TM 11-4014

WAR DEPARTMENT TECHNICAL MANUAL

SIGNAL REPAIR SHOP

RADIO RECEIVER AND LOOP ROTATORS BC-470-D and -F

REPAIR INSTRUCTIONS

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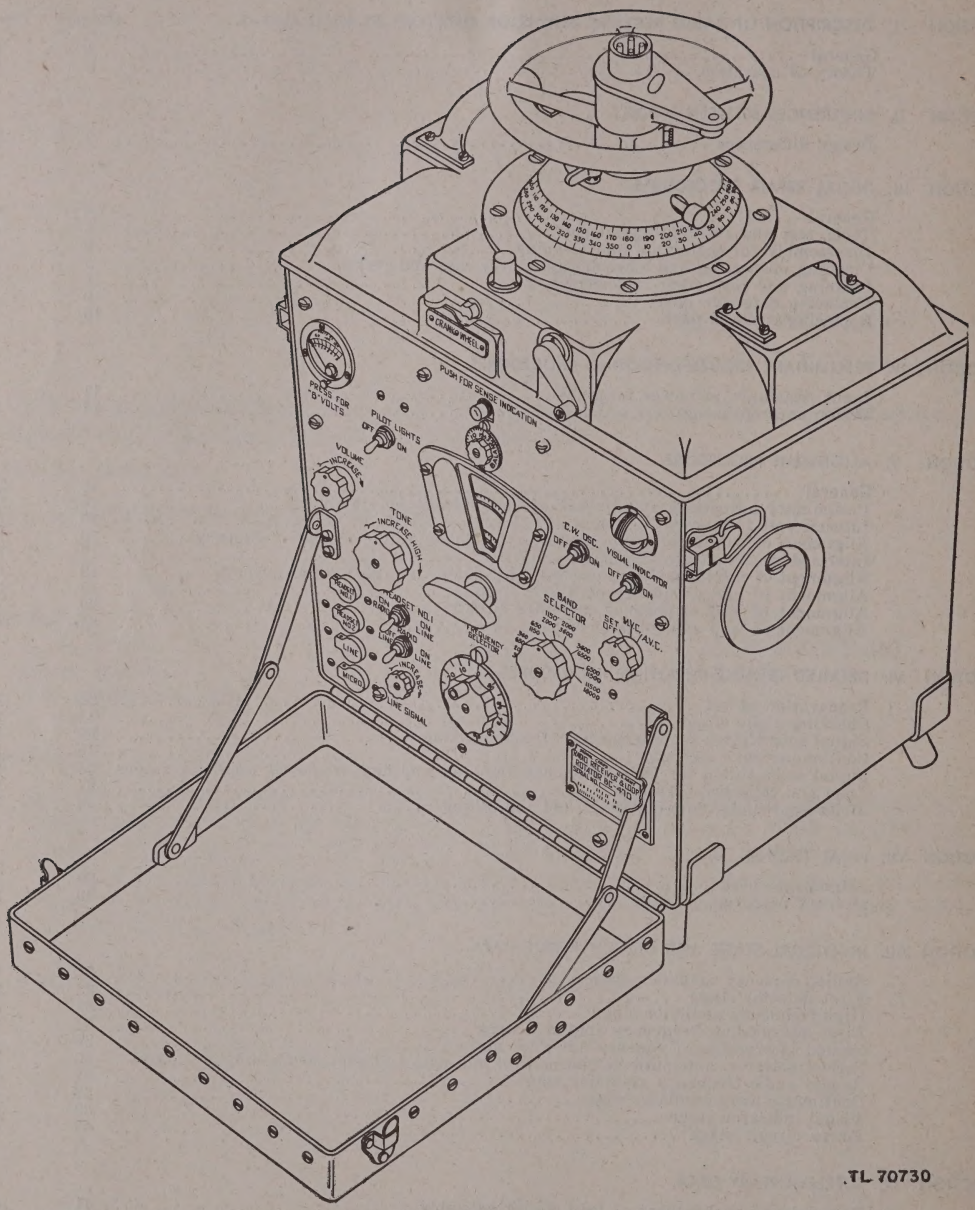


Figure 1. Radio Receiver and Loop Rotator BC–470–(*).

