

Radiola 20

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Radiola 20

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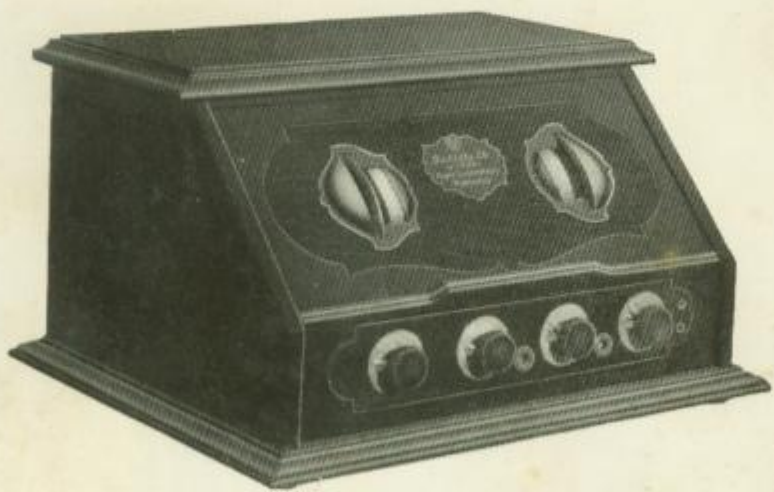
Instructions 86990
Edition C

Radio Corporation of America

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Radiola 20

IMPORTANT

Read the entire Instruction Book before attempting to install or operate this Radiola. The Preliminary Operations described in paragraph 2, page 6, should be performed immediately after removing the Radiola from the shipping container.

Radiola 20

TUNED RADIO FREQUENCY RECEIVER WITH TICKLER-CONTROLLED REGENERATION

INTRODUCTION

RADIOLA 20 is a five-tube dry battery operated broadcast receiver. This Radiola requires an antenna and ground for its operation. It possesses unusual sensitivity and selectivity, and at the same time is extremely simple to operate. It is designed for reception over the broadcast frequency band, 550 to 1500 kilocycles (550 to 200 meters, approximately).

Radiola 20 employs two stages of tuned radio frequency amplification, a regenerative detector and two stages of audio frequency amplification. The regeneration in the detector is separately controlled by means of a tickler coil and adds greatly to the sensitivity and selectivity of the Radiola, without causing interference to nearby receiving sets due to radiation. Ample volume without distortion is made possible by the use of the new RCA dry battery operated power amplifier Radiotron UX-120 in the last stage of audio frequency amplification.

The tuning of Radiola 20 is unusually simple due to the fact that the three separate tuning controls, which are usually found in receivers employing similar types of circuits, are replaced by a single selector control. The variable condensers are of the "straight-line-frequency" type which permit the broadcast stations to be received at uniform intervals on the "STATION SELECTOR" drum. The scale on the "STATION SELECTOR" drum refers to frequency rather than wavelength; therefore, in this Radiola the long wavelength (low frequency) stations are received at the lower scale readings of the drum.

EQUIPMENT

Radiola 20 is supplied with the following accessories:

- 2 Five foot leads with terminal pins for connection to antenna and ground.
- 1 Battery Cable, attached to receiver.
- 6 Short Battery Connectors.
- 4 Long Battery Connectors.

The following Radiotrons should be provided:

- 4 Radiotrons, Model UX-199.
- 1 Radiotron, Model UX-120.

The Radiola Loudspeaker Model 100 or UZ-1325 is recommended for use with Radiola 20.

BATTERIES REQUIRED

(A) Six Radio "A" dry cells, approximate size $2\frac{1}{2}'' \times 6\frac{1}{2}''$, such as:

- 6 Eveready Dry Cell Radio "A" Batteries No. 7111, or
- 6 Eveready Columbia Ignitor No. 6 Dry Cells, or
- 6 Burgess No. 6 Radio "A" Dry Cells, or
- 6 Ray-O-Vac No. 1211 Radio "A" Cells, or equivalent.

(B-1) Two 45 volt extra large "B" batteries, approximate size $8\frac{3}{16}'' \times 4\frac{7}{16}'' \times 7\frac{3}{16}''$, such as:

- 2 Eveready No. 486 or No. 770, or
- 2 Burgess No. 10308, or
- 2 Ray-O-Vac No. 9303, or equivalent.

(B-2) One 45 volt large "B" battery for supplying the extra plate voltage required for the operation of the Radiotron UX-120, approximate size $8\frac{3}{16}'' \times 3\frac{1}{4}'' \times 7\frac{1}{8}''$, such as:

- 1 Eveready No. 772, or
- 1 Burgess No. 2308, or
- 1 Ray-O-Vac No. 2303, or equivalent.

NOTE—Two $22\frac{1}{2}$ volt "B" batteries may be used for group B-2 in place of the single 45 volt "B" battery if a 45 volt block is not available.

