INSTRUCTION BOOK

FOR

RADIO STATION

RS-6

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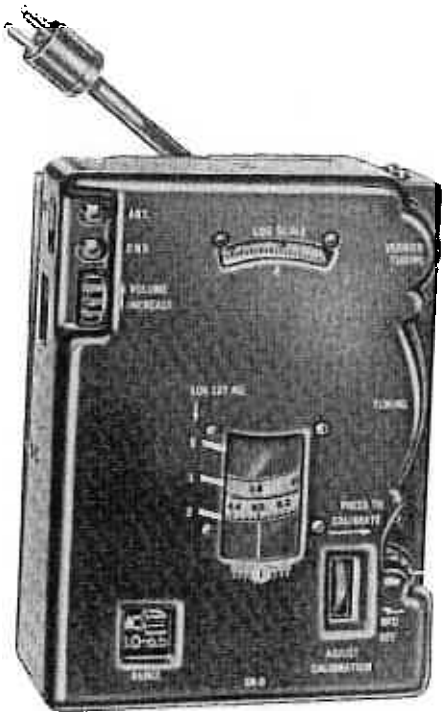
TRANSMITTER RT-6



RECEIVER RR-6

POWER SUPPLY RP-6

FILTER-ACCESSORY UNIT RA-6

Figure 1. Radio Station RS-6 Components.

CHAPTER 1
INTRODUCTION

SECTION I. GENERAL

1. SCOPE

This instruction book contains a description, the theory of operation, and instructions for maintenance and repair of Radio Station RS-6.

2. DESCRIPTION

Radio Station RS-6 is a compact four-unit set for transmitting CW and receiving CW or AM. It operates from a-c, storage battery, or hand generator, and consists of a Transmitter RT-6, Receiver RR-6, Power Supply RP-6, and a Filter-Accessory Unit RA-6, as shown in Figure 1.

SECTION II. TECHNICAL CHARACTERISTICS

3. TRANSMITTER RT-6

a. Type: 2-stage, crystal-controlled

b. Frequency range (two bands):
   (1) 3 to 7 mc (megacycles)
   (2) 7 to 16.5 mc

c. Power Output:
   6-10 watts (depending upon frequency)

d. Power Input:
   (1) Transmitting: 400-v dc at 75 ma (milliamperes). Idling during break-in: 400-v dc at 25 ma
   (2) 6.3-v ac-dc at 1.2 amp (amperes)

e. Weight: 2 lb 14 oz

f. Dimensions (inches): $6\frac{3}{4}$ x 5 x $2\frac{3}{32}$

4. RECEIVER RR-6

a. Type: Superheterodyne, variable tuning or crystal-controlled, fixed frequency

b. Frequency range (two bands):
   (1) 3 to 6.5 mc
   (2) 6.5 to 15 mc

c. Power Input:
   (1) 90-v dc at 15 ma regulated
   (2) 90-v dc at 10 ma regulated
   (3) 6.3-v ac-dc at 1.2 amp

d. Weight: 3 lb 2 oz

e. Dimensions (inches): $6\frac{3}{4}$ x 5 x $2\frac{1}{4}$

Headset 2000Ω

5. POWER SUPPLY RP-6

a. Power Source: a-c line or 6-volt storage battery

b. Power Input:
   (1) a-c 70 to 270 v, 40 to 400 cps (cycles per second), 80 watts nominal
   (2) d-c 6.3-v at 12 amp — NEED RESISTOR ½ OHM @ 75W for 12V OPERATION

c. Power Output:
   (1) 6.3-v ac-dc at 2.4 amp
   (2) 400-v dc at 75 ma
   (3) 90-v dc at 25 ma regulated
   (4) 90-v dc at 25 ma regulated
   (5) Battery charging - 6 VDC @ 2.5 amperes

d. Fuses:
   (1) a-c—1.5 amp
   (2) d-c—15 amp

e. Power Factor:
   (1) 40 cps—60
   (2) 60 cps—86.7
   (3) 400 cps—96.3

f. Weight: 5 lb 11 oz

g. Dimensions (inches): $8\frac{1}{16}$ x 4 x $2\frac{3}{16}$

6. FILTER-ACCESSORY UNIT RA-6

a. Function:
   (1) Filters B+
   (2) Regulates receiver B+
   (3) Switches B+ to transmitter and to receiver

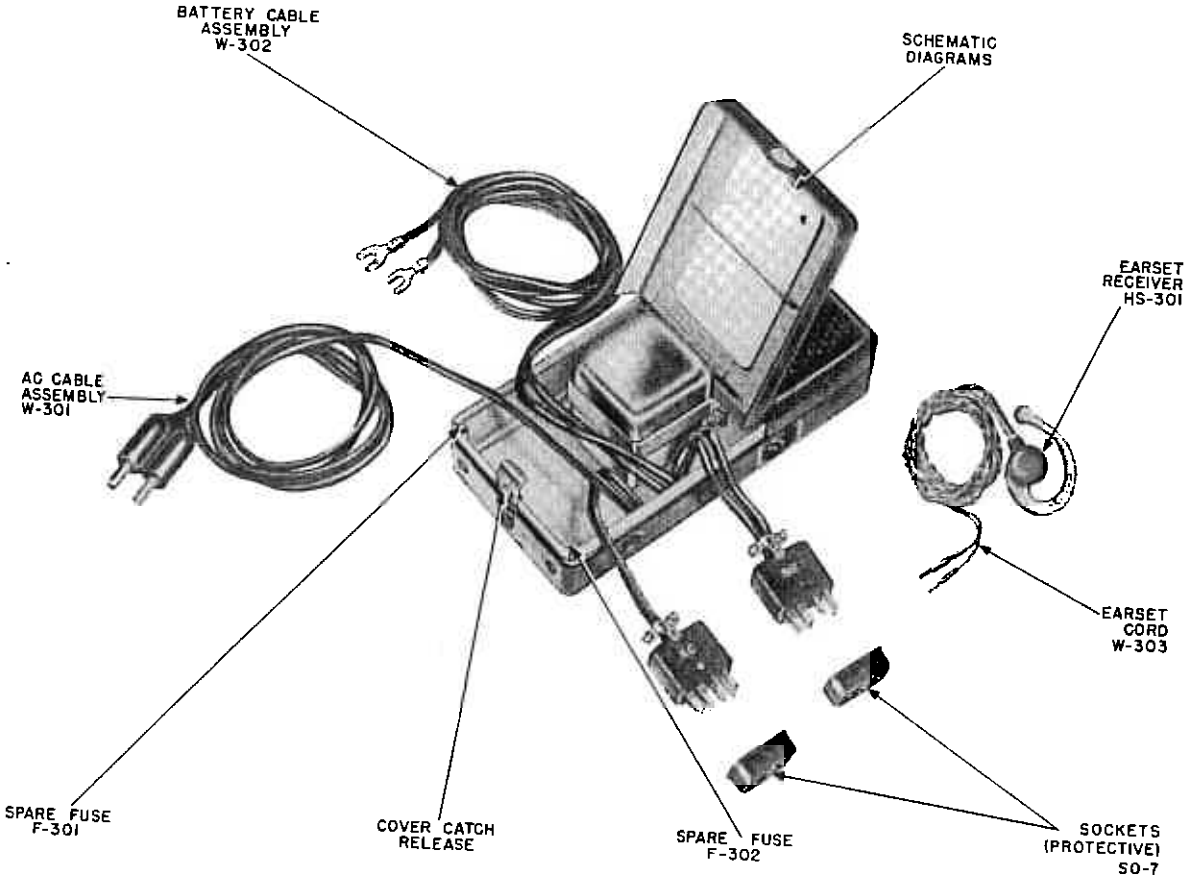


Figure 2. Filter-Accessory Unit RA-6 opened, showing accessories.

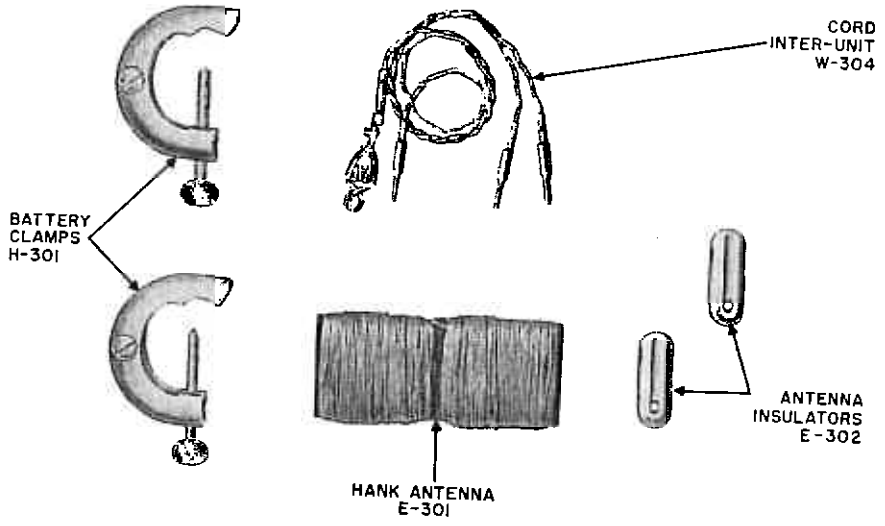


Figure 3. Additional Accessories.

