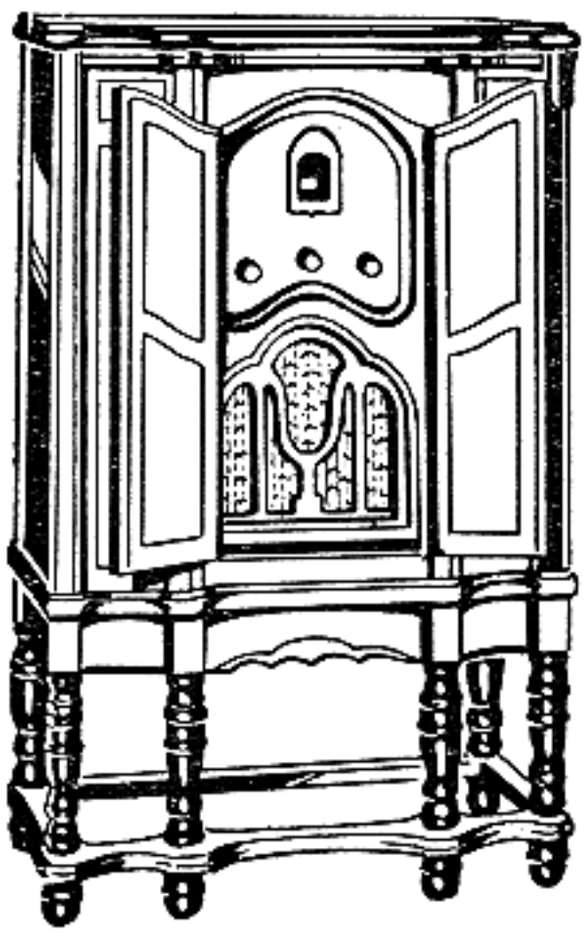
RCA Victor

Bi-Acoustic Super-Heterodyne

Model R-78

SERVICE NOTES



RCA Victor R-78

SERVICE DIVISION

RCA Victor Company, Inc.

Camden, N.J.

A RADIO CORPORATION OF AMERICA SUBSIDIARY

REPRESENTATIVES IN PRINCIPAL CITIES

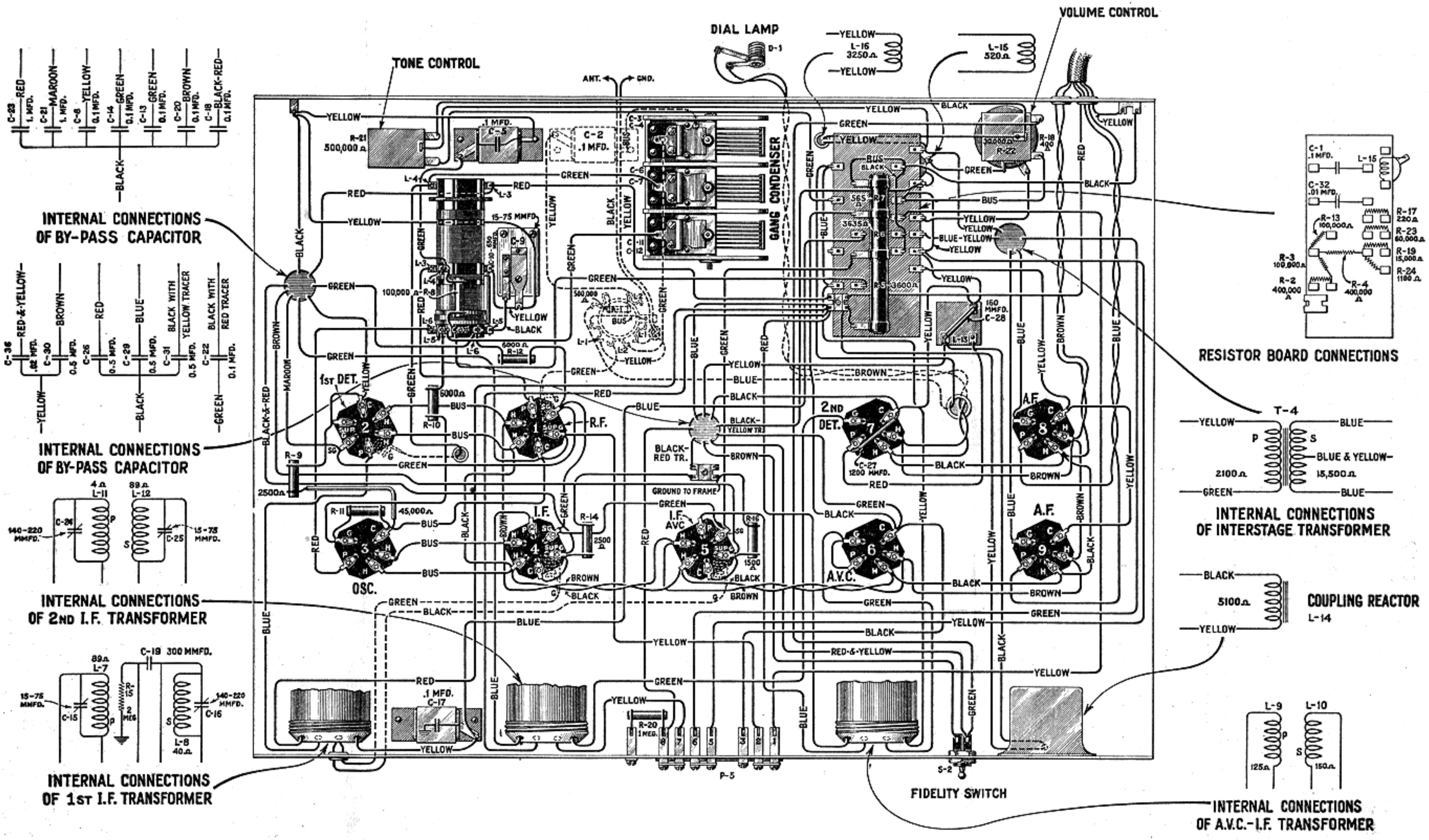


Figure 6—Receiver Assembly Wiring Diagram

(c) 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.

(d) First check the chassis and carefully ascertain that the dial pointer reads exactly at the short line on the scale when the tuning capacitor rotor plates are fully meshed with the stator plates.

(e) 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 at its maximum position. Adjust the oscillator input so that an excessive reading on the output meter is not obtained.

(f) 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. These capacitors are accessible through holes located in the bottom cover of the chassis, the one to the front being the R.F., the detector next and the oscillator to the rear.

(g) 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 5, 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.