(C) One $22\frac{1}{2}$ volt *tapped* "B" battery used as a "C" battery, approximate size $6\frac{3}{4}'' \times 4\frac{1}{8}'' \times 3\frac{3}{16}''$, such as:

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

NOTE—If a *tapped* "B" battery as specified for the "C" battery is not available, an ordinary $22\frac{1}{2}$ volt "B" battery may be used, but in this case an additional $4\frac{1}{2}$ volt "C" battery will be required. The positive (+) terminals of the two batteries must in this case be joined together by a connecting wire and either positive terminal

considered as the positive (+) $22\frac{1}{2}$ volt terminal of the "C" battery combination in following the connection diagram, Fig. 2. The cable leads tagged " $-4\frac{1}{2}$ C" and " $-22\frac{1}{2}$ C" are then connected to the corresponding negative (-) terminals of the two "C" batteries.

NOTE—The fact that the Radio Corporation of America does not list batteries of all manufacturers is not intended as a reflection on the products of any battery manufacturer not mentioned. Any battery having dimensions, capabilities and satisfactory terminal connections similar to those of the batteries listed may be used. By using "B" batteries of the dimensions recommended for groups B-1 and B-2, approximately the same life is obtained from all of the "B" batteries and they will require renewal at about the same time.

ANTENNA

Outdoor Type—In general, best results will be obtained by using an outdoor antenna. It should be from 75 to 150 feet over all. This includes the lead-in and ground connections. It should be as far removed as possible from all obstructions and should be as high from the ground as can be conveniently arranged. The lead-in should preferably be a continuation of the antenna itself. All splices must be properly soldered to insure good electrical contact.

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 use of a flat "window-strip" type of lead-in is not recommended.

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.

Indoor Type—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 number 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.

GROUND

Too much 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 pipes or steam pipes generally 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 user experiment with various grounds, and employ the one giving the best results. Radiola 20 is capable of receiving over great distances when connected to an efficient antenna and a low resistance ground. A poor ground connection will not be apparent on local reception, but it is an important factor 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 be erected not 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.

INSTALLATION

1. Location—Radiola 20 may be installed in any convenient place, but preferably at a point where the lead-in and ground connections will be as short as possible.

2. Preliminary Operations—After Radiola 20 has been removed from its shipping container, and **before connecting the cable to the batteries**, the following preliminary operations are to be performed:

(a) Using a long screw driver, remove the screw at the end of wire A, Fig. 1, which screw fastens the audio transformer assembly to the cabinet floor. The wire may be used to lift the screw out of the cabinet.

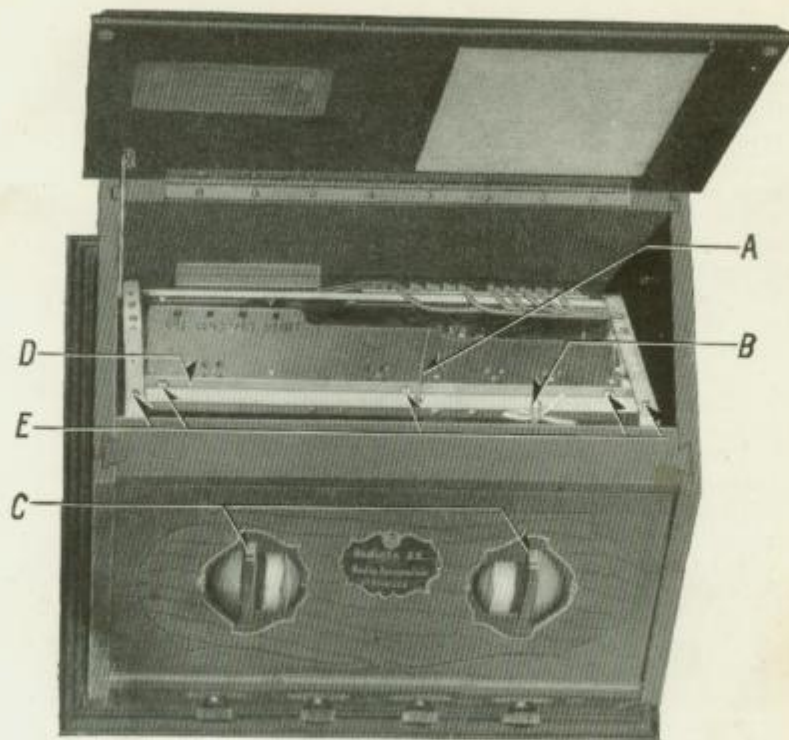


Fig. 1—Radiola 20, Showing Shipping Devices

- A*—Wire leading to screw holding transformer to cabinet floor.
- B*—Tape holding "AMPLIFICATION" mechanism.
- C*—Rubber wedges (Remove these before manipulating drum controls).
- D*—Shipping clamp (Remove this red clamp before inserting Radiotrons).
- E*—Screws fastening shipping clamp to frame and Radiotron shelf.

(*b*) Cut one side of tape loop *B*, Fig. 1, which holds the "AMPLIFICATION" mechanism.

(*c*) Remove the rubber wedges *C*, Fig. 1, which lock the "STATION SELECTOR" and "AMPLIFICATION" drum controls by pulling on the rubber wedges and at the same time rotating the drums downward.