SECTION I

DESCRIPTION OF RADIO RECEIVER AND LOOP ROTATORS BC–470–D AND –F*

1. General

a. USE. Radio Receiver and Loop Rotators BC–470–D and –F are components of a portable direction finder for ground use. They use a loop antenna, rod antenna, and nine tubes in a superheterodyne circuit. Amplitude-modulated (a-m) and continuous waves can be received, using either manual or automatic gain control.

b. DESIGNATION. Official nomenclature followed by the symbol (*) indicates all models of the item of equipment included in this Technical Manual. Thus Radio Receivers and Loop Rotators BC–470–(*) represents Radio Receivers and Loop Rotators BC–470–D and BC–470–F.

c. FREQUENCY RANGE. The frequency range is 200 to 18,000 kilocycles (kc) and is covered in eight continuous bands.

d. INPUT CIRCUIT. The input circuit consists of a balanced loop antenna and a sectional rod antenna.

e. OUTPUT CIRCUIT. Output circuits are provided for connecting phones to the output of the set, talking over a goniometric intercept telephone line, and comparing signals with those on the line.

f. POWER REQUIREMENTS. The power for Radio Receiver and Loop Rotator BC–470–D is supplied from Box BX–29–D containing a 6-volt storage battery and plate Supply Unit PE–91–D through Cord CD–516. Radio Receiver and Loop Rotator BC–470–F is supplied through Cord CD–450 from Box BX–29–F, which also contains a 6-volt storage battery and Plate Supply Unit PE–91–F. The total power consumption of either model is 46 watts.

2. Theory of Operation

a. GENERAL. The block diagram of the nine-tube superheterodyne circuit of Radio Receiver and Loop Rotator BC–470–(*) (fig. 2) shows the path of the signal from the input at the antenna to the output at the headset.

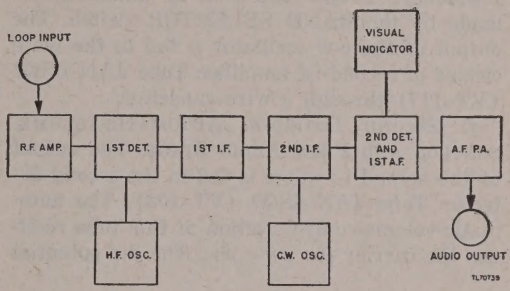


Figure 2. Block diagram, Radio Receiver and Loop Rotator BC–470–(*).

b. RADIO-FREQUENCY STAGE. Signal energy picked up by the loop is fed through a tuned transformer to the control grid of radio-frequency (r-f) amplifier Tube JAN–6SK7 (VT–117). Signal energy picked up by the vertical rod antenna can be injected into the grid circuit by depressing the sense button to obtain a unidirectional bearing. The amplified signal appears in the plate circuit of Tube JAN–6SK7 (VT–117) across a tuned circuit resonant to the signal frequency.

c. FIRST DETECTOR AND HIGH-FREQUENCY OSCILLATOR STAGES. The output of the r-f stage is fed to No. 3 grid of the first detector Tube JAN–6SA7 (VT–150). In this stage the incoming signal is mixed with the output of the high-frequency (h-f) oscillator stage consisting of an oscillator of the tuned grid type using Tube JAN–6J5 (VT–94). The intermediate-frequency (i-f) output appears in the plate circuit of the first detector tube. On bands 1,

*See TM 11–317 for installation, operation, and other maintenance data on these equipments.

2, and 3 (200 to 1,150 kc) the intermediate frequency is 147.5 kc. On bands 4, 5, 6, 7, and 8 the intermediate frequency is 805 kc.

d. INTERMEDIATE-FREQUENCY STAGES. The 147.5-kc or 805-kc output of the first detector stage is inductively coupled to the control grid of Tube JAN–6SK7 (VT–117) in the first i-f amplifier stage. The output of this tube is transformer coupled to the control grid of second i-f amplifier Tube JAN–6SK7 (VT–117). Appropriate i-f transformers tuned to the proper frequency are automatically selected by the BAND SELECTOR switch.

e. CONTINUOUS-WAVE OSCILLATOR STAGE. The continuous wave (c-w) stage consists of a Hartley oscillator circuit using Tube JAN–6J5 (VT–94) as the oscillator tube. Two oscillator coils are provided, one for each intermediate frequency. Proper selection is automatically made by the BAND SELECTOR switch. The output of the c-w oscillator is fed to the plate circuit of second i-f amplifier Tube JAN–6SK7 (VT–117) through a wire capacitor.

f. SECOND DETECTOR AUTOMATIC-VOLUME-CONTROL AND FIRST AUDIO STAGE. The output of the second i-f stage is fed to the second detector Tube JAN–6SQ7 (VT–103). The automatic-volume-control section of this tube rectifies the carrier for a-v-c use. The d-c potential developed is passed through resistance-capacitance filters to the grid return circuits of the r-f amplifier, first detector, and i-f stages. The other diode section of V6 is used to develop the audio-frequency (a-f) component of the carrier wave. The a-f voltage output of this diode is fed to the grid of the triode section of Tube JAN–6SQ7 (VT–103) through a coupling capacitor.

g. SECOND AUDIO STAGE. The output of the first audio stage is impressed on the control grid of a-f output amplifier Tube JAN–6K6–GT/6 (VT–152). The amplified output of this tube is fed through an output transformer and jacks to the telephone headset. An additional a-f transformer permits the output of the set to be impressed on a telephone line. A microphone may be coupled to the line through this transformer. A headset may be so connected that one earphone is coupled to the output of the set, and the other earphone to a telephone line.

h. VISUAL INDICATOR. The visual tuning indicator is of the electron-ray type using Tube JAN–6U5/6G5 (VT–98). The direct-current (d-c) voltage for the grid of this stage is obtained from one of the diode sections of the second detector tube through a resistance capacitance filter.

