RCA Victor

32-Volt D. C. Receiver Model 223

6-Tube Broadcast and Police Call Super-Heterodyne

SERVICE NOTES

SERVICE DIVISION

RCA Victor Company, Inc.

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

A RADIO CORPORATION OF AMERICA SUBSIDIARY

REPRESENTATIVES IN PRINCIPAL CITIES

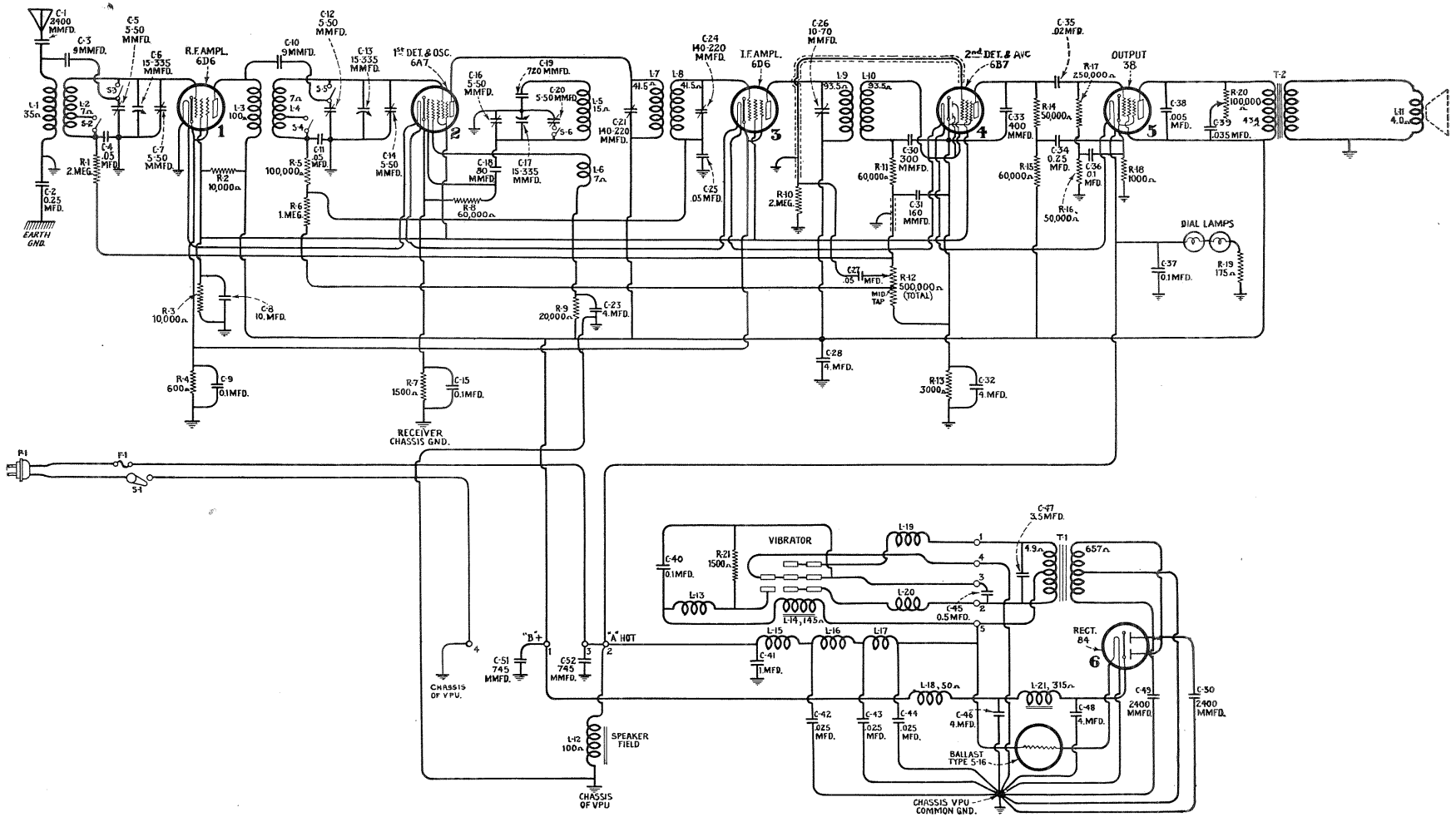


Figure 1—Schematic Circuit Diagram

RCA VICTOR MODEL 223
SERVICE NOTES

Electrical Specifications

Voltage Rating.....26–40 Volts D. C.
Power Consumption.....60 Watts at 32 Volts
Number and Types of Radiotrons.....2 RCA-6D6, 1 RCA-6A7, 1 RCA-6B7, 1 RCA-38, 1 RCA-84 —Total, 6
Type of Ballast Lamp.....Amperite 5-16
Undistorted Output....1.1 Watts (Max. 1.6 Watts)
Tuning Frequency Range.....540 K. C.–1500 K. C. and 1400 K. C.–2800 K. C.

This receiver is a six-tube, 32-volt D. C. superheterodyne designed primarily for operation from 32-volt farm lighting circuits. Excellent sensitivity and selectivity, large undistorted output and excellent tone quality are inherent features of this receiver. Other outstanding features include 10-inch electro-dynamic loudspeaker, wide tuning range (police, aviation and broadcast), ballast lamp for voltage fluctuations, and a separate power supply with a newly designed filter unit.

