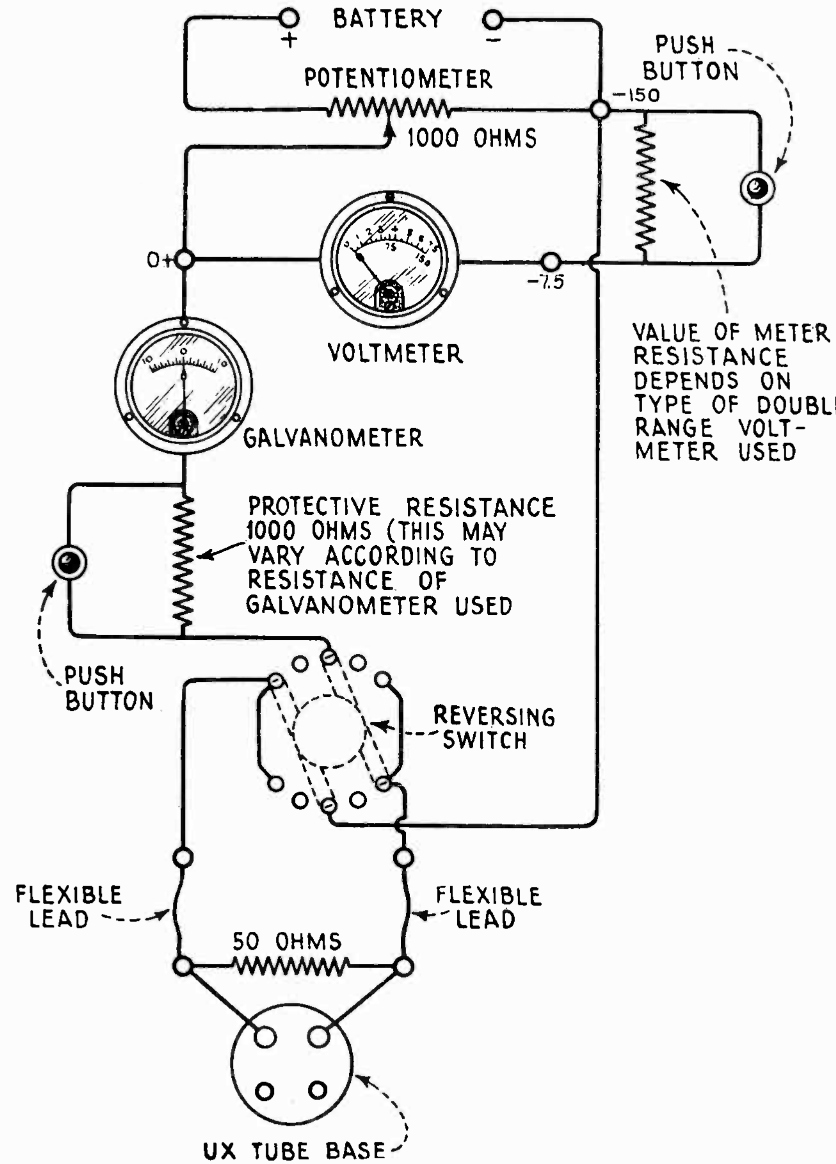


Figure 6—*Panel layout, circuit diagram and complete model of the No-Current Voltmeter*

(2) HIGH, LOW OR NO VOLTAGE READINGS AT TERMINAL STRIP OF RADIOLA

This condition may be caused by a defective A.C. package or R.P.A. unit. A check at the terminal board of the R.P.A. unit will isolate the trouble to the condenser bank of the A.C. package or cable. If the condenser bank or cable tests O.K. the R.P.A. unit should be checked for the following indications. It is assumed that the Radiotrons are of known operating condition and light to normal brilliancy.

No voltage at R.P.A. unit may be due to:

(a) Shorted Resistor UP-591. (Used in place of Radiotron UX-874.)

(b) Open connections at R.P.A. terminal board.

(c) Shorted 7 Mfd. or 4 Mfd. filter condenser. (This will be indicated by excessively hot plates of Rectrons UX-216-B.

(d) Shorted 2 Mfd. condensers. (Check by means of continuity test.)

Low voltage at R.P.A. Unit may be caused by:

(a) Shorted turns in high voltage winding of power transformer.

(b) Low emission Rectrons UX-216-B.

(c) Leaky 7 Mfd. or 4 Mfd. filter condensers.

(d) Leaky 2 Mfd. condenser (located next to resistance units).

(e) Defective Resistance Units.

High voltage in R.P.A. unit may be caused by:

(a) Defective Pot magnet.

(b) Defective Resistance Units.

(c) Shorted turns in primary of power transformer.

(d) Open Resistance Units R2 or R3.

(3) NO-CURRENT VOLTMETER

When measuring the plate or filament voltages of an A.C. operated Radiola it is necessary to use a high resistance voltmeter if true values are to be obtained. High resistance voltmeters are expensive and scarce, consequently need exists for other means of measuring these various voltages. A method of obtaining correct voltages with any type of D.C. voltmeter is described below which may be relied on up to the accuracy of the meter itself and as being more accurate on voltages from an R.P.A. unit than most high resistance voltmeters.

The various parts and circuit diagram are shown in Figure 6. These parts consist of a 0-7.5 voltmeter with multiplier, D.C. galvanometer, potentiometer, reversing switch, safety resistance, UX-199 plug and an external voltage in excess of that to be measured. A compensating resistance of 50 ohms, shunted across the filament prongs of the "UX Tube Base" is necessary when using the "UX Tube Base" to measure the filament voltage of any Radiotron UX-199 in an A.C. operated Radiola. This will compensate for the loss of filament resistance caused by the removal of the Radiotron UX-199.

The following procedure should be used when measuring any D.C. voltage.

(a) The voltmeter scale covering the voltage to be measured should be used.

(b) If not using UX-plug, disconnect it and 50-ohm resistance from circuit.

(c) Adjust potentiometer so that voltmeter reads approximately that of the voltage to be measured.

(d) Connect external voltage to proper "Battery" binding posts.

(e) Connect voltage to be measured to "Flexible Lead" terminals.

(f) Set "Reversing Switch" for correct polarity (determined by experiment).

(g) With "Protective Push Button" open, adjust potentiometer by zero reading of the galvanometer.

(h) After obtaining zero reading close "Protective Push Button" and readjust potentiometer for zero reading.

(i) Voltage now indicated at voltmeter is correct voltage of circuit under measurement.

When measuring filament voltage of an A.C. operated catacomb the "UX-Tube Base," with compensating resistance, is used to connect the source of voltage to be measured to the test set; otherwise the operations are the same.

The theory of the "No-Current Voltmeter" is based upon the condition that when an external voltage is applied so as to oppose the voltage of the circuit under measurement, the galvanometer will read zero when the two voltages are exactly the same. The voltmeter connected across the opposing voltage makes it a simple matter to read what external voltage is necessary to exactly balance the circuit under measurement.

(4) DISTORTION IN THE SPEAKER

Distortion in the Reproducer unit of the Loudspeaker may be caused by any of the following:

(a) Poor input from Radiola. (Examine Radiola.)

(b) Shorted 2 Mfd. condenser in R.P.A. unit (located next to 7 Mfd. condenser).

(c) Shorting of movable coil to pole piece of pot magnet. (Replace cone.)

(d) Defective Radiotron UX-210. (Replace Radiotron.)

(e) Leads from movable coil broken away from cone. (Make these fast with a little shellac.)

(f) Mis-alignment of Reproducer cone.

The reproducer cone may be readily realigned by removing the front grille and very carefully adjusting the small round head screw in the center of the cone. In making this adjustment care must be exercised to prevent damaging the cone, which may be caused by the screwdriver being pulled out of control by the strong magnetic field about the pole piece of the pot magnet behind the cone.

(5) FLUTTERING

Fluttering sometimes is encountered when an A.C. installation is made. 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 correct this condition. The following remedies are suggested.

(a) Change A.C. Package.

(b) Interchange Radiotrons UX-199 of Catacomb.

(c) Connect 30 to 50-henry choke across terminals 10 and 15 of catacomb terminal strip. (Count from left when facing front of Radiola.)

(d) Connect 2 Mfd. condenser in series with 30-henry choke and then place combination across terminals 15 and 22 in the Radiola 28. The choke goes to 15 and condenser to 22.

(6) BLASTING

This condition is present when the volume control is near or at maximum, and signals are being received from nearby stations. Interchanging the Radiotrons, keeping those having the least microphonic tendencies in the two detector and first audio sockets and a change of the UX-210 may help. Also the distance from the Radiola to the Loudspeaker should be increased. In some cases it may be necessary to insert a choke across terminals 10 and 16 of Radiola 28 terminal strip. The primary of a Radiola 104 Loudspeaker input transformer or the complete winding of a Radiola III-A output transformer has the correct impedance for this choke. This may be relied upon to clear up the most obstinate cases of blasting.

(7) HOWLING

Howling may be caused by sound waves from the Loudspeaker setting the elements of Radiotron UX-199 into vibration. This vibration is amplified and reproduced in the loudspeaker. Increasing the distance from the Loudspeaker to the Radiola and interchanging the Radiotrons will usually eliminate howling. The microphonic Radiotrons should be kept in the intermediate and R.F. sockets.

(8) FADING OF SIGNALS

Fading of signals beyond the normal slight drop after the speaker has been placed in operation may be due to any of the following causes:

(a) Defective Radiotron UX-210. This will be accompanied by rough and unnatural reproduction.

(b) Defective Radiotron UV-876 (or UV-886).

(c) Defective Resistances in R.P.A. Unit. (Indicated by the defective resistance becoming excessively hot. This does not apply to unit R-4, which becomes very hot during normal operation.)

RCA

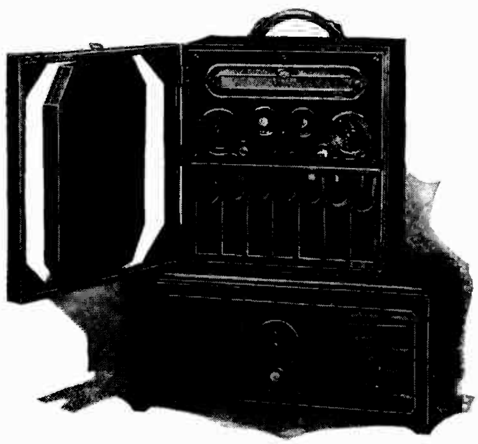
Circuit Tests

RCA

Radiolas 26, 24, Super-Heterodyne and Super-VIII

SERVICE NOTES

Third Edition—5M—June, 1928



Radio Corporation of America

SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT

233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

326 Broadway
New York City

2001 West Pershing Road
Chicago, Ill.

274 Brannan St.
San Francisco, Cal.

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.

Circuit Tests
RCA Radiolas 26, 24, Super-Heterodyne and Super-VIII

PREPARED BY RCA SERVICE DIVISION

These Circuit Tests are divided into two parts, the first part covering Radiola 26 and the second part Radiolas 24, Super-Heterodyne and Super-VIII.

PART I—RADIOLA 26

The catacomb of Radiola 26 is mounted differently than in other Radiolas employing the standard six-tube catacomb and the connections thereto are reversed. As a stage change switch is not used, the built-in loudspeaker is at all times connected to the second audio stage and the phone tip pin jacks to the first stage.

TEST PROCEDURE

(1) See if the filaments of all Radiotrons are lighted. If none of the Radiotrons light, look for a possible cause at the filament rheostat or "A" battery connections.

(2) If No. 3 from the left alone does not light, examine the volume control rheostat. With volume control at 100 Radiotron No. 3 should be of equal brilliancy with the other Radiotrons.

(3) If Radiotrons light, tap lightly with the finger the fourth Radiotron from the left. There should be a distinct ringing noise in the loudspeaker. If this noise is not obtained, one of the three last Radiotrons to the right may be defective.

(4) After substituting new Radiotrons in the three right hand sockets if the ringing noise is not obtained check the battery voltages with a high resistance type of voltmeter.

The readings should be taken at the terminal block in the battery compartment, or if the home battery box is used, at terminal block on the back. The plug should be removed and the readings in cabinet from top to bottom and in home battery box from left to right should be as follows:

Terminal Numbers	*Should Read*
1 to 2	4.5 volts. If less than 3.5 replace "A" batteries.
1 to 3	4.5 volts. If less than 4.0 replace "C" batteries.
2 to 4	45 volts. If less than 34 replace "B" batteries.
2 to 5	90 volts. If less than 68 replace "B" batteries.

If batteries test O. K. and Radiotron No. 2 from left is functioning properly a distinct click should be heard in the loudspeaker when the finger is placed on the stator plates of the right hand condenser. Another click should be heard when the finger is removed.

If none of the above tests give any indication of the failure, the circuit tests on the panel and catacomb should be made to isolate the trouble. The panel must be removed from the cabinet in order to get at the terminal strip, and the battery cable disconnected from the panel, which is accomplished by pulling the connection plug *out* in the battery compartment. A pair of head phones with at least 4½ volts in series should be used in making this test.

CIRCUIT TESTS

The numbers of the terminals referred to in the following tests apply to the terminals on the connecting strip at the rear of the catacomb. 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. For example G2 would indicate the grid contact of the second socket. P6 would indicate the plate contact of the sixth tube 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 designation of the socket contacts are shown in Fig. 2 (page 7).

Fig. 1 (page 6) shows the continuity circuit of the standard six-tube catacomb and is included to assist in testing catacombs.