SECTION II

DIFFERENCES BETWEEN MODELS

3. Design Differences

a. OPERATIONAL CHANGES. There are no operational differences between models.

b. CAPACITORS AND RESISTORS. The values of a number of resistors and capacitors in Radio Receiver and Loop Rotator BC–470–D have been changed in Radio Receiver and Loop Rotator BC–470–F. (See fig. 31.) The reference numbers for these resistors and capacitors have also been changed.

SECTION III

INITIAL REPAIR PROCEDURES

4. General

Note. Before making any repairs or adjustments, all authorized Modification Work Orders should be applied. See War Department Pamphlet 12–6 for applicable Modification Work Orders.

Maintenance personnel should follow the procedure outlined in this manual when repairing and overhauling Radio Receiver and Loop Rotator BC–470–(*). The repair information in this and the following sections is presented in the order in which the repairman should actually perform the various operations on the equipment in the repair shop. This procedure will permit repair of the equipment in the shortest time possible and will result in performance comparable to that of new equipment.

5. Tools, Test and Cleaning Equipment

The equipment in table I should be available for the proper repair of Radio Receiver and Loop Rotator BC–470–(*).

Table I.

Item	Description
Dental mirror.	
Assorted hand tools.	Soldering iron, pliers, screw drivers, small socket wrenches and a small adjustable wrench.
Flashlight or probing light.	
Solvent, dry-cleaning.	
Assorted brushes.	
Compressed air.	Clean, dry, low-pressure.
Sandpaper.	Fine grade.
Crocus cloth.	
Volt-ohm-milliammeter.	Sensitivity of at least 1,000 ohms per volt with the following ranges: 0 to 150 volts, 0 to 5 megohms, 0 to 1 ma.
Tube tester.	Emission or mutual conductance type.
Output meter.	4,000-ohm, 0–25-volt.
Signal generator.	Accurately calibrated; covering a frequency range of 140-kc to 18.1-mc with 400-cycle, 30 percent modulation. Attenuator calibrated in microvolts: 0 to 100,000.
Audio oscillator.	400-cycle; 0- to 1-volt output.
Vacuum-tube voltmeter.	High input impedance. A-c and d-c ranges of 0 to 1, 0 to 10, 0 to 150 volts.
Capacity bridge.	Range 0 to 150 mmf.
Headset P–21.	
Microphone T–35.	
Plate Supply Unit PE–91–D with fuse.	
6-volt storage battery.	
Dummy antenna capacitor.	0.1-mf; 400-vdcw.
For testing Radio Receiver and Loop Rotator BC–470–D:	For testing Radio Receiver and Loop Rotator BC–470–F:
Antenna AN–35–D including Mast Sections MS–105 to MS–109.	Antenna AN–35–F including Mast Sections MS–105 to MS–109.
Box BX–29–D.	Box BX–29–F.
Cord CD–516.	Cord CD–450.
Loop LP–22–D.	Loop LP–22–F.

6. Disassembly for Inspection and Cleaning

Caution: Do not lift the set or support any part of its weight with the loop handwheel.

a. REMOVAL FROM CASE. Remove the socket cover from the power receptacle on the rear of the chassis and remove the knurled socket mounting nut from Socket SO–77. (See fig. 3.) Remove the eight slotted thumbscrews on the front panel, and the four slotted thumbnuts on the front cover stays. Grip the T-handle on the front panel (fig. 4) and pull the chassis out of the set box.

b. TUBES. All tubes, except visual indicator Tube JAN–6U5/6G5 (VT–98), should be removed by pulling them directly from their sockets in the chassis. Remove the visual indicator tube by loosening the wingnut under the main supporting bracket which is fastened to the rear of the panel. Remove the tube (with its clamp) and the socket (with its supporting bracket) from the main supporting bracket. Pull the tube from the socket and remove the tube clamp from the tube.

c. LAMPS. (1) *Azimuth scale light.* Remove three screws holding pilot lamp housing (fig. 4) to top of case and remove the housing and