(*d*) Remove the red shipping clamp *D*, Fig. 1, as follows: First remove the three large round-head screws which fasten the clamp to the Radiotron socket shelf. Then remove the two smaller round-head screws which fasten the clamp to the metal frame at each end. Move the red clamp toward the front panel

and down to the right so that its left end may be raised clear of the frame. It may then be withdrawn from the set. (If any screws or lock washers should accidentally fall into the cabinet, these should be removed by turning the set upside down before proceeding further.)

The above shipping devices, including fastening screws and lock washers, should be saved for replacement in event of the owner desiring to ship the Radiola at a later date.

3. Installation of Batteries and Radiotrons—Whenever batteries are being installed or renewed, **be sure that the Radiotrons are removed from the sockets.** Do not allow any of the battery terminals or ends of battery leads to touch one another.

Connections from Radiola 20 to the batteries are made by means of the seven-conductor cable which emerges from a hole in the bottom of the cabinet.

Place the batteries conveniently near the set, either on the table or on the floor. Connections should be made in accordance with the diagram, Fig. 2, also shown on the instruction card attached to the inside of the cabinet cover.

(a) *Connections to "A" Battery*—The six "A" dry cells should be connected in two parallel groups of three each in series, six short connectors being provided for this purpose.

Connect three cells in series by joining the positive (+) terminal (center) of one cell to the negative (—) terminal (edge) of the second cell. The positive (+) terminal of this second cell should be connected to the negative (—) terminal of the third. The other three cells should be similarly connected.

The two groups should be connected in parallel by joining the two negative (—) terminals of the two groups of three cells each, as shown at the right end of the "A" battery in Fig. 2. Likewise the two positive (+) terminals at the other end of the two groups should be joined. The yellow lead with the metal tag marked "+A" should be connected to one of the two positive terminals just joined together. The green lead with yellow and red tracer marked "—A—B+C" should be connected to one of the two negative terminals which have been joined together.

Care must be taken that the "A" batteries are connected exactly as described above and as shown in Fig. 2. Otherwise serious damage to the Radiotrons may result.

(b) *Insertion of Radiotrons*—Turn the "BATTERY SETTING" knob *M*, Fig. 4, to the left until the pointer rests on "OFF." Unpack the five Radiotrons, handling them with due care and

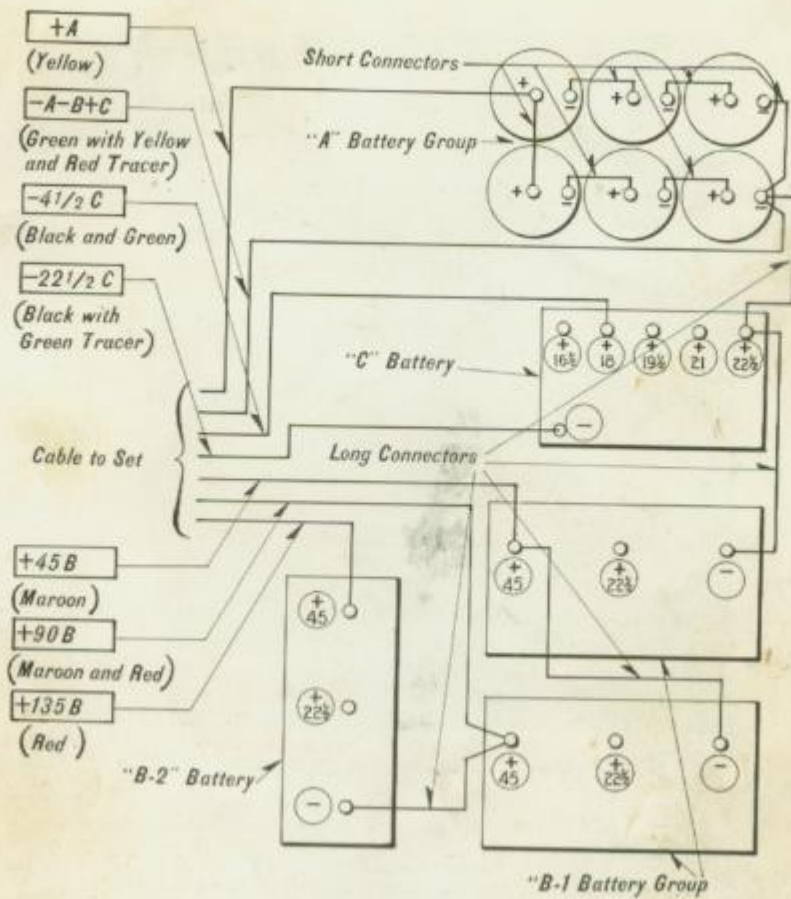


Fig. 2—Battery Connections for Radiola 20

insert them in the sockets as shown in Fig. 3. Be sure to put Radiotron UX-120 (which is marked "FOR LAST AUDIO STAGE ONLY") in the middle socket, marked 5.