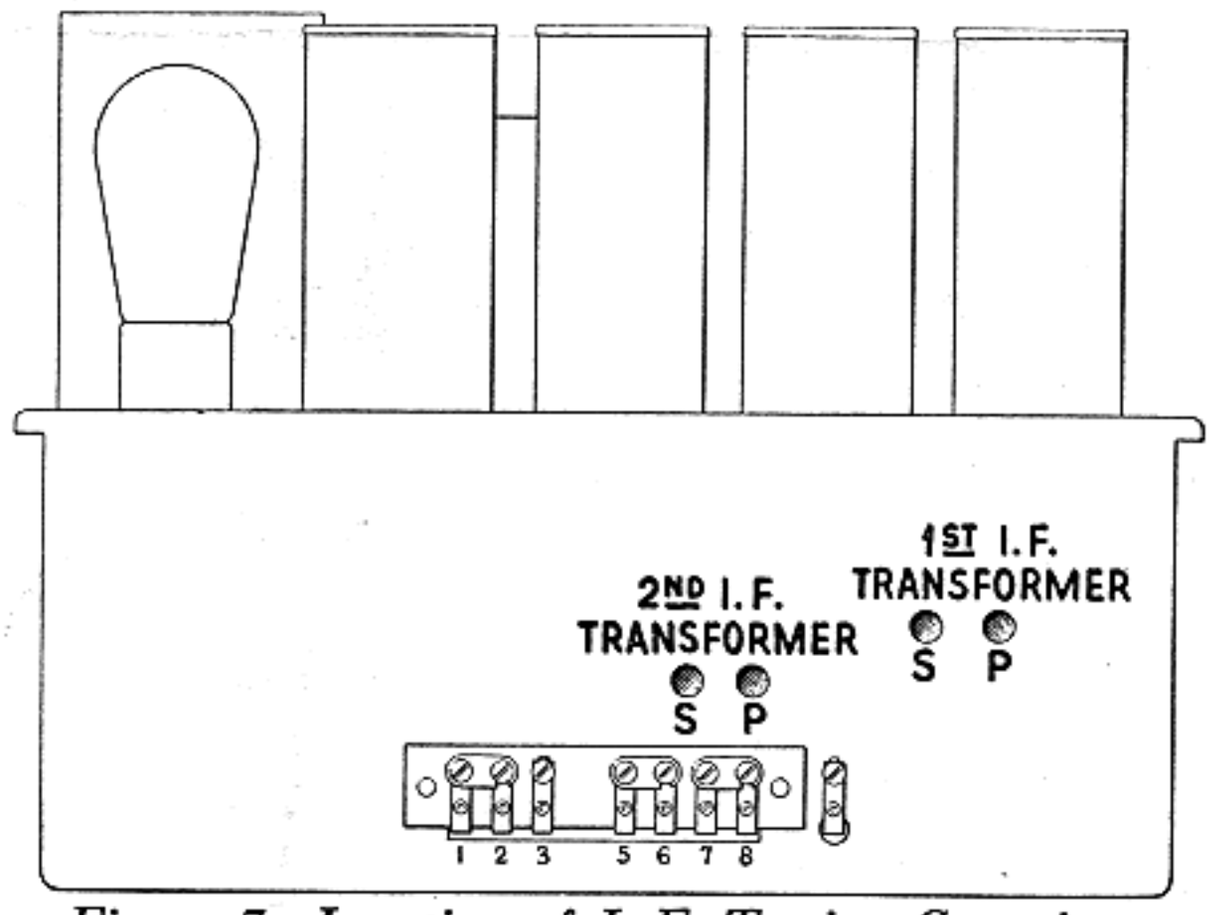


Figure 7—Location of I. F. Tuning Capacitors

(h) 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.

(4) 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:

(a) 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.

(b) An output meter is necessary. This may be a current squared galvonometer 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.

(c) A dummy Radiotron RCA-56 is necessary to substitute for the one normally used in the A.V.C. socket.

(d) Remove the oscillator tube, see Figure 5, 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.

(e) Refer to Figure 7. 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.

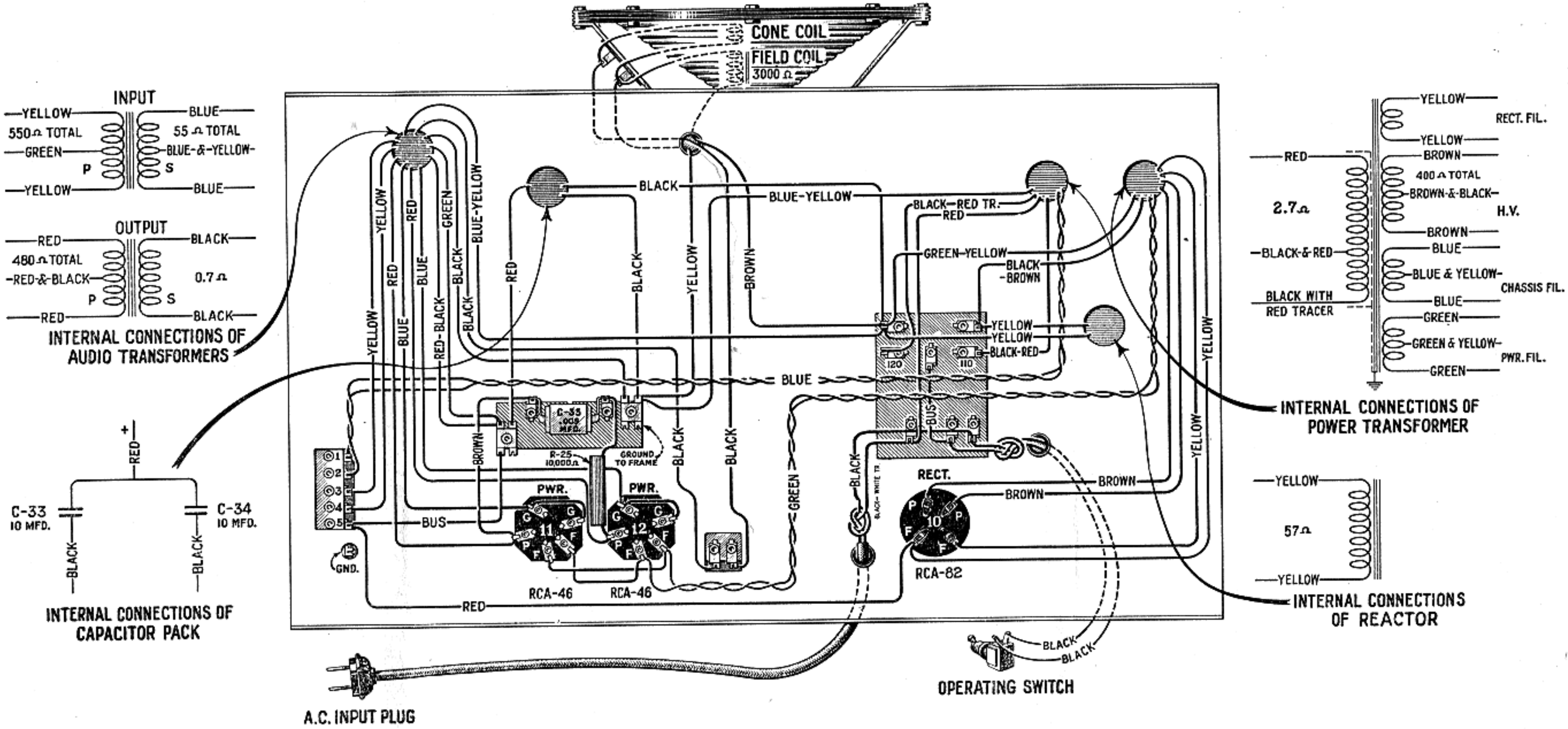


Figure 8—Amplifier Wiring Diagram

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 proceeding section.

(5) VOLTAGE READINGS

The following voltages taken at each Radiotron socket with the receiver operating but no signal being received should prove of value when checking with the usual set analyzer. The plate currents given are not necessarily accurate for each tube due to the cable in the test box causing some circuits to oscillate. Small variations may be caused by different tubes and line voltages. Therefore the following values must be taken as approximately those that will be found under varying conditions. The numbers in column 1 indicate the socket numbers shown in Figure 5.

It will be noted that the present type set analyzers do not have provision for the new six prong Radiotrons. In such cases a set of adapters will be necessary in order to take suitable readings.

RADIOTRON SOCKET VOLTAGES

120 Volt A.C. Line

No signal being received — Volume Control at minimun

Tube No.	Cathode to Heater Volts D. C.	Cathode or Filament 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.	7.0	0	100	210	3.0	2.5
2—1st Det.	10.0	0	95	210	1.5	2.5
3—Osc.	7.0	0	—	70	5.0	2.5
4—I.F.	8.0	0	95	210	2.5	2.5
5—A.V.C.—I.F.	7.0	0	95	210	3.0	2.5
6—A.V.C.	15.0	0	—	0	0	2.5
7—2nd Det.	12.0	12.0	—	200	1.0	2.5
8—A.F.	11.0	8.0	—	210	5.0	2.5
9—A.F.	11.0	8.0	—	210	5.0	2.5
10—Pwr.	—	0	—	400	6.0	2.5
11—Pwr.	—	0	—	400	6.0	2.5

(6) MAGNETIC PICKUP CONNECTIONS

Due to the audio system of the receiver being designed to compensate for the radio end of the receiver, its characteristics must be altered slightly for phonograph operation. It is therefore necessary to use the auxiliary switches, resistors and capacitors with the T-5 and PT-33 shown in Figures 9 and 10 as well as the complete switching shown in Figure 11 when making connections to magnetic pickups. When using these devices, the usual record volume control should be set at maximum and the volume adjusted by means of the "Radio" volume control. In some cases a slight reduction of the high frequencies by means of the tone control may prove desirable. If the degree of compensation is too great—too many highs and lows—this may be remedied by reducing the record volume control setting and advancing the radio volume control.

