

# Instructions for RCA Victor R-90 Bi-Acoustic Superheterodyne with Tonalite Control

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## INTRODUCTION

This ten-tube superheterodyne radio receiver offers superb musical reproduction—the result of many recent developments and improvements. Two of the new A. F. Pentode Radiotrons RCA-2A5 are used in the push-pull output stage. Acoustic “tone equalizer” chambers are built into the cabinet, effectually preventing sound distortion resulting from cabinet resonance. A tuning meter, having a translucent illuminated scale, is mounted just above the station selector dial. This meter permits *exact* visual tuning of stations and thus prevents faulty reproduction resulting from inaccurate tuning.

An outstanding feature of this instrument is the use of colored illuminated indicators for all operating controls, showing at a glance just where each control is set. This feature is new, being used for the first time in this series of models. Not only does the harmonious color illumination provide a modern and artistic refinement in appearance, but the indicators will be found of great usefulness in the manipulation of

the receiver. Another improvement which has been initiated in this series of instruments is the recessing of the panel for all controls, reducing the extent of knob projection and rendering the controls less conspicuous. A double tone control is provided, also for the first time in this instrument series. Separate tone control knobs permit independent adjustment of the bass and treble response.

The automatic volume control minimizes the effects of “fading.” This control also tends to maintain the volume level for which it is set when the dial is shifted from one station to another, thus eliminating “blasting” when passing through the settings of powerful stations.

The silent-tuning control (noise “suppressor” or “silencer”) may be set for quiet tuning between station settings, without loss of ability to receive distant stations whose signals are above the background noise level.

## INSTALLATION

**Preliminary**—Remove the packing material from the Radiotrons. Refer to the tube location diagram on rear of receiver, and *make certain*:

- (a) That all tubes are in the proper sockets and pressed down firmly. *Never apply power to the instrument unless all Radiotrons are in place.*
- (b) That all shields are rigidly in place over the Radiotrons shown by double circles on the diagram.
- (c) That the short flexible leads shown on the diagram are attached to the top grid contacts of the proper Radiotrons as indicated, and that the spring contact caps are pressed down firmly. Particular attention should be given to the proper connections of the adjacent green and black leads in accordance with the diagram.
- (d) That the lid is securely in place on the shield of the RCA-58 Radiotron designated by the heavy circle on the diagram.

**Location**—The instrument should be located close to the antenna lead-in and ground connections, and near an electrical outlet.

**Antenna and Ground**—An antenna 25 to 75 feet long, including the lead-in and ground connections, is recommended. The antenna should be well insulated from all objects, and

should not be run close to or parallel with electric circuits inside or outside the building. Generally, an indoor antenna of short or medium length should be found satisfactory. An outdoor antenna of greater length may provide some increase in the receiving range, and is recommended for localities remote from broadcasting stations. When the receiver is installed in a building of metallic construction, an outdoor antenna is essential for satisfactory results.

A *good* ground connection is necessary for best performance of this receiver. The connection to ground should be as short and direct as possible. If the ground connection cannot be made to a cold water pipe, a metal stake driven from 4 to 6 feet into moist earth is recommended. An approved ground clamp should be used to insure a tight and permanent connection.

A terminal board is provided at the rear of the receiver chassis for connecting to the antenna and ground. Connect the antenna lead to the left-hand terminal (marked “ANT”) and the ground lead to the right-hand terminal (marked “GND”). Tighten the terminals with a screw driver to insure permanent electrical connections.

**Power Supply**—Connect the power cord to an electrical outlet supplying alternating current at the voltage and frequency (cycles) specified on the rating label, located on the rear of the receiver.

## OPERATION

The operating controls are shown in Figure 1. Proceed as follows:

1. Apply power by turning the Volume Control knob clockwise from the "off" position. Set this control near the middle of its range by observing the illuminated colored indicator associated with the control knob. Several seconds are required for the Radiotrons to heat before satisfactory reception is possible.