In placing Radiotrons in the sockets make certain that the two large pins are aligned with the two large holes of the sockets. Grasp each Radiotron by its bakelite base, and press firmly into its socket. 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

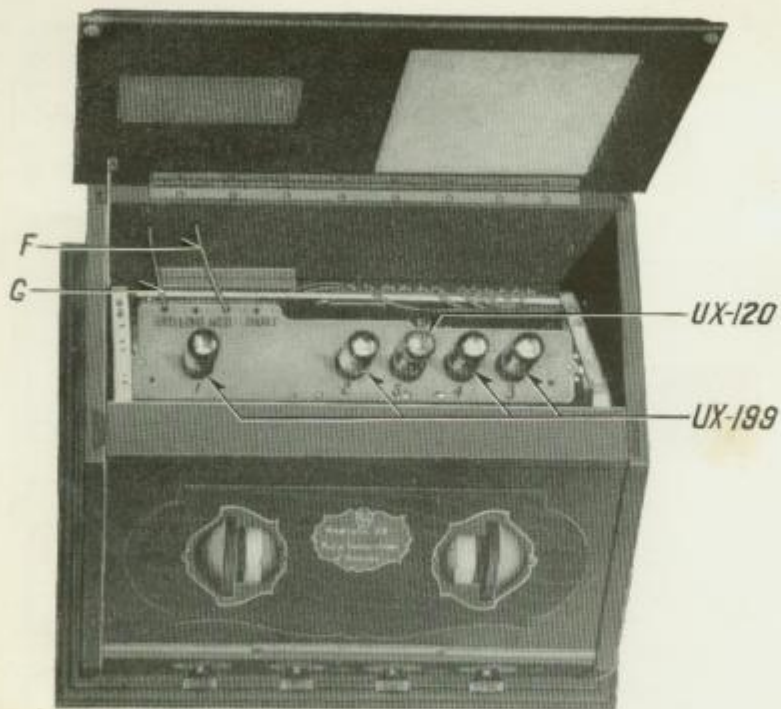


Fig. 3—Radiola 20, Showing Radiotrons in Place

- F*—Lead to antenna.
- G*—Lead to ground.
- 1*—First radio frequency amplifier (Radiotron UX-199).
- 2*—Second radio frequency amplifier (Radiotron UX-199).
- 3*—Regenerative detector (Radiotron UX-199).
- 4*—First audio frequency amplifier (Radiotron UX-199).
- 5*—Second audio frequency amplifier (Radiotron UX-120).

be removed with a file or knife. Never use force to seat the Radiotrons or the socket contacts may be sprung out of place.

Turn the "VOLUME CONTROL" knob *N*, Fig. 4, to the right until its pointer rests at "LOUD," and turn the "BATTERY SETTING" knob *M*, Fig. 4, to the right to approximately "3" on its scale. The filaments of all the Radiotrons should now be lighted, as may be noted by the slight glow usually visible near the base of each tube. After determining that all

Radiotrons light properly, turn the "BATTERY SETTING" control to "OFF" and remove the Radiotrons from their sockets.

(c) *Connections to "B" and "C" Batteries*—Connect the "A," "B" and "C" batteries together by means of the long connectors as shown in Fig. 2, or on the instruction card on the inside of the Radiola cover. Connect the positive (+) $22\frac{1}{2}$ volt terminal of the tapped $22\frac{1}{2}$ volt battery (used as a "C" battery) to one of the two joined negative (—) edge terminals of the "A" battery. Connect the same positive (+) $22\frac{1}{2}$ volt terminal of this battery to the negative (—) terminal of one of the extra large 45 volt "B" batteries of group B-1. Connect the positive (+) 45 volt terminal of this "B" battery to the negative (—) terminal of the other extra large 45 volt "B" battery of group B-1, and connect the positive (+) 45 volt terminal of this battery to the negative (—) terminal of the large 45 volt battery B-2.

Now connect the cable lead tagged " $-4\frac{1}{2}$ C" (black and green) to the positive (+) 18 volt terminal of the $22\frac{1}{2}$ volt "B" battery used as a "C" battery. Connect the lead tagged " $-22\frac{1}{2}$ C" (black with green tracer) to the negative (—) terminal of the $22\frac{1}{2}$ volt "B" battery which is used as a "C" battery. Connect the lead tagged "+45 B" (maroon) to the positive (+) 45 volt terminal of the first 45 volt extra large "B" battery of group B-1. The negative (—) terminal of this 45 volt "B" battery has already been connected to the positive (+) $22\frac{1}{2}$ terminal of the "C" battery and negative (—) terminal of the "A" battery. Next connect the cable lead tagged "+90 B" (maroon and red) to the positive (+) 45 volt terminal of the second 45 volt extra large battery of group B-1. Connect the cable lead tagged "+135 B" (red) to the positive (+) 45 volt terminal of the large 45 volt battery B-2.

This completes the connections for the batteries. After carefully checking all connections against the diagram, Fig. 2, the Radiotrons should be re-inserted.

4. Connections to Antenna and Ground—On the rear of the Radiotron shelf, at the left end (when facing the front of the cabinet) will be found four small holes leading to pin-jacks, marked in order "GRD," "LONG," "MED" and "SHORT," which are for connection to ground, and long, medium and short length antennae respectively. The free ends of the two five foot leads equipped with terminal pins should be pushed from the inside out through the holes at the rear of the cabinet. These wires should be connected securely to the antenna and ground leads, being soldered and taped where spliced.