Figure 1 shows the schematic circuit diagram, Figures 2 and 3 the chassis and power unit wiring, and Figure 5 the assembly wiring diagram. The replacement parts are given on page 9.

Description of Circuit

The circuit of this receiver is similar in many ways to the usual six-tube superheterodyne, although the power supply differs in several respects. Chiefly among the differences is the use of a vibrator interrupter for obtaining alternating current and a tube rectifier for rectifying it at a higher voltage.

The R. F. stage uses Radiotron RCA-6D6, which is a six-volt heater type super-control R. F. amplifying tube. The function of this stage is to select and amplify the desired incoming signal and apply it to the first detector.

The next tube is a combined oscillator-detector which is known as the RCA-6A7 and which provides a local signal and a detector for obtaining an I. F. frequency. The local oscillator, due to the bridge circuits used, provides a signal that has a constant frequency difference from the incoming R. F. signal (175 K. C. higher) at all points throughout the tuning range. The detector portion of the tube serves to extract the beat frequency from the combined signals (oscillator and signal) and apply it to the grid of the I. F. stage.

The plate circuit of the first detector and the grid and plate circuits of the I. F. tube are all tuned by means of small adjustable capacitors to 175 K. C. This group of tuned circuits, together with the R. F. circuits, provides the high selectivity of the receiver. Radiotron RCA-6D6 is used in the I. F. stage.

Radiotron RCA-6B7 is used as a diode second detector, automatic volume control and audio amplifier. The D. C. component of the rectified I. F. signal on the second detector diode is used for automatic bias on the R. F., first detector and I. F. tubes. The audio component of the rectified signal is applied to the pentode section of the RCA-6B7 for further amplification at audio frequencies.

The output of the second detector is applied to the grid of Radiotron RCA-38, pentode output amplifier. Resistance coupling is used between the detector and the output tube while a step-down transformer serves as an impedance matching device between the plate circuit of the RCA-38 and the voice coil of the loudspeaker.

Field excitation for the loudspeaker is obtained by connecting it directly across the 32-volt direct current supply. Heater excitation for the tubes described is obtained by connecting them in series and placing the entire circuit across the 32-volt line.

Plate and grid voltages for all tubes are obtained from a special plate supply unit which consists of a vibrator, a tube rectifier, a thermal voltage regulator and a special filter network for reducing hum or vibrator interference to a negligible degree. The purpose of the vibrator is to interrupt the direct current and apply it first in one direction and then in the opposite direction across individual sections of the primary of the power transformer. The transformer steps the voltage up several times and applies it to the plates of the full-wave rectifier, Radiotron RCA-84. The filament of this tube is connected in series with the Amperite 5-16 voltage regulating tube. This regulating tube maintains a constant current through the rectifier filament over a wide variation of line voltages.

The range switch provides a quick means of shifting from one frequency band to the other. The regular band covers from 540 K. C. to 1500 K. C., while the police band covers from 1400 K. C. to 2800 K. C. This shift is accomplished in the following manner.

A tap is provided on the grid coils of the R. F. and first detector circuits. Also additional coupling capacitors are connected from the antenna to the R. F. grid and from the R. F. plate to the first detector grid. In the oscillator, R. F. and detector circuits, an extra trimmer capacitor is available for paralleling to the main tuning condenser. The effect of these various