PANEL

From Terminal No.	*To Terminal No.*	*Should Test*
1	5	Closed
2	7	Closed thru loop
3	4	Closed
5	6	Closed
9	10	Closed

CATACOMB

Terminal No.	*To*	*Should Test*
3	P 1 and P 3	Closed
3	Terminal 13	Closed
3	Whisker 13	Closed
4	P 2	Closed
5	G 2	Closed
7	G 1, 3, 5 and 6	Closed
9	— F 3	Closed
10	— F 1, 2, 4, 5 and 6	Closed
11	all + F	Closed
11	G 4	Closed thru grid leak
11	P 4	Open
12	P 4	Closed
16	P 6	Closed

PART II

Radiolas 24, Super-Heterodyne and Super-VIII

The testing procedure to determine the cause of imperfect operation of Radiolas 24, Super-Heterodyne or Super-VIII is as follows:

1. See if filaments of all the Radiotrons light. If none of the Radiotrons light look for a possible cause in the filament switch or "BATTERY SETTING" rheostat.

Put volume control at 100. If third Radiotron from right does not light, look for cause in the volume control rheostat.

2. If Radiotrons light, tap lightly with the finger, the fourth Radiotron from the right end of catacomb. With two stages of audio amplification there should be a distinct ringing noise in the loudspeaker. If this noise is not obtained, one of the three last Radiotrons may be defective.

3. If after substituting new Radiotrons in the last three sockets and still the ringing noise is not obtained by tapping the fourth Radiotron, check the battery voltages with a high resistance type voltmeter as follows:

The numbers refer to terminals on the catacomb terminal board starting at the right when looking at the front of the panel.

Terminal No. *From*	*To*	*Remarks*
6	9	Should measure 4.5 volts and not less than 4 volts. If less replace "C" battery. Positive terminal of voltmeter to be placed on terminal 9.
9	10	Should measure 4.5 volts and not less than 3 volts with all tubes lighted. If less replace the "A" batteries. Positive terminal of voltmeter to be placed on terminal 10.
10	11	Should measure 45 volts. If less than 34 volts replace "B" batteries. In Super-Heterodyne, in *right* hand compartment and in Super-VIII in the *middle* compartment.
11	12	Should measure 45 volts. If less than 34 volts replace "B" batteries. In Super-Heterodyne, in *left* hand compartment and in the Super-VIII the *upper* compartment.
8	10	Should measure 3 volts when the volume control rheostat is at 100 and the Battery Setting rheostat is adjusted to the proper point.

4. If batteries test O.K. try substituting new Radiotrons for those in the first three sockets. If the second Radiotron is working properly a distinct click should be heard in the loudspeaker when the finger is placed on the stator plates of the right hand variable condenser. Another click should be heard when the finger is removed.

5. If batteries are all O.K. inspect panel wiring, making sure all connections are tight. Test the jack circuits with a telephone and battery. These circuits are shown in the instruction book that comes with the set.

6. Test for continuity of loop between terminals 1 and 6.

7. Test for continuity of oscillator coils between terminals 5 and 6 and terminals 3 and 4.

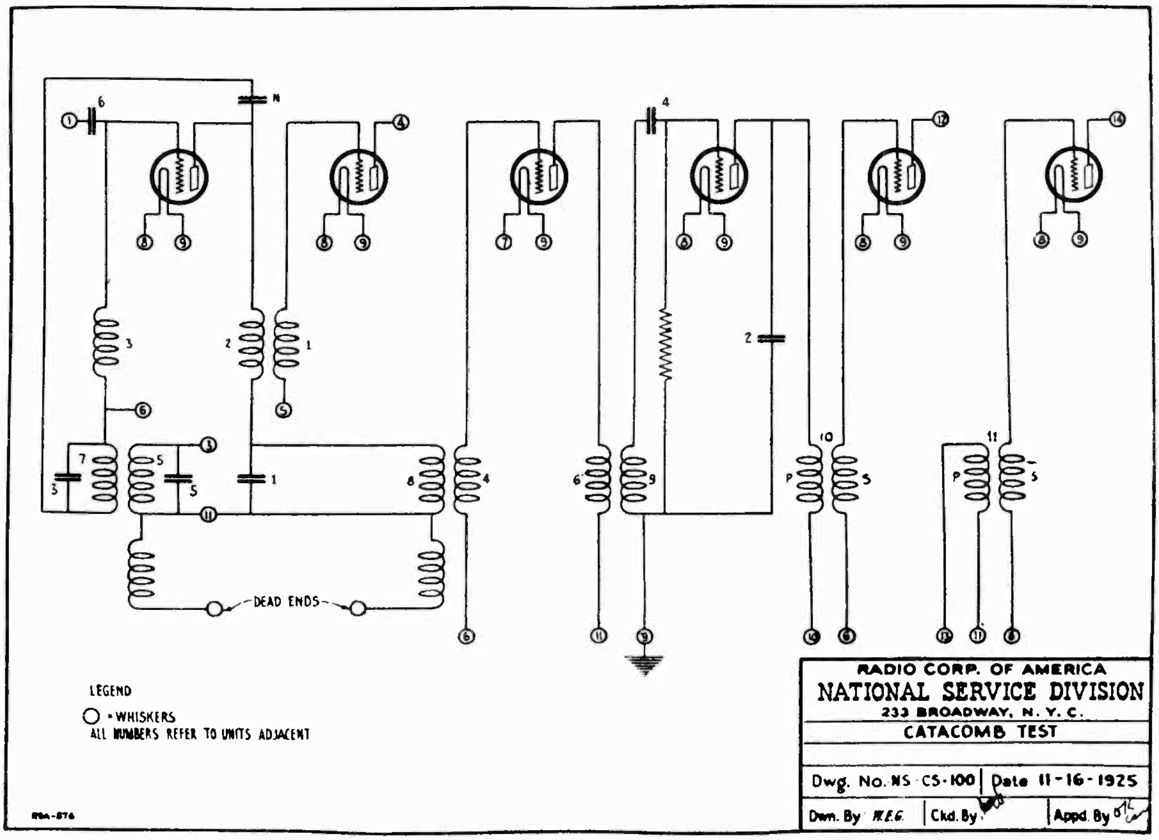


Figure 1

Continuity test circuit of standard six-tube catacomb

8. If none of the above tests give any indications of the trouble try the following series of tests on the catacomb without removing it from the panel. Use head phones with at least 4.5 volts in series or voltmeter with voltage sufficient to give full scale

deflection when connected directly across the battery terminals. The battery cable should be disconnected from the panel during this test and the Radiotrons removed.

From Terminal No.	*To*	*Should Test*
1	Grid of 1st socket	Open
12	Terminal 3	Closed
12	P of 1st socket	Closed
12	P of 3rd socket	Closed
15	P of 6th socket	Closed
12	Terminal 14	Closed
4	P of 2nd socket	Closed
5	G of 2nd socket	Closed
6	P of 1st socket	Open
6	G of 1st socket	Closed
6	G of 3rd socket	Closed
6	G of 5th socket	Closed—weak click in phones
6	G of 6th socket	Closed—weak click in phones
7	— F of 3rd socket	Closed
8	— F of 1, 2, 4, 5, 6, socket	Closed
10	P of 4th socket	Open
10	Catacomb Can	Closed
10	All + F	Closed
10	G of 4th socket	Open
11	P of 4th socket	Closed
13	P of 5th socket	Closed
15	P of 6th socket	Closed

If the catacomb fails to pass any of the tests in part 1 or 2 of these instructions 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. Some service men have made a practice of indicating the defect in the catacomb by markings on the catacomb cover. To indicate the defect in the catacomb for future reference, attach tag to catacomb and note thereon observed defect.

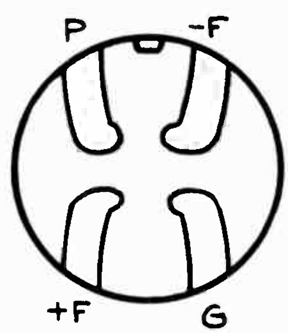


Figure 2
Radiotron UV-199 Socket Terminals

RCA

Printed in U.S.A., 1928

RCA
Radiola 28

(Battery Operated)

SERVICE NOTES

Third Edition—5M—June, 1928

Radio Corporation of America
SERVICE DIVISION OF THE PRODUCTION AND SERVICE DEPARTMENT
233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

326 Broadway
New York City

2001 West Pershing Road
Chicago, Ill.

274 Brannan St.
San Francisco, Cal.

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.

RCA RADIOLA 28

(Battery Operated)

SERVICE NOTES

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.

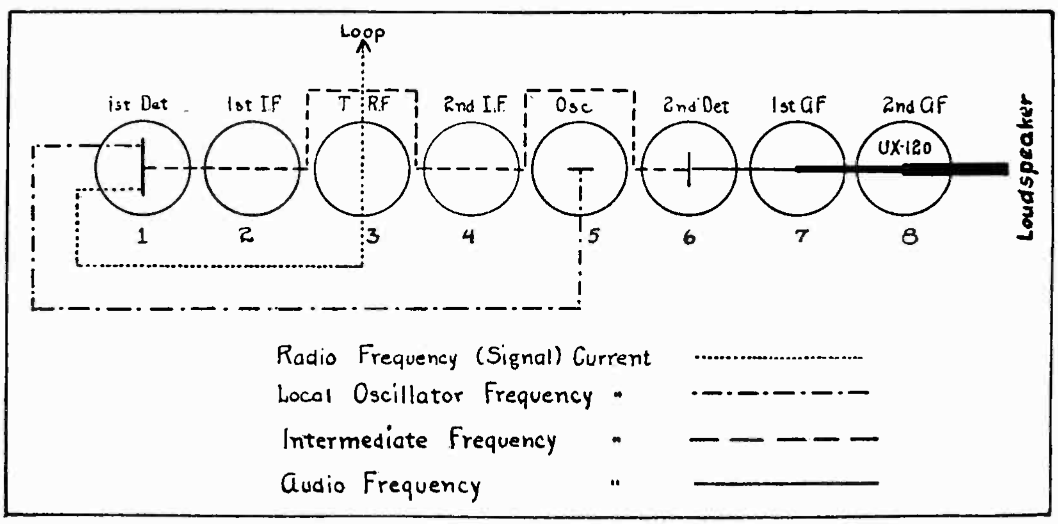


Figure 1—Radiola 28 Radiotron sequence

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.

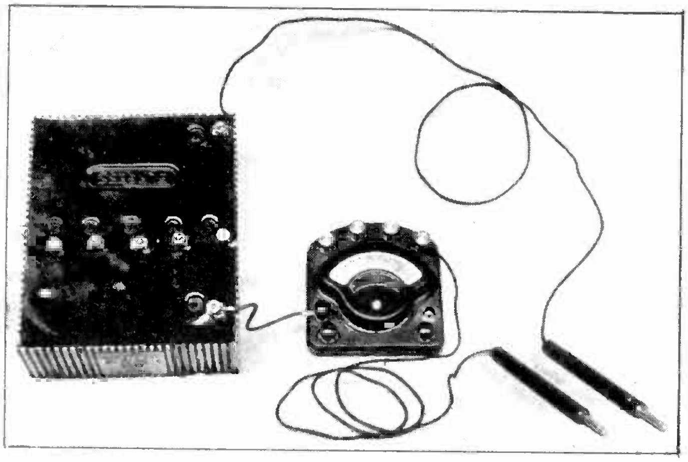


Figure 2—Testing equipment

(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.

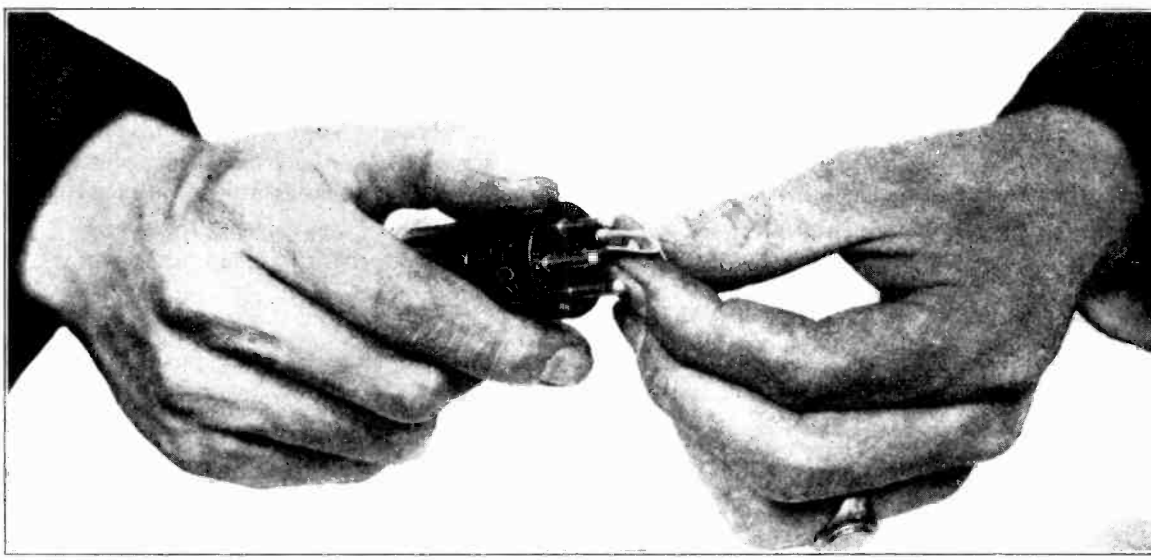


Figure 3—Raditron prongs may be cleaned with fine sandpaper

(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-

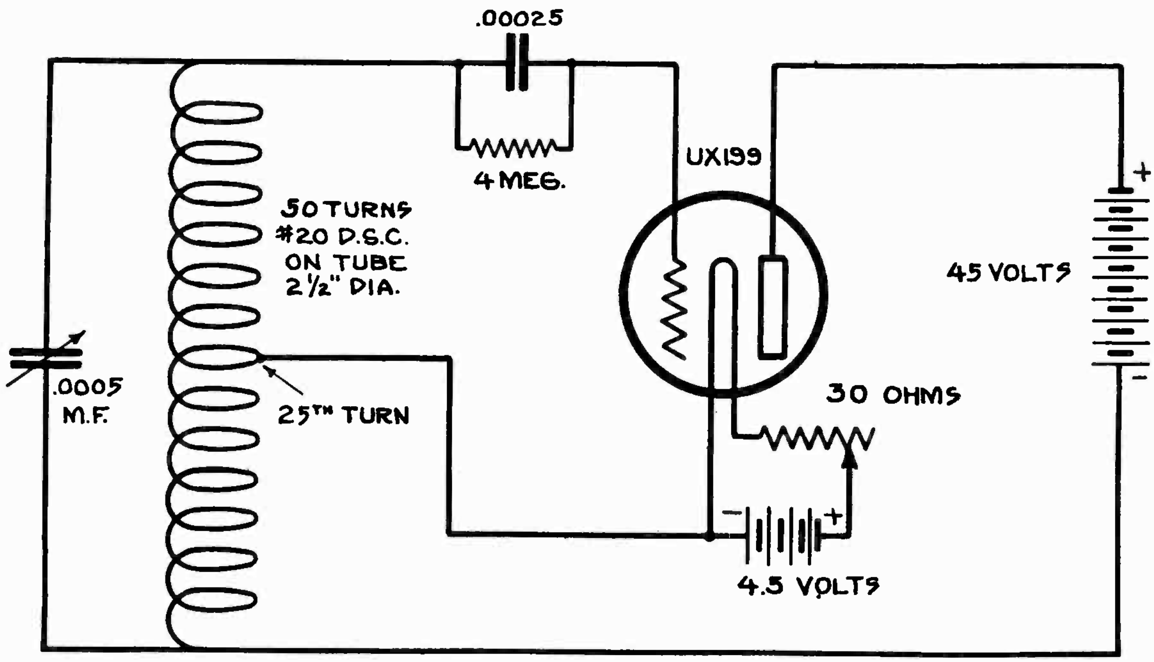


Figure 4—Wiring diagram of the modulated oscillator

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 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 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.