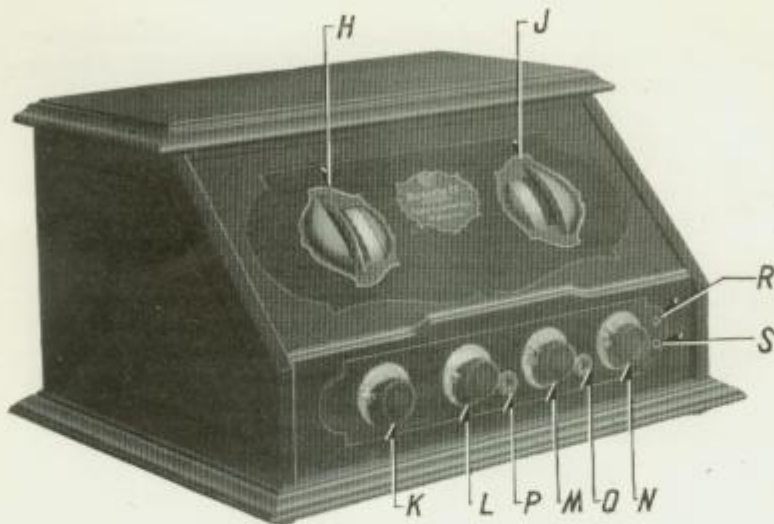


Fig. 4—Operating Controls of Radiola 20

- H*—"STATION SELECTOR" drum control.
- J*—"AMPLIFICATION" drum control.
- K*—First radio frequency stage "VERNIER" control.
- L*—Second radio frequency stage "VERNIER" control.
- M*—"BATTERY SETTING" control.
- N*—"VOLUME CONTROL."
- P*—First stage telephone jack.
- Q*—Second stage telephone jack.
- R* and *S*—Voltmeter pin-jacks.

The terminal pin leading to the ground connection should be inserted in the "GRD" pin-jack as shown at *G*, Fig. 3. The other terminal pin leading to the antenna connection should be inserted in one of the antenna pin-jacks as shown at *F*, Fig. 3, the particular pin-jack used depending on the length of the antenna. An antenna whose total overall length including the lead-in is over 100 feet would be classed as long, one between 75 and 100 feet would be considered medium, while one less than 75 feet in length would be designated as short.

Following the above recommendations for the selection of the correct antenna pin-jack should result in the first radio frequency "VERNIER" control *K*, Fig. 4, being set at approximately "5" on its scale when tuned for maximum response. With certain types of antennae this result may not be obtained and it will then be advisable to use whichever antenna pin-jack causes the first radio frequency "VERNIER" control

to be set nearest "5" on its scale when tuned for maximum response. This is explained in more detail in the section on "Operation."

CONTROLS

Battery Setting—This control, shown at *M*, Fig. 4, serves to turn on and regulate the current to the filaments of all five of the Radiotrons. **When Radiola 20 is not in use, this control must be turned as far as possible to the left so that the pointer rests at "OFF."**

Volume Control—This control, shown at *N*, Fig. 4, serves to regulate the volume and does so by controlling the filament current of the Radiotron at the extreme left. Loudest volume is secured by turning this knob to the right as far as it will go.

Station Selector—The drum control at the left of the sloping panel, shown at *H*, Fig. 4, serves to tune the three radio frequency circuits to the frequency (or wavelength) of the desired broadcast station.

Verniers—The two knobs at the left of the vertical control panel, shown at *K* and *L*, Fig. 4, allow a more accurate adjustment of the first two of the radio frequency circuits controlled by the "STATION SELECTOR" drum located just above.

Amplification—This drum control, shown at *J*, Fig. 4, serves to control the regeneration in the detector circuit.

OPERATION

Insert the phone plug of a loudspeaker or telephone headset into one of the two jacks shown at *P* and *Q*, Fig. 4. In general, the left hand (first stage) jack *P* will be used for head telephone reception, and the right hand (second stage) jack *Q* for loudspeaker operation.

Filaments—Turn the "VOLUME CONTROL" *N*, Fig. 4, to "LOUD." Turn the "BATTERY SETTING" control *M* to a position where good results are obtained. With new "A" batteries this point comes at about 3.25 on the scale. Raise the cover and note that all Radiotrons are lighted. The life of the Radiotrons will be considerably lengthened by setting the pointer of the "BATTERY SETTING" control as far to the left as practicable and then advancing slightly to improve the quality of reproduction. This control may be advanced from time to time as the "A" batteries grow weaker.

Tuning—When operating Radiola 20 for the first time, it will be best to "tune in" only the strongest signals at first. After some familiarity with its operation is thus obtained, the more distant or weaker stations may be tuned in successfully.