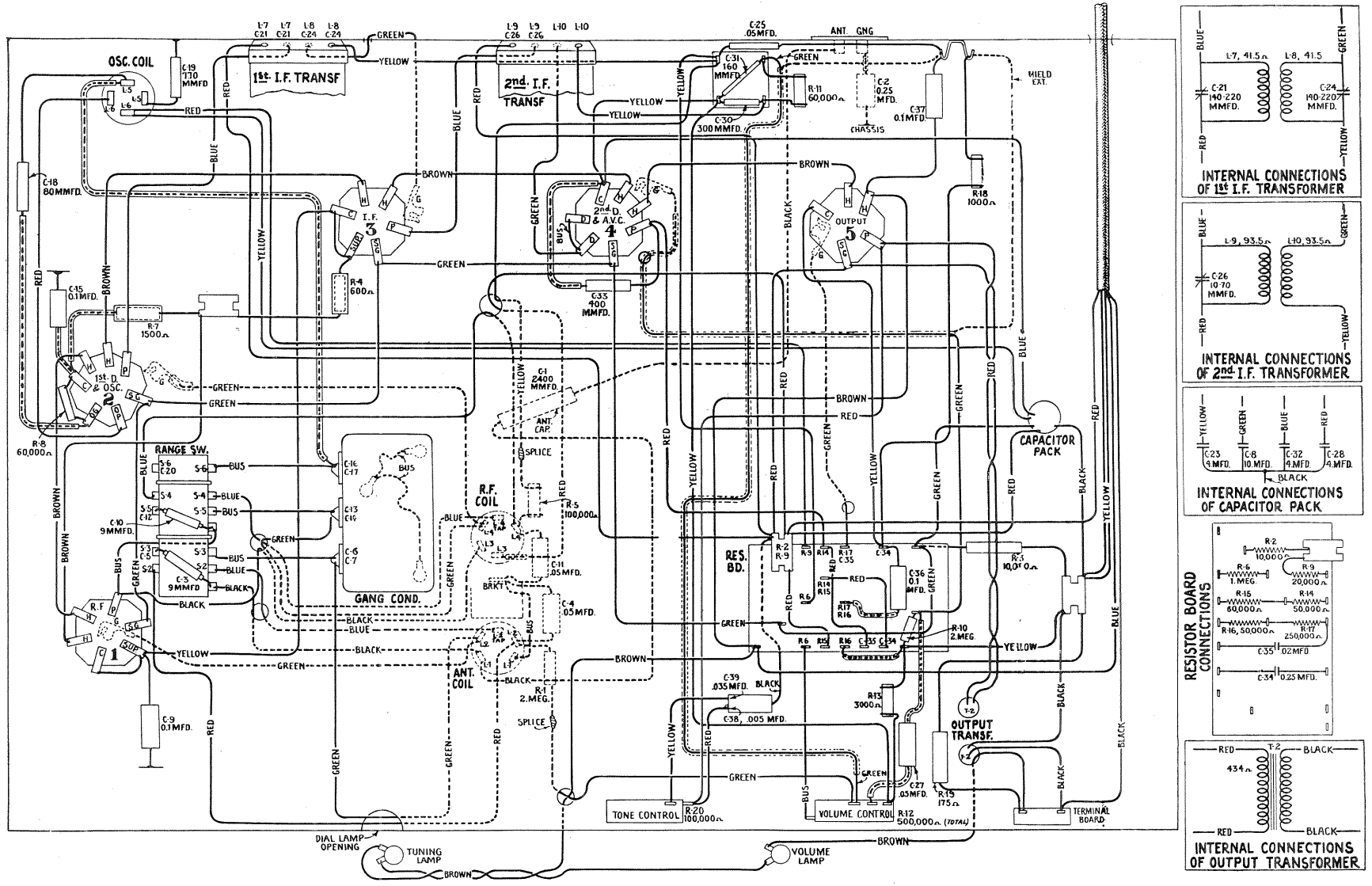


Figure 2—Chassis Wiring Diagram

taps and capacitors is to change the tuning range as follows:

1. At the broadcast position all of the additional circuits are open as shown in Figure 1.

2. At the police band position, all of the additional switches are closed. Shorting of turns in the grid coils reduces their inductance so that the tuning capacitors cover the high frequency range. Connecting the two coupling capacitors increases the coupling and thereby the sensitivity at the higher frequency position. The trimmer capacitor on the oscillator circuit provides proper tracking with the R. F. circuits.

Line-up Adjustments

Inoperation, poor tone quality, or lack of proper sensitivity and selectivity are direct results of lack of alignment. In event the receiver is to be aligned, carefully use the following procedure:

I. F. Tuning Adjustments—Two transformers comprising three tuned circuits (the secondary of the second transformer is untuned) are used in the intermediate amplifier. These are tuned to 175 K. C. and the adjustment screws are accessible as shown in Figure 4. Proceed as follows:

(a) Procure a modulated oscillator giving a signal at 175 K. C., a non-metallic screwdriver such as Stock No. 4160 and an output meter. Test Oscillator, Stock No. 9050, is suitable and recommended for making these adjustments.

(b) Short-circuit the antenna and ground terminals and tune the receiver so that no signal is heard. Set the volume control at maximum and connect a ground to the chassis.

(c) Connect the oscillator output between the first detector control grid and chassis ground. Connect the output meter across the voice coil of the loudspeaker and adjust the oscillator output so that with the receiver volume control at maximum, a slight deflection is obtained in the output meter.

(d) Adjust the primary of the second, and the secondary and primary of the first I. F. transformers until a maximum deflection is obtained. Keep the oscillator output at a low value so that only a slight deflection is obtained on the output meter at all times. Go over these adjustments a second time, as there is a slight interlocking of adjustments. This completes the I. F. adjustments.

R. F. and Oscillator Adjustments—The three-gang capacitor screws are accessible at the bottom of the chassis. The high frequency capacitor screws are located on the Range Switch. Proceed as follows:

(a) Procure a modulated oscillator giving a signal at 1400 and 2440 K. C. (Stock No. 9050), a non-metallic screwdriver such as Stock No. 4160, and an output meter.

(b) Connect the output of the oscillator to the antenna and ground terminals of the receiver. Check the dial at the extreme maximum position of the tuning capacitor. The indicator should be at the last division. Then set the dial at 140, the oscillator at 1400 K. C. and connect the output meter across the cone coil. Adjust the oscillator output so that a slight deflection is obtained when the receiver volume control is at maximum.

(c) With the Range Switch at the counter-clockwise position, adjust the three tuning condenser line-up capacitors until maximum deflection is obtained in the output meter. Then shift the oscillator to 2440 K. C., the Range Switch to the clockwise position and the dial to 120. The three line-up capacitors located on the Range Switch should then be adjusted for maximum output.

When making both the I. F. and R. F. adjustments, the important point to remember is that the receiver volume control must be at its maximum position. Also the minimum input signal necessary from the oscillator will permit a more accurate adjustment.