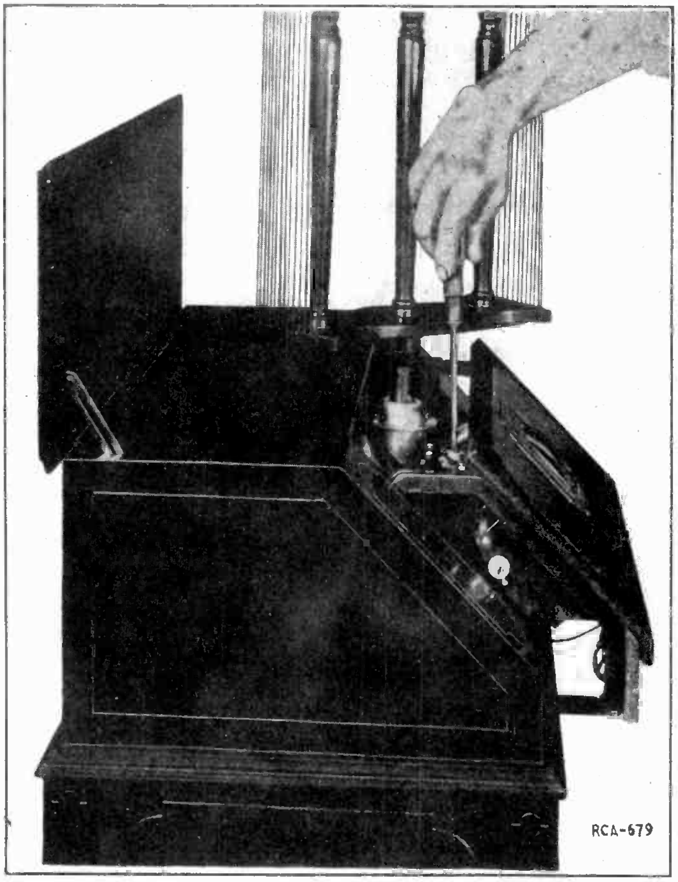


Figure 5—Adjusting the loop compensating condenser

(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.

(12) OSCILLATION

A Radiola 28 may at times oscillate, due to the following causes:

(a) Excessive filament voltage.

(b) Defective neutralizing condenser between terminals 7 and 8 of the catacomb terminal board.

(c) Defective catacomb.

The remedies are obvious. Reduce filament voltage if excessive. The other units, if they test defective, must be replaced. Some Radiola 28 models have adjustable loop neutralizing condensers. Refer to RCA Radiola 30A or 32 Service Notes for detailed adjustment procedure.

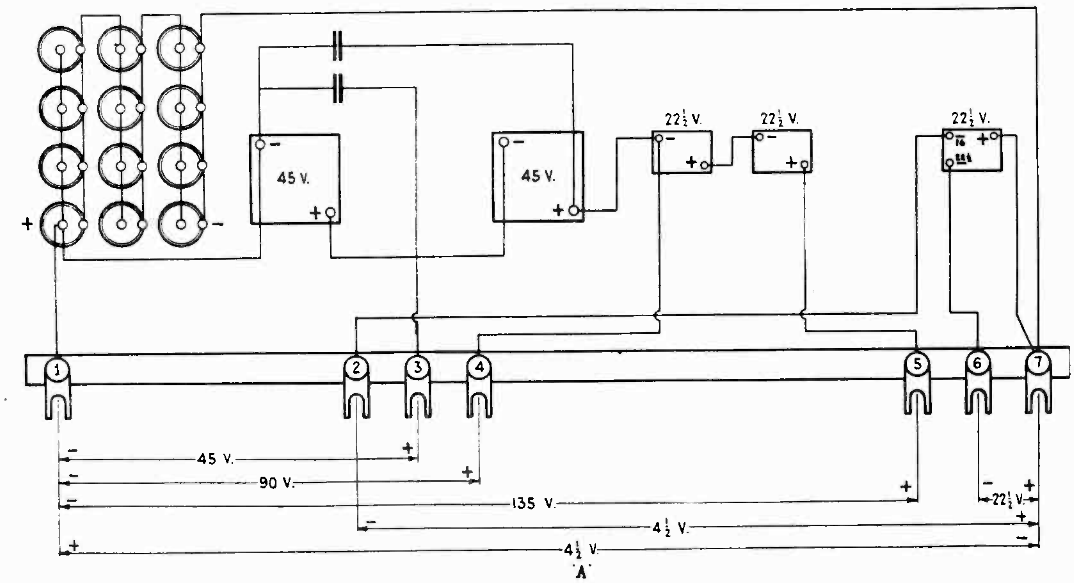


Figure 6—Correct voltage readings across battery terminal strip

(13) PROPER BATTERY CONNECTIONS

Disconnect battery terminal strip from the catacomb terminal board by loosening the screws holding it in place. Battery readings may then be taken directly across the various battery terminals by a high resistance type voltmeter. Figure 6 shows the correct readings to be obtained on the battery terminal strip. Approximately a 25% drop is permissible before renewal is necessary.

(14) LOUD SPEAKER 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 some 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 jack 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 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.

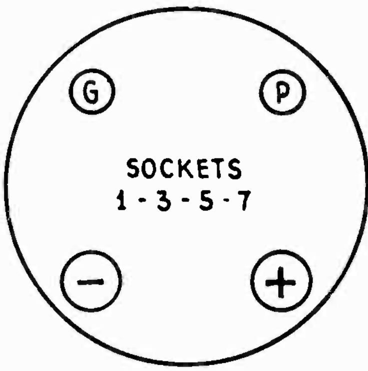
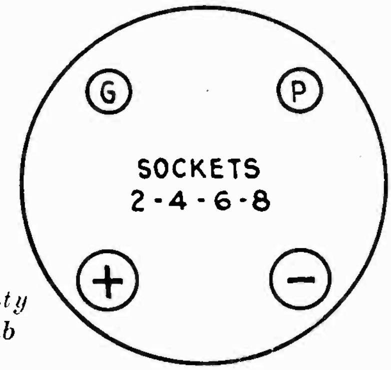


Fig. 7—Filament polarity of the various catacomb sockets



(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 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.

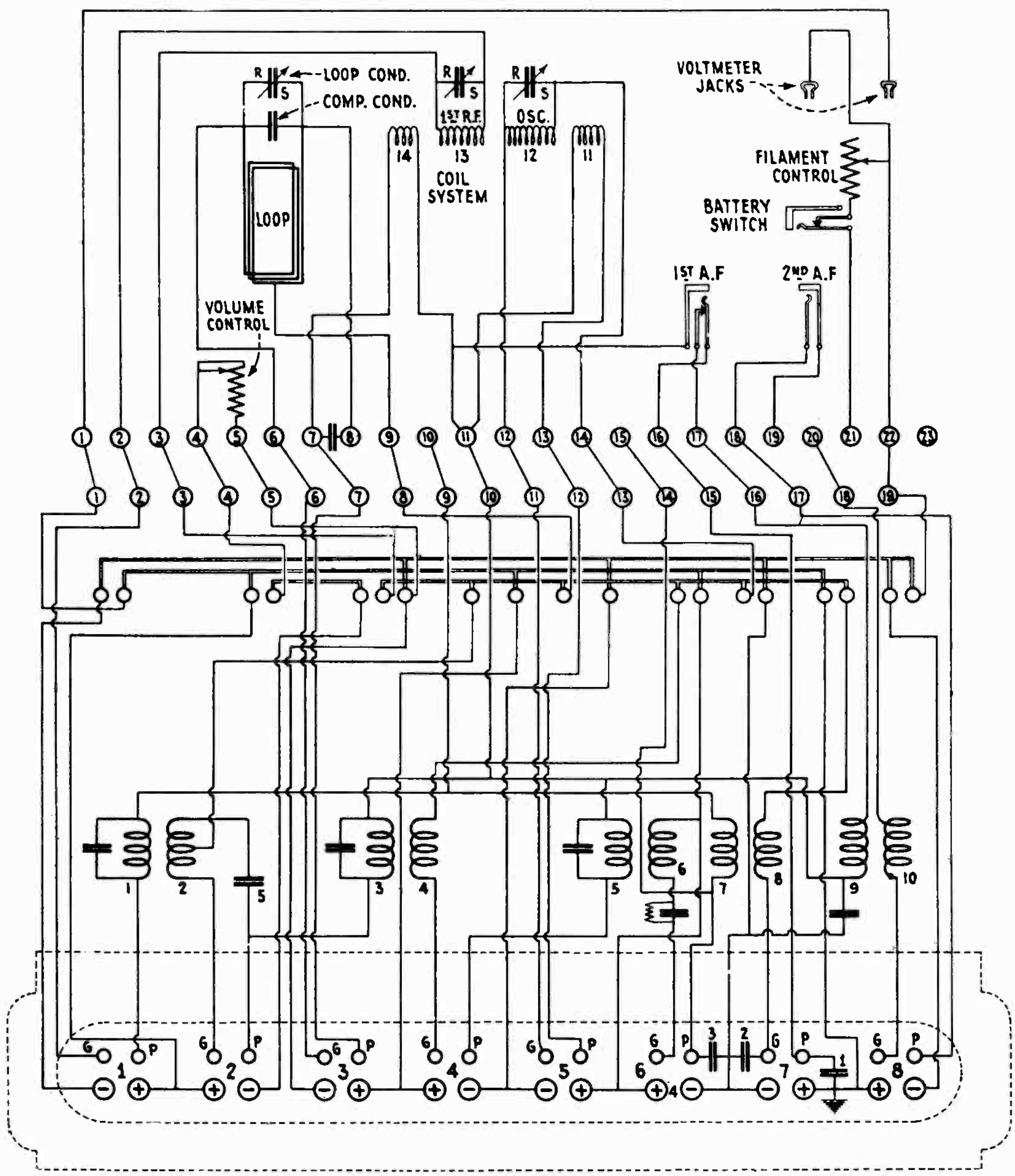


Figure 8—Radiola 28 continuity diagram

The contacts of the test equipment should be placed across the terminals indicated under the colum 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 colum 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:

Circuits	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by:*
Loop	6 to 8	Closed	Open loop
	6 to 9	Closed	Open ½ loop
	8 to 9	Closed	Open ½ 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)

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

CATACOMB TEST (Condensers)

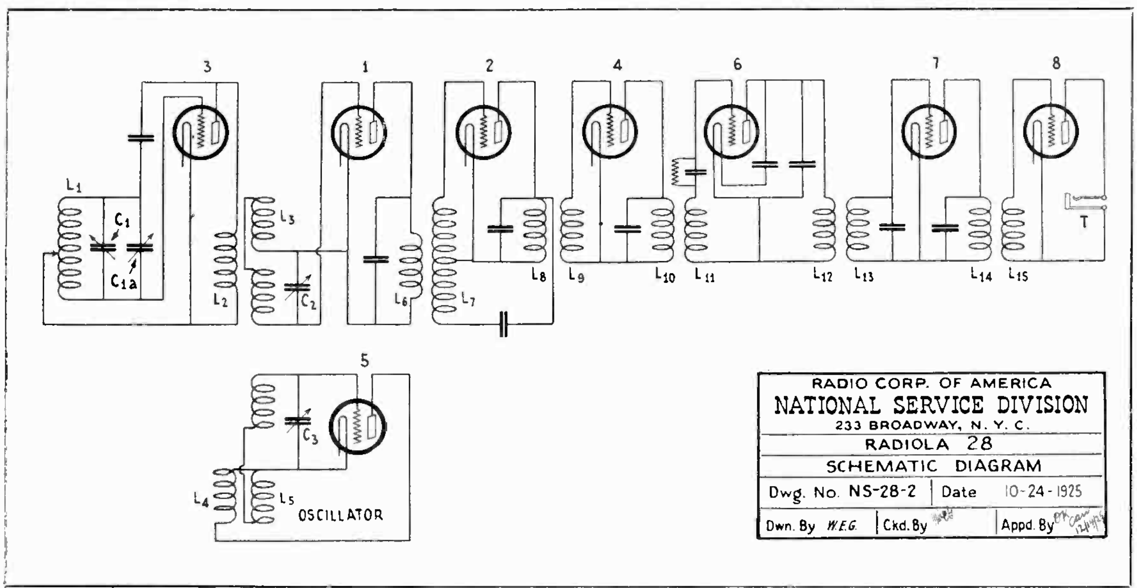
Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by:*
Grid	G2 to P2	Open	Shorted condenser No. 5
	G7 to 22	Open	Shorted condenser No. 2
Plate	P6 to 1	Open	Shorted condenser No. 4
	P6 to 22	Open	Shorted condenser No. 3

CATACOMB TEST (Coils and Connections)

Circuit	*Terminals*	*Correct Effect*	*Incorrect Effect Caused by:*
Grid	G1 to 2	Closed	Open connections
	G2 to 3	Closed	Open ½ 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 through grid leak	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.