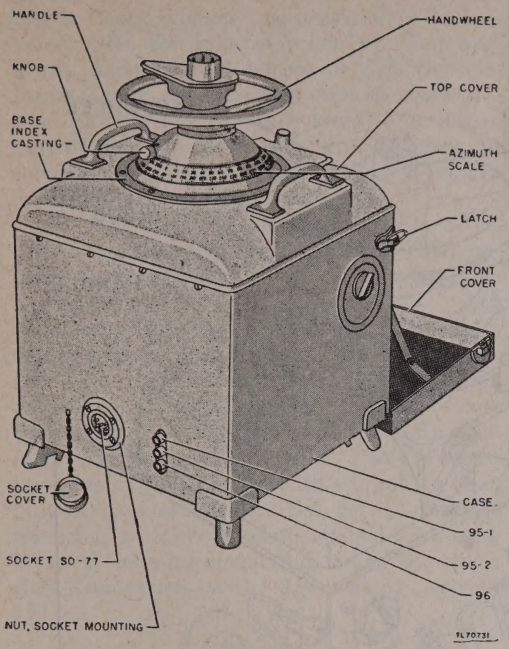


Figure 3. Parts location, rear view, Radio Receiver and Loop Rotator BC–470–(*).

gasket. Remove the bayonet type lamp by pressing it into its socket, turning one-quarter turn counterclockwise, and lifting the lamp out.

(2) *Dial lights.* Remove the four thumbscrews holding the dial escutcheon (fig. 4) to the front panel. Remove the bayonet type lamps by pressing them into their sockets turning one-quarter turn counterclockwise, and lifting them out.

d. Loop Rotator Mechanism. Remove screws holding top cover to the case (fig. 3) and lift top cover and loop rotator mechanism from the case by means of the handles. Loosen captive thumbscrew of loop receptacle cover, raise it to the limit of its motion, and remove cover.

e. Removal of Miscellaneous Parts. (1) Remove vertical plate located on the right side of chassis (as viewed from the panel) adjacent to Tube JAN–6SA7 (VT–150), by loosening the five screws near the edges.

(2) Remove the side covers (fig. 4) on each side of the outer case by loosening wingnuts and lifting plates out.

7. Cleaning, Inspecting, and Lubricating Receiver Case and Chassis

a. Receiver Case. Use clean, dry, low-pressure compressed air to blow out all dust particles in the case. Remove corrosion from all parts of the case with a fine grade of sandpaper. Straighten the case if it is bent. Repaint all surfaces that are worn or chipped.

b. Chassis. Use clean, dry, low-pressure compressed air to blow out all dust particles in unit. Use a clean brush to remove dust from corners and other spots difficult to reach. Exercise care when cleaning terminal contact points, switches, jacks, binding posts, etc. Remove corrosion from terminals, pins, and other unpainted parts of the chassis, using a fine grade of sandpaper. *Do not use abrasives on switch contacts.* Apply dry-cleaning solvent (SD) with a brush, to switch contact points and other parts difficult to reach. Blow out loosened particles with compressed air. Inspect wires for broken connections, frayed ends, shorts, and poor insulation. Check resistors, capacitors, chokes, etc., for broken parts, charred spots and other signs of overload. Inspect terminals to see that they are secure and properly soldered. Check for chipped or broken parts in sockets, plugs, switches, jacks, binding posts, etc. Check for loose, bent, or broken prongs and pins on plugs. Tighten all screws and nuts. Wipe off collector loop brushes with cloth moistened with dry-cleaning solvent (SD). Straighten bent brushes. Clean the FREQUENCY SELECTOR gear drive and the BAND SELECTOR gear mechanism assemblies with dry-cleaning solvent (SD) applied with a brush. Lightly lubricate the gear assemblies with an approved light grease. Do not use oil. *Do not oil the capacitor bearings or wiper springs.* Check smoothness of operation in moving and rotating parts throughout the limit of their motion. Check for backlash and slipping of controls. Check toggle and rotary switches to see that they snap firmly into each contact position. Insert appropriate plugs into proper jacks to inspect firm seating and good contact. Inspect power cable socket SO–77 for damaged plugs or threads. Clean socket with dry-cleaning solvent (SD).

8. Cleaning and Inspecting Removed Parts

a. Tubes. Inspect the removed tubes. Clean pins of each tube with dry-cleaning solvent (SD), applied with a brush. For heavier corrosion use crocus cloth applied with care to nickel-plated surfaces of pins. Inspect tube for bent pins, also internal and external breaks. Shake tube to detect loose pins and loose ele-