(4) Provides storage space for accessories and power cables. See Figure 2.

b. Weight: 3 lb 11 oz

c. Dimensions (inches): 8 1/16 x 4 x 2

d. Accessories:

1 A-C cable assembly
1 Battery cable assembly
1 Spare fuse—1.5 amp
1 Spare fuse—15 amp
1 Set Schematic Diagram Cards
1 Earset and cord

7. ADDITIONAL ACCESSORIES

The following accessories are contained in a plastic pouch (see Figure 3):

1 Hank antenna (100 ft)
2 Antenna insulators
2 Battery clamps
1 Inter-unit connecting cord with two leads to connect sidetone and antenna from transmitter to receiver
1 Incandescent lamp. Spare for E103

CHAPTER 2
OPERATING INSTRUCTIONS

SECTION I. SETTING UP EQUIPMENT

8. AC OPERATION HOOK-UP

a. Turn the input voltage selector switch on Power Supply RP-6 (Figure 4) to OFF.

b. Pull the sending key out of the recess on Transmitter RT-6.

c. Connect the equipment as shown in Figure 5. (Receiver crystal shown is optional.)

(1) The Jones plug marked AC must be inserted in the OPERATE receptacle on Power Supply RP-6 before the power plug is connected to an a-c power source, otherwise "hot" terminals will be exposed and a power line fuse may be blown.

(2) Connect the two-prong plug of the a-c cable assembly to any a-c power source whose voltage is between 70 and 270 volts, and frequency between 40 and 400 cycles per second. The two prong a-c power plug can be adapted to various receptacles in the following ways:

(a) Vary the spacing between the prongs by compressing plug.

(b) Prongs can be unscrewed and reversed to provide any combination of small and large prongs as required to fit various power outlets.

d. Turn the input voltage selector switch on Power Supply RP-6 clockwise to the first position at which the neon indicating light glows. The transmitter and receiver are now ready for operation.

e. Do not turn off the equipment by disconnecting the Jones plug marked AC. This would expose "hot" terminals. Turn off the equipment by pulling the power plug from the power source or by rotating the input voltage selector switch counterclockwise to the OFF position.

f. Refer to Sections II and III of this chapter for detailed transmitter and receiver operating instructions.

9. BATTERY OPERATION HOOK-UP

a. Turn the input voltage selector switch on Power Supply RP-6 (Figure 4) to OFF.

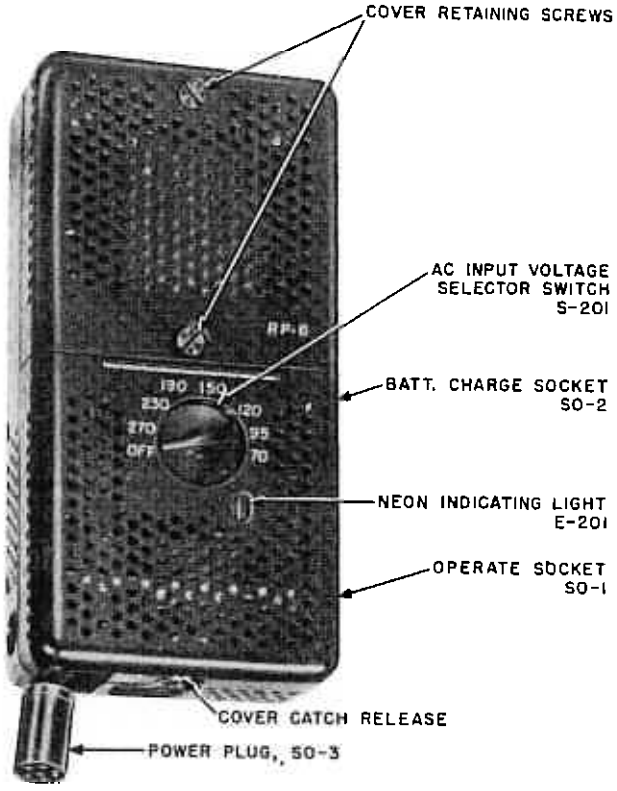


Figure 4. Power Supply RP-6 showing control switch and power plug.

b. Pull the sending key out of the recess on Transmitter RT-6.

c. Connect equipment as shown in Figure 6 (receiver crystal shown is optional).

(1) Use only a 6-volt storage battery source. If only an 8- or 12-volt storage battery is available, connect across only 6 volts (3 cells) of the battery. See Figure 6.

(2) The Jones plug marked BAT must be inserted in the OPERATE receptacle on Power Supply RP-6 before the battery clamps are connected to the storage battery, otherwise "hot" terminals will be exposed and equipment may be damaged.

(3) Connect the red battery lead to the positive 6-volt terminal of the battery, and the black battery lead to the negative terminal.

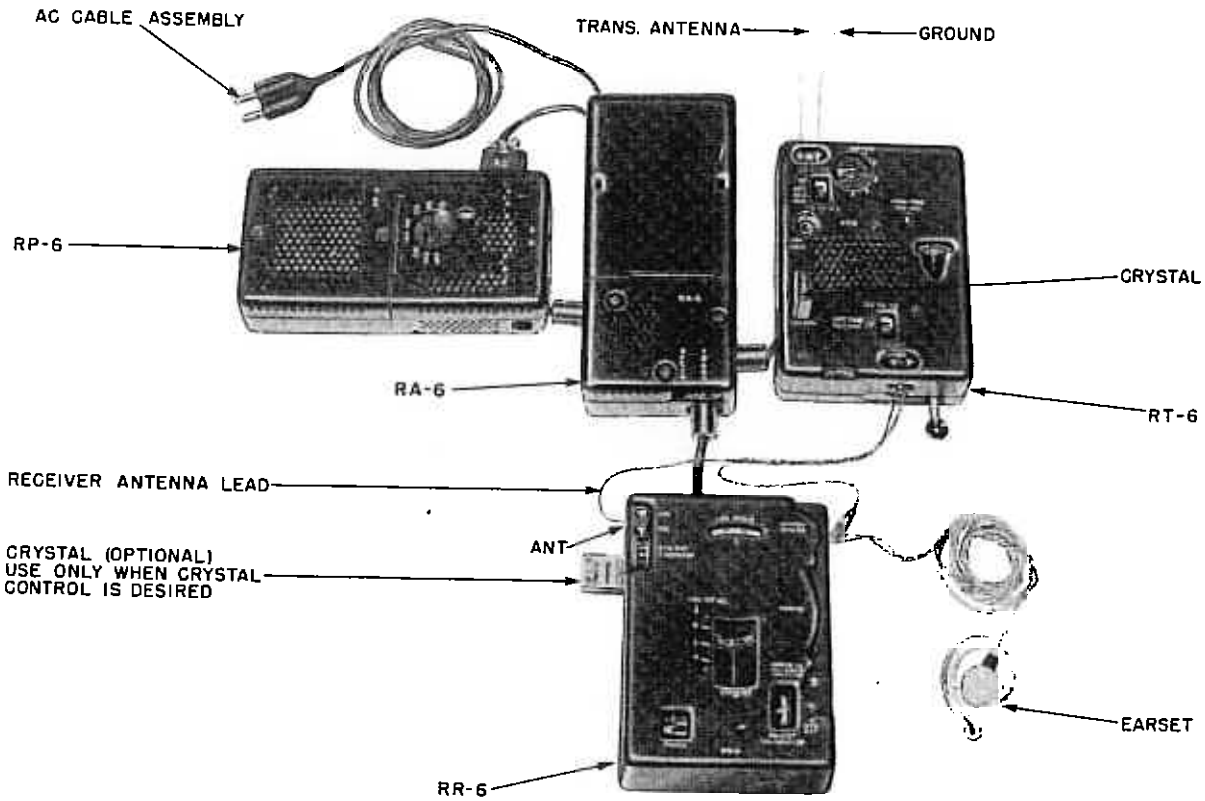


Figure 5. Radio Station RS-6, a-c operation hook-up.

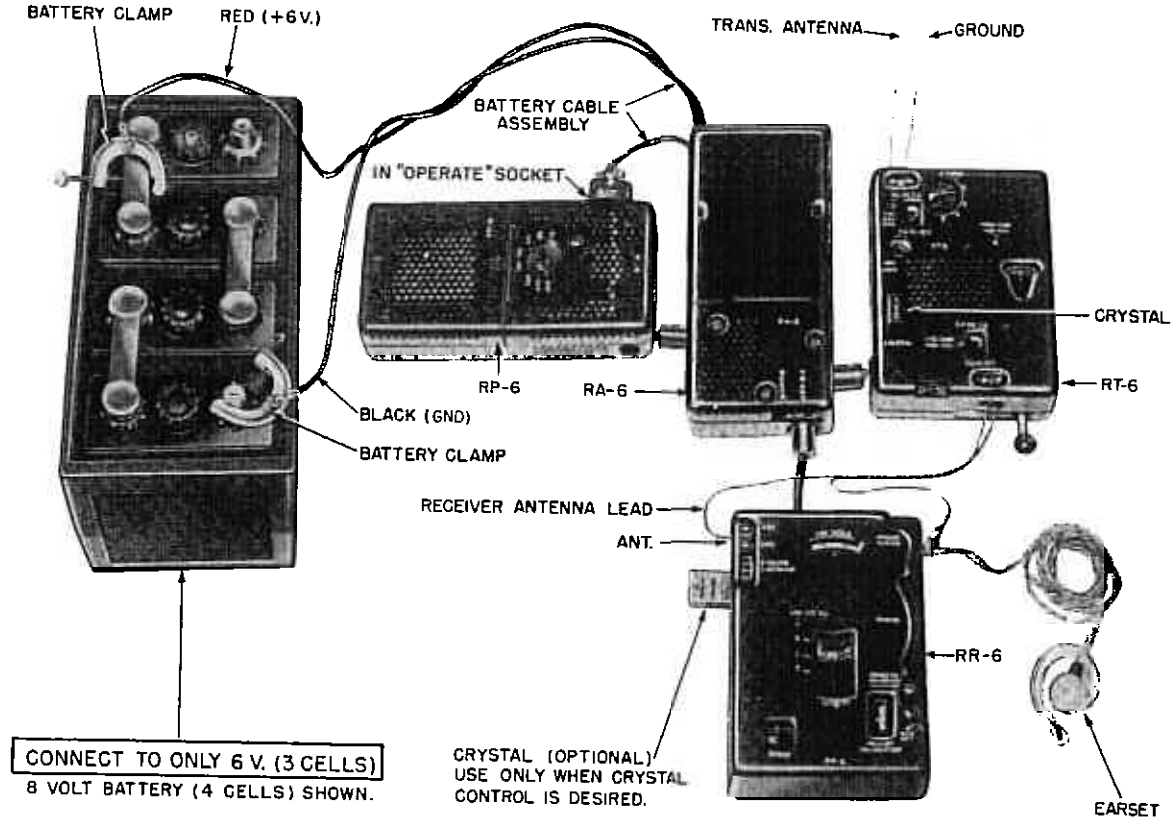


Figure 6. Radio Station RS-6, battery operation hook-up.