(7) SHORT WAVE ADAPTOR CONNECTIONS

Figure 12 shows the correct connections for attaching the Short Wave Adaptor SW-2 to the R-78.

It will be noted that the Wafer Connector is not used due to the output rectified voltage being too high. The output voltage from terminal No. 5 on the amplifier is approximately 230 volts and is therefore suitable for this use.

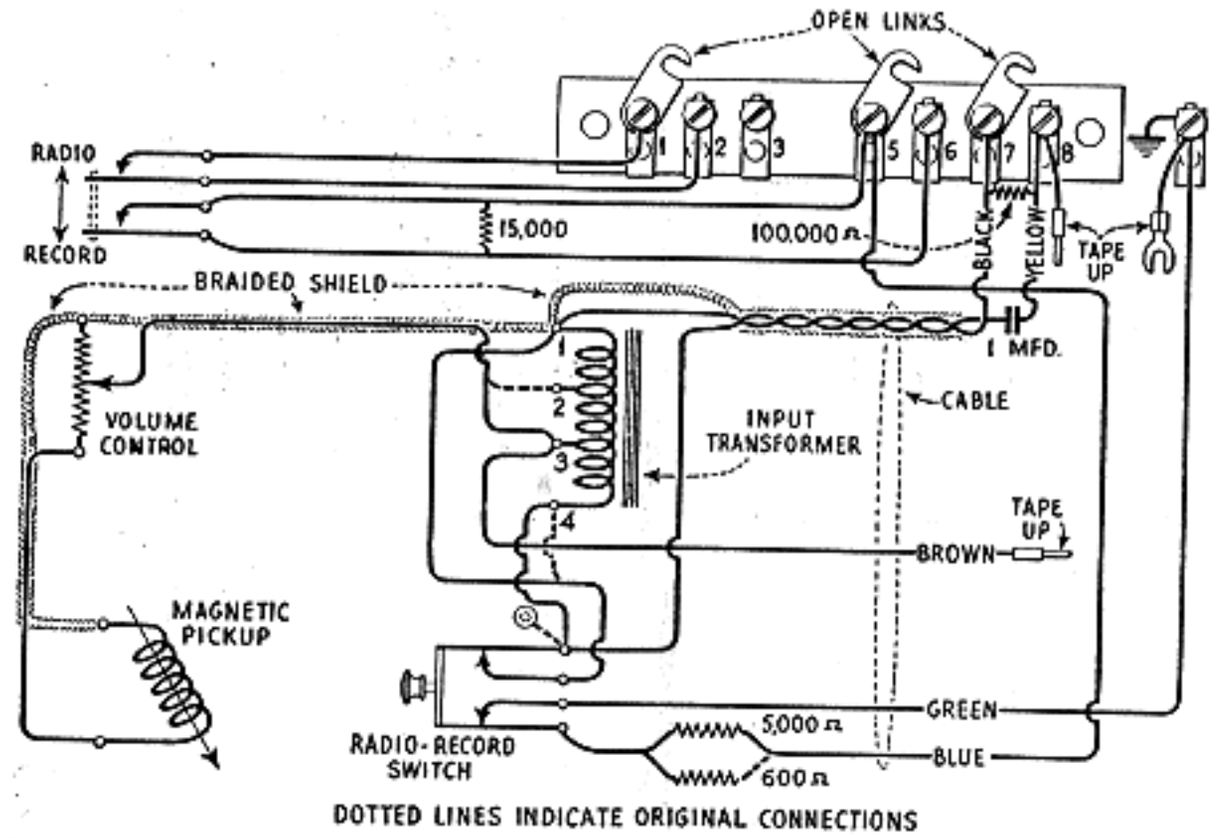


Figure 9—Connections for Attaching End Table Model T-5

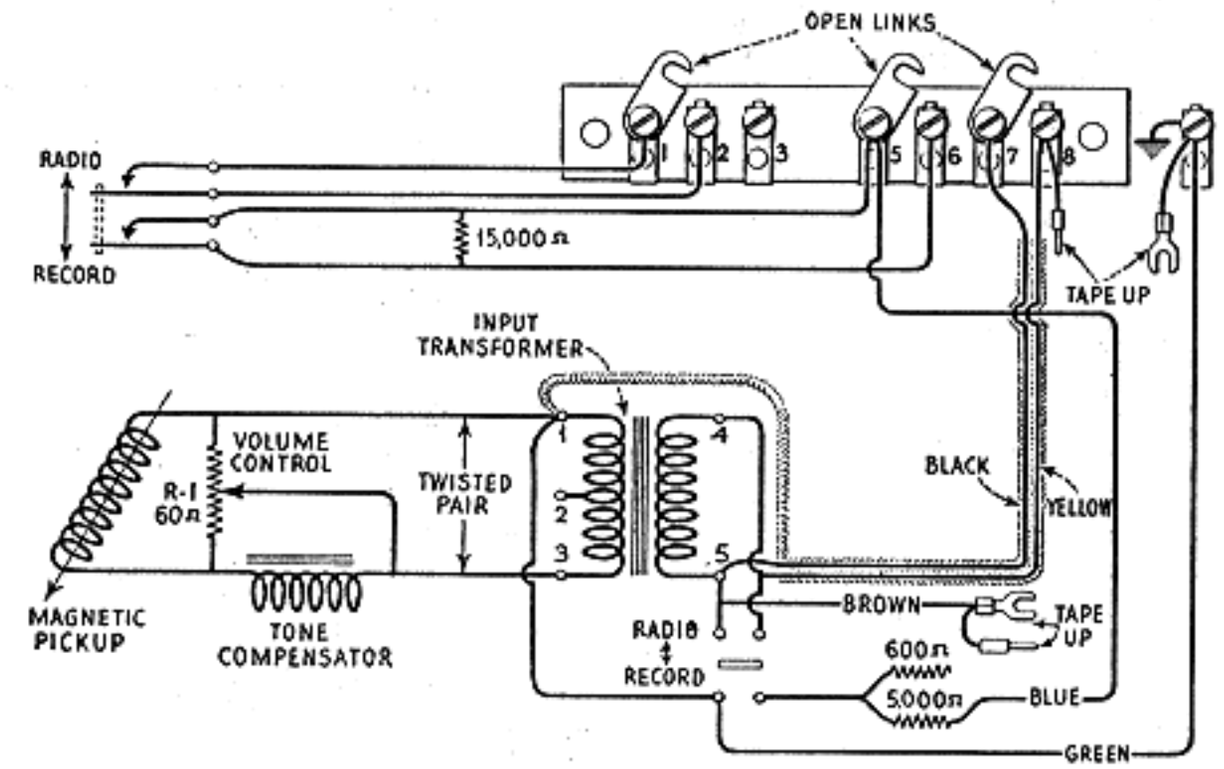


Figure 10—Connections for Attaching Portable Turntable Model PT-23

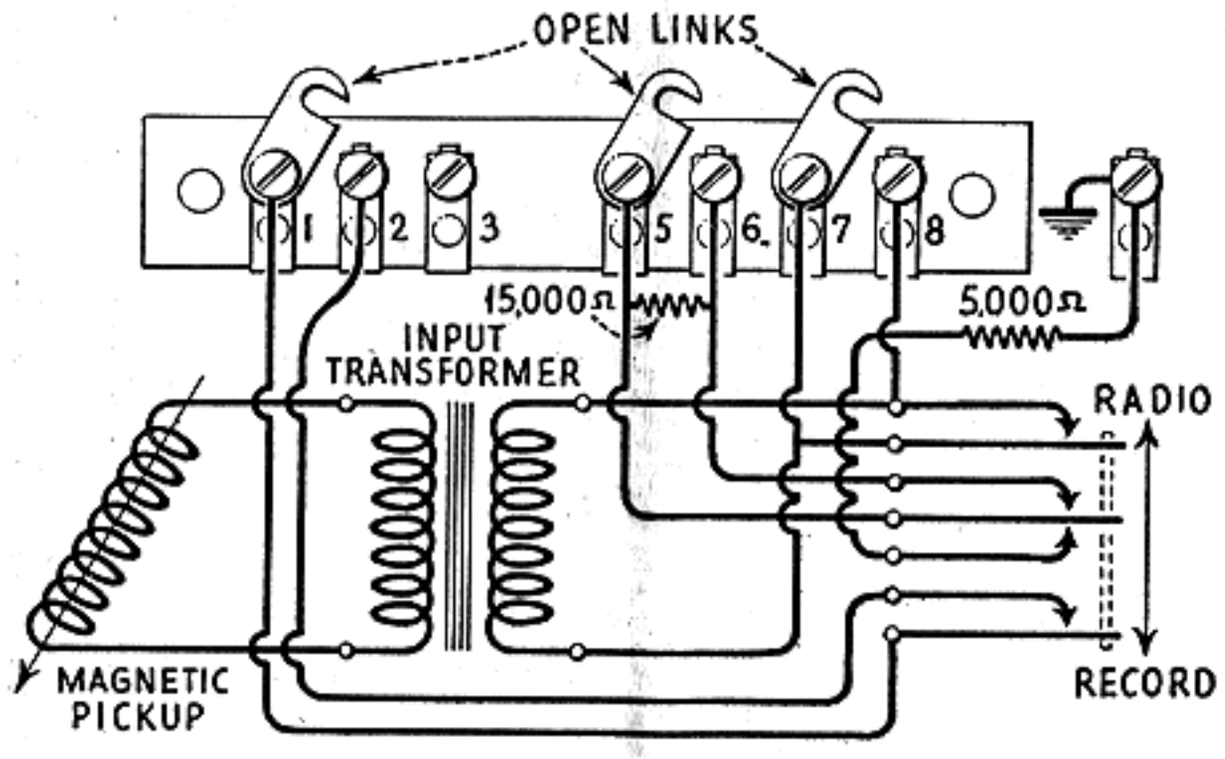


Figure 11—Connections for Attaching Magnetic Pickup

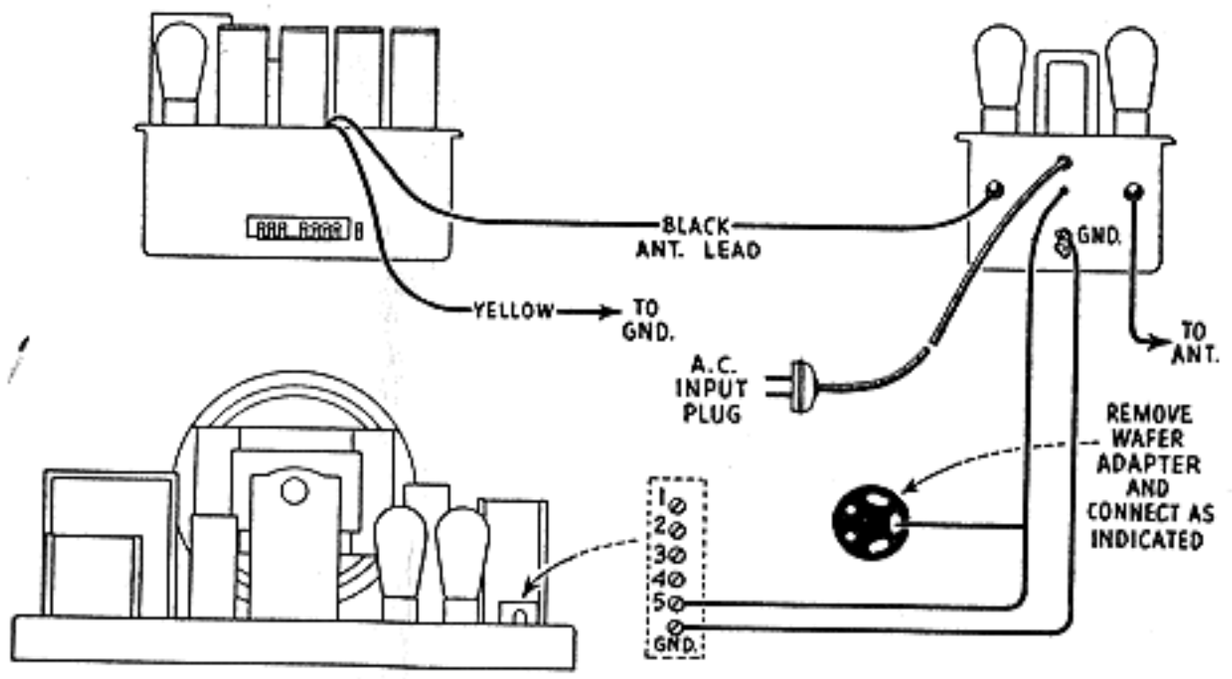


Figure 12—Connections for Attaching Short Wave Convertor Model SW-2

REPLACEMENT PARTS

Stock No.	DESCRIPTION	List Price
	RECEIVER ASSEMBLIES	
2723	Switch—Fidelity switch—Package of 5	$3.00
2746	Socket—Dial lamp socket	.50
2747	Contact cap—Package of 5	.50
3047	Resistor—1,500 ohms—Carbon type—½ watt—Package of 5	2.50
3055	Cushion—Sponge rubber chassis support cushions—One set of 4	.50
3076	Resistor—1 megohm—Carbon type—½ watt—Package of 5	2.50
6142	Resistor—6,000 ohms—Carbon type—½ watt—Package of 5	2.00
6189	Bracket—Dial lamp bracket and indicator—Package of 2	.65
6190	Shaft—Tuning condenser drive shaft with one flat washer and two "C" washers—Package of 5	.85
6192	Spring—3 gang tuning capacitor drive cord tension spring—Package of 10	.50
6251	Capacitor—1200 mmfd.—Package of 5	2.30
6275	Volume control—Complete with mounting nut	3.25
6276	Tone control—Complete with mounting nut and washer	2.10
6277	Capacitor—0.1 mfd. capacitor	.75
6279	Resistor—750,000 ohms—Carbon type—½ watt—Package of 5	2.50
6280	Resistor—400,000 ohms—Carbon type—½ watt—Package of 5	2.50
6281	Resistor—1,100 ohms—Carbon type—½ watt—Package of 5	2.50
6282	Resistor—60,000 ohms—Carbon type—½ watt—Package of 5	2.50
6283	Resistor—Voltage divider resistor	1.50
6284	Reactor—Tone control reactor	1.35
6285	Choke coil—2nd detector plate choke coil	1.10
6286	Capacitor—0.1 mfd. capacitor	.70
6288	Knob—Station selector—Tone control or volume control knob—Package of 5	1.50
6298	Cord—3 gang tuning capacitor drive cord—Package of 5	1.00
6308	Coil—R.F. coil complete with mounting bracket	1.90
6312	Capacitor—650 mmfd.—Oscillator series—Package of 5	.50
6313	Resistor—220 ohms—Carbon type—½ watt—Package of 5	2.50
6314	Capacitor—160 mmfd.—Package of 5	2.50