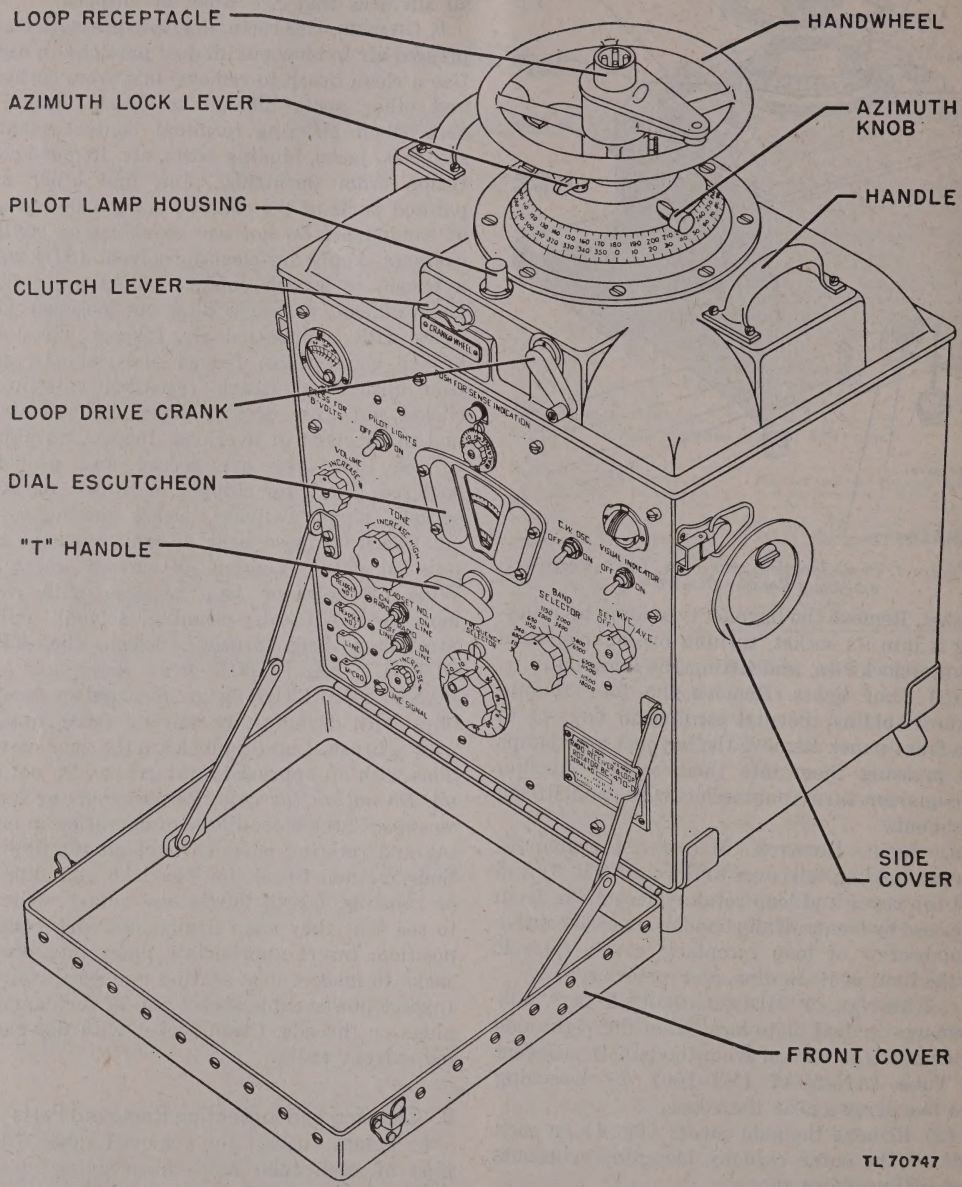


Figure 4. Parts location, front view, Radio Receiver and Loop Rotator BC–470–(*).

ments. Check tube on tube tester, allowing sufficient time for tube to warm up. Tap tube gently during test for loose or defective elements. Check for shorts between elements.

b. LAMPS. (1) *Azimuth scale light.* Clean base of the 6- to 8-volt lamp with dry-cleaning solvent (SD), applied with a brush, and remove corrosion with crocus cloth.

(2) *Dial lights.* Clean bases of 6- to 8-volt pilot lamps with dry-cleaning solvent (SD) applied with a brush, and remove corrosion with crocus cloth.

c. LOOP ROTATOR MECHANISM. Use clean, dry, low-pressure compressed air to blow out all dust particles. Use a clean brush to remove dust from spots difficult to reach. Lubricate the worm and worm gear (figs. 5 and 6) sparingly with an approved grease. Use dry-cleaning solvent (SD) applied with a brush, to clean pins of loop receptacle. (See fig. 4.) Remove corrosion with crocus cloth applied with care. Wipe off collector rings (figs. 5 and 6) with a cloth moistened with dry-cleaning solvent (SD).