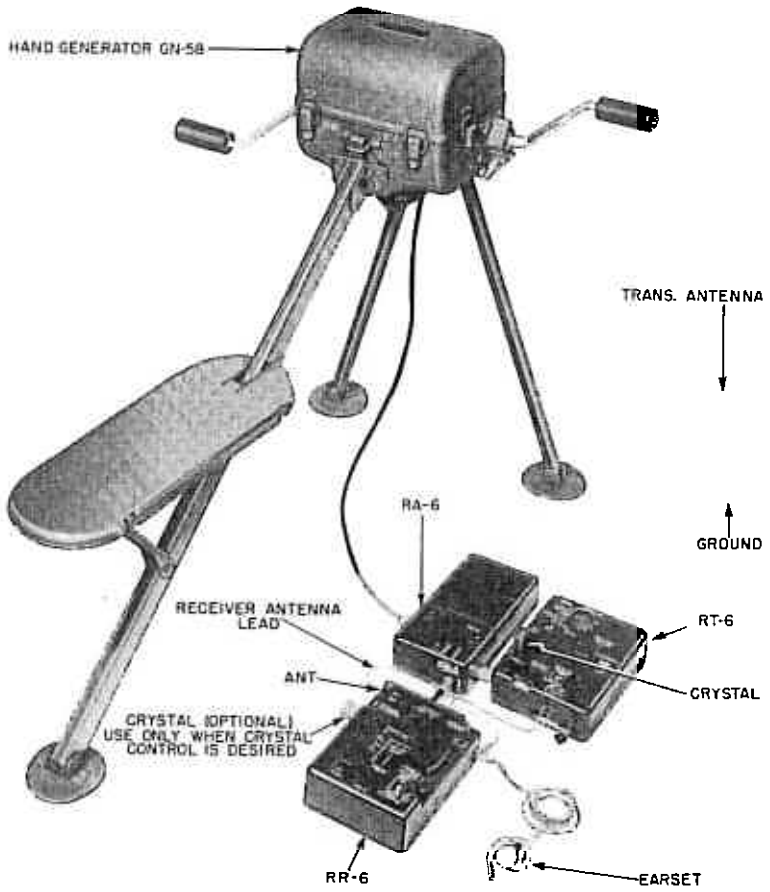


Figure 7. Radio Station RS-6, hand generator operation hook-up.

NOTE: An alternate method of connection may be necessary. If the battery is in a vehicle and its positive terminal is grounded to the frame, electrical contact between the frame and the case of the RS-6 will cause a short, i.e., the battery will discharge and the lead will overheat. To prevent this, the black battery lead should be connected to the battery terminal that connects to the vehicle body frame, and the red battery lead should be connected to the "hot" terminal of the battery. When the black battery lead is connected to the positive terminal, and the red battery lead is connected to the negative terminal of the battery, the RS-6 cannot be used to charge the battery; the fuse will burn out.

d. The transmitter and receiver are now ready for operation.

e. Do not turn the equipment off by disconnecting the Jones plug marked BAT. This would expose "hot" terminals. Turn off equipment by disconnecting the clamp from the positive or "hot" battery terminal.

f. Refer to Sections II and III of this chapter for detailed transmitter and receiver operation.

10. HAND GENERATOR OPERATION HOOK-UP

a. Pull the sending key out of recess on Transmitter RT-6.

b. Connect the equipment as shown in Figure 7. (Receiver crystal shown is optional.) Hand Generator GN-58 should be used.

NOTE: Power Supply RP-6 is not used in this method of operation. The transmitter and receiver are now ready for operation.

c. Refer to Sections II and III of this chapter for detailed transmitter and receiver operating instructions.

11. BATTERY CHARGING HOOK-UP AND OPERATION

a. Only a 6-volt (3 cell) wet type storage battery can be charged with this apparatus.

(1) When the electrolyte in a lead-acid storage battery has a specific gravity of 1.180, the charging rate will be at least 3.5 amperes. When the specific gravity of the electrolyte increases to 1.280 as the battery charges, the charging current gradually drops .8 ampere.

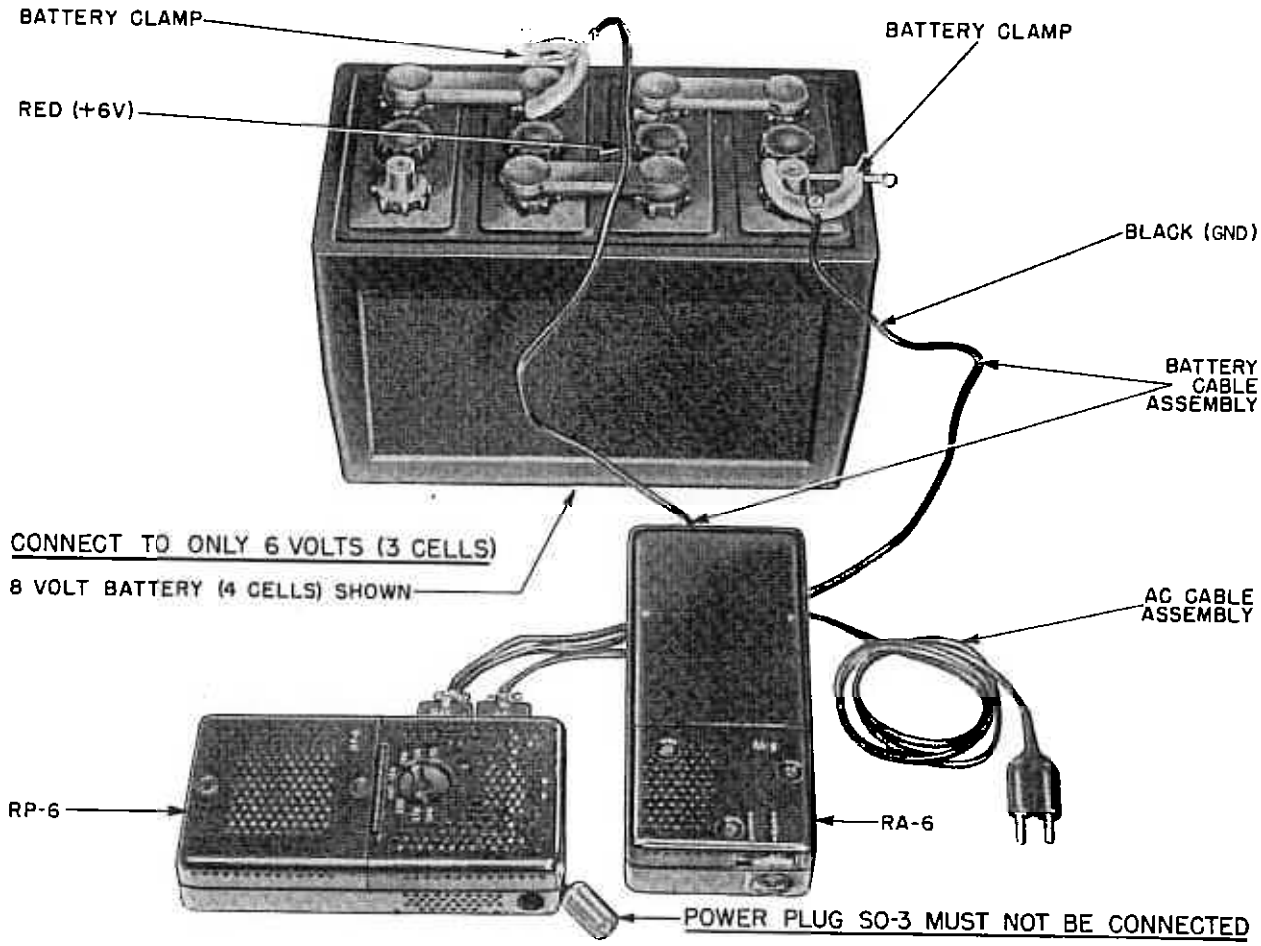


Figure 8. Radio Station RS-6 Battery Charging Hook-up.

(2) The battery should be charged only in a well ventilated room as dangerous gases are formed during the charging process.

b. It is desirable to keep the storage battery as fully charged as possible. The RP-6, when connected as a charger, should be used approximately 5 times as long as that period of time that the RS-6 was operating from the battery power source. A hydrometer is recommended to accurately determine the charge of the battery.

c. Connect the equipment as follows: (See Figure 8).

(1) Turn the input voltage selector switch on Power Supply RP-6 to OFF. (Figure 4)

(2) Disconnect Power Supply RP-6 power plug from the Filter-Accessory Unit, RA-6, if it is not already disconnected. This plug must be disconnected to avoid blowing the fuse.

(3) Insert the Jones plug marked BAT in the receptacle marked BATT-CHARGE.

(4) Connect the red battery lead to the positive 6-volt terminal of the storage battery.

(5) Connect the black battery lead to the negative terminal of the storage battery.

(6) Insert the Jones plug marked AC in the receptacle marked OPERATE.

(7) Connect the two-prong plug of the AC cable assembly to any a-c power source whose voltage is between 70 and 270 volts, and frequency between 40 and 400 cps. The two-prong a-c power plug can be adapted to various receptacles in the following ways:

(a) The spacing between the prongs can be varied by compressing the plug.