TUBE SOCKET VOLTAGES

32-Volt D.C. Input — No Signal — Volume Control at Minimum

Radiotron No.	Cathode to Ground, Volts	Cathode to Screen Grid, Volts	Cathode to Plate, Volts	Plate Current M. A	Heater Volts
RCA-6D6 R. F.	8.4	77	216	4.2	6.2
RCA-6A7—Osc. Det.	9.7	76	215	6.5	6.2
RCA-6D6 I. F.	8.4	77	216	4.2	6.2
RCA-6B7—2nd Det.	5.7	80	52	1.9	6.2
RCA-38 Pwr.	19.5	205	197	21.5	6.2
RCA-84 Rect.	244			50	6.5–7.0*

*Varies with ballast tubes and with time.

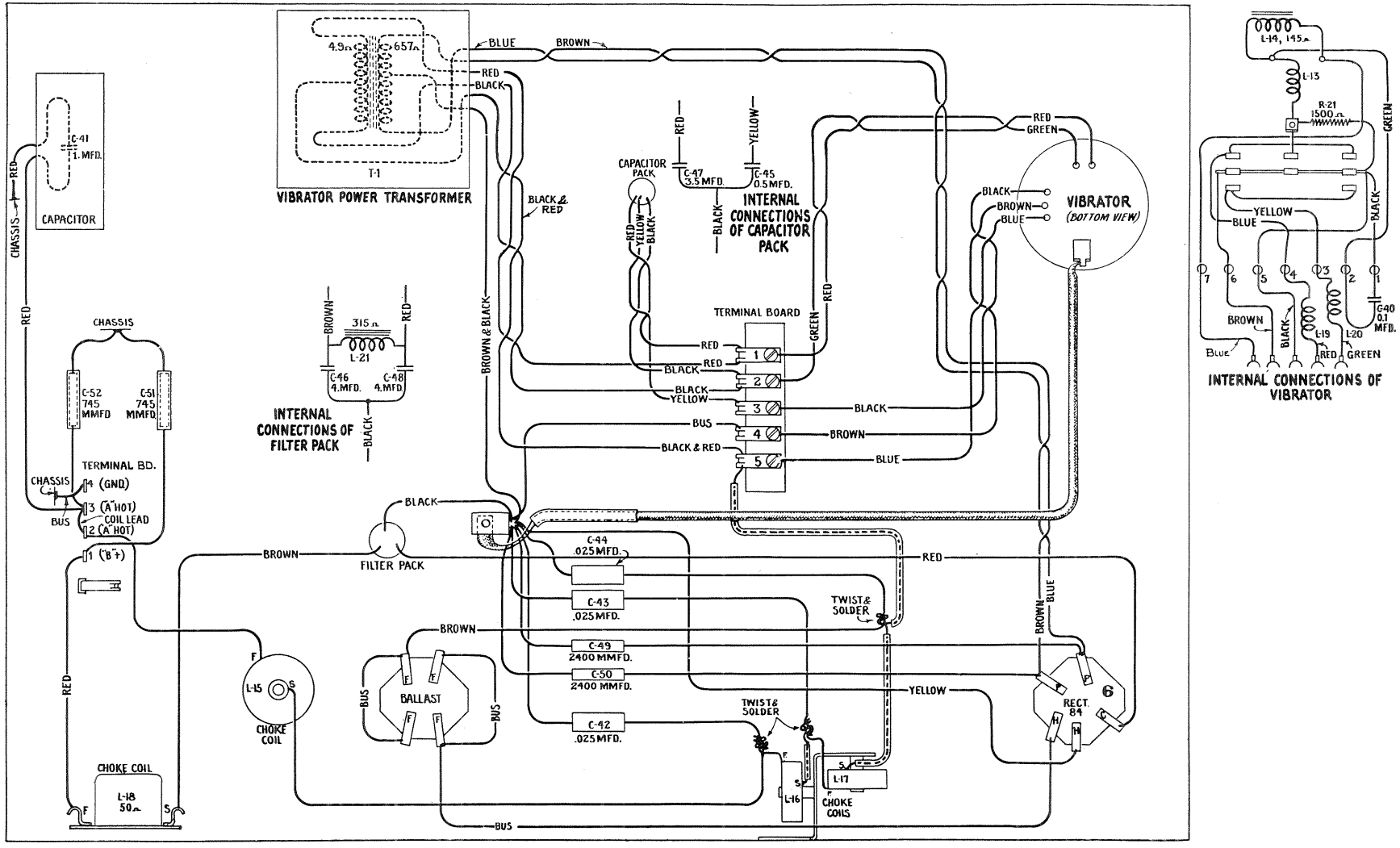


Figure 3—Power Unit Wiring Diagram

SUPPRESSION OF GENERATOR AND IGNITION INTERFERENCE

Operating this receiver while the 32-volt generator is running may present difficulties caused by the radiation of radio-frequency interference from the generator and gasoline engine. This interference usually travels over the lighting lines and is picked up by the antenna system of the receiver. There are two methods of reducing this interference, both of which may be required in bad cases.