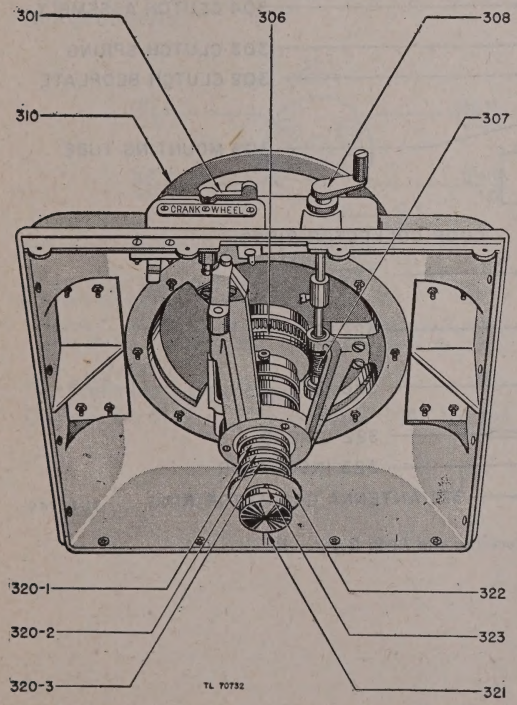


Figure 5. Loop rotator mechanism, Radio Receiver and Loop Rotator BC–470–(*).

d. LOOP ANTENNA SOCKET COVER. Clean corrosion from cover with a fine grade of sandpaper and blow out all loosened particles with compressed air. Retouch all painted surfaces that are chipped or worn.

e. CASE. Remove corrosion from case, side disks, and protective lamp cover with a fine grade of sandpaper. Inspect latches for bent parts. Inspect condition of all gaskets. Straighten bent parts of chassis. Blow out all loosened particles with compressed air. Retouch all painted surfaces that are chipped or worn. Replace side covers into case.

9. Replacing Defective Parts

Before replacing any part which during inspection indicated improper electrical operation, or signs of overload, such as charring and burning, make a thorough electrical check of the circuit to discover the cause of improper operation. Check voltages and resistances as outlined in section VIII, and correct trouble before replacing defective parts. Replace all wires having charred or poor insulation. Resolder all broken or poor connections. Replace all worn or missing gaskets. Replace defective tubes, capacitors, resistors and other defective components. Replace all defective or missing screws, bolts, and nuts.

10. Replacing Removed Parts

Replace vertical plate on right side of chassis (as viewed from the panel) adjacent to Tube JAN–6SA7 (VT–150). Replace loop rotator mechanism and top cover on case with screws on two sides and rear of case. Be sure that the edges of the case fit into grooves of top cover and that sealing packing is not disturbed. Replace loop receptacle cover and tighten captive thumbscrew. Fasten gasket, pilot lamp, and pilot lamp housing to top of case by three screws. Place all tubes back in their proper sockets in the set. Insert the visual indicator tube into the socket at the end of its cable, replace clamp on tube and screw the clamp and bracket assembly together, seating the small grommet in the slot of the supporting bracket. See that the top of the tube is pushed firmly against the large rubber grommet on the panel. Place the two pilot lamps in their sockets on either side of the dial on the front panel and fasten the dial escutcheon to panel with the four screws.