(b) The prongs can be unscrewed and reversed to provide any combination of small and large prongs as required to fit various power outlets.

d. Turn the input voltage selector switch of Power Supply RP-6 clockwise to the first posi-

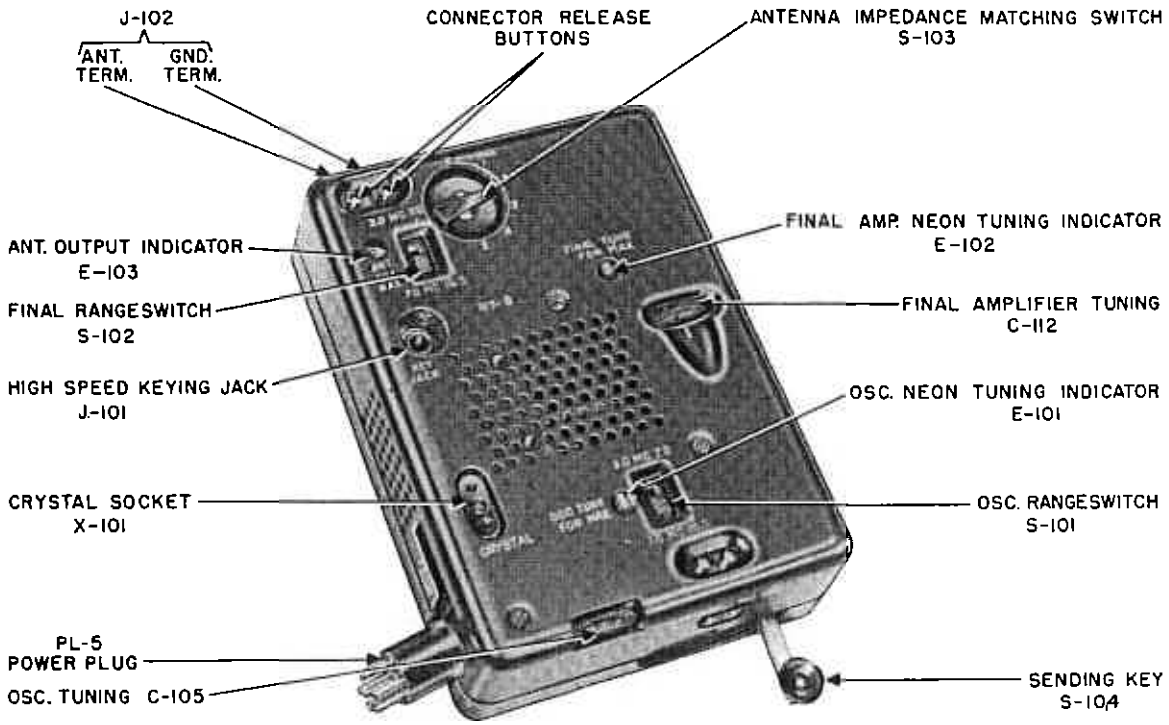


Figure 9. Transmitter RT-6 showing control locations

tion at which the neon indicating light glows. The battery is now being charged.

e. To stop the charging process proceed as follows:

(1) Turn the input voltage selector switch on the Power Supply RP-6 to OFF.

(2) Disconnect the two-prong a-c plug from the power source.

(3) Remove the battery leads from the battery.

SECTION II. TRANSMITTER RT-6

12. CONTROLS AND FUNCTIONS—(See Figure 9)

a. OSCILLATOR RANGESWITCH—Selects the desired band for the oscillator.

(1) Blue position—3 to 7 mc
(2) Red position—7 to 16.5 mc

b. FINAL RANGESWITCH—Selects the desired band for the final amplifier.

(1) Blue position—3 to 7 mc
(2) Red position—7 to 16.5 mc

c. OSCILLATOR TUNING—Tunes the oscillator tank to the desired frequency.

(1) Blue scale—3 to 7 mc
(2) Red scale—7 to 16.5 mc

d. FINAL AMPLIFIER TUNING—Tunes the final amplifier plate tank to the desired frequency.

(1) Blue scale—3 to 7 mc
(2) Red scale—7 to 16.5 mc

e. ANTENNA IMPEDANCE MATCHING SWITCH—Matches the output impedance of the final amplifier to the antenna impedance.

f. SENDING KEY—Used for hand-keying the transmitter and for controlling the operation of the transmitter with other methods of keying.

13. CRYSTAL SELECTION

a. Any desired frequency within the range of the transmitter (3 to 16.5 mc) can be obtained by selecting an appropriate crystal within the range of 3 to 7 mc. This is accomplished by using the fundamental (the frequency stamped on the crystal), the second harmonic (two times funda-

mental), or the third harmonic (three times fundamental) of the crystals.

b. DO NOT use overmode crystals, nor operate crystals on fourth or higher harmonics.

14. ANTENNA LENGTH AND HEIGHT

a. The length of the quarter wave "L" antenna for a given frequency can be calculated from the following formulas:

$$L\ (\text{feet}) = \frac{234}{\text{freq (megacycles)}}$$

$$L\ (\text{meters}) = 0.238 \times \text{wavelength}$$

b. The antenna should be as high as possible.

c. Connect the color coded lead of the short twisted cord to the REC ANT post on the transmitter and to the ANT TERM on the receiver.

15. GROUND CONNECTION

Connect the terminal marked GND to a metal member buried in moist earth (water pipe, gas pipe, or ground stake).

16. TUNING — (Refer to Figure 9)

a. Plug a crystal into the socket marked CRYSTAL. Its fundamental operating frequency must be either:

(1) The same as the desired transmitting frequency (fundamental operation),

(2) One-half the desired transmitting frequency (2nd harmonic operation), or

(3) One-third the desired transmitting frequency (3rd harmonic operation).

b. Set the oscillator and final rangeswitches to the desired band. Both switches must be set to the same color.

(1) The blue position covers frequencies from 3 to 7 mc.

(2) The red position covers frequencies from 7 to 16.5 mc.

c. Set the oscillator and final amp tuning dials as closely as possible to the desired transmitting frequency. The dials are calibrated in megacycles and both dials must be set to the same color scale. The blue scale covers the same frequencies as are covered by the blue position of the rangeswitch and the red scale covers the frequencies covered by the red position of the rangeswitch.

d. Set the RECVR-TRANS switch on the Filter-Accessory Unit RA-6 to TRANS. See Figure 10.

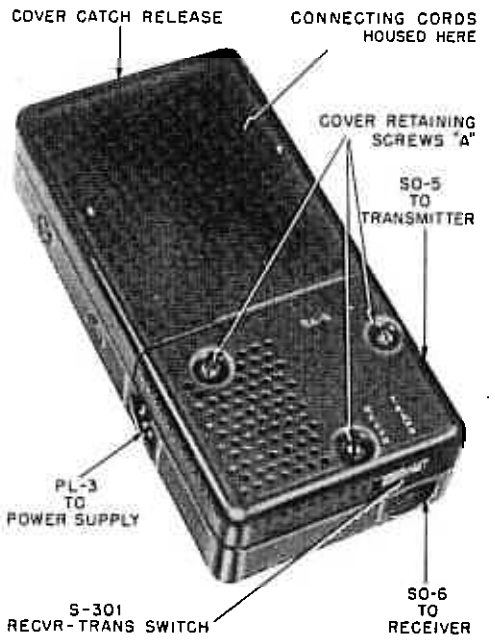


Figure 10. Filter-Accessory Unit RA-6 showing RECVR-TRANS switch.

e. Turn the antenna impedance matching switch to TUNE (zero). This disconnects the antenna and reduces radiation to a minimum while tuning up the transmitter.

f. Press the sending key and retune the final amp tuning dial slightly to obtain a distinct increase in brilliance of the FINAL TUNE FOR MAX indicator. Release the key.

g. Press the sending key and retune the oscillator tuning dial slightly to obtain a distinct increase in brilliance of the OSC TUNE FOR MAX indicator. If a pronounced brilliance peak is not noted on the indicator (as may be the case when using the third harmonic of a crystal) re-peak the oscillator tuning dial for peak brilliance of the FINAL TUNE FOR MAX indicator. Release the key.

h. Press the sending key down and turn the antenna impedance matching switch to that position where the ANT ADJ MAX indicator glows brightest. Release the key.

i. Press the sending key down and retune the final amp tuning dial slightly for peak brilliance of the ANT ADJ MAX indicator. Release the key.

17. KEYING

a. The transmitter is keyed:

(1) by the attached sending key (Figure 9). A keying speed not exceeding 40 wpm (words per minute) may be attained.

(2) by inserting a semi-automatic (bug) key half-way into the KEY JACK (Figure 9) and leaving the attached sending key out. A keying speed not exceeding 40 wpm may be attained.

(3) by completely inserting an automatic tape keyer into the KEY JACK (Figure 9) and leaving the attached sending key out. A keying speed not exceeding 60 wpm may be attained.

b. Break-in operation is provided on the TRANS position of the RECVR-TRANS switch. When the attached sending key or the semi-automatic (bug) key is released, the receiver will operate. Automatic switching of the antenna from the transmitter to the receiver is accomplished by the keying relay. The antenna signal is fed to the receiver through the color coded lead in the twisted cord connected between the ANT TERM on the receiver and to the REC ANT post on the transmitter. When the RECVR-TRANS switch is in the RECVR position, it is necessary to connect the antenna directly to the ANT TERM on the receiver.

c. Sidetone for monitoring the transmitted signal is fed to the earset by the twisted cord lead inserted in the MONITOR post on the transmitter and clipped to the upper phones connector pin.

d. The transmitter is transmitting when the attached sending key is folded into the recess on the front panel. Therefore, the attached sending key must be left out when using external keying.

e. Coding of the transmitted signal is possible by inserting a frequency shift unit into the crystal socket.