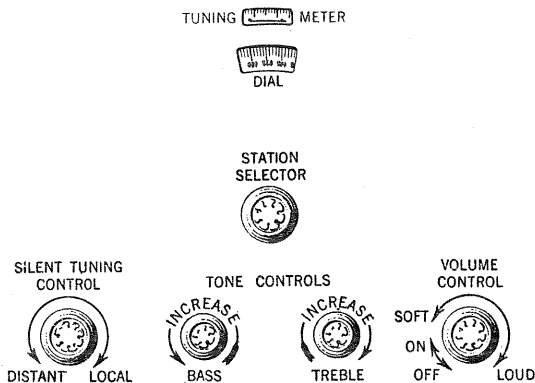


Figure 1

2. With the Silent-Tuning Control set in the extreme counter-clockwise position, turn the Station Selector to a point near the middle range of the dial, at which no station is heard within several scale divisions. Then turn the Silent-Tuning Control clockwise until the background noise (static) just disappears. (The setting of the Silent-Tuning Control is shown by the illuminated colored indicator associated with this control knob.)

**NOTE**—The adjustment just described provides quiet tuning, that is, *suppression of background noise between station settings*, and permits reception of all stations whose signals are above the existing noise level.

3. Turn the Station Selector slowly in either direction until a station is heard. (The dial scale is calibrated in kilocycles, for locating stations of known frequency assignment.)

**NOTE**—If no stations are received throughout the complete range of the dial, it is an indication that there are no station signals above the prevailing level of background noise. In this case it may be possible to tune in distant or weak stations by turning the Silent-Tuning Control counter-clockwise (in small steps) and continuing to rotate the Station Selector until signals are heard. When this is done, a higher level of background noise is, of course, to be expected.

40090 (2-2)

4. When a desirable station signal is heard, accurate tuning for best reproduction is accomplished as follows:

- Turn the Volume Control counter-clockwise (if necessary) until the volume is at a low level.
- Adjust the Station Selector carefully to the position at which the indicator of the tuning meter travels furthest to the right (as designated by the arrow on the meter scale). When receiving a powerful local station, the Station Selector dial should be set at the center of the scale range for which the meter deflection is maximum (this range may be narrowed somewhat by turning the Silent-Tuning Control clockwise).
- Adjust the Volume Control to obtain the desired sound level.

5. Adjust the two Tone Controls to obtain the tone shading preferred. The full range of musical reproduction is obtained with the right-hand knob all the way clockwise and the left-hand knob fully counter-clockwise, and is represented by full illumination of the tone color indicator which extends between the two knobs. Modifications of the tone range may be obtained as follows:

- To reduce the high-frequency (treble) response, or to decrease the background noise (static) interference on station settings, turn the right-hand tone control knob counter-clockwise. The extent of high-frequency cut-off thus obtained is indicated by shading of the yellow illumination at the right-hand side of the tone color indicator.
- To reduce the low-frequency (bass) response, or to decrease low pitched hum present on the signals of some stations, turn the left-hand tone control knob clockwise. The extent of low-frequency cut-off thus obtained is indicated by shading of the blue illumination at the left-hand side of the tone color indicator.
- The red illumination at the center of the tone color indicator represents the middle range of musical response. This illumination is not cut off by rotation of either of the tone control knobs as described in the preceding paragraphs (a) and (b).

6. When through operating, interrupt the power by turning the Volume Control to the extreme counter-clockwise (off) position.

**Radiotrons**—Improved results may sometimes be obtained by interchanging Radiotrons of the same type, either RCA-56 or RCA-58, in their sockets. Spare Radiotrons should be kept on hand.