1. Suppression of the interference at its source by means of the accessories furnished with the receiver.
2. Placing the antenna in such a position that the interference will not be picked up, and using a Stock No. 7718 Shield Kit for transmitting the signal from the antenna to the receiver without picking up noise on the lead-in.

Figure 4 shows a typical installation of the suppression equipment. This equipment is connected as follows:

SUPPRESSOR:—In single-cylinder installations, the suppressor is connected to the spark-plug for the suppression of the high-tension interference generated at this point. In twin-cylinder installations, the single-distributor type suppressor should be installed and should eliminate this interference. However, in some cases it may be necessary to install both distributor and plug suppressors.

GENERATOR CAPACITOR:—A capacitor is connected from each brush of the generator to the generator frame, which must be grounded. This reduces the interference caused by sparking at the commutator of the generator. If excessive sparking occurs, it is very unlikely that the capacitors will reduce the noise sufficiently. In this case, the commutator must be thoroughly cleaned and sanded and the brushes reseated. In bad cases it is usually best to clean the foreign matter from between the commutator segments by means of a three-cornered file, and then sand the commutator by placing the sand-paper around a small block and holding it squarely against the commutator while it is running. *Never use emery cloth.*

COIL CAPACITOR:—Some installations will require a capacitor connected from the battery side of the ignition coil to ground. This reduces the interference caused by the primary breaker.

GROUNDS:—It is important that the frame of the generator be thoroughly grounded. A steel ground-rod, driven at least six feet in moist earth, provides a good ground. In event one side of the line is grounded, it is important that the ground be a good one. The ground should be applied at the generator, at the point where the line enters the building where the radio receiver is located and at the extreme far end of the line.

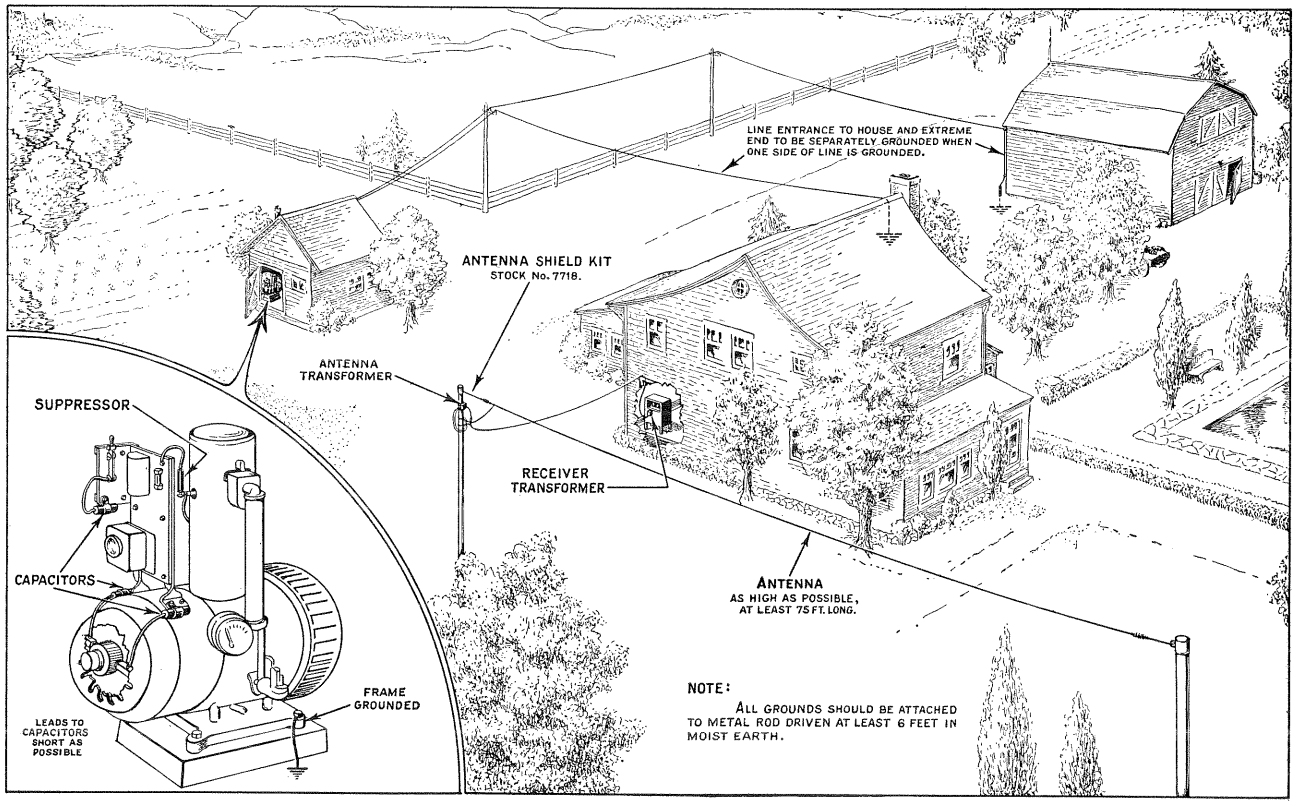


Figure 4—Typical Installation showing suppression equipment and proper antenna system