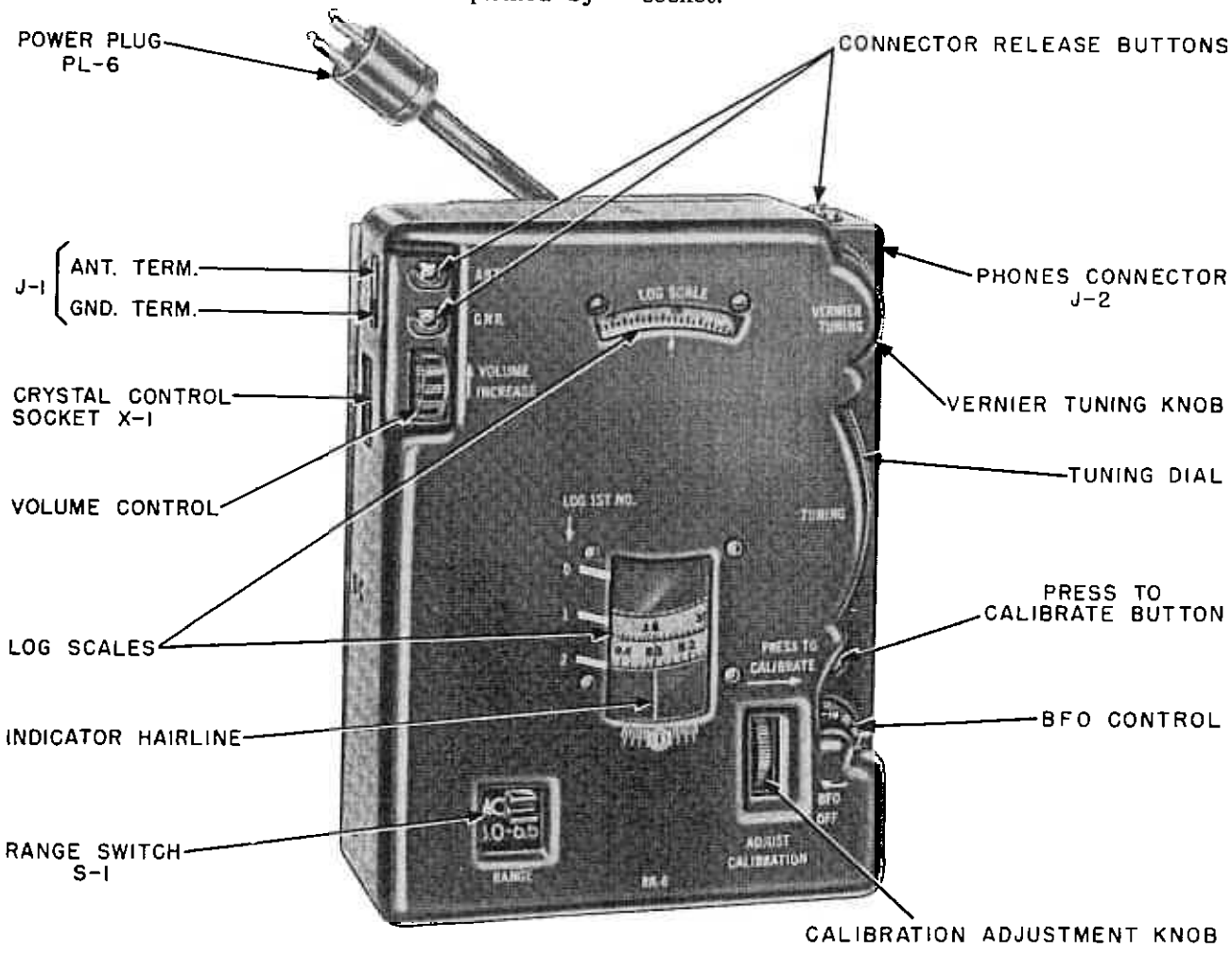


Figure 11. Receiver RR-6 showing control locations.

SECTION III. RECEIVER RR-6

18. CONTROLS AND FUNCTIONS—(See Figure 11)

a. VOLUME—Controls volume of received signals.

b. RANGE—Selects proper frequency band.
(1) Blue position—3 to 6.5 mc
(2) Red position—6.5 to 15 mc

c. TUNING—Rapidly adjusts the oscillator and r-f tuned circuits to any point within receiver frequency range.

d. VERNIER TUNING—A finer control of the large TUNING dial.

e. PRESS TO CALIBRATE—Provides crystal-controlled frequency for dial calibration every 0.5 megacycle (500 kc).

f. ADJUST CALIBRATION—Corrects error in dial calibration by moving the indicator hairline with respect to the dial scale.

g. BFO—Turns the 455 kc oscillator on and off and varies the pitch of the audio signal produced.

19. CALIBRATING THE TUNING DIAL

a. A signal generated by a crystal-controlled oscillator in the receiver offers a means of checking the accuracy of the frequency indicated on the dial. By means of harmonics, the 500 kc crystal provides signals in 500 kc steps throughout the dial. Thus, each megacycle mark and each half-megacycle mark become a calibration point. To calibrate the dial, proceed as follows:

(1) Set the RECVR-TRANS switch (Figure 10) on Filter-Accessory Unit RA-6 to RECVR. Although calibration can be accomplished with the RECVR-TRANS switch in the TRANS position, power consumption will be less with this switch in the RECVR position.

(2) Turn the BFO dial until zero is aligned with the white mark on the housing.

(3) Hold down the button marked PRESS TO CALIBRATE.

(4) Turn VERNIER TUNING until zero beat is heard, always tuning in from the low frequency direction to eliminate any error due to slack in the tuning system.

NOTE: Zero beat is the no sound point between the two sound peaks. The VOLUME control should be set at the lowest gain setting sufficient to hear the zero beat. Higher settings may make it possible to hear spurious responses that will result in an inaccurate calibration. A beat note that sounds discordant may be an undesired spurious response. Generally, a low gain setting of the VOLUME control is sufficient at the lower frequency settings of the dial. High frequency settings of the dial usually require higher gain settings of the VOLUME control to compensate for the weaker harmonics of the 500 kc calibration crystal at those frequencies.

(5) Turn ADJUST CALIBRATION (Figure 11) until the hairline coincides with the calibration point on the dial scale.

b. When setting the receiver to a desired frequency, first calibrate the tuning dial at the closest calibration point.

20. TUNING (Variable)

a. The receiver will operate with the RECVR-TRANS switch in the TRANS position when the transmitter is not keyed. Automatic switching of the antenna from the transmitter to the receiver is accomplished by the keying relay when the ANT TERM on the receiver is connected to the REC ANT post on the transmitter. When the RECVR-TRANS switch is in the RECVR position, it is necessary to connect the antenna directly to ANT TERM on the receiver.

NOTE: Momentarily press the sending key down after switching the RECVR-TRANS switch to the RECVR position. Until the sending key circuit is closed, the transmitter will idle, as in the case of break-in or key-up, when the RECVR-TRANS switch is thrown to RECVR. This is because the interval between the break and make of the RECVR-TRANS switch is too short to open the B supply link between the receiver and the transmitter. Pressing the sending key down will release the keying relay and remove B power from the transmitter. This can also be accomplished by folding the transmitter key into the recess on the side of the panel (only with RECVR-TRANS switch set on RECVR). If this precaution is not taken, unnecessary current drain from the battery will reduce battery life.

b. Set RANGE switch (Figure 11) for the proper frequency band:
(1) Blue—Low band: 3—6.5 mc
(2) Red—High band: 6.5—15 mc

c. The dial scale is calibrated directly in megacycles. Use the blue scale for the low band and the red scale for the high band.

d. First tune for stations with the TUNING (coarse) control. For more precise adjustment use VERNIER TUNING, always tuning in from the low frequency direction to eliminate any error from slack in the tuning system.

e. Calibrate the dial on the nearest megacycle or half-megacycle calibration point as directed in the previous paragraph. Turn BFO dial until zero is aligned with the white mark on the housing before calibrating dial.

NOTE: For a-m (voice) reception, turn BFO clockwise to OFF.

f. Set the dial to the desired frequency and then retune slightly, if necessary, for best reception.

21. TUNING (Crystal)

a. Plug the specified crystal in CRYSTAL CONTROL socket (Figure 11).

NOTE: The oscillator frequency is 455 kc higher than the received frequency. The fundamental, the second harmonic, or the third harmonic of a crystal may be used.

b. Tune the receiver to the desired frequency any proceed as above.

22. LOG SCALE

a. Signals may be accurately logged to three figures through the use of the LOG SCALE.

(1) After a station is accurately tuned in, note the position of the white horizontal line with respect to the numerals 0, 1, or 2 located to the left of the dial scale window. These numerals represent the first digit of the log scale.

(2) Read and record the numeral located immediately above the white horizontal line on the window for the first digit. Read and record the other two digits on LOG SCALE.

(3) Once a station is logged in, the tuning dial may be re-set by these numbers for future location of that station on the dial.