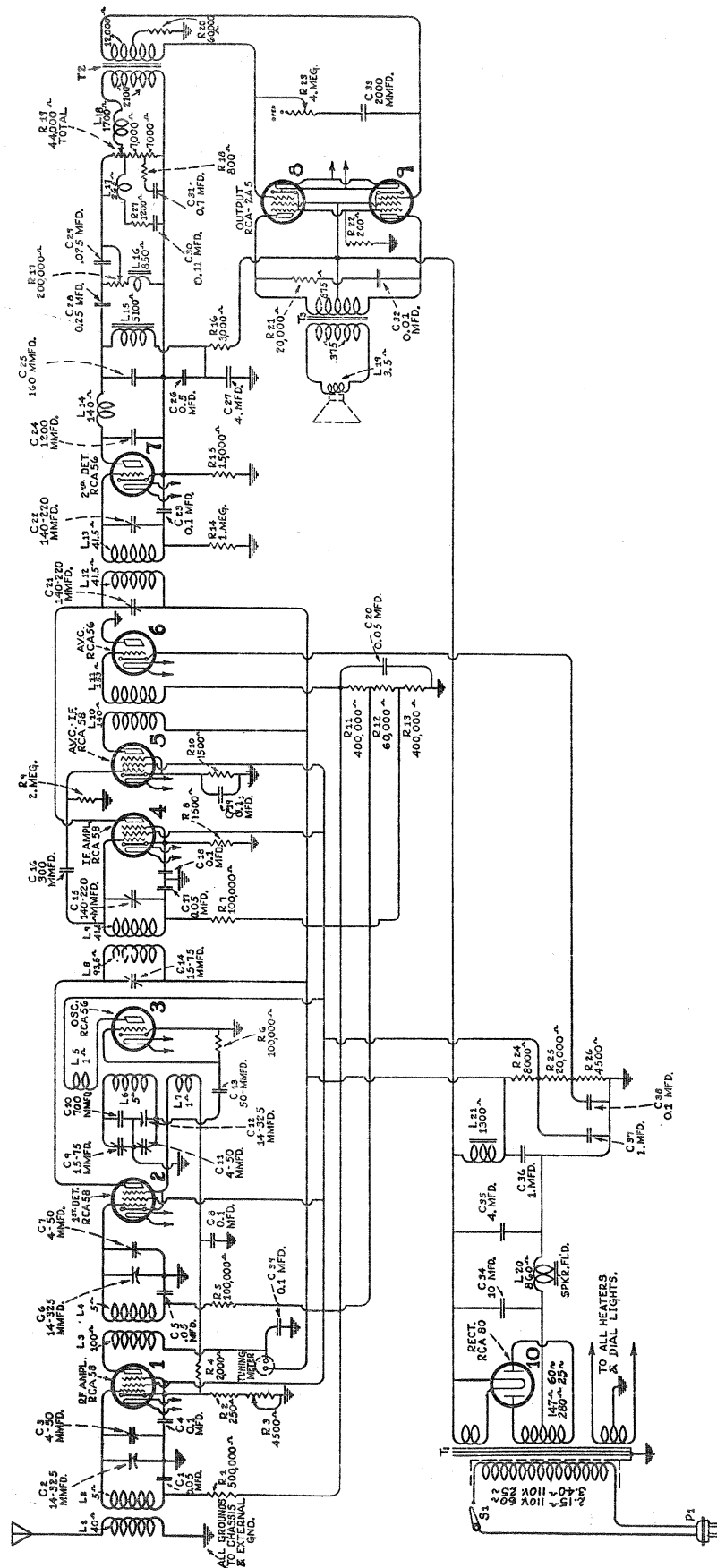


Figure A—Schematic Diagram

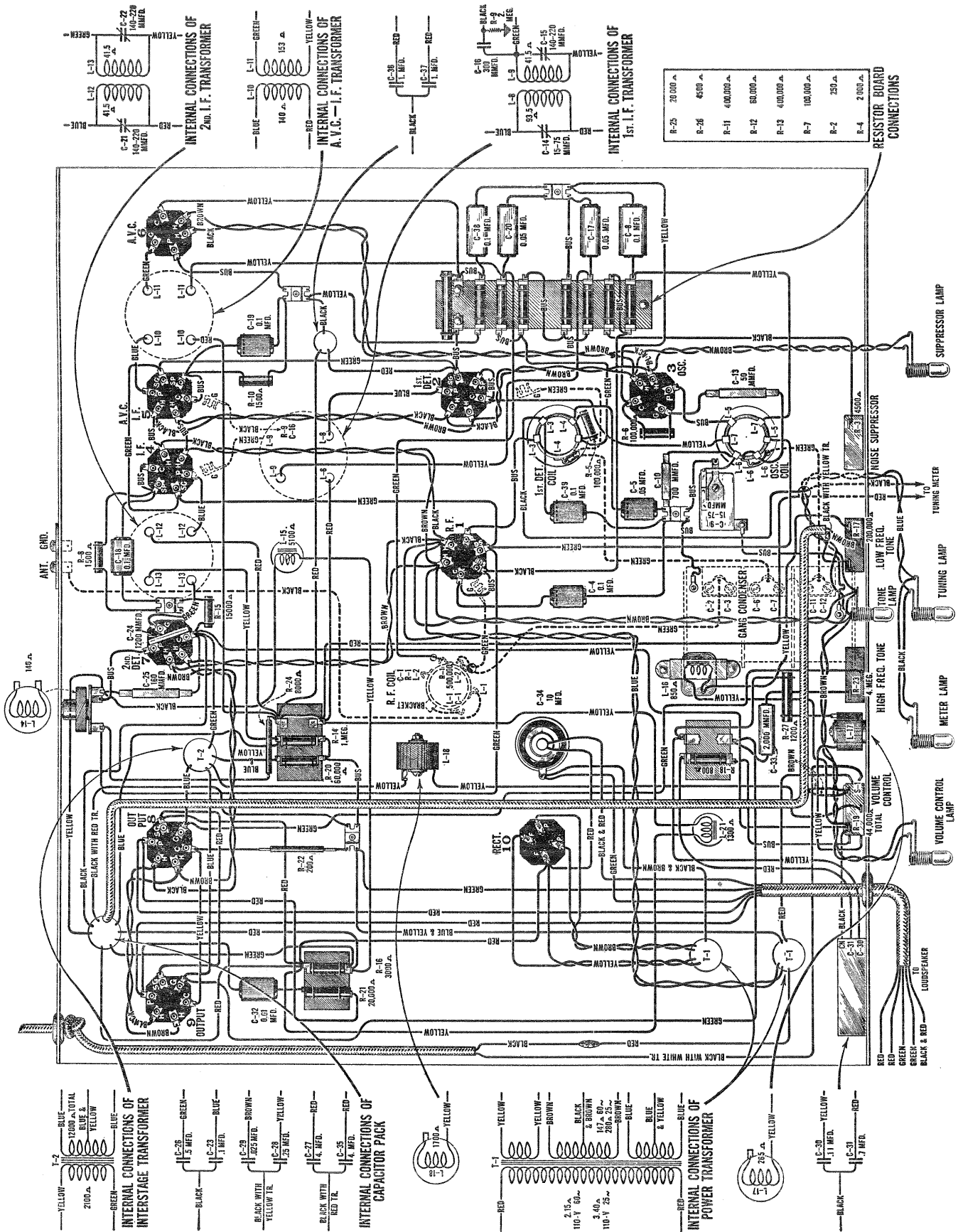


Figure B—Wiring Diagram

**INTERNAL CONNECTIONS OF INTERSTAGE TRANSFORMER**

L-1 2000 $\mu$  TOTAL  
 BLUE  
 BLACK & WHITE TR.  
 YELLOW

L-2 2000 $\mu$   
 GREEN  
 BLUE

L-3 1.5 MFD.  
 GREEN

L-4 1 MFD.  
 BLUE

L-5 1.5 MFD.  
 BROWN

L-6 2.5 MFD.  
 YELLOW

L-7 1.5 MFD.  
 RED

L-8 1.5 MFD.  
 RED

L-9 1.5 MFD.  
 RED

**INTERNAL CONNECTIONS OF CAPACITOR PACK**

L-10 110 $\mu$   
 YELLOW

L-11 2.15 $\mu$   
 110 $\mu$  50 $\mu$   
 3.40 $\mu$   
 110 $\mu$  25 $\mu$   
 YELLOW  
 BROWN  
 BLACK & BROWN  
 BLUE & BROWN  
 BLUE & YELLOW

**INTERNAL CONNECTIONS OF POWER TRANSFORMER**

L-12 265 $\mu$   
 YELLOW

L-13 11 MFD.  
 BLACK