6315	Resistor—45,000 ohms—Carbon type—½ watt—Package of 5	2.50
6316	Resistor—2,500 ohms—Carbon type—½ watt—Package of 5	2.50
7062	Capacitor—Adjustable trimming capacitor—15 to 70 mmfd.	1.00
7065	Screwdriver—Non-metallic screwdriver for oscillator and I.F. adjustments	1.10
7298	Capacitor—0.01 mfd. capacitor	.80
7438	Capacitor—3 gang variable tuning capacitor complete with mounting screws and washers	5.20
7439	Drum—Dial drum with set screws and 3 dial mounting nuts	.50
7440	Scale—Dial and dial scale	.75
7477	Capacitor pack—Comprising two 1. mfd. and five 0.1 mfd. capacitors in metal container	2.90
7478	Capacitor pack—Comprising four 0.5 mfd., one .02 mfd., and one 0.1 mfd. capacitors in metal container	3.00
7479	Transformer—Interstage audio transformer in metal container	3.90
7480	Transformer—1st intermediate frequency transformer	3.15
7481	Coil—Detector and oscillator coil complete with mounting bracket	3.50
7483	Reactor—Compensating reactor	1.00
7484	Socket—UY type Radiotron socket—5 used	65
7485	Socket—Radiotron 6 contact socket—4 used	.70
7486	Board—Phonograph terminal board—7 terminals and 3 links	$1.00
7487	Shield—Radiotron tube shield—7 used	.50
7488	Shield—Tube shield top—1 used	.50
7490	Board—Resistor board—Less resistors and capacitors	1.10
7492	Transformer—3rd intermediate transformer	3.00
7498	Reactor—Volume control reactor	2.50
7499	Transformer—2nd intermediate transformer	3.00
7500	Cable—6 conductor—From receiver to S.P.U.	1.50
	AMPLIFIER ASSEMBLIES	
2725	Fuse—1.5 ampere—Cartridge type fuse—Package of 5	.50
2731	Resistor—10,000 ohms—1 watt—Carbon resistor—Package of 5	2.00
2757	Strip—Terminal strip—2 terminals	.50
3032	Socket—UX type Radiotron socket with insulator	.50
3056	Shield—Radiotron tube shield—Package of 2	.50
3099	Capacitor—.005 mfd. capacitor	.75
3147	Cover—Fuse cover with bushing and insulator	.95
6289	Strip—Terminal strip—5 terminals	.85
6290	Board—Terminal board complete with terminals, fuse clips, and insulator	1.00
6291	Board—Terminal board complete with terminals and insulator—Less capacitor	.90
6292	Switch—Operating switch	1.25
7054	Cord—Power cord	1.00
7370	Cover—Terminal strip cover with insulator—5 terminals	.55
7491	Socket—UY type Radiotron socket with insulator	.70
8910	Capacitor pack—Comprising two 10 mfd. capacitors in metal container	7.00
8911	Reactor—Filter reactor	4.75
8912	Transformer—Audio transformer pack comprising input and output transformer in metal container	6.50