CHAPTER 3
MAINTENANCE

SECTION I. RECEIVER RR-6

23. CIRCUIT DESCRIPTION—(See Schematic, Figure 12)

a. Receiver RR-6 is an eight-tube superheterodyne, two-band receiver. The incoming signal is amplified by a 5899 tuned r-f stage (V1) and is transformer coupled to the mixer grid. The transformer has both inductive and capacitive coupling. The rangeswitch selects the desired antenna, r-f, and oscillator coils. When the switch is in the high band position the low band coils are shorted out to prevent undesired absorptive coupling. The 5899 local oscillator (V2) normally is a tuned plate type variable oscillator. It can be converted to crystal control by inserting the crystal into the socket (X1). A switch in the crystal socket automatically makes the necessary circuit changes. When used with crystal control it becomes a Pierce electron coupled type and the plate tank tunes to the desired harmonic of the crystal.

b. Oscillator injection is accomplished inductively by small coupling loops on the oscillator and r-f transformer coil forms. Very loosely coupled double-tuned i-f transformers (T7, T8, and T9) operating at 455 kc are used; the primaries of T8 and T9 are center-tapped to reduce plate loading. This design results in a very narrow band receiver. The mixer i-f transformer (T7) primary tap is not used because of the need for effective bypassing of the high frequency components in the mixer plate circuit. Two i-f stages (V4 and V5) are used, not so much to achieve gain, but to obtain selectivity. Large unbypassed cathode resistors (R13 and R18) are used in the i-f stages in order to prevent regeneration.

c. Plate detection is used in the 2nd detector (V6) in order to reduce loading of the 3rd i-f transformer (T9) and thereby maintain utmost selectivity. An i-f filter consisting of R23 (56K), C39 (.001), and C40 (56uuf) is in the plate of the 2nd detector to prevent i-f energy from getting into the audio amplifier. Capacitor C40, in conjunction with C51, also controls the feedback for the 500 Kc crystal calibrator.

d. By means of a capacity probe, the signal from the Hartley BFO stage (V8, 5718) is injected into the detector grid. This signal mixes with the 455 kc i-f frequency and produces an audio beat in the output of the second detector. The audio beat is applied to the audio amplifier (V7, 5718) and reaches the headphone. When the BFO is turned off, C49 is shorted out and the frequency of the tank is lowered to approximately 400 kc, which is far enough away in frequency to be rejected by the i-f amplifier. Any signal which does get to the detector produces a beat outside the audio range. With the BFO "off" the receiver can receive a-m signals. The frequency of the BFO is changed rather than turned off in order to provide the negative d-c voltage required by the volume control. A germanium crystal detector (CR1) in the BFO stage rectifies part of the oscillator tank voltage. This rectified voltage is applied as fixed bias to the detector, V6, and is also applied to the VOLUME control, R28, to control the bias of the r-f and i-f stages.

e. The audio output stage, V7, is also used as a 500 kc, crystal-controlled oscillator to provide an accurate signal for checking the calibration of the dial. Sufficient harmonics are generated to provide 500 kc check points throughout the two bands. The stage is converted to a Pierce-type oscillator by the PRESS TO CALIBRATE button, which connects the crystal (Y2) between the grid and plate. The signal is fed back to the r-f-amplifier control grid by a capacity probe.

24. CORRECTIVE MAINTENANCE OF RECEIVER

a. Determine precisely the cause and location of the fault before attempting the substitution of parts. Changing parts may create new difficulties. Successful repair is difficult because the RR-6 receiver is compact and complex. The general method of analysis is first to determine the faulty section and then locate the defective component within that section. A trouble-shooting chart is supplied as an aid in locating trouble.

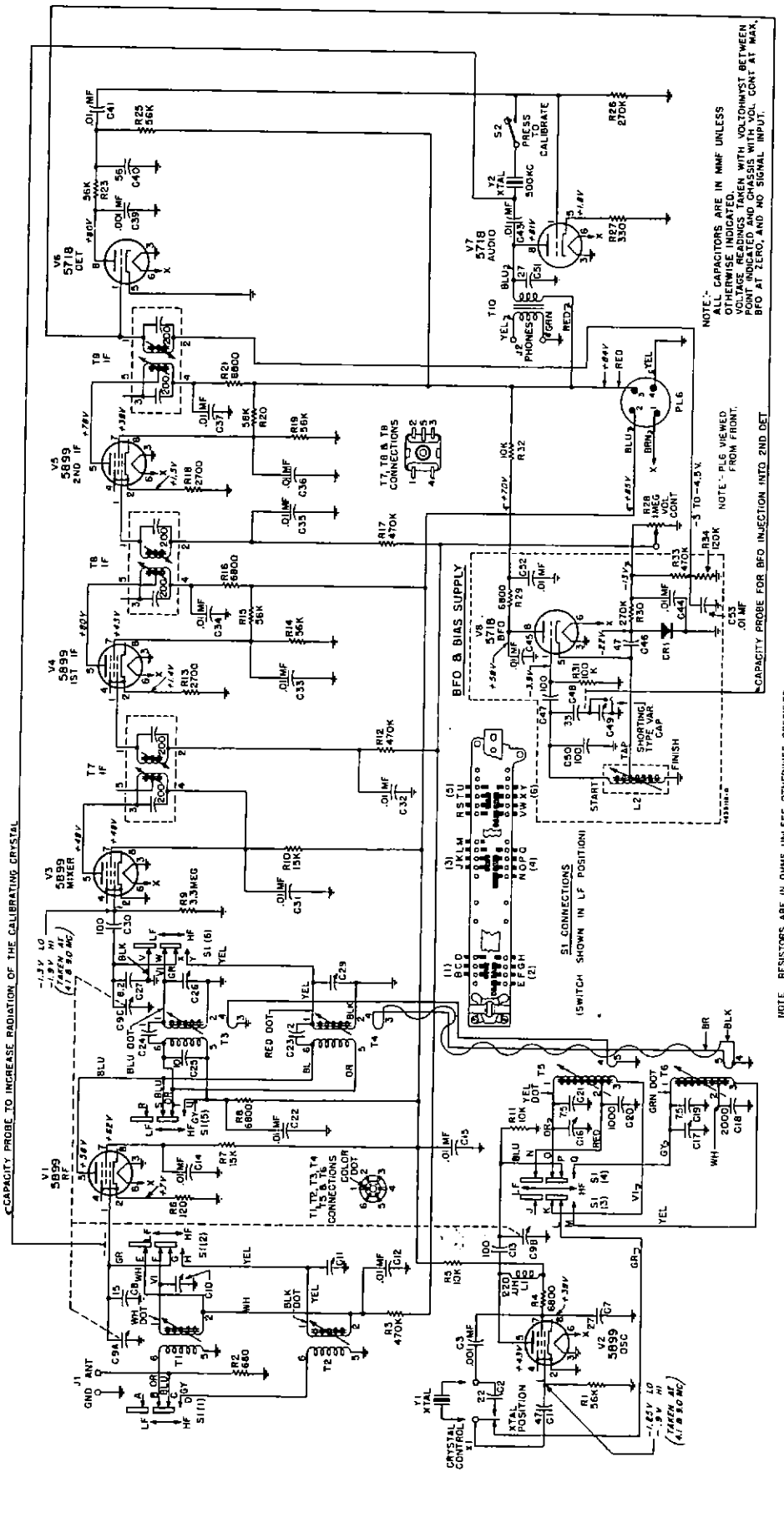


Figure 12. Receiver RR-6 schematic diagram.

This chart lists symptoms which the serviceman may observe while making a few tests. The symptoms noted will determine what further steps are to be taken. The particular stage or circuit that may be defective is indicated in the second column. Voltage and resistance measurements of the defective circuit should ordinarily be sufficient to isolate defective components not specifically mentioned.

RECEIVER RR-6 TROUBLE-SHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
Too much variation in gain across band.	Mistracking.	Realign.
	Mistracking due to bent plates in antenna or r-f sections of variable capacitor.	Replace variable capacitor and realign.
	Insufficient oscillator injection in mixer at low end of band.	Replace oscillator tube.
	Insufficient injection due to open link circuit.	Replace or repair oscillator coil or mixer coil.
500 Kc crystal calibrator inoperative.	Defective crystal.	Replace.
	Defective switch.	Replace.
No calibration beats at upper end of high band.	Weak crystal.	Replace.
	Open feedback capacitor C40 or C51.	Replace.
Spurious beats 45 kc above or below correct beat when using crystal calibrator.	Open capacitor C39.	Replace.
	Volume control set for too much receiver gain.	Reduce volume control setting.
Beat note produced on calibration check sounds broken up and does not change pitch with tuning of variable capacitor.	Volume control set for too much receiver gain.	Reduce volume control setting.
Low sensitivity.	Low i-f gain.	Realign i-f transformers.
		Replace i-f tubes.
	Low r-f gain.	Realign antenna and r-f coils.
		Replace r-f tube.
	Insufficient oscillator injection in mixer.	Replace oscillator tube.
	Open oscillator injection link (usually broken at coil terminal).	Repair or replace coil.
	Low detector gain.	Change tube.
	Too high fixed bias on detector.	Repair bfo.
	Open r-f or i-f bypass: C32 or C12.	Replace.
	Open antenna coil.	Replace or repair.
Audio output low.	Excessive bias on detector. Should be −3 to −4.5 volts.	Repair bfo.

RECEIVER RR-6 TROUBLE-SHOOTING CHART (Cont.)

SYMPTOM	PROBABLE CAUSE	REMEDY
High noise output.	I-f amplifier cathode resistor shorted to ground.	Remove short.
Gain control not effective on strong signals.	Short to ground at i-f transformer grid return lug.	Remove short.
	Shorted bypass capacitor C32, C35, or C12.	Replace.
	Bfo not operating or operating weakly.	Repair bfo.
	Bfo signal not rectified.	Replace crystal CR1.
Dial calibration incorrect.	Improper oscillator alignment.	Realign receiver.
	Bent oscillator plates in variable capacitor.	Replace gang.
No beat heard on cw signal.	Bfo coil improperly aligned.	Align bfo coil.
	Bfo trimmer shorted.	Remove short.
Squeal heard on a-m signal reception.	Bfo trimmer not shorting because stop is bent or broken.	Replace bfo trimmer.
Fine tuning mechanism binds when rotating large dial by hand.	Rubber idler shaft in fine tuning mechanism improperly aligned.	Remove assembly and adjust.
	Screw holding fine tuning bracket and earphone jack to post loose.	Tighten screw.
	Pivot bolt on fine tuning assembly too loose.	Take out looseness by tightening nut.
No B+ voltage.	Broken lead in plug.	Repair.
No filament voltage.	Broken lead in plug.	Repair.
B+ much higher than 105 volts.	Defective voltage regulator tube in filter	Replace.

b. Use of the Signal Input Chart will make it possible to locate the defective section to correct a set having low over-all gain.

c. Low over-all gain could be the result of trouble in any of the following sections: the audio amplifier, the detector, the i-f or r-f amplifiers or the antenna coil. The first step is to measure the sensitivity of the receiver at the various stages starting with the antenna input and proceeding toward the audio output stage. By consulting the Signal Input Chart, the nominal input at each grid is known for 5 mw of audio output. A .01 uf capacitor should be connected in series with the hot lead of the signal generator so as not to upset the bias at the test signal input points. The gain of the audio stage can be measured best with an audio oscillator such as a Hewlitt Packard Model 200C.