RCA

Printed in U.S.A., 1928

RADIOLA 30

Reg. U. S. Pat. Office

SERVICE NOTES

NS-30-2

Second Edition—November, 1926

RADIO CORPORATION OF AMERICA

Prepared by

NATIONAL SERVICE DIVISION

233 Broadway, New York City

DISTRICT SERVICE STATIONS

326 Broadway
New York City

10 South La Salle Street
Chicago, Ill.

3308 Fourteenth Street, N. W.
Washington, D. C.

28 Geary Street
San Francisco, Cal.

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

Prepared By

NATIONAL SERVICE DIVISION

NS-30-2

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.

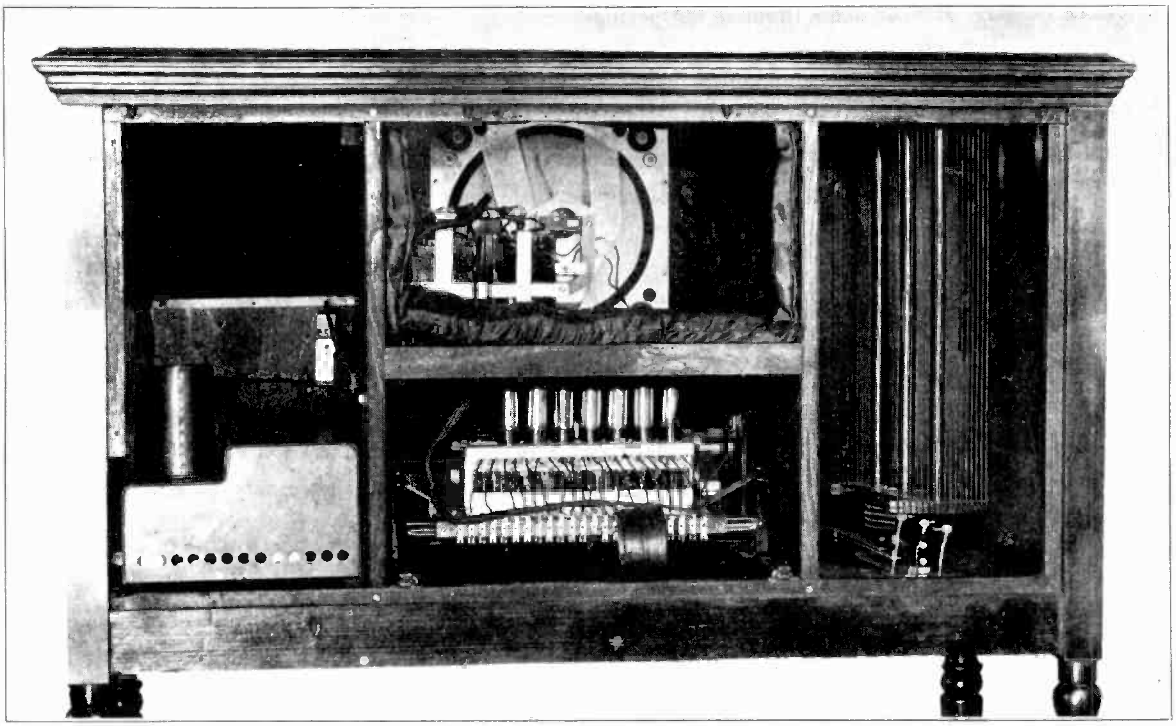


Figure 1—Back view of Radiola 30 showing arrangement of parts

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.

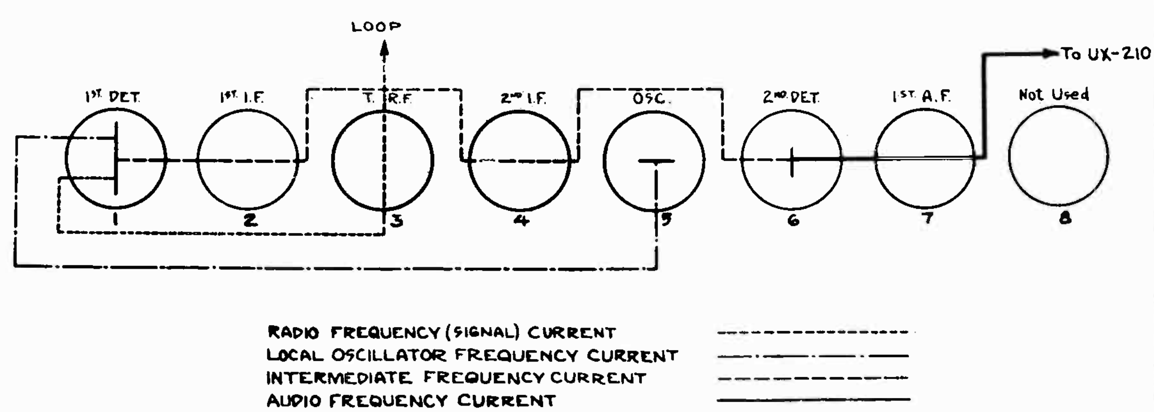


Figure 2—Radiotron sequence and path of the different currents.

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.

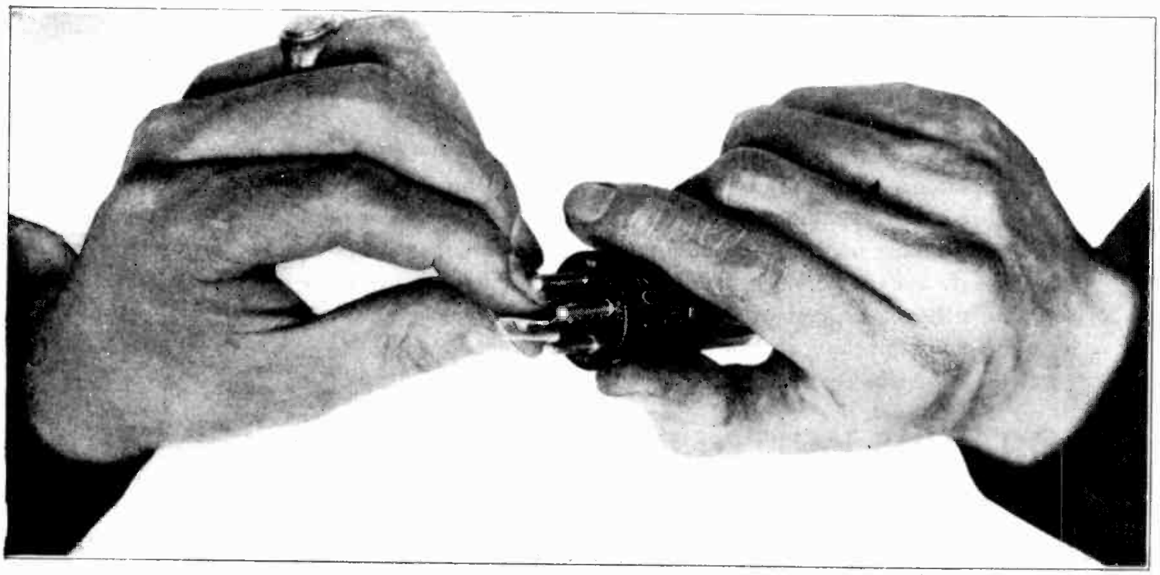


Figure 3—Radiotron prongs may be cleaned with fine sandpaper

(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 $2\frac{1}{2}$-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 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.

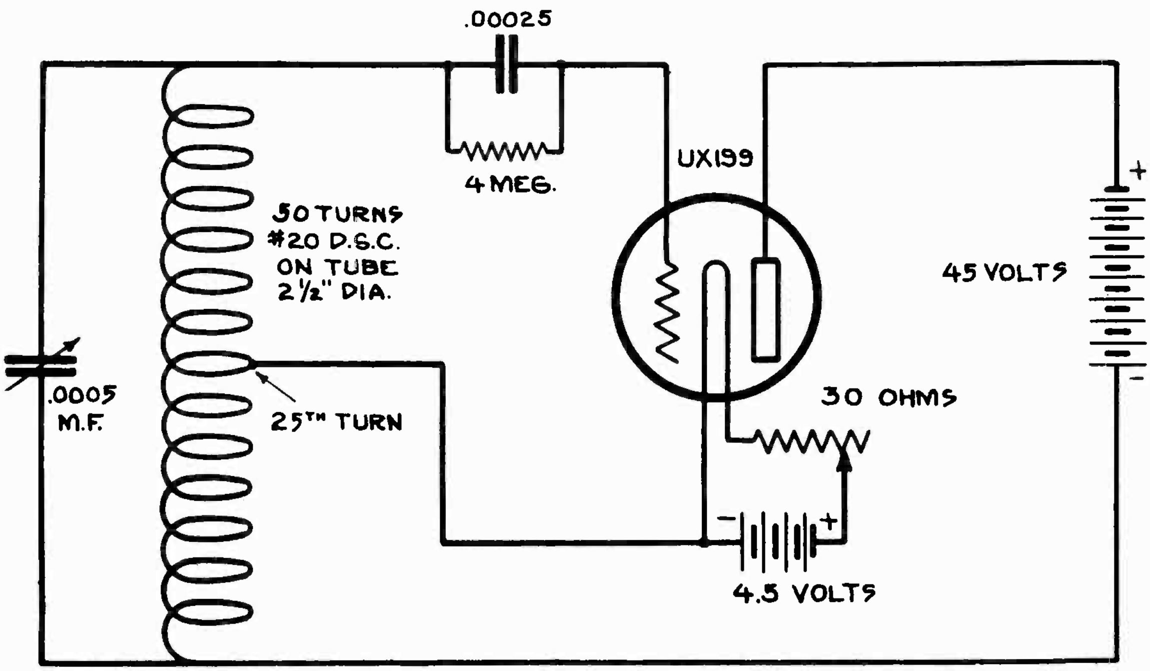


Figure 4—Wiring diagram of the modulated oscillator

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.

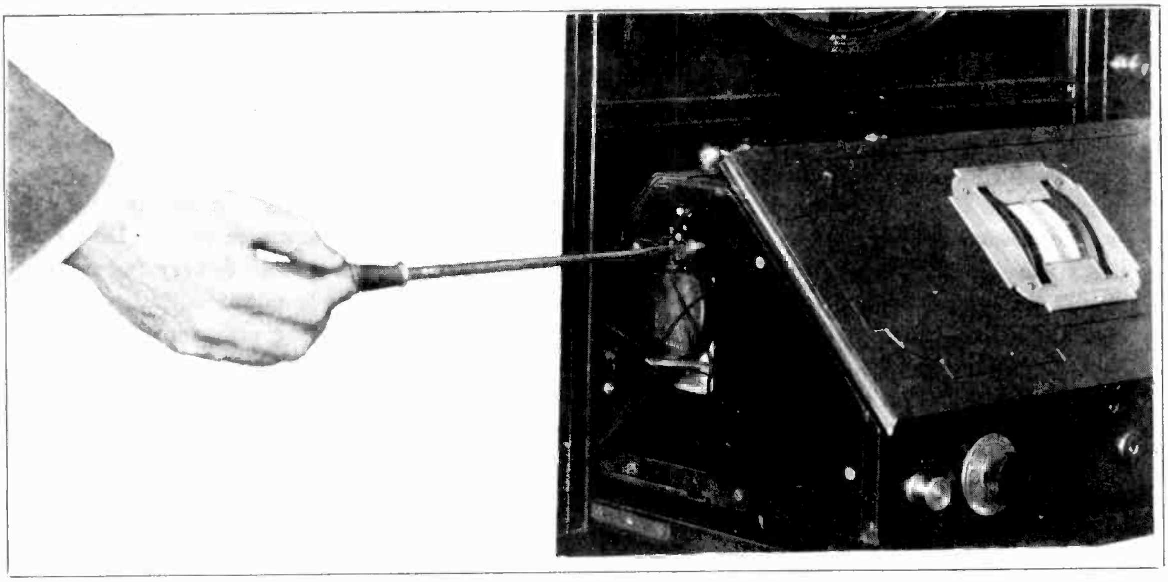


Figure 5—Adjusting the compensating condenser with a non-metallic screw-driver

(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.