1. *Tuning in Strong Signals ("Local" Stations)*—

- (a) Turn both "VERNIER" controls *K* and *L*, Fig. 4, to a scale setting of "5."
- (b) Turn the "AMPLIFICATION" drum *J*, Fig. 4, to a scale setting of approximately "8."
- (c) With the left hand move the "STATION SELECTOR" drum *H*, Fig. 4, from one end of its scale toward the other until a whistle is heard which varies in pitch as this drum is moved.
- (d) Adjust the "STATION SELECTOR" drum so that the pitch (tone) of this whistle is as low as possible.
- (e) Reduce the setting of the "AMPLIFICATION" drum to the point where no whistling is heard as the "STATION SELECTOR" drum is moved slightly in both directions. If the station is broadcasting speech or music, this should now be heard.
- (f) Adjust the "STATION SELECTOR" drum to loudest signal.
- (g) Try the antenna lead *F*, Fig. 3, in each of the three antenna jacks. Leave it in the jack which results in the loudest signal. (This setting should preferably be made for a station tuned in near the middle of the "STATION SELECTOR" drum scale.)
- (h) Adjust both "VERNIER" controls to loudest signal.
- (i) Adjust the "VOLUME CONTROL" to the desired signal strength.

Other strong signals, when present, may be tuned in by adjusting the "STATION SELECTOR" drum alone. Before attempting this, the "VOLUME CONTROL" should be turned to "LOUD."

2. *Tuning in Distant Stations*—

- (a) Set both filament controls ("VOLUME CONTROL" and "BATTERY SETTING") as explained previously under "Filaments."
- (b) Turn both "VERNIER" controls to a scale setting of "5."
- (c) Set the "AMPLIFICATION" drum at a low value (a scale setting of about "2" or "3" should be satisfactory).
- (d) With the left hand, move the "STATION SELECTOR" drum back and forth over its range. Simultaneously, with the right hand, move the "AMPLIFICATION" drum toward "10" on its scale until whistles of varying pitch are *just* heard. (In general, these whistles indicate that the "STATION SELECTOR" is being turned through settings corresponding to the frequency—or wavelength—of broadcast stations in operation. Exceptions are discussed in Note 2, page 15.)

- (e) Adjust the "STATION SELECTOR" drum so that one of these whistles is received at a low pitch.
- (f) Adjust the second "VERNIER" control *L*, Fig. 4, so that the whistle is loudest.
- (g) Likewise adjust the first "VERNIER" control *K*, Fig. 4, to loudest whistle.

NOTE—In case the whistle is received loudest with the pointer of this "VERNIER" at either end of its scale ("0" or "10") change the antenna lead *F*, Fig. 3, to another antenna pin jack. That jack should be used permanently which results in a scale setting of "VERNIER" *K*, Fig. 4, nearest to "5" when a whistle is being received at loudest volume with a setting of the "STATION SELECTOR" drum near "50."

- (h) Move the "AMPLIFICATION" drum a slight amount toward lower scale readings until the whistling just stops.
- (i) The signals should now be heard if the station is broadcasting at the moment. Slight readjustments of the "STATION SELECTOR" and the "VERNIER" controls may improve the volume.

NOTE—If readjustment of the second "VERNIER" control results in the production of whistles or distortion, reduce the setting of the "AMPLIFICATION" drum until this "VERNIER" control may be moved over its entire scale without producing distortion.

When careful adjustments of the "AMPLIFICATION" drum and of the two "VERNIER" controls have been made in accordance with the above instructions, it should be possible to tune in other distant stations merely by turning the "STATION SELECTOR" drum. This is especially true when the adjustments have been made for receiving a station near the middle of the "STATION SELECTOR" scale.

NOTE 1—It is not possible to bring in the speech or music of a broadcast station whose "whistle" is exceedingly weak in the loudspeaker. A little practice will show the relation between strength of whistle and loudness of signal.

NOTE 2—Due to the congestion of broadcast stations, it sometimes happens that two stations are transmitting on very nearly the same frequency (or wavelength). This results in a whistle of *constant pitch*. It is sometimes necessary to distinguish between whistles arising from this cause, and whistles produced during the process of tuning in distant signals, as described above. Whistles produced in the normal tuning process vary in pitch (tone) as the "STATION SELECTOR" drum is turned, and these whistles disappear when the "AMPLIFICATION" control setting is reduced. Whistles which do not change in pitch when the "STATION SELECTOR" control is moved, but change only in intensity, are due to two broadcast stations on nearly the same wavelength, and the whistle cannot be stopped while receiving either station.

A third class of whistle is sometimes heard, which is caused by improperly operated receivers in the neighborhood radiating in much the

same way as does a broadcast station, but of course on a much smaller scale. These whistles appear and disappear, and vary in intensity and in pitch, even when your own receiver is not being touched.

When finished receiving, turn the "BATTERY SETTING" control knob as far to the left as possible so that its pointer rests at "OFF."

Voltmeter—In order to obtain the maximum useful life of Radiatrons and batteries, it is recommended that a high-grade high-resistance type voltmeter be used to adjust the filament terminal voltage to a value not exceeding 3.3 volts. This voltage may be measured by inserting the leads of the voltmeter, preferably equipped with phone tips, into the pin-jacks *R* and *S*, to the right of the "VOLUME CONTROL" knob *N*, Fig. 4. With the "VOLUME CONTROL" at "LOUD" and the "BATTERY SETTING" control at "OFF," insert the voltmeter leads not more than one inch into the pin-jacks, the lead from the positive (+) terminal of the voltmeter entering the lower pin-jack. Then advance the "BATTERY SETTING" control slowly until the voltmeter registers the proper value—which should be as low as will give good results and should **never be over 3.3 volts**. Whenever the "VOLUME CONTROL" is used to reduce the volume, the voltmeter reading should be observed and the battery setting reduced, if necessary.