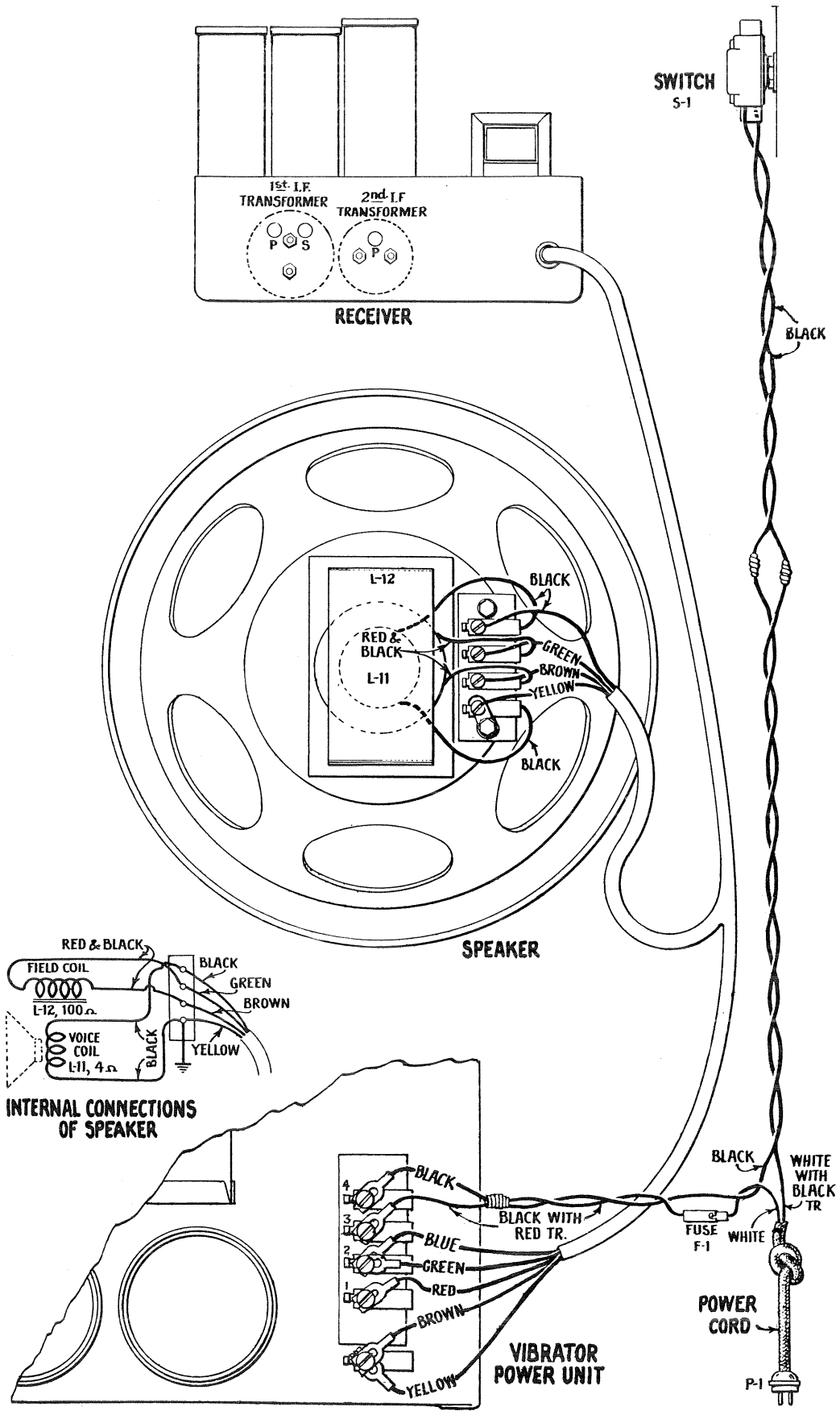


Figure 5—Assembly Wiring Diagram

REPLACEMENT PARTS

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

Stock No.	Description	List Price
	RECEIVER ASSEMBLIES	
2816	Resistor — 1,000 ohms — Carbon type — ½ watt (R18)—Package of 5	$1.00
3047	Resistor — 1,500 ohms — Carbon type — ½ watt (R7)—Package of 5	1.00
3076	Resistor—1 megohm—Carbon type—½ watt (R6)—Package of 5	1.00
3252	Resistor—100,000 ohms—Carbon type—½ watt (R5)—Package of 5	1.00
3358	Resistor — 3,000 ohms — Carbon type — ½ watt (R13)—Package of 5	1.00
3514	Resistor—250,000 ohms—Carbon type—½ watt (R17)—Package of 5	1.00
3572	Socket—7 Contact Radiotron socket	.38
3584	Ring—Antenna, R. F. or oscillator coil retaining ring—Package of 5	.40
3594	Resistor—50,000 ohms—Carbon type—½ watt (R14, R16)—Package of 5	1.00
3597	Capacitor—.25 mfd. (C34)	.40
3602	Resistor—60,000 ohms—Carbon type—¼ watt (R8, R11)—Package of 5	1.00
3616	Capacitor—300 mmfd. (C30)	.34
3622	Shield—Antenna or R. F. coil shield	.36
3624	Socket—Dial lamp socket and bracket	.40
3625	Scale—Volume indicator scale assembly	.40
3626	Shield—Oscillator coil shield	.22
3630	Resistor—10,000 ohms—Carbon type—3 watt (R2, R3)	.25
3634	Capacitor—160 mmfd. (C31)	.34
3639	Capacitor—.02 mfd. (C35)	.25
3750	Capacitor—.25 mfd. (C2)	.36
3783	Capacitor—9 mmfd. (C3, C10)—Package of 2	.50
3877	Capacitor—.1 mfd. (C9, C15, C36, C37)	.32
3888	Capacitor—.05 mfd. (C4, C11, C25, C27)	.25
3892	Resistor—600 ohms—Carbon type—½ watt (R4)—Package of 5	1.00
3993	Screw—Set screw for volume control dial—Package of 10	.25
4046	Resistor—2 megohm—Carbon type—½ watt (R1)—Package of 5	1.00
4142	Mounting assembly for receiver chassis—Comprising 8 cushions, 8 washers, 4 spacers, 4 lockwashers and 4 screws	.38
4143	Capacitor—2400 mmfd. (C1)	.25
4144	Clamp—Capacitor mounting clamp—Package of 5	.20
4145	Shield—Radiotron shield	.30
4181	Capacitor—720 mmfd. (C19)	.30
4182	Capacitor—80 mmfd. (C18)	.25
4183	Capacitor—400 mmfd. (C33)	.26
4184	Capacitor pack—Comprising one .035 and one .005 mfd. capacitors (C38, C39)	.30
4185	Resistor—175 ohms—Wire wound (R19)	.78
6242	Resistor — 2 megohms — Carbon type — ¼ watt (R10)—Package of 5	1.00
6282	Resistor—60,000 ohms—Carbon type—½ watt (R15)—Package of 5	1.00
6303	Resistor—20,000 ohms—Carbon type—½ watt (R9)—Package of 5	1.00
6471	Coil—Oscillator coil (L5, L6)	.74
6483	Transformer—First intermediate frequency transformer (L7, L8, C21, C24)	1.84