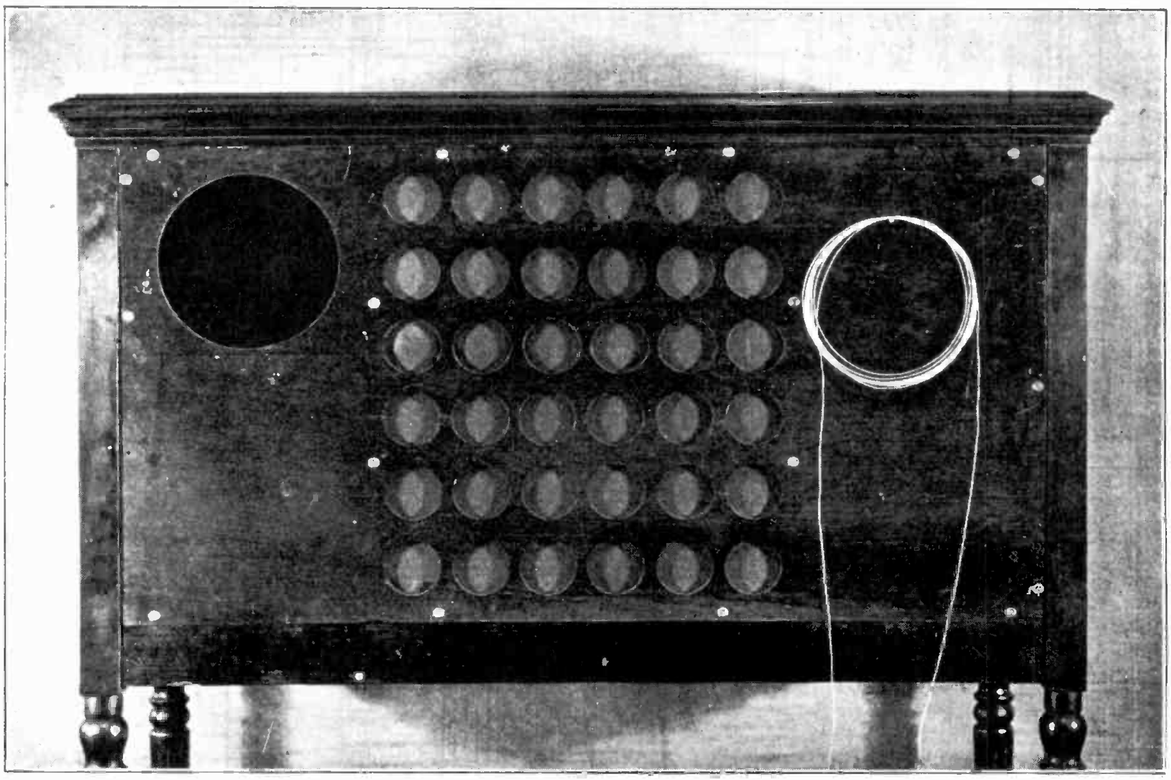


Figure 6—Proper installation of the coupling coil when using a small outdoor antenna to bring in signals in a highly shielded location

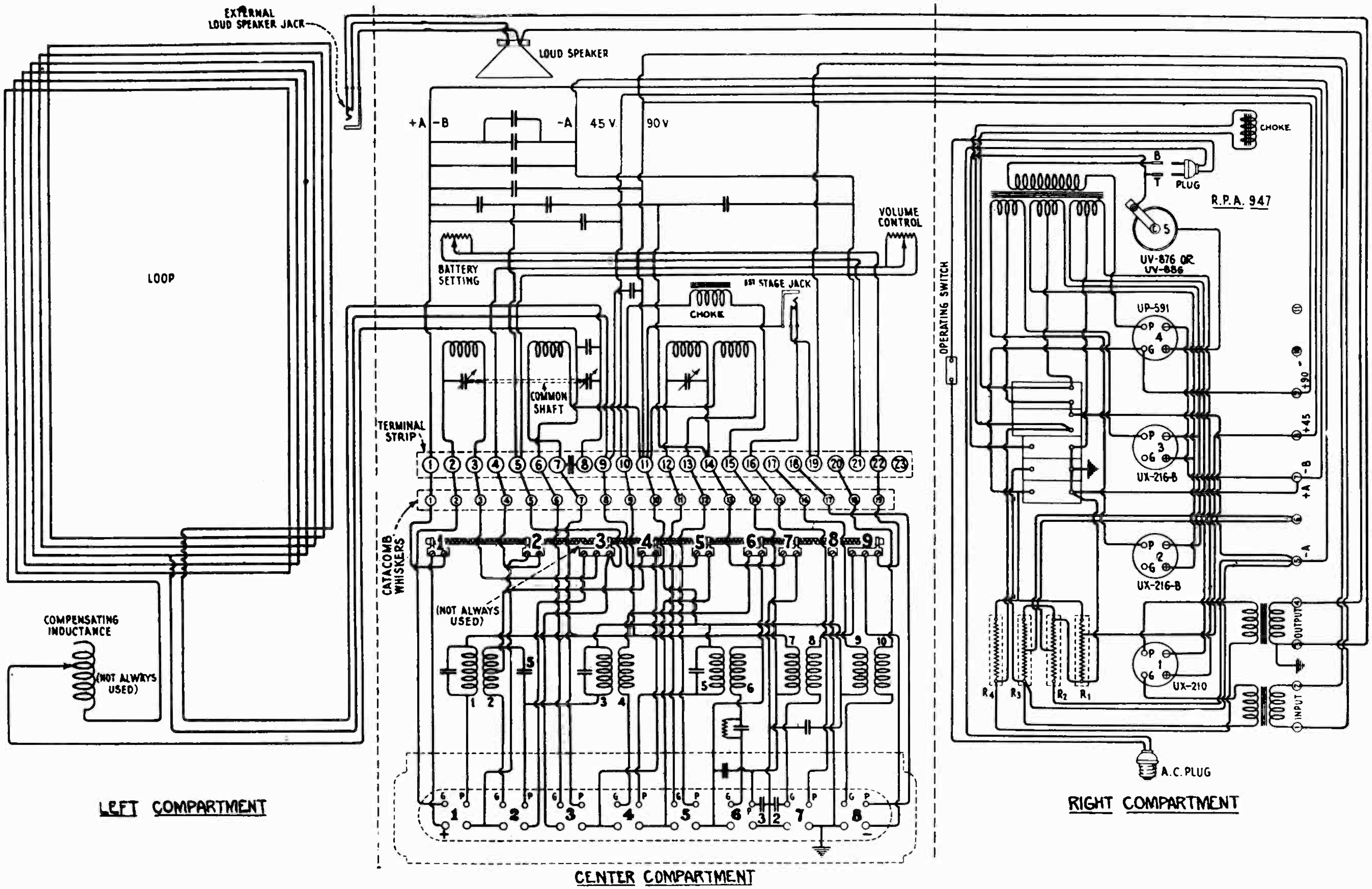


Figure 7—Radiola 30 continuity wiring diagram

(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.

$$R = \frac{E}{I} \left\{ \begin{array}{l} \text{Where R equals ohms, E equals} \\ \text{volts and I equals amperes} \end{array} \right\}$$

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

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

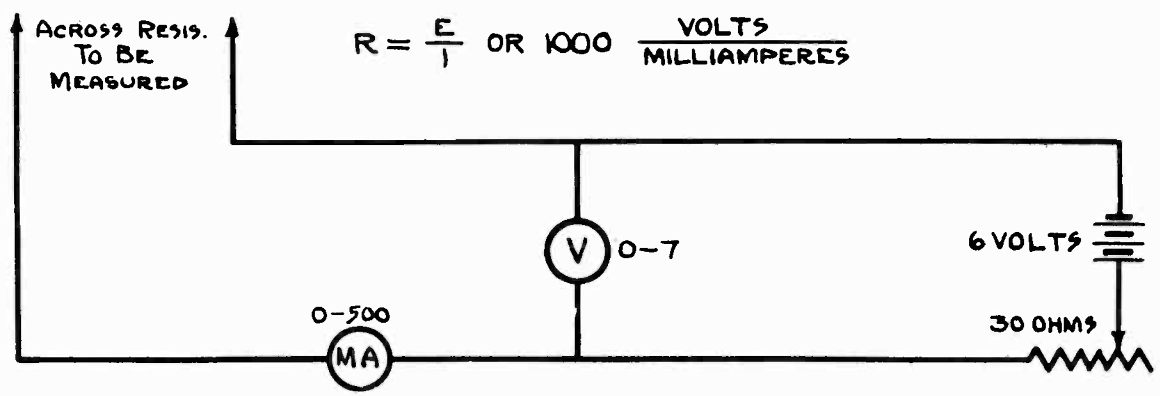


Figure 8—Wiring diagram for resistance measurement

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.

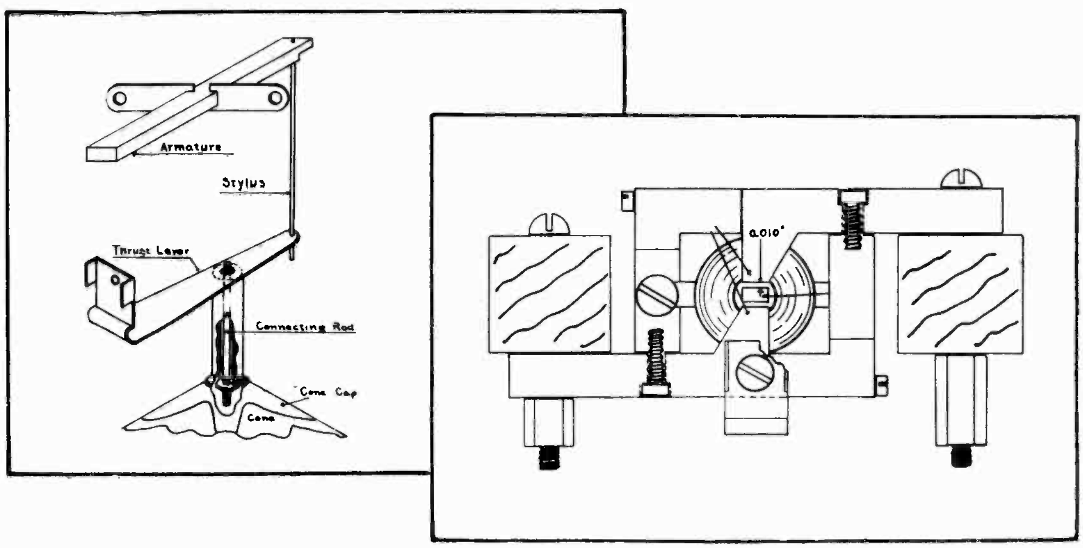


Figure 9—Details of loudspeaker unit

(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.

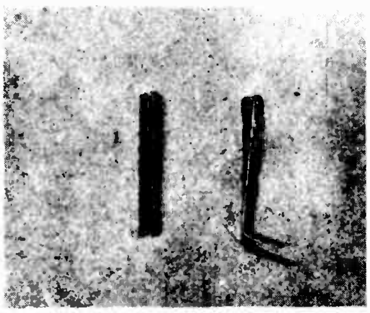
(e) Loose or bent connecting rod.

(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



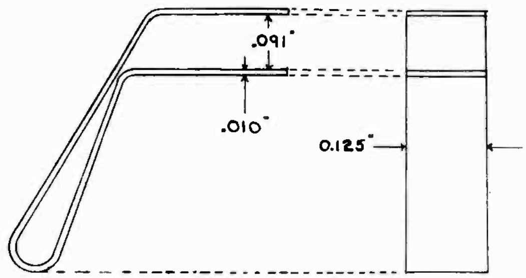


Figure 10—*Constructional details of spacer tools*

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.