8913	Transformer—Power transformer—105–125 volts, 50–60 cycles	12.50
8914	Transformer—Power transformer—105–125 volts, 25–50 cycles	16.00
8915	Transformer—Power transformer—200–250 volts, 50–60 cycles	13.50
10907	Fuse—3 ampere fuse (for 25 cycle use)—Package of 5	.50
	CABINET ASSEMBLIES	
	Prices Furnished Upon Request	
2776	Catch assembly—Door catch and strike with nails—Package of 2 sets	
6293	Pull—Door pull with mounting screw and back plate	
6294	Hinges—Door hinges—Set of 4 hinges with mounting screws	
9413	Cabinet—Cabinet complete—Less equipment	
X101	Top—Cabinet top	
X102	Panel—Control panel	
X103	Leg—Cabinet leg	
X104	Foot—Cabinet foot	
X105	Doors—Cabinet door—Right and left hand—1 pair	
X106	Board—Baffle board with grille cloth and reproducer pad—Assembled	
X107	Ornament—Front corner post ornament—1 pair	
X108	Stretcher—Stretcher assembly comprising front, back, and side rails	
	REPRODUCER ASSEMBLIES	
7292	Screw assembly—Comprising two screws, two nuts, two lock-washers, and 1 plate—For mounting speaker to amplifier	.95
8559	Ring—Cone retaining ring	.80
8916	Cone—Reproducer cone complete with voice coil—Package of 5	15.00
9418	Coil assembly—Comprising field coil, magnet, and cone support	12.00

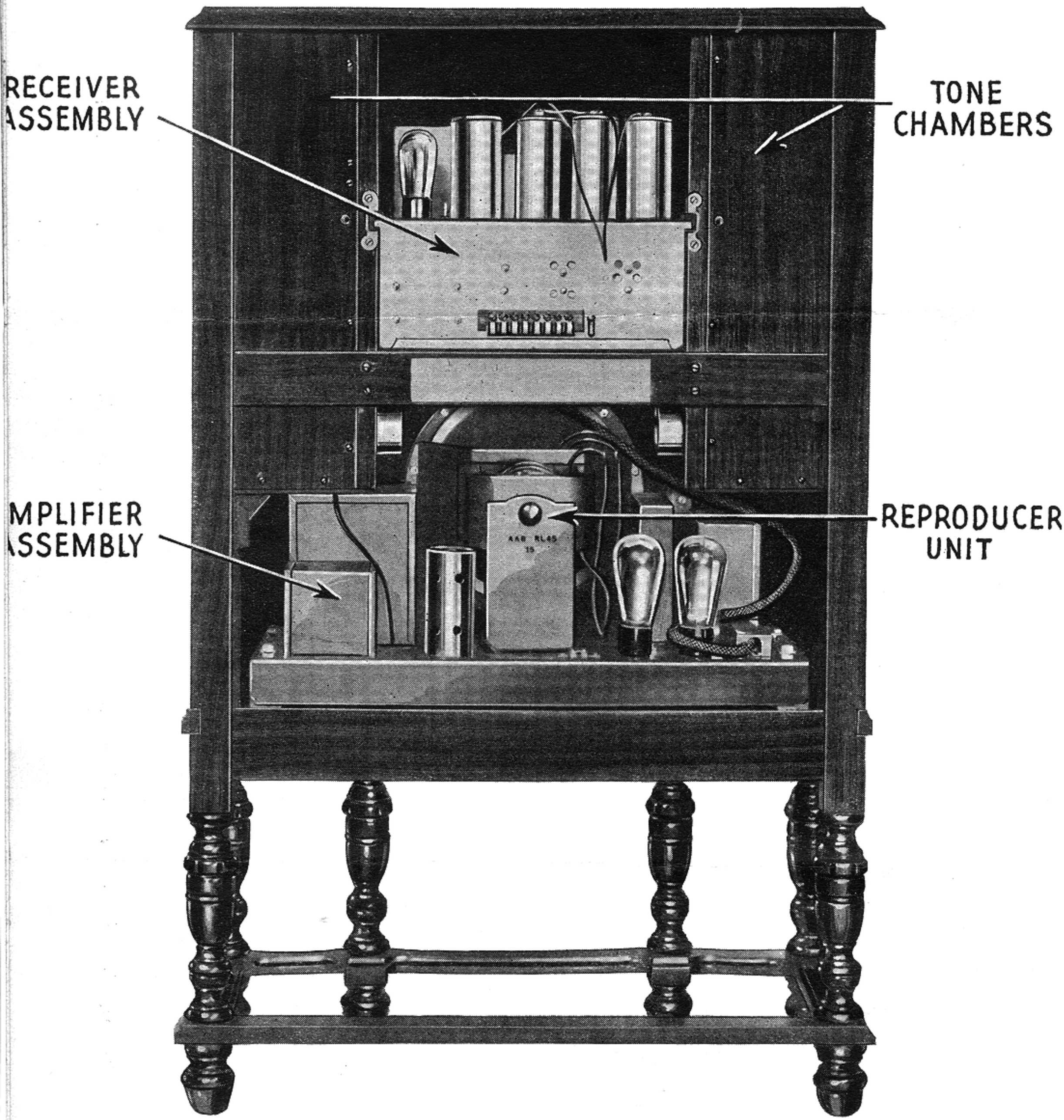


Figure 1—Rear Interior View of Model R-78

RCA Victor R-78

(Bi-Acoustic Super-Heterodyne)

SERVICE NOTES

ELECTRICAL SPECIFICATIONS

Voltage Rating.....105–125 Volts
Frequency Rating.....50–60 Cycles
Power Consumption.....110 Watts Average
(The input wattage may vary from 70 to 130 watts depending on the output volume being used)
Recommended Antenna Length.....25–100 Feet
Type of Circuit..Super-Heterodyne with A.V.C., Compensated A.F. system and Class "B" output stage
Type and number of Radiotrons.....4 RCA-58, 5 RCA-56, 2 RCA-46, and 1 RCA-82, Total 12
Number of R. F. Stages.....One
Type of first detector.....Exponential with control grid voltage varied by A.V.C. tube
Number of Intermediate Stages.....Two, one for signal and one for A.V.C.
Type of Second Detector.....Power Grid Bias
Number of A. F. Stages.....Two, one Push-Pull driver and one Class "B" output
Type of tone control....Reactor capacitor and variable resistor for reducing high frequency response
Type of Rectifier.....Mercury vapor full wave RCA-82
Undistorted output.....Approximately 20 watts Maximum

PHYSICAL SPECIFICATIONS

Height.....43 inches
Width.....28¼ inches
Depth.....14 inches
Weight Packed for Shipment.....168 Lbs.