CALIBRATION

To obtain the most satisfactory service from Radiola 20, it is desirable that any broadcast station, once received, may be tuned in at will. This may be done if the dial settings are known, if the desired station is in operation, and if receiving conditions permit such reception. The user of course, has no control over the two latter conditions.

To enable the user to return to stations that have previously been logged, the "STATION SELECTOR" drum control is furnished with a scale arbitrarily graduated from zero to 100, as well as with a blank space in which the call letters of the received stations may be noted at the proper points. At the same time the scale settings for the various stations may be recorded on the chart commencing on page 22 of this book.

Records on the "STATION SELECTOR" drum should be made with a *soft* lead pencil as they are subject to possible change due to reassignment of call letters or frequency. Ink should not be used as it cannot be erased from the drum. It is further recommended that a soft eraser be used to avoid injuring the surface of this indicator strip. The call letters should be printed with small neat lettering.

MAINTENANCE

Should trouble develop in the use of Radiola 20 it may be due to loss of active material in the Radiotron filaments or to the exhaustion of the batteries. As the batteries are used, they decrease in voltage.

Radiotrons—When not mistreated the five Radiotrons should last for many months. However, it is recommended that at least one or two spare Radiotrons of each type be kept on hand for emergency use, as this will insure against annoying interruptions of service and will permit testing at any time to determine whether any Radiotron is defective, by substituting for it a Radiotron known to be in good operating condition. Radiotrons may be seriously damaged or their normally long useful life lessened by:

(A) Mechanical injury resulting from dropping or severely jarring the Radiotron, causing displacement of the internal elements, or breakage of the filament.

(B) Electrical injury caused either by advancing the "BATTERY SETTING" control further in a clockwise direction than is necessitated by the condition of the "A" battery, or by accidental connection of "B" battery voltage across the filaments.

When the filaments are operated at too high a voltage ("BATTERY SETTING" control advanced too far), the active material in the filaments is rapidly driven off, and the useful life of the Radiotrons and batteries is considerably shortened, without proportional increase in signal strength or ease of operation. Should it be suspected that the filaments have been so damaged, it is recommended that the Radiotrons be taken to the dealer from whom the Radiola was purchased to be tested and, if possible, restored to usefulness.

Filament or "A" Battery—There are several indications by which the user may determine when the filament or "A" battery is becoming exhausted. These are low filament brilliancy, weak signals and distortion, the signals becoming less and less recognizable. When satisfactory operation cannot be obtained, even with the "BATTERY SETTING" knob advanced to "10" (or when the voltmeter, if used, fails to register 3.0 volts with the "BATTERY SETTING" knob at "10"), the filament batteries are exhausted. The six "A" cells should then be replaced by new ones. The old cells are of no value and should be discarded.

Plate or "B" Battery—When the signals become weak with the filaments operating at the proper terminal voltage, or

when operation becomes noisy, the "B" batteries should be replaced. If a high resistance type of voltmeter is available, these batteries may be tested. They should be discarded when the voltage has fallen to 17 volts for a $22\frac{1}{2}$ volt block, or to 34 volts for a 45 volt block.

Grid or "C" Battery—Indications of an exhausted "C" battery are distorted signals and a tendency to howl. It is recommended that the "C" battery be renewed whenever the "B" batteries are replaced.

NOTE—All measurements of "A," "B" and "C" voltages should be made under load conditions; that is, with the Radiotrons lighted.

Loudspeaker—If certain that the Radiotrons and batteries are in good operating condition but reception is unsatisfactory, check the loudspeaker for possible defect by replacing it with a pair of headphones. If the same condition exists when headphones are used, it may be taken for granted that the loudspeaker is not causing the trouble.

Antenna and Ground—The antenna and ground connections should be carefully examined to make certain that all connections are tight. After a few months the ground connection and any unsoldered splices may have become corroded, thus causing a high resistance contact. Accumulation of soot or other dirt on the antenna insulators may cause leakage which would result in decreased range and volume.

Loose Connections—When *sudden* changes in volume or complete interruptions of reception take place intermittently, a loose connection is usually the cause. Also, a loose connection often causes loud, irregular noises, which may be accentuated by jarring the set or batteries slightly. All battery connections and antenna and ground connections should be carefully examined. The symptoms of a loose connection should not be confused with "fading," which is purely an atmospheric phenomenon. Changes in volume due to fading are gradual while those due to a loose connection are instantaneous.

Important—The foregoing suggestions should aid in the location of the trouble, but if the difficulty appears to be elsewhere, it is recommended that the dealer from whom the set was purchased be consulted.

Polishing the Exterior—Finger marks resulting from handling the cabinet may be removed by an application of furniture polish and the finish thus restored. The polish chosen should be of a grade which will leave the cabinet free from an oily appearance. Rub to a dull gloss finish, using a piece of cheese cloth or other material free from lint.

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."



