

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-acoustic unit) giving vastly 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 $1\frac{1}{2}$ 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 $2\frac{1}{2}$ inches and a height not exceeding $6\frac{1}{2}$ inches and having screw and thumb nut terminals.

"B" Battery (for plate supply)

Four $22\frac{1}{2}$ 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 $4\frac{1}{8}$ by $2\frac{3}{4}$ 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 $4\frac{1}{2}$ 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 $1\frac{3}{8}$ 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 acoustic 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 $22\frac{1}{2}$ 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". 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.

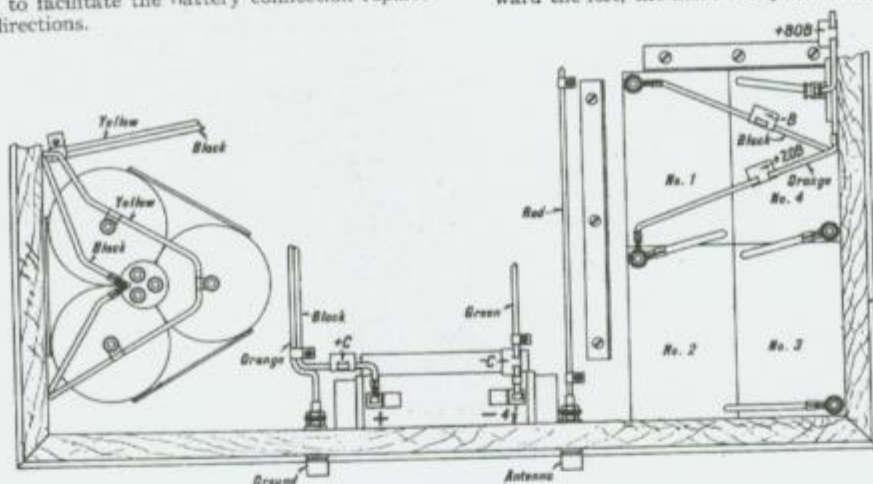


Fig. 2—Diagram of Battery Connections

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.

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-acoustics 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.

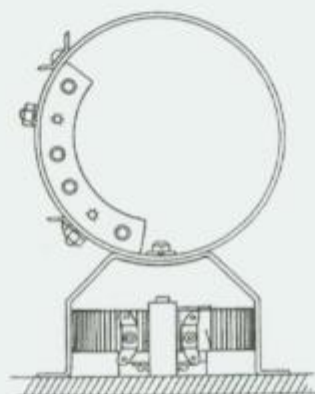


Fig. 3—View Showing Top of Antenna Coil