The RCA Victor R-78 is a 12-tube Bi-Acoustic Super-Heterodyne Radio Receiver incorporating all the usual Super-Heterodyne features, together with the New RCA Victor Automatic Volume Control, Compensated Audio System and Class "B" output amplifier. These features, mainly evidenced by the greatly improved tone quality and high output, give the R-78 a degree of performance not obtainable with any existing type of Radio Receiver.

In order to economically build the R-78 several new types of Radiotrons have been produced. These are namely the RCA-58, a new R. F. Amplifier Pentode, the RCA-56, a high efficiency general purpose tube similar to the UY-227, the RCA-46, a new output tube designed for Class "B" operation and the RCA-82, a new mercury vapor rectifier Radiotron giving the degree of voltage regulation necessary for a Class "B" Amplifier.

A brief technical description of this remarkable new receiver follows. Figure 2 shows the schematic wiring diagram.

In order to understand the reasons for many of the design features of the R-78 it is necessary to first review some of the requirements of a radio receiver. These may be listed in the following order:

Sensitivity. The primary requirement for any Radio receiver is its ability to bring in a station. The R-78 has sensitivity that reaches into the noise level even in a quiet location.

Selectivity. The ability of a receiver to separate stations even on adjacent channels is that quality known as selectivity. The R-78 has the ability to separate stations on adjacent channels even though one is a local station. In addition, the Automatic Volume Control is so designed that it does not tend to spread the band of any particular station due to its action.

Fidelity. Fidelity is that quality of a radio receiver that determines how exact the reproduced sound follows that produced in the broadcasting studio, of course, excepting any distortion that may originate in the transmitting station. Fidelity must cover every quality of a set from input to sound pressure output. Not only must the receiver and amplifier be considered but also the loudspeaker and cabinet, the latter being very important. Fidelity also includes distortion that occurs at reduced volume due to certain characteristics of the human ear. These will be discussed later.

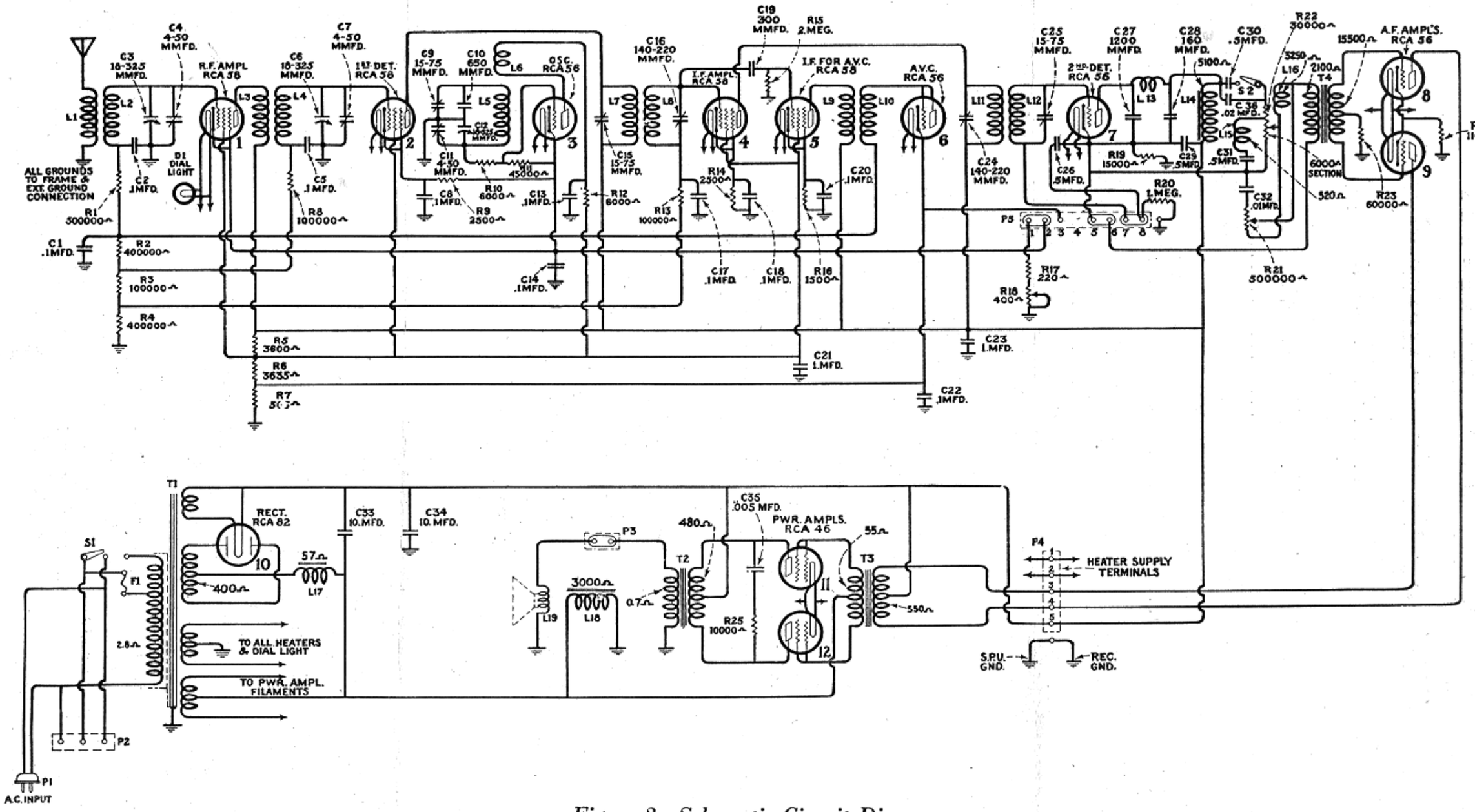


Figure 2—Schematic Circuit Diagram

The Automatic Volume Control used in the new R-78 has a very definite relation to sensitivity and selectivity. It is of the two element (diode) type and has a special I. F. stage to drive it. This volume control is many times more effective than any existing type. Due to its action the R. F. voltage applied to the Second Detector is substantially constant, for a signal of from 100 microvolts input to that of several volts. Such regulation, in addition to being desirable from an entertainment viewpoint is also essential in this receiver due to the location of the volume control. Since there is no danger of overload on the detector grid the volume control may therefore be located in the audio circuit.

Referring to the schematic circuit, Figure 2, it will be noted that the A.V.C. functions in the following manner:

The input signal voltage for the I.F. Amplifier is applied also to the A.V.C. amplifier tube due to the grids of both being coupled together by means of the 300 mmfd. capacitor C-19. The output of the I.F. amplifier is applied to the Second Detector through a sharply tuned transformer. However, the output of the A.V.C. amplifier is coupled to the A.V.C. tube through a broadly tuned transformer. The reason for the location of the A.V.C. and coupling it in this manner is due to two reasons. First, too much selectivity ahead of the A.V.C. is not desirable as it introduces excessive distortion and overload as a station is tuned in. However, a certain amount of selectivity is essential, otherwise the A.V.C. will be caused to function by a local station when it is desired to tune in a weaker station on an adjacent channel. It will be noted that the grid and plate of the A.V.C. tube are tied together.