L-14 7 MFD.  
 RED

**INTERNAL CONNECTIONS OF 2nd. I.F. TRANSFORMER**

L-15 41.5 $\mu$   
 140-270 MFD.  
 BLUE

L-16 41.5 $\mu$   
 140-270 MFD.  
 RED

L-17 41.5 $\mu$   
 140-270 MFD.  
 GREEN

L-18 41.5 $\mu$   
 140-270 MFD.  
 YELLOW

**INTERNAL CONNECTIONS OF A.V.C.—I.F. TRANSFORMER**

L-19 140 $\mu$   
 BLUE

L-20 63 $\mu$   
 GREEN

L-21 140 $\mu$   
 RED

L-22 63 $\mu$   
 YELLOW

**INTERNAL CONNECTIONS OF 1st. I.F. TRANSFORMER**

L-23 50 $\mu$   
 15-75 MFD.  
 BLUE

L-24 50 $\mu$   
 15-75 MFD.  
 RED

L-25 50 $\mu$   
 15-75 MFD.  
 GREEN

L-26 50 $\mu$   
 15-75 MFD.  
 YELLOW

**RESISTOR BOARD CONNECTIONS**

R-25	20,000 $\mu$
R-26	4,000 $\mu$
R-11	400,000 $\mu$
R-12	50,000 $\mu$
R-13	400,000 $\mu$
R-7	100,000 $\mu$
R-2	250 $\mu$
R-4	2,000 $\mu$