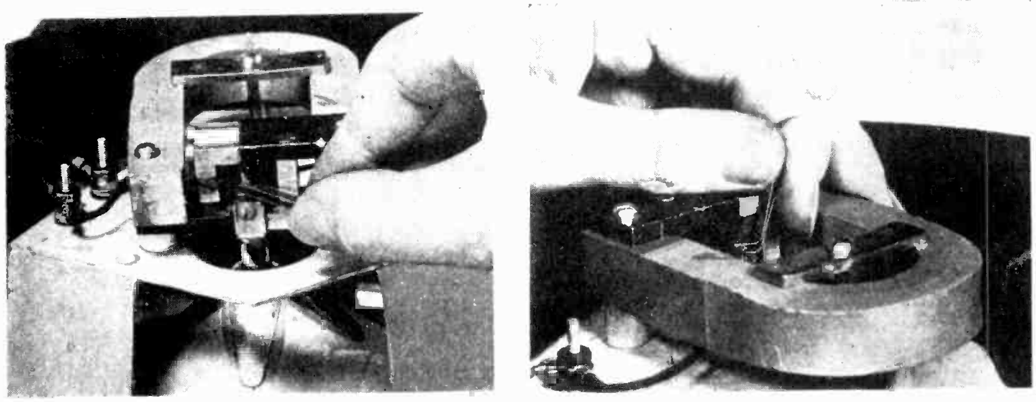


Figure 11—Use of spacer tools in armature adjustment

(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

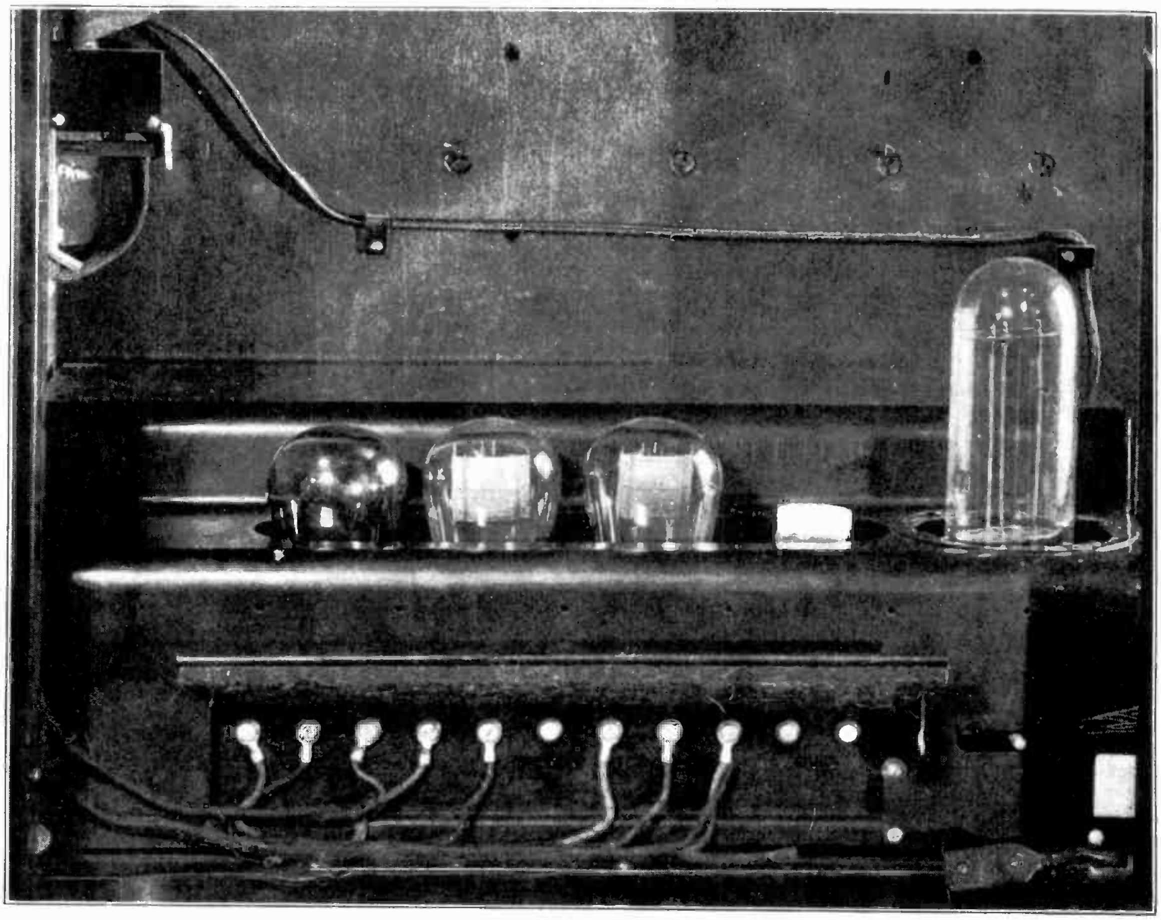


Figure 12—The Rectifier-Power-Amplifier unit

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

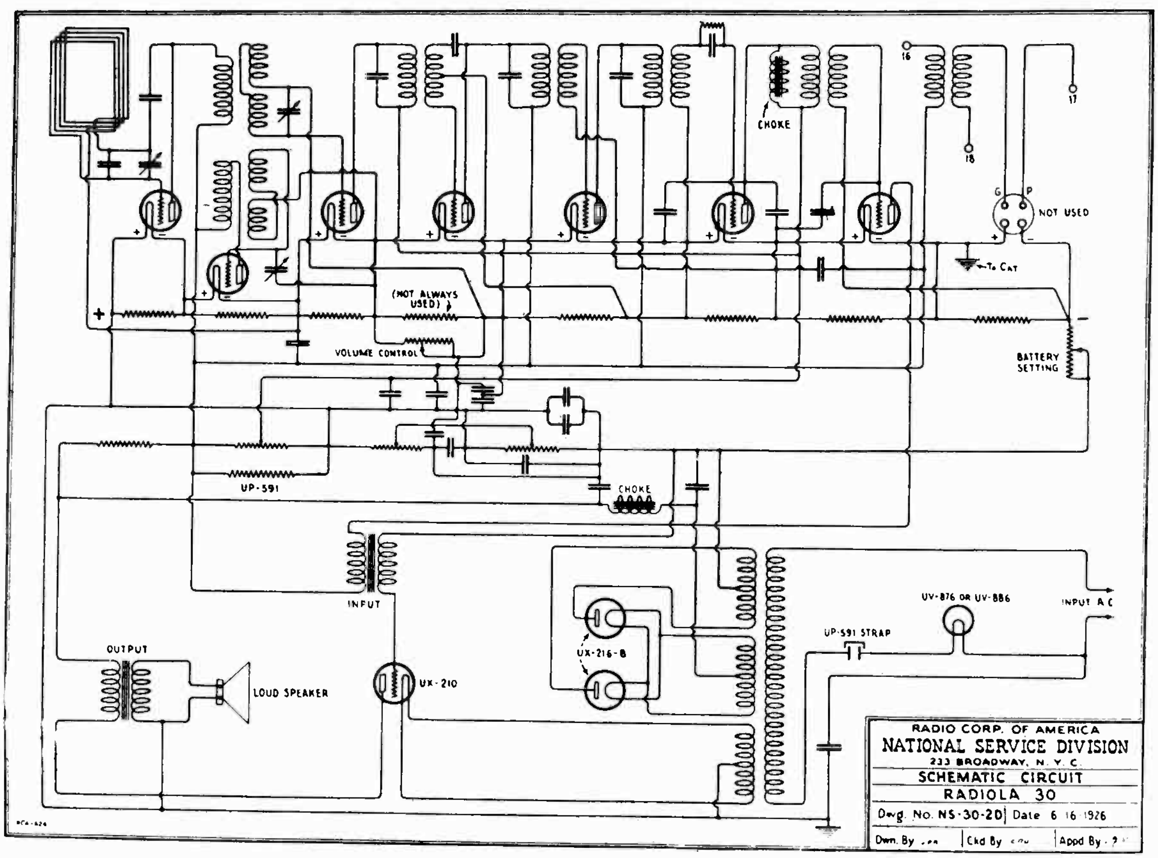


Figure 13—*Schematic circuit diagram of Radiola* 30

RCA

RCA
Radiola 30A
SERVICE NOTES

RCA Radiola 30A

Second Edition—10M—January, 1929

Radio Corporation of America
233 BROADWAY, NEW YORK CITY

DISTRICT SERVICE STATIONS

BROOKLYN, N. Y.
Bld. No. 19—168 - 39th St.

CHICAGO, ILL.
2001 West Pershing Road

SAN FRANCISCO, CAL.
274 Brannan St.

DALLAS, TEX.
Santa Fe Bldg., Unit No. 2

ATLANTA, GA.
Monroe Bonded Warehouse, Spring and Peters Sts.

A WORD OR TWO ABOUT SERVICE

Service goes hand in hand with sales. The well informed RCA Dealer renders service at time of sale in affording information as to proper installation and upkeep. Subsequent service and repair may be required by reason of wear and tear and mishandling, to the end that Radiola owners may be entirely satisfied.

Obviously this service can best be rendered by properly equipped service organizations having a thoroughly trained personnel with a knowledge of the design and operation of RCA Loudspeakers and Radiolas.

Such service organizations have been established by RCA Distributors, and RCA Authorized Dealers are advised to refer any major work or replacement to their selected Distributors. Minor replacements and mechanical and electrical adjustments may be undertaken by the RCA Dealer.

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

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

In addition to supplying the Service Notes, the RCA Service Division maintains a corps of engineers who are qualified to render valuable help in solving service problems. These engineers call upon the trade at frequent intervals to advise and assist RCA Distributors in the performance of service work.

CONTENTS

PART I—PANEL ASSEMBLY

PART II—REPRODUCER UNIT

PART III—RECTIFIER-POWER-AMPLIFIER UNIT

PART IV—MAKING REPLACEMENTS

ILLUSTRATIONS

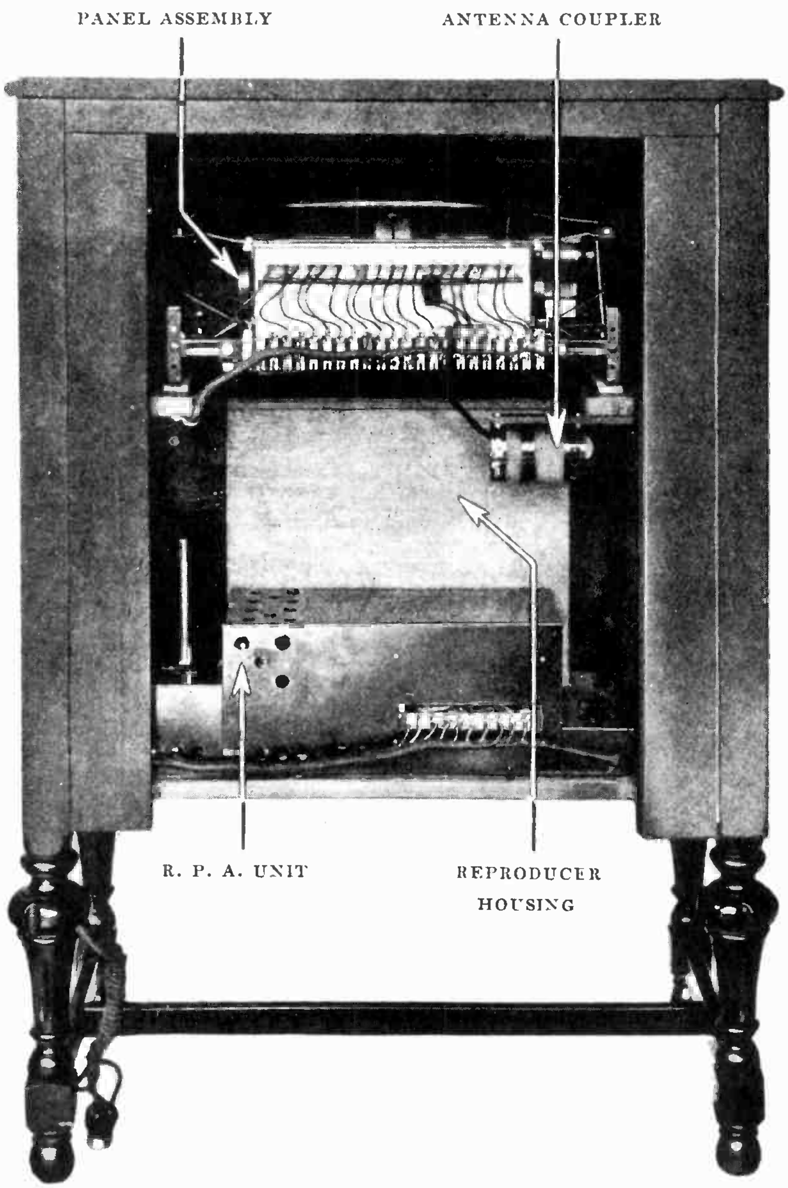


Figure 1—Rear view of Radiola 30A (doors removed) showing the panel assembly, antenna coupler, R.P.A. unit and reproducer housing

RCA RADIOLA 30A

SERVICE NOTES

Prepared by RCA Service Division

INTRODUCTION

Radiola 30A is a cabinet radio broadcast receiver, utilizing the well-known eight-tube super-heterodyne circuit, together with RCA 100A Loudspeaker unit as reproducer (Figure 1). It is designed for socket power operation—either A.C. or D.C. These notes cover A.C. type only. Very little service work should be required on Radiola 30A. However, the following information has been prepared for the guidance of those called upon to locate and remedy any trouble that may occur.

The notes are divided into four parts, namely: Part I, Panel assembly (Figure 2); Part II, Reproducer Unit; Part III, R.P.A. Unit; Part IV, Making Replacements. The particular part referring to the service work at hand should be consulted for any necessary information.

PART I—PANEL ASSEMBLY

(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.

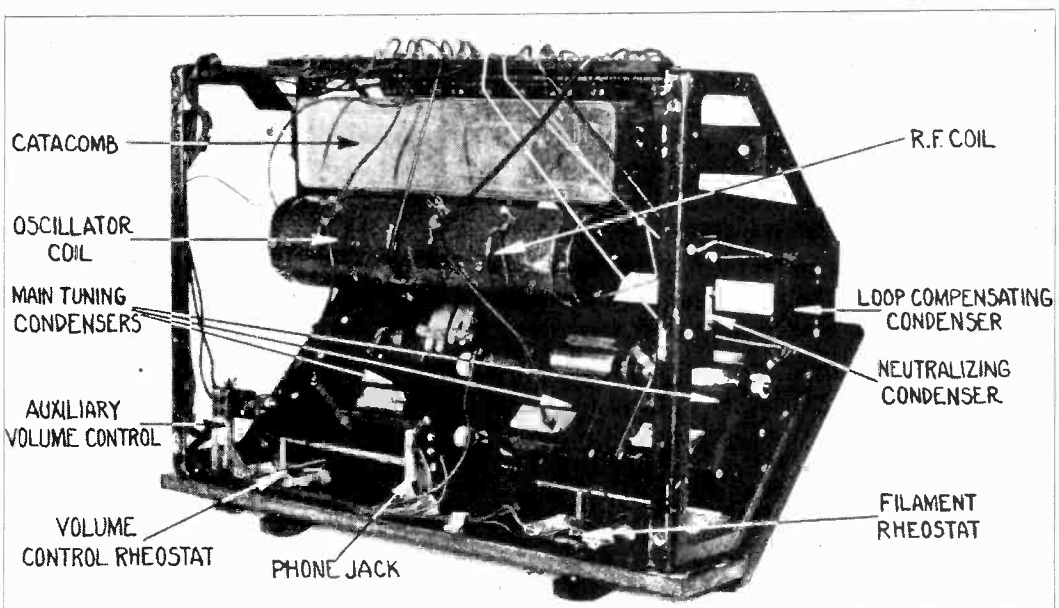


Figure 2—Rear view of panel assembly

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 Radiotron No. 7 and Radiotron UX-171 in the R.P.A. unit. Figure 3 illustrates the Radiotron sequence and the path of the different currents through them.

(2) ANTENNA COUPLER

Radiola 30A is designed for use with an antenna. An antenna coupler is provided for coupling the antenna inductively to the receiver in an efficient manner.

The antenna system necessary for satisfactory operation of Radiola 30A need not be elaborate. A small piece of insulated wire, approximately 25 feet long, placed under a rug or around the picture moulding will give sufficient pick-up for most locations. A ground to the radiator or cold water pipe will function satisfactorily.