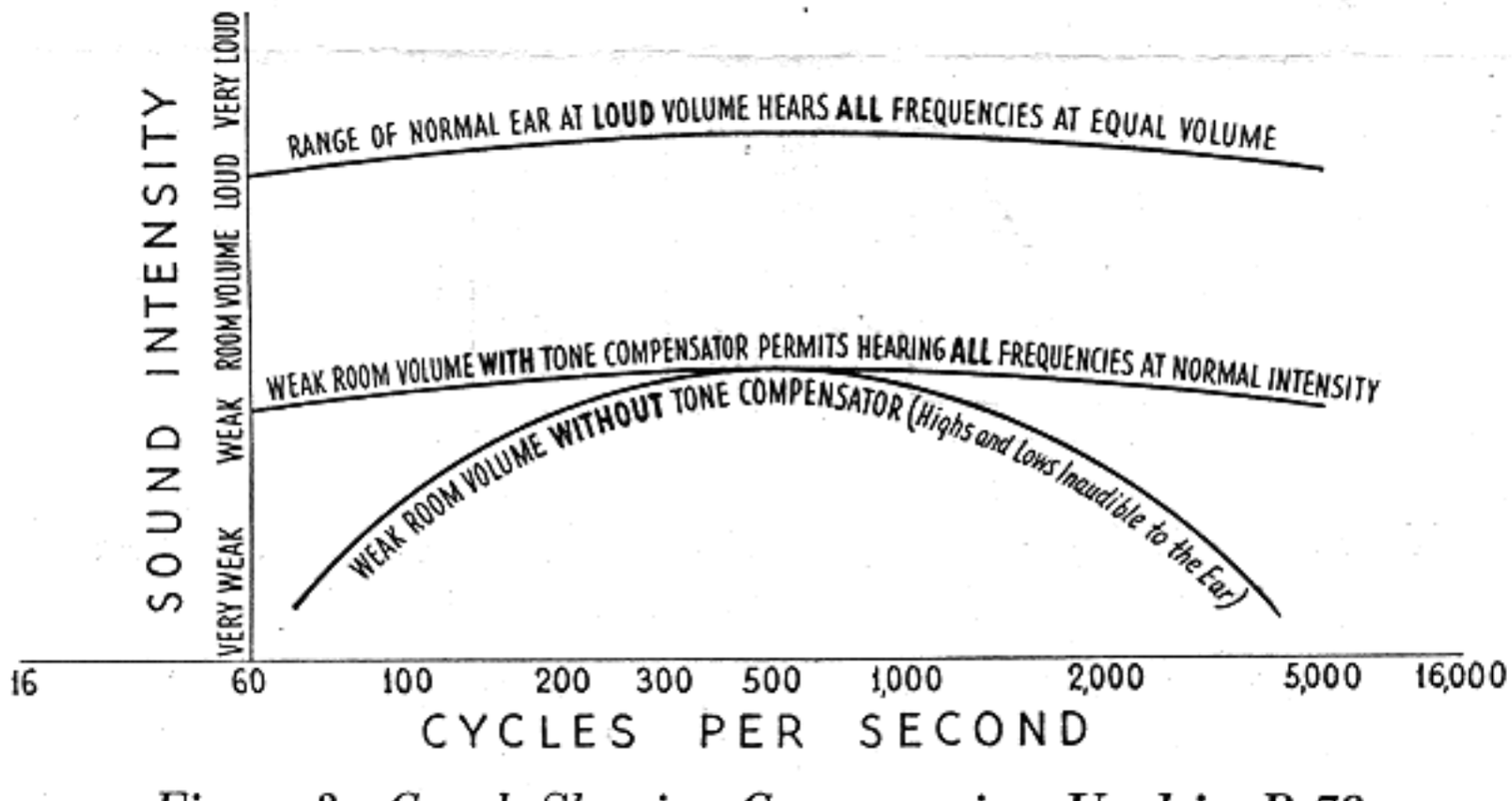


Figure 3—Graph Showing Compensation Used in R-78

This gives a straight rectifier action and the drop across Resistors R-2, R-3, and R-4 gives the bias for the R.F. Stage. The drop across R-3 and R-4 comprises the grid voltage for the First Detector, and that across R-4, the grid voltage for the I. F. Amplifier. As the drop in these Resistors is due to the signal voltage applied to the A.V.C. tube and this voltage is in turn dependent on the bias of the R.F., 1st Detector and I.F. Amplifier, an automatic action is obtained. The reason for the greater voltage applied to the R.F. stage and first detector than that applied to the I.F. is to prevent overloading of these tubes on the side of a strong carrier.

We may now bring our attention to the audio stage and manual volume control. Both of these features are of entirely new design. However, before discussing them it is well to review a few of the requirements of a receiver that is to have good quality. First, the receiver must have good fidelity. That is, it must be capable of reproducing the very low notes as well as the high ones. The R-78 covers the range from approximately 35 cycles to 5000 cycles. Second, the receiver must have a large undistorted output otherwise signals of high amplitude will overload the output stage. The R-78 has between ten and twenty Watts undistorted output, the exact maximum depending on the percentage of modulation of the incoming signal. Third, the fidelity of the receiver must be changed with different settings of the volume control to compensate for the sensitivity of the ear in relation to different frequencies at various intensities. The ear is far less sensitive to both low and high frequencies at low degrees of volume than it is to the middle register. The R-78 volume control tends to bring up the low and high frequency response in relation to the middle frequencies as the volume is reduced. This greatly improves the quality of output at a room volume. The manner in which this is done follows:

The output of the Second Detector is coupled to the grid circuit of the driver stage by means of impedance-transformer coupling. The plate supply to the Detector is fed through the coupling reactor L-14 and the audio component passes through the 0.5 mfd. coupling Capacitor C-30 and the .02 mfd. capacitor C-36. The volume control is located between these stages and functions to reduce the voltage applied to the primary of the interstage transformer. It will be noted that the first section of the volume control is 30,000 ohms and at this point a trap circuit consisting of reactor L-15 and capacitor C-31 are directly in the output circuit of the Detector.

The trap circuit tunes to approximately the middle of the audio response range and causes greater attenuation of the middle register than at either end as the volume is reduced. The effect as this point is reached is to reduce the general volume level but the middle register a greater amount than at the low and high ends. From this point to the minimum position the volume control acts as a potentiometer across the trap circuit and reduces the volume without changing the response to any greater degree. One has to but use this volume control to appreciate its great advance over existing types. Figure 3 gives an illustration of the manner in which this compensation is made.

The foregoing description applies only to one section of the volume control. Actually there are two sections, the other being between the R.F. and 1st detector cathodes and varying the overall sensitivity. This control prevents all noises and signals of a very weak character from being received and only functions over last 20° of the angular movement of the volume control. However if such signals are desired it is only necessary to advance the volume control in the usual manner to its maximum position.

It will be noted that the value of the coupling capacitors in the circuit varies, depending on the position of the switch S-2. The purpose of this switch is to decrease the low frequency output when receiving stations that have carrier waves with an excessive hum component. Also a certain amount of low frequency growl due to heterodyning of stations may be eliminated by this switch.