# SERVICE DATA

## Electrical Specifications

Voltage Rating	105-125 Volts
Power Consumption	120 Watts
Type and Number of Radiotrons	3 RCA-56, 4 RCA-58, 1 UX-280, 2 RCA-2A5—Total, 10
Frequency Range	.540 K. C.—1500 K. C.
Undistorted Output	4.0 Watts

This receiver is a ten tube Super-Heterodyne radio receiver. Features such as illuminated control, improved automatic volume control, noise suppressor, compensated volume control, heater pentode output tubes operated as a push-pull stage, acoustically correct cabinets and the inherent sensitivity, selectivity and tone quality of the Super-Heterodyne are included in this instrument.

Figure A shows the schematic circuit, Figure B the wiring diagram, Figure C the location of the adjustable capacitors and Figure D, the loudspeaker wiring. The Radiotron socket voltages, the line-up procedure and the replacement parts are given on the following pages.

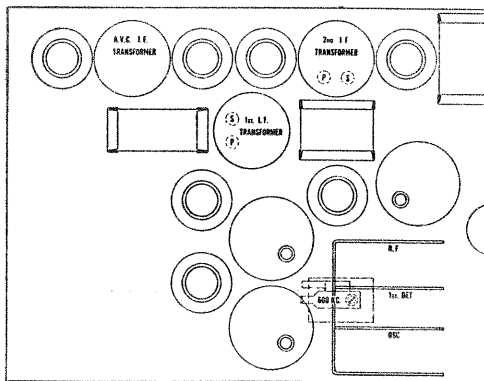


Figure C—Location of Adjustable Capacitors

## R. F. and Oscillator Line-Up Capacitor Adjustments

Four adjustable capacitors are provided for aligning the R. F. circuits and adjusting the oscillator frequency so that the oscillator will maintain a constant frequency—175 K. C.—difference from that of the incoming signal. Poor quality, insensitivity, poor A. V. C. action and possible inoperation of the receiver may be caused by these capacitors being out of adjustment.

If the other adjustments have not been tampered with—the intermediate transformer tuning capacitors—the following procedure may be used for aligning these capacitors.

- Procure an R. F. Oscillator giving a modulated signal at 600 K. C. and 1400 K. C. Also procure a non-metallic screw driver such as Stock No. 7065.
- An output meter is necessary. This may be a current squared galvanometer connected to the secondary of the output transformer instead of the cone coil, a 0.5 milliammeter connected in series with the plate supply to the second detector or a low range A. C. voltmeter connected across the reproducer unit cone coil.
- A dummy Radiotron RCA-56 is necessary to substitute for the one normally used in the A. V. C. socket. This should be a tube that is otherwise normal in all respects but having one heater prong removed. Insert this tube in the A. V. C. socket.
- First check the chassis and carefully ascertain that the dial pointer reads exactly at the first line on the scale when the tuning capacitor rotor plates are fully meshed with the stator plates.
- Place the oscillator in operation at exactly 1400 K. C. and couple its output to the antenna. Set the dial scale at exactly 1400. Connect the output meter to the set and place the volume control and suppressor control, if noise level will permit, at its maximum position. Adjust the oscillator input so that an excessive reading on the output meter is not obtained.

- With a suitable socket wrench—the nuts are at ground potential—adjust the oscillator, first detector and R. F. line-up capacitors, until a maximum deflection is obtained in the output meter.
- Set the oscillator at 600 K. C. Tune in the signal with the receiver until a maximum deflection is obtained in the output meter. Now adjust the 600 K. C. series capacitor, Figure C, until a maximum deflection is obtained in the output meter. Rock the tuning capacitor back and forth while making this adjustment as the tuning capacitor and oscillator series capacitor adjustments interlock.

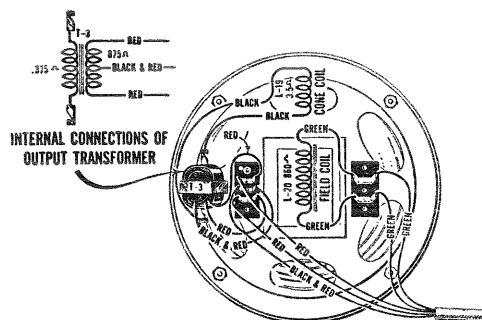


Figure D—Loudspeaker Wiring

- Change the frequency of the oscillator to 1400 K. C. and set the dial at 1400. Again make the adjustments given under (f) and (g). So adjusted, the R. F. circuits are properly aligned and the oscillator will maintain a constant frequency difference from the incoming R. F. signal.