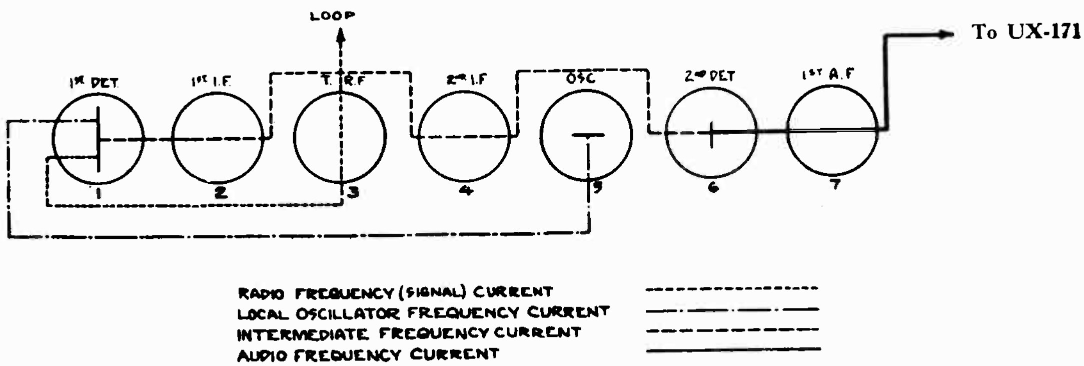


Figure 3—Radiola 30A Radiotron sequence and path of the different currents

In some shielded localities, especially in houses where metal lathing is used, satisfactory results cannot be secured with an indoor antenna. Conditions of this kind will necessitate an outdoor antenna of approximately 75 feet in length, measured from the far end of the antenna to the ground connection. It should be erected as high as can be conveniently arranged and away from any obstruction, if possible. The lead-in should preferably be a continuation of the antenna itself, thus avoiding all splices, which introduce additional resistance to the antenna system and may corrode and affect reception. It is desirable to keep the lead-in a foot or more from the building, where possible. An outdoor antenna should be protected by a lightning arrester designed in accordance with the requirements of the National Fire Underwriters' Code.

(3) RADIOTRON SOCKETS

In placing Radiotrons in their respective sockets, care should be exercised to make certain that the two large 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, examine it for excessive solder on one or more of the prongs. This may be removed with a file or knife. Never try to force a Radiotron into its socket, because it is designed to fit in snugly with very little pressure. It might be possible, by exerting considerable pressure, to force the prongs into the wrong holes, resulting in a filament burn-out when the current is switched on in the set.

(4) RADIOTRON PRONGS

Dirty Radiotron prongs may cause noisy operation. This can be avoided by cleaning the prongs occasionally with a piece of fine sandpaper. The use of emery cloth or steel wool is not recommended. Before re-inserting the Radiotrons wipe the prongs and base carefully, to make certain that all particles of sand are removed.

(5) LOOSE RHEOSTAT CONTACTS

To get at the rheostat contacts, release the panel assembly by removing the four bolts that hold the panel in position, and pull it out of the rear of the cabinet. First, however, the wire which is threaded through each bolt must be removed by unsoldering it at

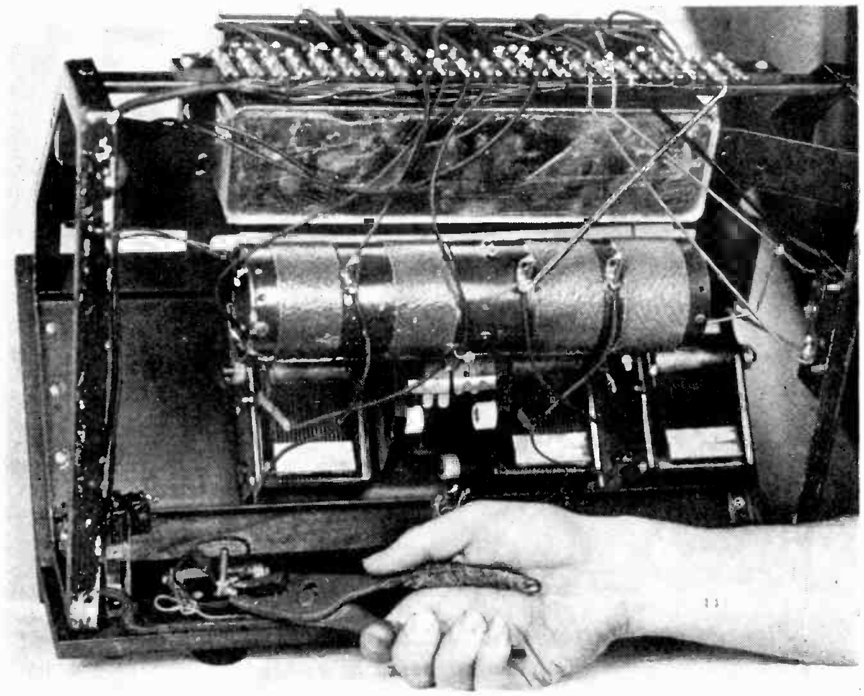


Figure 4—Adjusting contact arm on rheostat

its splice. With the bolts removed, the terminal strip cable disconnected and dropped to prevent interference, the removal of the panel assembly is easily accomplished and examination of the rheostats made possible.

The square-head set screw holding the contact arm to the shaft of the rheostat may now be loosened (Figure 4), 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. When this adjustment has been completed tighten the set screw and slip panel assembly back into cabinet, taking care to see that the panel is supported on the rubber strips and does not touch any part of the cabinet, including the apron hanging from the top of the cabinet. When viewed from the front, this apron appears to touch the top front panel, but actually it does not. If it should touch, serious microphonic trouble may result. After ascertaining that the panel is in its proper position, the four bolts, washers and lock wire should be returned to their original position.

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

The adjustment of control drums touching the escutcheon plate on the panel is attended by noisy reproduction in the loudspeaker, and 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 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 a poorly aligned condenser, remove the panel assembly, as previously instructed, and adjust the mounting screws of

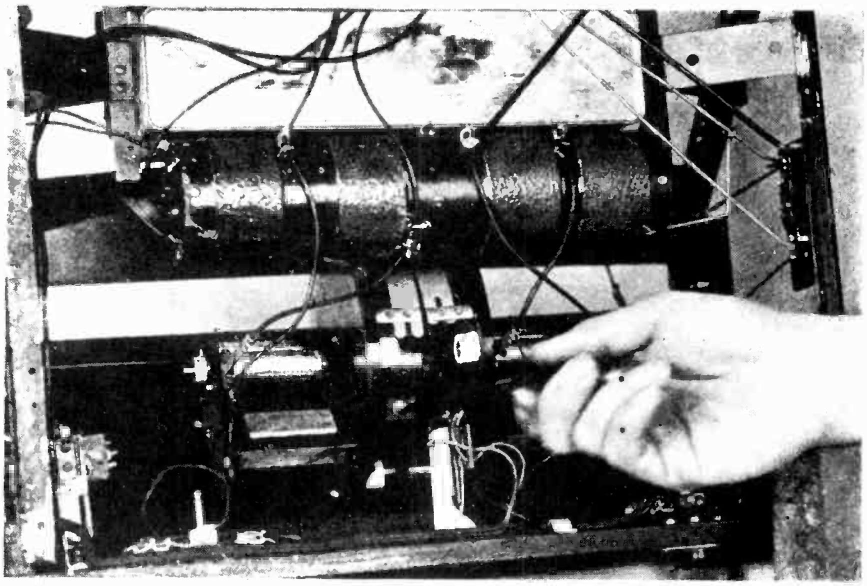


Figure 5—Adjusting friction shaft clutch tension screw inside of tuning drum assembly

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) DRUMS FAIL TO HOLD POSITION

When adjustment is necessary to correct slipped tuning drums the following procedure should be used:

(a) Remove panel assembly from cabinet and re-adjust the friction shaft clutch tension screw located inside of the tuning drum assembly (Figure 5). This screw controls the pressure of the friction clutch against the shaft of the opposite condenser. If one drum turns too hard when the other is held, release the tension screw slightly.

(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 plates.

(8) 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 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 reproduction from the loudspeaker. The remedy consists in adjusting the drum set screws to provide the necessary clearance between the dials. If adjusting the set screws does not provide the necessary clearance the points on the dials that touch should be filed until clear. Care should be taken to prevent scratching the dials.

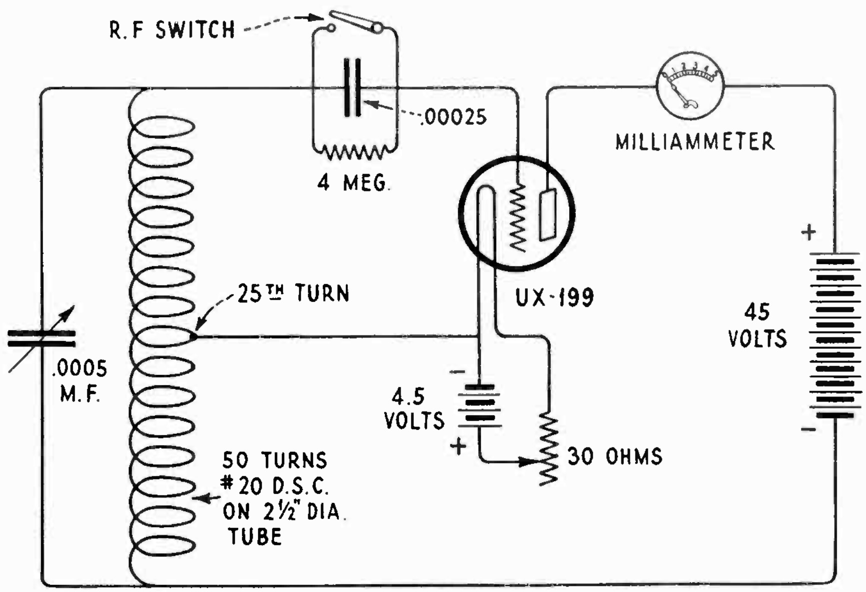


Figure 6—Schematic circuit diagram of the radio frequency and audio frequency oscillator

(9) ANTENNA COUPLER COMPENSATING CONDENSER

The antenna coupler compensating condenser is connected in shunt to the grid circuit of the antenna coupler to compensate the coupler for any increased distributed capacity in the radio frequency windings. It is adjusted at the factory to properly balance the coupler and should, therefore, not be tampered with unless proper facilities are available for correctly adjusting it.

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 necessary. The necessary equipment consists of a calibrated R. F. oscillator and a non-metallic screwdriver at least 8 in. long. The circuit diagram of the oscillator is shown in Figure 6. 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. This oscillator will cover the frequency range of 550 to 1,500 K.C. (200 to 546 meters) very efficiency. The grid condenser and leak will modulate the output when the oscillator is used, where modulation is necessary The meter is a standard 0-5 milliampere meter. A 4-megohm grid leak and .00025 grid condenser is used. A 45-volt "B" battery for plate supply and 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 condensers and neutralizing other Radiolas of this type 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 antenna coupler compensating condenser is necessary proceed as follows:

(a) Remove tubes from Radiola catacomb.

(b) Disconnect the three antenna coupler leads from terminals 6, 8 and 9 of the catacomb terminal strip.

(c) Place oscillator into operation at 1,500 K.C. with the exploring coil in an inductive relation to the tuned R. F. coil of the panel assembly. (Left end of long coil facing panel from the front.)

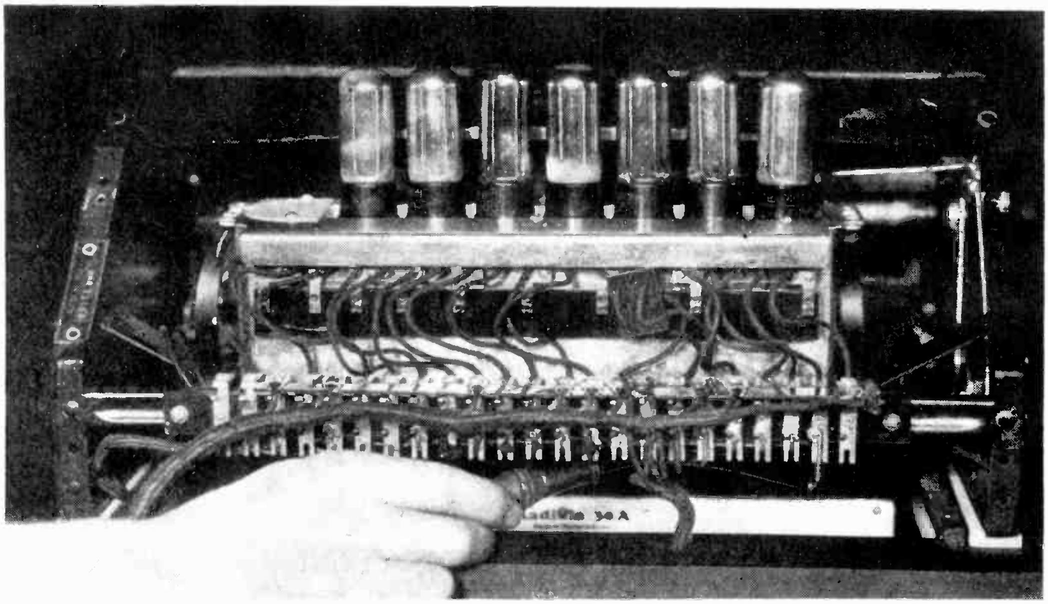


Figure 7—Adjusting neutralizing condenser

(d) Now move the left tuning drum, leaving the right one at the extreme low frequency end, until a dip is noted in the meter. Adjust this drum for maximum deflection.

(e) Now without disturbing the setting of the oscillator, move it to an inductive relation to the antenna coupling coil. Reconnect the three leads of the antenna coupler to the terminal strip.

(f) If the circuit is properly compensated, there will be a deflection obtained with the antenna coupler connected to the terminal strip and the oscillator in its new position.

(g) If no deflection is obtained under these conditions it will be necessary to adjust the compensating condenser until a maximum deflection is obtained with the left tuning control in the position for the maximum deflection previously obtained with the oscillator at the R. F. coil.

(h) Set oscillator at 550 K.C. and repeat entire procedure. Make any re-adjustment that may be necessary.