6484	Transformer—Second intermediate frequency transformer (L9, L10, C26)	1.70
6485	Volume control with mounting nut (R12)	$1.20
6527	Coil—Antenna coil (L1, L2)	1.08
6528	Coil—R. F. coil (L3, L4)	.94
6534	Switch—Range switch (S2, S3, S4, S5, S6, C5, C12, C20)	1.25
6598	Condenser—3-gang variable tuning condenser (C6, C7, C13, C14, C16, C17)	3.00
6622	Dial—Station selector dial scale and drive assembly	.95
6859	Capacitor—Comprising three 4 mfd. and one 10 mfd. capacitors (C8, C23, C28, C32)	2.85
6860	Tone control with mounting nut (R20)	1.15
6851	Transformer—Output transformer (T2)	1.36
7484	Socket—5-contact Radiotron socket	.35
7485	Socket—6-contact Radiotron socket	.40
	VIBRATOR POWER UNIT ASSEMBLIES	
3765	Capacitor—.025 mfd. (C42, C43, C44)	.34
3859	Socket—4-contact Radiotron socket	.30
3860	Socket—5-contact Radiotron socket	.32
4145	Shield—Radiotron shield—Rectifier	.30
4148	Suspension assembly—Comprising one bolt assembly, one "C" washer, two cup washers, two springs, two damping bushings	.40
4150	Clamp assembly—Vibrator mounting clamp assembly	.22
4186	Capacitor—2400 mmfd. (C49, C50)	.28
4187	Capacitor—745 mmfd. (C51, C52)	.25
6852	Filter pack—Comprising one reactor and two 4.0 mfd. capacitors (C46, C48, L21)	3.34
6863	Capacitor—Comprising one 3.5 mfd. and one .5 mfd. capacitors (C45, C47)	3.46
6864	Tube—Regulator tube	3.00
6865	Shield—Regulator tube shield	.22
6866	Coil—Line R. F. choke coil (L15)	.96
6867	Coil—Line R. F. choke coil	.54
6868	Coil—Line R. F. choke coil (L16)	.78
6869	Capacitor—1.0 mfd. capacitor (C41)	.88
6870	Shield—Outer shield with felt pad for vibrator assembly	.60
6871	Coil—Filter coil (L18)	.76
7734	Transformer—Power transformer (T1)	3.60
7735	Vibrator complete (L13, L14, L19, L20, C40, R21)	8.20
	REPRODUCER ASSEMBLIES	
4149	Shield—Terminal board shield	.20
8935	Cone—Reproducer cone (L11) Package of 5	5.25
9474	Reproducer complete	7.10
9475	Coil—Field coil magnet and cone support (L12)	4.55
	MISCELLANEOUS PARTS	
3592	Knob—Station selector—Volume control or tone control knob—Package of 5	.80
3615	Knob—Range switch knob—Package of 5	.60
3881	Escutcheon—Station selector escutcheon	.42
3899	Escutcheon—Volume control escutcheon	.42
4292	Capacitor—Generator capacitor—.5 mfd.	.90
6151	Suppressor—Spark plug suppressor	.56
6152	Suppressor—Distributor suppressor	.56
6516	Connector—Fuse connector complete	.16