## I. F. Tuning Capacitor Adjustments

Although this receiver has two I. F. stages, one for the second detector and one for the A. V. C., only two of the three I. F. transformers are tuned by adjustable capacitors and require adjustment. The stage used for the A. V. C. is broadly tuned and does not require any adjustment.

The transformers are all tuned to 175 K. C. and the circuits broadly peaked.

A detailed procedure for making this adjustment follows:

- Procure a modulated R. F. Oscillator that gives a modulated 175 K. C. signal. Also procure a non-metallic screw driver such as Stock No. 7065.
- An output meter is necessary. This may be a current squared galvanometer connected to the secondary of the output transformer instead of the cone coil, a 0.5 milliammeter connected in series with the plate supply to the second detector or a low range A. C. voltmeter connected across the reproducer unit cone coil.
- A dummy Radiotron RCA-56 is necessary to substitute for the one normally used in the A. V. C. socket.
- Remove the oscillator tube and make a good ground connection to the chassis. Place the oscillator in operation and couple its output from the control grid of the first detector to ground. Adjust the oscillator output, with the receiver volume control at maximum, until a deflection is obtained in the output meter.
- Refer to Figure C. Adjust the secondary and primary of the second and then the first I. F. transformer until a maximum deflection is obtained in the output meter. Go through these adjustments a second time as a slight readjustment may be necessary.

When the adjustments are made the set should perform at its maximum efficiency. However, due to the interlocking of adjustments, it is good practice to follow the I. F. adjustments with the R. F. and oscillator line-up capacitor adjustments. The correct method of doing this is given in the preceding section.

## RADIOTRON SOCKET VOLTAGES

120 Volt, A. C. Line—No signal being received—Volume Control at minimum

Radiotron No.	Cathode to Control Grid Volts, D. C.	Cathode or Filament to Screen Grid Volts, D. C.	Cathode or Filament to Plate Volts, D. C.	Plate Current, M. A.	Heater or Filament Volts, A. C.
1. R. F.	3.0	100	230	7.0	2.4
2. 1st Detector	8.0	95	220	2.5	2.4
3. Oscillator	—	—	105	6.0	2.4
4. I. F.	7.5	100	225	2.5	2.4
5. A. V. C.—I. F.	7.5	100	225	2.5	2.4
6. A. V. C.	20.0	—	0	—	2.4
7. 2nd Detector	17.0	—	250	1.2	2.4
8. Power	18.0	255	245	33.0	2.4
9. Power	18.0	255	245	33.0	2.4

# REPLACEMENT PARTS

Insist on genuine factory tested parts, which are readily identified and may be purchased from authorized dealers