The compensating condenser is now properly adjusted.

This method of adjusting these circuits by use of a milliammeter in the plate circuit of an R.F. oscillator is much more accurate than any method that uses an audible indication of resonant points. The reason for this is, that a meter is much more sensitive to small variations of current than the human ear is to small changes of sound intensity.

(10) OSCILLATION

Radiola 30A may oscillate over portions of the tuning scale or throughout its entire range. When this trouble is encountered, it may be due to one of the following causes:

(a) Defective neutralizing condenser inside of the catacomb. The remedy in this case is to replace the entire catacomb. However, before assuming this to be the trouble all other possible causes should be check.

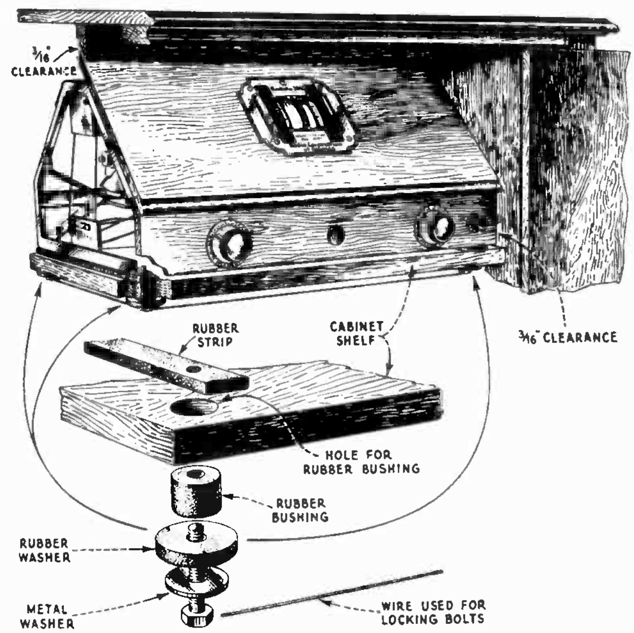


Figure 8—Panel assembly supports with rubber insulation to prevent microphonic action

(b) The antenna coupler neutralizing condenser connected across terminals 7 and 8 of the catacomb terminal strip may be out of adjustment. A procedure for properly adjusting this condenser follows: The necessary equipment is a modulated oscillator (described in Part I, Section 9); a "dummy" Radiotron; made by removing one filament prong of an otherwise O.K. Radiotron UX-199; a long non-metallic screwdriver and a 50-ohm compensating resistance.

1. Place modulated oscillator into operation at 1,000 K.C. about 20 feet from Radiola.
2. Tune in signal from oscillator in usual manner, adjusting all controls for loudest signal.
3. Now remove Radiotron No. 3, counting from left to right facing the front of the Radiola, and replace with the "dummy" Radiotron. Also connect the

50-ohm compensating resistance across terminals 3 and 4 of the catacomb resistance strip.

4. With the foregoing changes the oscillator signal should be very weak or should not be heard at all. If it is heard, even though weak, break the wax seal of the neutralizing condenser adjusting screw and alter the condenser capacity (Figure 7) until there is a minimum signal heard in the reproducer unit. If the volume control is reduced so that the neutralizing adjustment will cause the signal to just disappear, a proper adjustment has been found, and the adjusting screw should be again sealed with ordinary sealing compound, to prevent any change.
5. The "dummy" Radiotron and compensating resistance are now removed and the set is returned to normal operation.

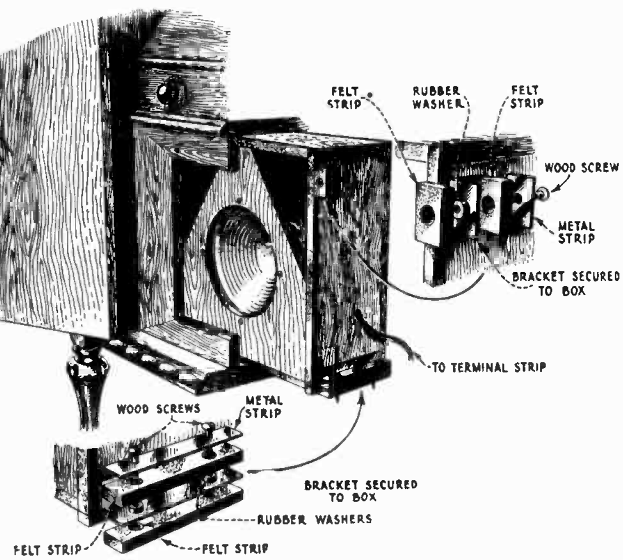


Figure 8A—Method of insulating reproducer unit from cabinet to prevent microphonic action

(11) HOWLING

Howling may be caused either by a microphonic Radiotron in the catacomb, or some part of the panel assembly touching the cabinet.

In the case of a microphonic Radiotron UX-199 in the catacomb, the sound waves from the reproducer set the Radiotron elements into vibration, which in turn, produces an amplified howl in the loudspeaker output. Conditions being favorable, the howl will increase in intensity. The remedy is to interchange the Radiotrons, remembering that Radiotrons 1, 3 and 6 are the most sensitive to microphonic conditions.

If interchanging the Radiotrons does not remedy the condition, an inspection must be made of the insulating supports of the panel assembly (Figure 8). The panel assembly rests on rubber strips. The bolts holding the frame are provided with large rubber washers. The panel assembly resting on the rubber strips should be free-floating within the cabinet. The front panels should be carefully examined to see that they do not touch either side of the cabinet or the apron hanging from the top of the cabinet. Any contact of the panel assembly or the loudspeaker assembly with the cabinet will be sufficient to cause the Radiola to develop a howl. Figure 8A illustrates method of insulating the reproducer unit from cabinet to prevent microphonic action.

(12) RESISTANCE STRIP TESTS

The resistance 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 9.

The resistance may then be calculated by the use of Ohm's law.

$R = \frac{E}{I}$ where R equals ohms, E equals volts and I equals amperes

$$\text{or ohms} = 1{,}000 \frac{\text{volts}}{\text{milliamperes}}$$

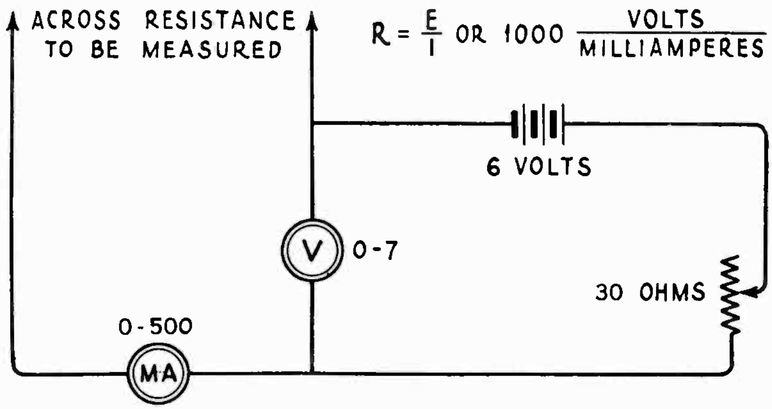


Figure 9—Schematic circuit diagram for resistance measurement

Since the current reading is taken in milliamperes (or $\frac{1}{1{,}000}$ ampere) it is necessary to multiply by 1,000 to get the resistance value in ohms.

The allowable values in ohms for the different sections of the resistance strips in Radiola 30A are tabulated below:

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

(13) CATACOMB AND PANEL CONTINUITY TEST

Both filament control and volume rheostats should be adjusted so that half the resistance is in the circuit, the antenna coupler connections removed and the power supply cable disconnected from the terminal strip at the rear of the catacomb.

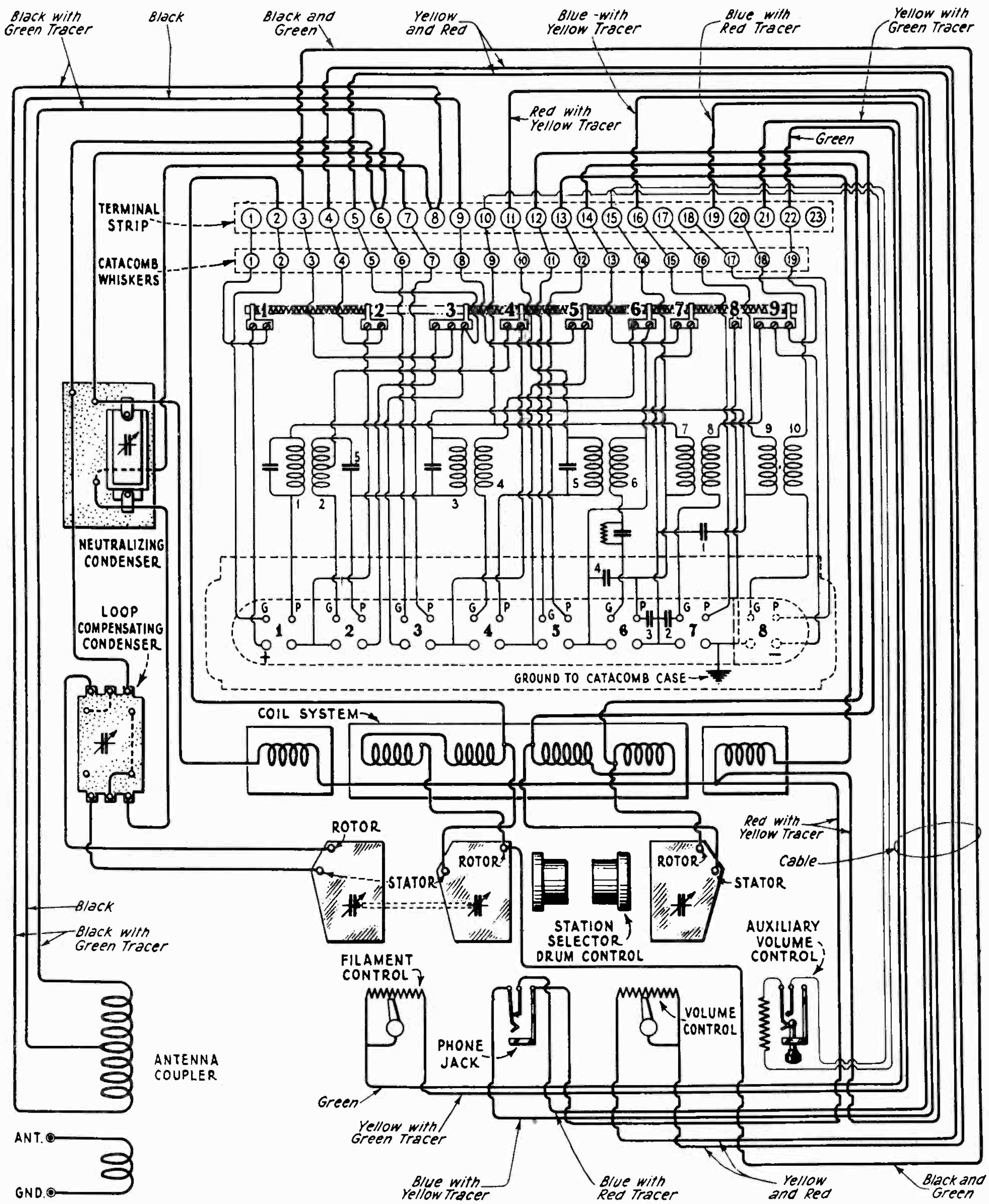


Figure 10—Panel and antenna coupler assembly continuity wiring diagram

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 the 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 "Incorrect Effect Caused By." 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 10.

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 TESTS (Coils and Connections)

The Radiotrons, Cable and Antenna Coupler Connections Are to Be Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
2 to G1	Closed	Open connection
6 to G3	Closed	Open connection
7 to P3	Closed	Open connection
9 to G2	Closed	Open ½ coil No. 2 or resistance strip
9 to G4	Closed	Open coil No. 4 or resistance strip
10 to P1	Closed	Open coil No. 1
10 to P6	Closed	Open coil No. 7
11 to P2	Closed	Open coil No. 3
11 to P4	Closed	Open coil No. 5
11 to Terminal No. 17	Closed	Open coil No. 9
12 to G5	Closed	Open connection
13 to P5	Closed	Open connection
16 to P7	Closed	Open connection
22 to G7	Closed	Open coil No. 8

PANEL TESTS

With Radiotrons, Cable, Antenna Coupler Connections and Resistance Strip Removed

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
3 to 2	Closed	Open R. F. coil
5 to 4	Closed	Open volume control
11 to 7	Closed	Open R. F. coil
13 to 11	Closed	Open oscillator coil
14 to 12	Closed	Open oscillator coil
16 to 11 (With shorted telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
19 to 16 (With no telephone plug in 1st stage jack)	Closed	Defective 1st stage jack
22 to 21	Closed	Open filament control

PANEL TESTS (Condensers)

Antenna Coupler Disconnected

Terminals	*Correct Effect*	*Incorrect Effect Caused by:*
8 to 6	Open	Compensating Condenser or the main tuning condenser shorted
8 to 7	Open	Shorted neutralizing condenser

(14) VOLTAGE READINGS

The following are the voltages obtained at the catacomb terminal strip, when tests are taken across the terminals indicated in the table below. A high resistance voltmeter of at least 600 ohms resistance per volt should be used. The allowable variation plus or minus is approximately 5 volts.

VOLTAGE READINGS OF RADIOLA 30A

Taken at Catacomb Terminal Strip—Count Terminals from Left to Right When Facing Front of Radiola 30A

Terminals	*Correct Effect*
1 to 21	Should measure 31 volts, normally, with all Radiotrons lit and battery setting near "Off." Positive terminal of voltmeter on No. 1.
1 to 10	Should measure 21.5 volts, normally. Positive terminal of voltmeter to No. 10.
10 to 11	Should measure 41 volts, normally. Positive terminal of voltmeter to No. 11.