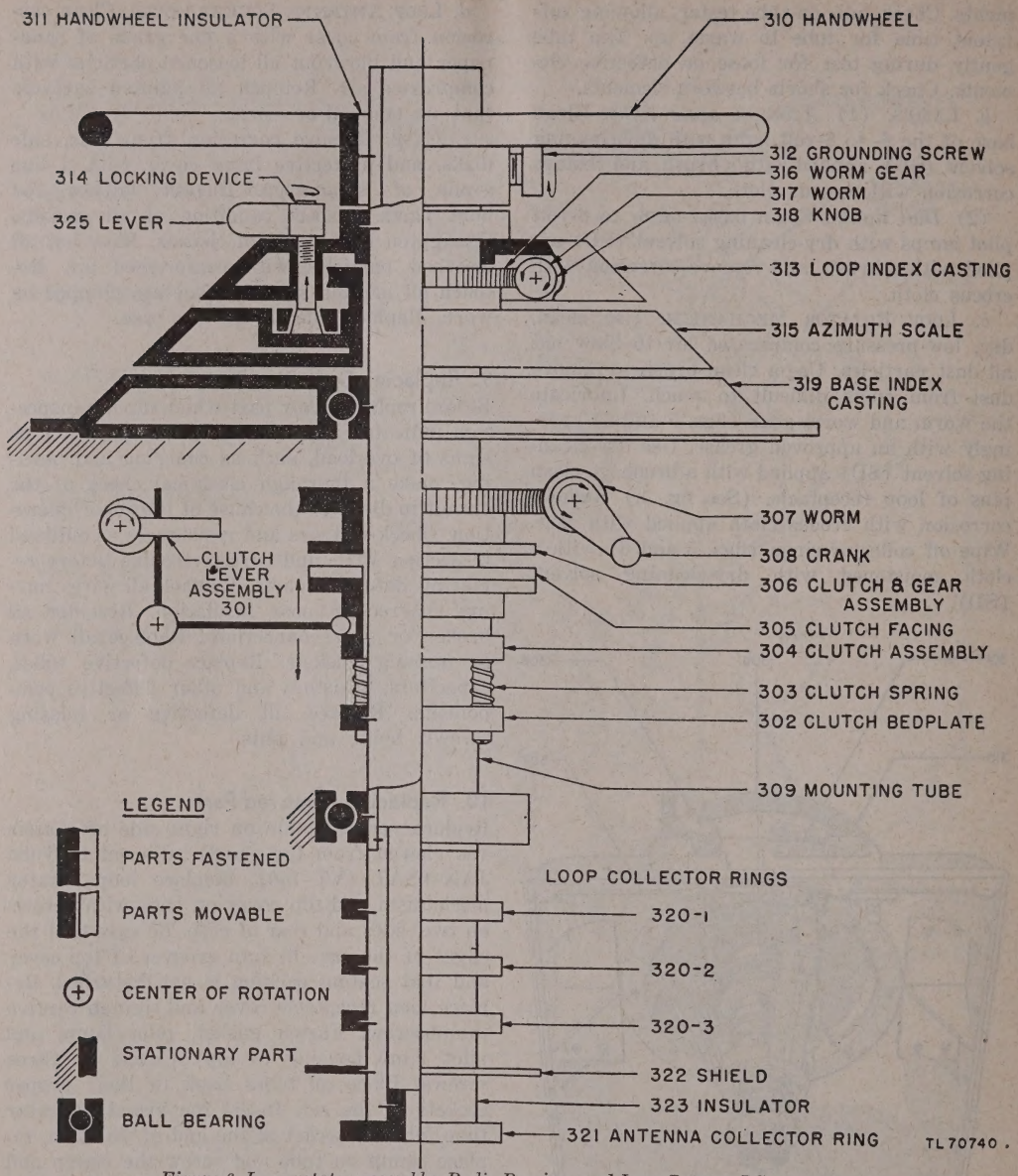


Figure 6. Loop rotator assembly, Radio Receiver and Loop Rotator BC–470–(*).

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

11. Input Resistance at Power Terminals

Trouble within the receiver can often be detected by checking the resistance of the filament and high-voltage circuits at the power input terminals of the set before applying power to the equipment, thereby preventing damage to the power supply. Before making cable connections from the power unit to the receiver unit, check the resistance of each of the six terminals of power Socket SO–77 (92–1) to ground. The resistance values that should be obtained are shown in the power socket diagram, figure 7. If the readings do not agree with those on the diagram, see section VIII, and correct fault before proceeding.

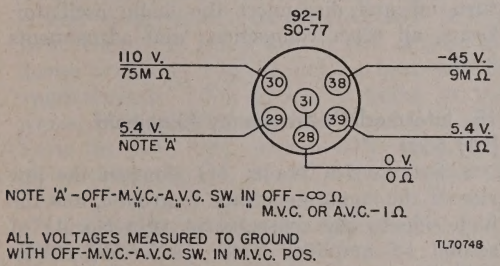


Figure 7. Power receptacle input resistances and voltages Radio Receiver and Loop Rotator BC–470–(*).

12. Preliminary Operating Test

Ground set at the GND terminal (96) located at the rear of the chassis. (See fig. 3.) Connect the three uppermost collector springs (which connect the loop to the antenna coils) together with a jumper. This is necessary to provide a complete grid return circuit for the first r-f amplifier tube on bands 5, 6, 7, and 8. Connect to power supply and turn on receiver by setting the SET OFF M.V.C.-A.V.C. switch in either the M.V.C. or A.V.C. position. Inspect the set for any sign of abnormal operation such as smoking, arcing, crackling, burning, etc. If abnormal behavior is noted, turn the set off immediately. After the set has been turned on for about 1 minute, see that the tuning indicator has a green fluorescent glow. The filament battery voltage as indicated on the receiver voltmeter should be between 5.1 and 6 volts. If battery voltage is not indicated, check the 30-ampere fuse in the battery box. The plate supply voltage, as indicated on the receiver voltmeter when the voltmeter button is depressed, should be between 105 and 125 volts. If no B voltage is indicated, check fuses 227–2 and 227–½ located on the front of the battery box and in the dynamotor supply, respectively. Turn the set off before replacing the fuse, otherwise the capacitor charging current will burn out the new fuse. If a fuse is open, find the cause before replacing it. If signs of abnormal operation are indicated, see section VIII, and correct the fault before proceeding.