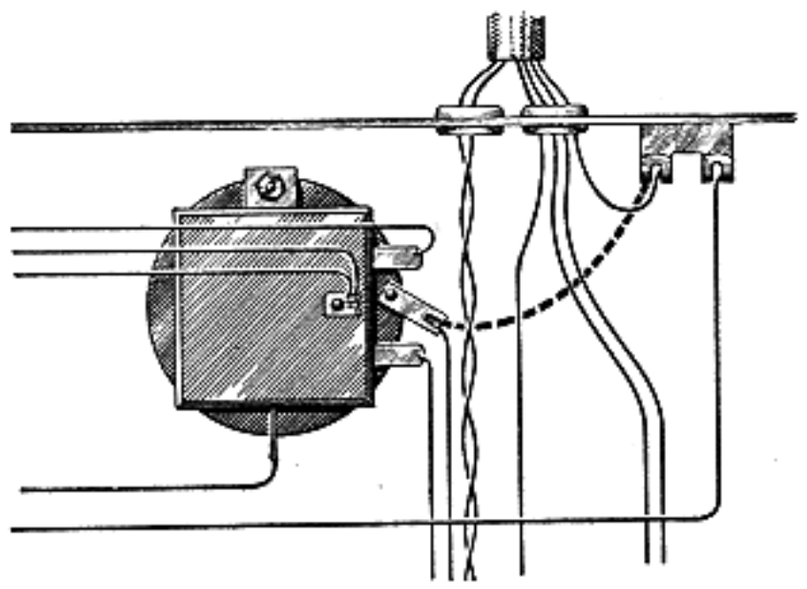


Figure 4—Wiring Change for Altering Volume Control Action
(Dotted Line Indicates Position of New Wire)

Two Radiotrons RCA-56 act as a driver stage for the output Class "B" Amplifier. In order to properly understand it, let us review the general principals of the Class "B" Amplifier.

There are two general types of audio amplifiers, namely, the Class "A" and the Class "B." Up to the present practically all modern radio receivers use the Class "A" Amplifier either in single or in a push-pull connection. In the Class "A" Amplifier the grid bias is so adjusted that either a positive or a negative voltage impressed on the grid will cause an equal increase or decrease in the normal plate current flowing. This increase and decrease is but a fraction of the total plate current and is the only useful part of it. Therefore, the major portion of plate circuit is entirely of a wasted nature.

In the Class "B" Amplifier, the grid bias is so adjusted that very little plate current is flowing, it virtually being biased to cut-off. As the grid swings negative there is very little reduction possible so that the practical effect is nil. However, as the grid swings positive the plate current increases tremendously and this is entirely of an A.C. character, there being no residual current. Due to the use of two tubes both sides of the cycle are taken care of, first by one tube and then by the other. This gives an output greatly in excess of the Class "A" Amplifier because less energy is dissipated as losses in the tube and not appearing as useful output. The R-78 uses the new dual grid output tube RCA-46 in which the grids are tied together which in effect acts as a high bias resulting in plate current cut-off even though the tubes are operated at zero bias. Due to the grids only functioning on the positive half of the cycle considerable grid current flows on the positive half signal waves and a low impedance input circuit is necessary. The transformer between the driver stage and the power stage is therefore a step-down transformer with a low resistance secondary. The limit of power output is determined by the point at which the driver stage overloads. On a highly modulated signal, the maximum undistorted output may exceed 20 watts.

From the above description it is obvious that the load on the plate supply system will be highly variable. In order to provide suitable regulation for such a load the new mercury rectifier RCA-82 has been provided. The internal drop in this tube remains constant for practically all loads. The output current peaks therefore have no appreciable effect on the output voltage.

The loudspeaker has been designed to handle the increased power output and is designed to have increased frequency range.

The cabinet has two sound chambers that nullify the effect of cabinet resonance. This, together with the large baffle area of the cabinet, gives the loudspeaker and amplifier full expression to their high quality output.

SERVICE DATA

(1) HUM

It is very important that a good ground always be connected to the yellow lead of the Receiver Chassis. Unless this is done excessive hum and noise will be obtained, even at low volume, from the RCA-82. Also lack of a good twist in the volume control leads will cause an undue amount of hum due to the pickup by the tone control reactor.

(2) CHANGE IN RECEIVER ASSEMBLY FOR LOW INTENSITY STATIONS

The automatic volume control in the R-78 is so designed that it maintains a constant output only on signals in excess of 100 microvolts. In the vast majority of locations this action is entirely satisfactory as stations rarely drop below this value. Having it work at a low value would greatly increase the noise between stations.

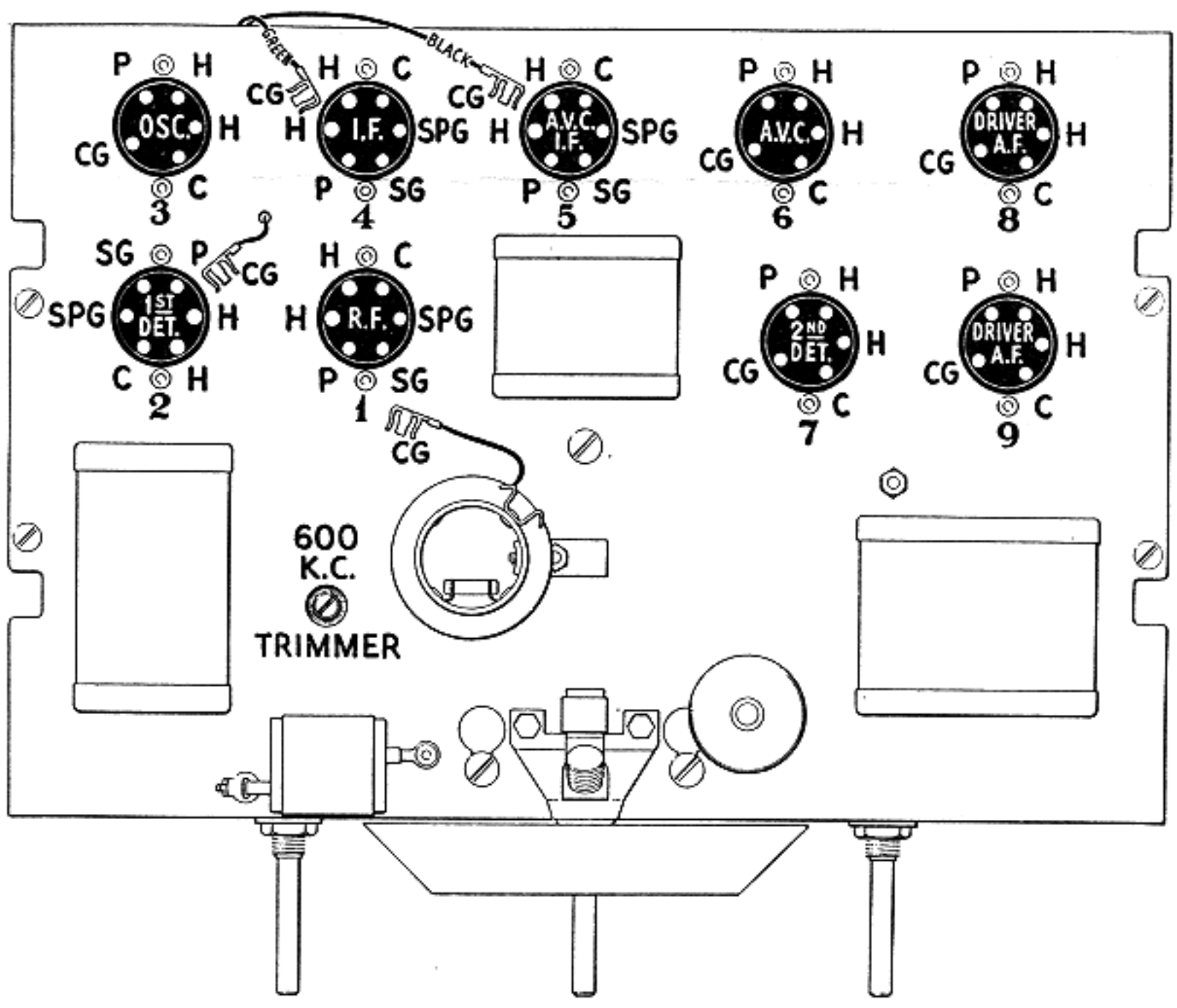


Figure 5—Radiotron Socket Layout

However if the receiver is to be operated in a locality remote from stations where the usual signal intensity is low, a slight change may be made in the receiver chassis that will extend the A.V.C. action to signals of much lower input. This may be done by removing the chassis and connecting a wire from the terminal on the 400 ohm section of the volume control to ground. Figure 4 shows the details of this change. It should be remembered when making this change that the noise level between stations will greatly increase when the change is made, due to the secondary section of the volume control not being in the circuit.

(3) 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.

(a) 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.

(b) An output meter is necessary. This may be a current squared galvonometer 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.