SIGNAL INPUT CHART

Signal generator output connection	Frequency 400 cps 30% modulation	Signal generator output (uv)
Antenna terminal through a 270 ohm resistor.	3.0 mc	10
	9.0 mc	10
RF grid, pin 1, V1.	3.0 mc	19
	9.0 mc	19
Mixer grid, pin 1, V3.	455 kc	65
1st i-f grid, pin 1, V4.	455 kc	15,300
2nd i-f grid, pin 1, V5.	455 kc	170,000
Det grid, pin 1, V6.	455 kc	1,000,000
Det grid, pin 1, V6.	400 cycles	200,000
Audio grid, pin 1, V7.	400 cycles	800,000

d. The conversion gain of the mixer stage may be low due to insufficient oscillator injection voltage. With the oscillator grid, pin 1 of V2, shorted to ground, measure the contact potential at the grid, pin 1 of the mixer tube, V3, using the d-c probe of a vacuum tube voltmeter. The residual contact potential usually measures from .5 to .8 volt. Remove the short from the oscillator and observe the rise of potential on the mixer grid. The oscillator injection voltage should result in a rise of .5 volt or more above the residual contact potential. Any value less than this indicates insufficient injection of the oscillator signal.

e. Low gain in the antenna or r-f stage will result in low receiver sensitivity. To check antenna and r-f gain, remove the oscillator injection voltage to the mixer by shorting the grid, pin 1, of the oscillator tube, V2, to ground. Place the d-c probe of a vacuum tube voltmeter on the grid, pin 1, of V3. Set the volume control at the maximum position. Use a 470K ohm resistor in series with the probe to avoid detuning the grid circuit. The voltage measured at the grid of V3 will be the residual contact potential and will be approximately .5 to .8 volt. Connect the output of a signal generator (GR-805C) to the antenna terminal through a 270 ohm resistor. The Antenna and RF stage gain chart lists the input voltage necessary to produce a rise of .5 volt over the residual contact potential at the mixer grid.

ANTENNA AND R-F STAGE GAIN CHART

Band	Frequency (mc)	Signal generator output connection	Signal generator output (uv) (for increase of .5V at mixer grid)
Low	3.5	Antenna terminal through 270 ohm resistor.	20,000-35,000
	6.0	Antenna terminal through 270 ohm resistor.	30,000-60,000
High	7.0	Antenna terminal through 270 ohm resistor.	20,000-35,000
	15.0	Antenna terminal through 270 ohm resistor.	30,000-60,000
Low	3.5	RF grid through 10,000 uuf capacitor.	30,000-70,000
	6.0	RF grid through 10,000 uuf capacitor.	50,000-120,000
High	7.0	RF grid through 10,000 uuf capacitor.	30,000-70,000
	15.0	RF grid through 10,000 uuf capacitor.	50,000-120,000

f. A diagram of point-to-point resistance measurements on the r-f rangeswitch is provided to locate defective coils easily. See figure 13. It is advisable to obtain an ohmmeter capable of accurate readings down to .01 ohm such as the Weston Model 301. If such a meter is not obtainable, a suitable low range ohmmeter can be constructed and calibrated as shown in figure 26.

25. BFO PANEL REMOVAL

To facilitate testing and circuit checking, the wires connected to the BFO panel are long enough to permit removal of the panel without interrupting circuit operation. The only wire which must be disconnected is the blue wire which serves as the capacity probe for BFO injection into the second detector. The excess wire is folded over the top of the panel and secured with a clamp. To remove the BFO panel, remove the six retaining screws, release the clamp holding the excess wires and lift out the panel.

26. ALIGNMENT

a. Equipment Required

(1) AM signal generator having:

(a) frequency coverage from 455 Kc to 16 mc.

(b) accurately calibrated, adjustable output.

(c) 400 cycle, 30% modulation.

(2) Output power meter, GR type 583-A or equivalent.

(3) Non-metallic screwdriver with $\frac{1}{8}$" blade (for i-f transformers).

(4) Small size screwdriver to fit antenna, r-f, and oscillator transformers.

(5) Medium size screwdriver with blade ground to fit trimmer slots without play. Blade should not ride in bottom of slot.

b. Procedure

(1) Connect the equipment, as directed in Chapter 2, Section I (do not connect phone when the output meter is used, as the output load impedance will be reduced by one-half).

(2) Set RECVR-TRANS switch on Filter-Accessory Unit RA-6 to RECVR.

(3) Expose bottom alignment adjustments as follows (see Figure 14):

(a) i-f—slide cover plate to right.

(b) bfo—turn cover plate counterclockwise.

(c) r-f—remove two screws and cover plate.

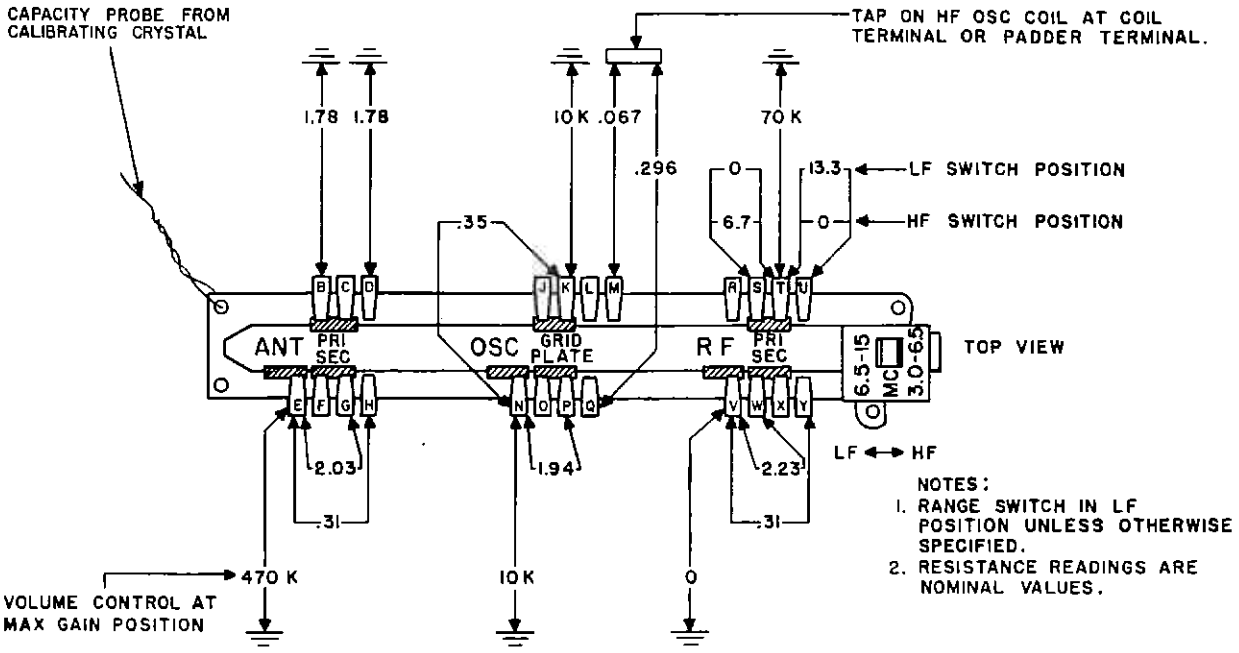


Figure 13. Point-to-point Resistance Measurements on Rangeswitch.