RCA VICTOR SHIELD KITS

Stock Nos. 7717 and 7718

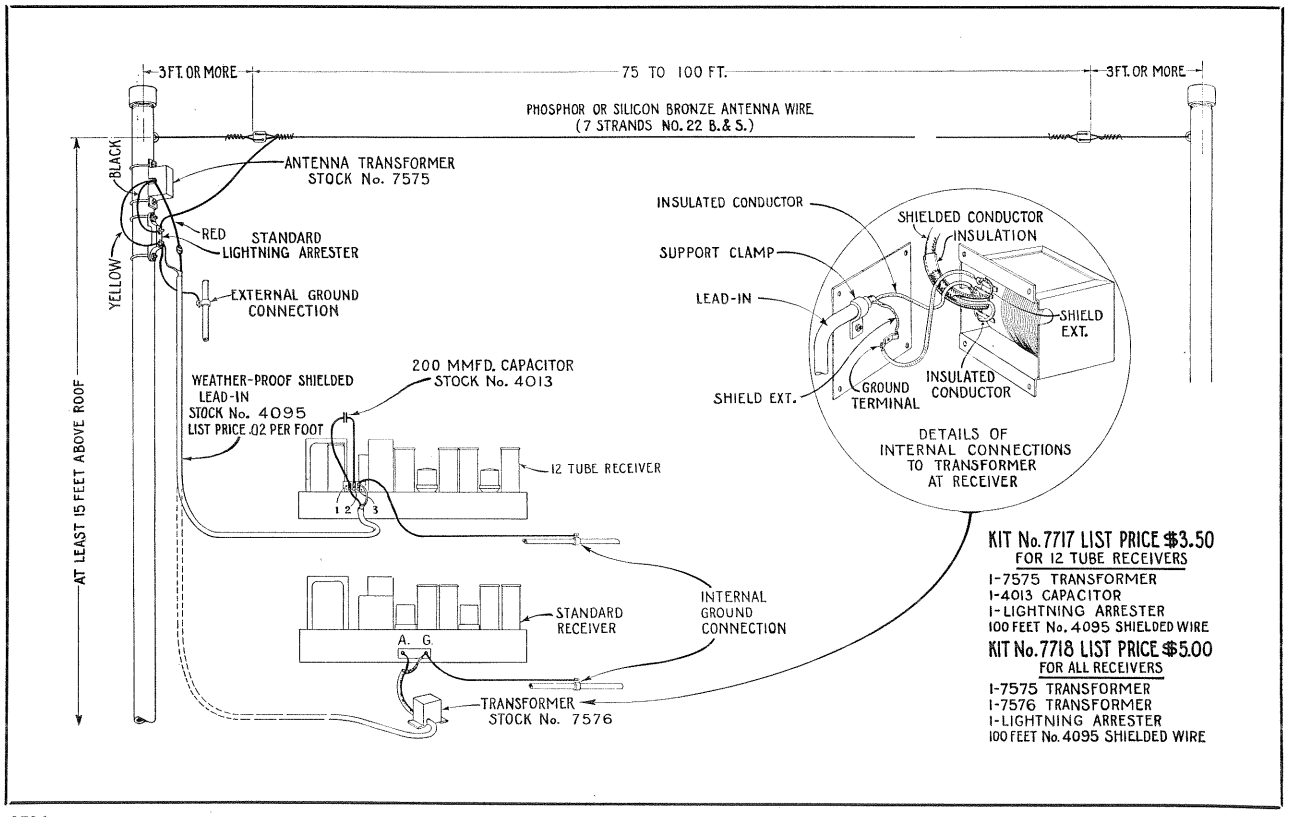
The RCA Victor Shield Kits, Stock Nos. 7717 and 7718, consist of an assembly of parts designed to be used in conjunction with radio receivers for the prevention of interference pickup by the lead-in portion of an antenna system. Inasmuch as the majority of man-made interference is picked up on the lead-in section of an antenna, installation of these kits greatly improves the ratio of signal to noise.

The Stock No. 7717 kit consists of an antenna transformer, 100 feet of low-impedance shielded lead-in wire, a 200 mmfd. capacitor and a lightning arrester. This kit is designed to be used with the RCA Victor Model 280 *only* and does not include a receiver coupling transformer. Such omission is made possible by the inclusion of a tap on the antenna coil of the Model 280, which matches the impedance of the shielded lead-in.

The Stock No. 7718 kit consists of an antenna transformer, 100 feet of shielded lead-in wire, a receiver transformer and a lightning arrestor. This kit is designed to be used with all types of broadcast receivers. The illustration below shows the proper manner of connecting these kits.

In conjunction with the Stock Nos. 7717 and 7718 kits, it must be remembered that these lead-in systems will not affect such conditions as natural atmospheric conditions which induce static into the antenna or any other noise that is picked up by the flat top portion of the antenna. To visualize the gain in these systems, the results will be approximately equal to the reception that would be obtained if the receiver were located at the top of the antenna pole.

These kits will give excellent results over the entire broadcast and police frequency bands. However, they are not recommended for the short-wave broadcasting bands.



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Proper Method of Connecting Kits to Antenna and Receivers