Radio Corporation of America

233 Broadway
New York City

10 So. La Salle Street,
Chicago, Ill.

28 Geary Street,
San Francisco, Cal.

SIMPLIFIED LIST OF BROADCASTING STATIONS

For complete lists see Newspapers or Radio Magazines

Freq. in K.C.	Wave-length Meters	Call	City	State	In THE SAME City	Freq. in K.C.	IN ANOTHER CITY		
							Call	City	State
1000	299.8	WPG	Atlantic City	N. J.		1000	{KSL	Salt Lake City	Utah
990	302.8	WLIR	Elgin	Ill.			{KPMQ	Fayetteville	Ark.
980	305.9	WJAR	Providence	R. I.		990	WGN	Chicago	Ill.
970	309.1	KDKA	Pittsburgh	Pa.		980	KTCL	Seattle	Wash.
960	312.3	C	Canada						
950	315.6	WGBS	New York	N. Y.	WAHG	950	{KPSN	Pasadena	Cal.
940	319.0	WGR	Buffalo	N. Y.		940	KFDM	Beaumont	Tex.
930	322.4	KOA	Denver	Colo.		930	WSMB	New Orleans	La.
920	325.9	WSAI	Cincinnati	Ohio		920	WJAZ	Mount Prospect	Ill.
910	329.4	C	Canada			920	WKRC	Mason	Ohio
900	333.1	WBZ	Springfield	Mass.		890	{WJAX	Jacksonville	Fla.
890	336.9	WCAL	Northfield	Minn.			{KNX	Los Angeles	Cal.
880	340.7	WMCA	Hoboken	N. J.		880	{KSAC	Manhattan	Kans.
870	344.6	WLS	Chicago	Ill.		880	{WKAQ	San Juan	P. R.
860	348.6	WEEI	Boston	Mass.		870	{KFAR	Lincoln	Nebr.
850	352.7	WWJ	Detroit	Mich.			{WCBD	Zion	Ill.
840	356.9	C	Canada						
833	360.1	WQAO	New York	N. Y.		800	{KWSC	Pullman	Wash.
830	361.2	KG-O	Oakland	Cal.			{KOB	State College	N. M.
820	365.6	WDAF	Kansas City	Mo.	WHB	850	WJAD	Waco	Tex.
810	370.2	WEBH	Chicago	Ill.		833	KZUY	Baguio	P. I.
800	374.8	KTHS	Hot Springs	Ark.		830	WHN	New York	N. Y.
790	379.5	WGY	Schenectady	N. Y.		810	WJJD	Mooschart	Ill.
780	384.4	WMBF	Miami Beach	Fla.	WGBU	800	KVOO	Bristow	Okla.
770	389.4	WTAM	Cleveland	Ohio	WEAR	790	WHAZ	Troy	N. Y.
760	394.5	WLIT	Philadelphia	Pa.	WFI	780	KJR	Seattle	Wash.
750	399.8	WHAS	Louisville	Ky.		760	WOAI	San Antonio	Tex.

Freq. in K.C.	Wave-length Meters	City	State	IN THE SAME CITY	Freq. in K.C.	IN ANOTHER CITY	
						Call	City State
740	405.2	New York	N. Y.		740	(KBJ	Los Angeles, Cal.
730	410.8	Canada				{WDR	Newark, N. J.
720	416.4	Minneapolis-St. Paul	Minn.		700	{KPO	San Francisco, Cal.
710	422.3	Harrison	Ohio			{KIDS	Independence, Mo.
700	428.3	Atlanta	Ga.		680	{WDWF	Cranston, R.I.
690	434.6	Arlington	Va.			{WMAF	Dartmouth, Mass.
680	440.9	Jefferson City	Mo.			{WLSI	Cranston, R.I.
670	447.5	Chicago	Ill.	WQJ	660	{KTW	Seattle, Wash.
660	454.3	New York	N. Y.		640	{KFOA	Seattle, Wash.
650	461.3	Pittsburgh	Pa.	WCAP	640	{KFI	Los Angeles, Cal.
640	468.5	Washington	D. C.		630	{WFAA	Dallas, Tex.
630	475.9	Hartford	Conn.			{WBAP	Fort Worth, Tex.
620	483.6	Davenport	Iowa		620	WSUI	Iowa City, Iowa
610	491.5	New York	N. Y.		610	KGW	Portland, Ore.
600	499.7	Memphis	Tenn.	WOO	600	KPRU	Columbia, Mo.
590	508.2	Philadelphia	Pa.	WJR	590	KLX	Oakland, Cal.
580	516.9	Pontiac	Mich.		570	{WHO	Des Moines, Iowa
570	526.0	New York	N. Y.	KFTO	570	{WOAW	Omaha, Neb.
560	535.4	Chicago	Ill.		560	WHA	Madison, Wis.
550	545.1	St. Louis	Mo.				

Stations bracketed have same frequency.

STATION LOG

Date	Call Letters	Location	Frequency in Kilocycles	Station Selector	First Vernier Control	Second Vernier Control
				11	2	2

A grid on aged, yellowish paper. The grid consists of 11 columns and 10 rows of empty rectangular cells, enclosed by a thin black border. The paper shows signs of age, including slight discoloration and a small dark spot near the bottom center of the grid.

Date	Call Letters	Location	Frequency in Kilocycles	Section Selector	First Vernier Control	Second Vernier Control

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