Stock No.	DESCRIPTION	List Price	Stock No.	DESCRIPTION	List Price
<b>RECEIVER ASSEMBLIES</b>					
3047	Resistor—1,500 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	\$1.00	6429	Capacitor pack—Comprising one 0.11 mfd. and one 0.7 mfd. capacitor in metal container	\$0.98
3076	Resistor—1 megohm—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6430	Capacitor pack—Comprising two 4.0 mfd., one 0.25 mfd., one 0.025 mfd., one 0.1 mfd. and one 0.5 mfd. capacitors	3.78
3358	Resistor—3,000 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6431	Reactor—Filter reactor	1.92
3435	Resistor—250 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6432	Transformer—Interstage audio transformer	3.69
3440	Resistor—4,500 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6433	Coil—Antenna coil assembly	1.80
3455	Capacitor—0.01 mfd. capacitor	.44	6434	Reactor—Second detector plate coupling reactor	1.96
3460	Capacitor—1.200 mmfd.	.30	6435	Transformer—First intermediate frequency transformer	2.54
3513	Capacitor—700 mmfd.	.48	6436	Reactor—High frequency tone control compensating reactor	.70
3526	Resistor—2,000 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6437	Coil—Oscillator coil assembly	1.24
3527	Resistor—800 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6438	Coil—Detector coil	1.44
3528	Bracket—Volume control or noise suppressor indicator lamp bracket	.18	6439	Reactor—High frequency tone control reactor	1.14
3529	Socket—Noise suppressor or volume indicator lamp socket	.32	6440	Transformer—Second intermediate frequency transformer	1.94
3530	Coil—Second detector plate choke coil	.72	6441	Transformer—Third intermediate frequency transformer	1.76
3531	Shutter—Volume control shutter	.50	6442	Reactor—Volume control series reactor	.88
3532	Shutter—Noise suppressor shutter	.50	6443	Capacitor—10 mfd.	1.50
3533	Shutter—High frequency tone control shutter	.50	6447	Volume control—Complete with mounting nut	1.92
3534	Shutter—Low frequency tone control shutter	.50	6448	Tone control—Low frequency tone control complete with mounting nut	1.04
3535	Socket—High or low frequency indicator lamp socket	.32	6449	Tone control—High frequency tone control complete with mounting nut	1.06
3548	Knob—High or low frequency tone control knob	.24	6450	Rheostat—Noise suppressor rheostat	1.24
3551	Screw assembly—Chassis mounting washer and screw assembly—Comprising 4 screws, 4 lock washers, 4 washers, 8 cushions and 4 spacers—One set	.68	6456	Escutcheon—Volume control escutcheon and color screen	.50
3552	Resistor—200 ohms—Porcelain type—20 watts	.80	6457	Escutcheon—Noise suppressor escutcheon and color screen	.50
3553	Resistor—8,000 ohms—Porcelain type—20 watts	.80	6458	Escutcheon—High and low frequency escutcheon and color screen	.92
3554	Resistor—1,200 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	6459	Cable—Braid covered—Five conductor reproducer cable	.54
3555	Capacitor—0.1 mfd. capacitor	.36	6461	Meter—Tuning meter	2.14
3556	Capacitor—0.05 mfd. capacitor	.34	6462	Bezel—Tuning meter bezel	.45
3557	Capacitor—0.002 mfd. capacitor	.30	7062	Capacitor—Adjustable trimming capacitor—15 to 70 mmfd.	.50
3558	Capacitor—50 mmfd. capacitor	.36	7065	Screw driver—Non-metallic screw driver for oscillator and I. F. adjustments	1.10
3563	Socket—Tuning meter lamp socket and bracket	.32	7439	Drum—Dial drum with set screws and three dial mounting nuts	.35
3564	Bracket—Station selector dial lamp mounting bracket	.25	7484	Socket—Five contact Radiotron socket	.35
3565	Socket—Dial lamp socket	.50	7485	Socket—Six contact Radiotron socket	.40
3638	Scale—Tuning meter scale—Package of 5	.60	7487	Shield—Radiotron tube shield	.25
6114	Resistor—20,000 ohms—Carbon type—1 watt—Package of 5	1.10	7488	Shield—Tube shield top	.20
6185	Resistor—100,000 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	7580	Scale—Dial and dial scale	.75
6192	Spring—Three gang tuning condenser drive cord tension spring—Package of 10	.30	7581	Condenser—Three gang variable tuning condenser assembly	5.00
6242	Resistor—2 megohm—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	8978	Transformer—Power transformer—105-120 volts—50-60 cycles	8.50
6279	Resistor—15,000 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	8979	Transformer—Power transformer—105-120 volts—25-40 cycles	12.88
6280	Resistor—400,000 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	8980	Transformer—Power transformer—210-240 volts—50-60 cycles	9.36
6282	Resistor—60,000 ohms—Carbon type— $\frac{1}{2}$ watt—Package of 5	1.00	8982	Capacitor pack—Comprising two 1.0 mfd. capacitors in metal container	1.44
6288	Knob—Volume control or noise suppressor knob—Package of 5	1.00	<b>REPRODUCER ASSEMBLIES</b>		
6298	Cord—Three gang tuning condenser drive cord—Package of 5	.60	6184	Board—Terminal board complete with three terminals—Package of 5	.50
6300	Socket—Four contact Radiotron socket	.35	6455	Transformer—Output transformer	1.95
6314	Capacitor—160 mmfd.—Package of 5	2.00	8920	Ring—Cone retaining ring	.35
6323	Shaft—Three gang variable tuning condenser drive shaft—Comprising 1 shaft, 2 "C" washers and 2 flat washers—Package of 2	.20	8969	Cone—Reproducer cone—Package of 5	6.35
			9425	Coil assembly—Comprising field coil, magnet and cone support	4.94