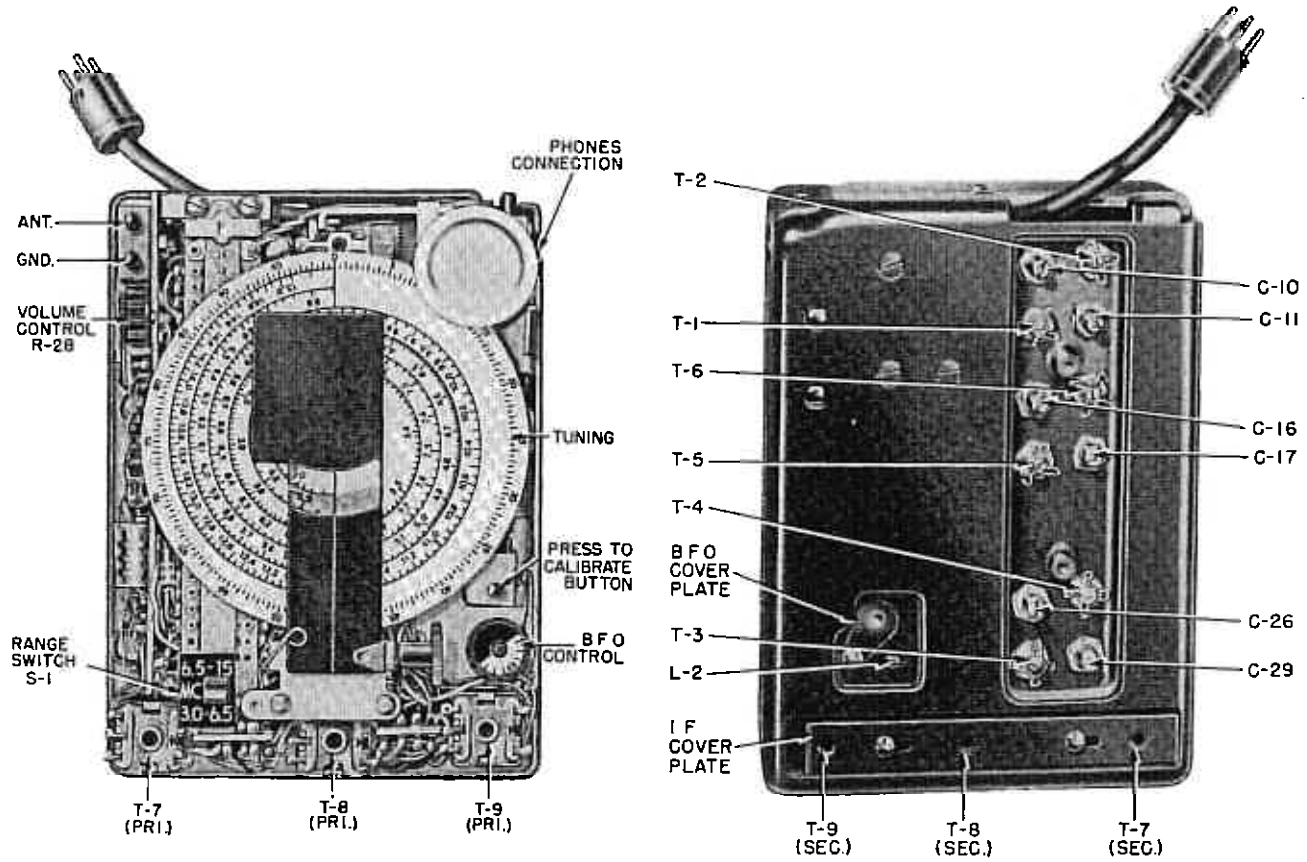


Figure 14. Receiver RR-6, top and bottom views showing alignment adjustment locations.

(4) Connect the output meter across the phones terminals J2. Set the "OHMS" knob to 40 and the impedance multiplier to 100. Set the meter multiplier to 1.

NOTE: Throughout the alignment procedure, reduce the generator output to a level which produces about 5 mw output indication on the output meter. This will avoid overloading the receiver.

(5) Remove the top cover and turn VOLUME control to maximum volume.

(6) Refer to Figure 14 for adjustment locations.

(7) Remove glyptal from the cores and trimmers in the r-f section with lacquer thinner or acetone. If thinner doesn't loosen the core sufficiently, apply the heat from a soldering iron.

c. IF Alignment

(1) Connect the AM generator to the grid of the mixer (pin 1, V3—See Figure 15—RF panel front view) and set it to 455 kc with 400 cycle, 30% modulation. Detune the receiver to remove unwanted signals.

(2) Set the generator output high enough to give about 5 mw output on the meter.

(3) Tune the primaries and secondaries of T9, T8, and T7 for maximum output on meter. (See Figure 14).

(4) The i-f sensitivity is normal if a generator output of 100 microvolts or less produces 5 mw output.

d. BFO Alignment

(1) With the equipment connected as above, turn off generator modulation, and set the BFO dial to zero. (The zero on the dial should be at three o'clock when viewed as in Figure 14.)

(2) Adjust the bfo coil (L2) for zero beat.

(3) After alignment of the bfo, apply glyptal to the adjustment screw.

e. RF Alignment

(1) Replace the top cover which was removed during i-f alignment, and place the receiver on its side.

(2) Connect the generator to the ANT-GND terminals (J1). Use a 270 ohm carbon resistor (dummy antenna) in series with the antenna terminal.

NOTE: This value is for a 30-ohm generator. If generator output impedance is other than 30 ohms, subtract the generator impedance from 300 ohms for the correct value of dummy antenna.

(3) Turn BFO dial to OFF.

(4) Set low-band trimmers C10, C16, and C26 so that screwdriver slots are parallel to the long edge of the compartment. This represents the mid-capacity positions.

(5) Turn the TUNING dial clockwise until it reaches the end stop (low frequency end). Then turn the VERNIER counterclockwise slightly to take up any slack in the drive.

(6) Turn ADJUST CALIBRATION knob until the hairline passes through the center of the circle at the bottom of the dial window.

(7) Set the generator frequency to 3.5 mc and the generator output to 100 microvolts with 400 cycle, 30% modulation.

(8) Set RANGE switch to "blue" position (3 to 6.5 mc).

(9) Set the receiver tuning dial at 3.5 mc.

(10) Tune the oscillator slug in T5 for maximum output on the meter.

CAUTION: Do not turn the slug too far into the coil; when turning becomes difficult, do not force, as damage to the terminal assembly may result.

NOTE: For final adjustment of the slug, reduce the generator output until a receiver output of 5 mw is obtained.

(11) Tune the slugs in T1 (antenna), T3 (r-f) and T5 (oscillator) for maximum output.

(12) Set the receiver and generator dials for alignment at 6.0 mc.

CAUTION: There will be two generator frequencies which will produce an output indication. One will be near the frequency setting of the receiver and the other, the image frequency, will be 0.91 mc higher. The lower one is the correct alignment frequency.

(13) Adjust the oscillator trimmer (C16) and antenna trimmer (C10) for maximum output. Do not adjust T1, T3, or T5.

(14) Since the r-f trimmer (C26) has some pulling effect on the oscillator, it will be necessary to find the true resonant frequency of the r-f tank by a "rocking" procedure as follows:

(a) Note the output reading on meter.

(b) Turn the r-f trimmer (C26) slightly counterclockwise until the output drops approximately one-third to one-half.

(c) Readjust the oscillator trimmer (C16) for maximum output.

(d) If the maximum reading is higher than that in step (a), repeat steps (a), (b), and (c), until the highest output is obtained. Lower the

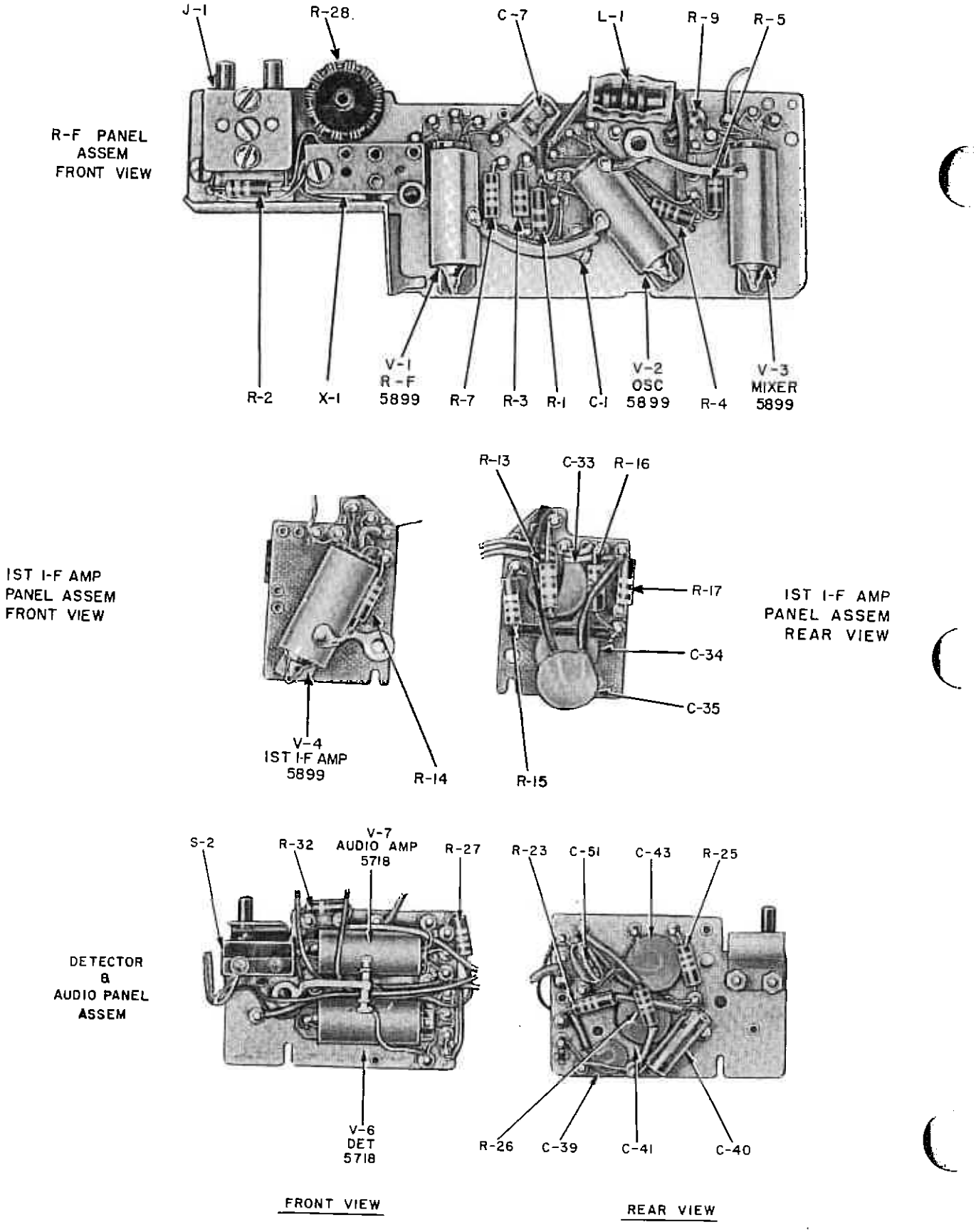


Figure 15. Receiver RR-6, showi