SECTION V

ALIGNMENT PROCEDURE

13. General

An accurately calibrated signal generator having a frequency range of 140 kc to 18.1 mc and 400-cycle 30-percent modulation, a 400-cycle audio oscillator, and a 4,000-ohm output meter of the a-c rectifier type, are required to align the receiver. The alignment should be performed with the chassis resting on a metal table top or bench to simulate the stray capacitance of the case box to the elements located in the bottom of the chassis. Failure to observe this precaution will result in calibration error. Ground the receiver chassis, table top and low side of the signal generator. All variable trimmer and padder capacitors and adjustable inductors are provided with a locknut which must be loosened for alignment and tightened when the alignment has been completed. Take care to prevent a change in setting when retightening the locknut. Connect the three uppermost collector springs together with a jumper. If trouble is encountered in alignment, see section VI for the method of localizing trouble to a stage. After trouble has been localized to a stage, see section VIII for repair procedure.

14. Preliminary Adjustments and Check of Audio-frequency Amplifier

a. Since the a-f amplifier must be used in conjunction with the output meter, the amplifier should be checked before alignment is begun.

(1) Connect the output meter to the line (L) terminals (95–1 and 95–2) at the rear of the receiver.

(2) Connect the low side of the 400-cycle audio oscillator to ground and the high side to the control grid (pin 2) of first a-f amplifier Tube JAN–6SQ7 (VT–103), through a 0.1-microfarads (mf) capacitor.

(3) Set the SET OFF M.V.C.-A.V.C. switch to M.V.C.

(4) Set the RADIO switch (86) to ON LINE.

(5) Turn the VOLUME control, TONE control, and LINE SIGNAL control to full clockwise position.

(6) Set the C.W. OSC. switch to OFF.

(7) Set the VISUAL INDICATOR switch to OFF.

(8) Set the HEADSET NO. 1 switch to ON LINE.

(9) Turn the audio oscillator on.

b. The input voltage to the amplifier should be not more than 1 volt for 5.8 volts indication on the output meter. For an aural check, plug headphones into HEADSET NO. 1 jack (89–1). If the a-f amplifier is functioning satisfactorily, turn off and disconnect the audio oscillator. Leave all other connections and adjustments as is.

15. Intermediate-frequency Alignment (147.5 kc)

a. SECOND I-F STAGE. (1) Connect the low side of the signal generator to ground, and the high side to the control grid (pin No. 4) of second i-f amplifier Tube JAN–6SK7 (VT–117), through a 0.1-mf capacitor. Firmly clip or fasten the shielded lead from the capacitor to the socket prong so that it will not jump off when the chassis is turned bottom down on the metal table top.

(2) Short the stator plates of the h-f oscillator tuning capacitor (1D) to ground with a jumper.

(3) Turn the signal generator on.

(4) After allowing sufficient time for the signal generator to reach its proper operating temperature, accurately set the generator to 147.5 kc, modulated 30 percent by 400 cycles.

(5) Set the receiver BAND SELECTOR to the 200- to 360-kc band.

(6) Set the receiver FREQUENCY SELECTOR to 360 kc.

(7) Adjust inductor screw 75 (fig. 8) for maximum output. Use the smallest output voltage from the signal generator consistent with a readable indication of the output meter. Reduce the signal generator output as alignment proceeds.

b. First I-f Stage. (1) Connect the signal generator lead to the control grid (pin No. 4) of first i-f amplifier Tube JAN–6SK7 (VT–117), through a 0.1-mf capacitor.

(2) Adjust inductor screws 73–3 and 73–4 (fig. 8) for maximum output. Reduce the signal generator output and check the settings of inductor screws 73–3 and 73–4 once more.

c. First Detector Stage. (1) Connect the signal generator to grid No. 3 (pin No. 8). Adjust first detector Tube JAN–6SA7 (VT–150), through a 0.1-mf capacitor.

(2) Adjust inductor screws 73–1 and 73–2 (fig. 8) for maximum output. Reduce the signal generator output and check settings of inductor screws 73–1 and 73–2 again.

16. Alignment of Continuous-wave Oscillator for 147.5-kc Intermediate Frequency

Leaving all connections as in paragraph 15*c*, remove the modulation from the signal generator. Plug phones into HEADSET NO. 1 jack. Turn C.W. OSC. switch ON. Adjust inductor screw 77 (fig. 8) until a beat note of approximately 1,000 cycles is heard in the phones. Tighten locknut while listening to note. Turn the C.W. OSC. switch OFF. This completes alignment of the 147.5-kc i-f channel.

17. Intermediate-frequency Alignment (805 kc)

a. Second I-f Stage. (1) Accurately set the signal generator to 805 kc, modulated 30 percent at 400 cycles.

(2) Connect the output lead of the generator through the 0.1-mf capacitor to the control grid (pin No. 4) of second i-f amplifier Tube JAN–6SK7 (VT–117).

(3) Set the receiver BAND SELECTOR to the 1,150- to 2,000-kc band.

(4) Set the FREQUENCY SELECTOR to 2,000 kc.

(5) Adjust inductor screws 74–5 and 74–6 (fig. 8), for maximum output. Reduce the signal generator output and check settings of inductor screws 74–5 and 74–6 again.

b. First I-f Stage. (1) Connect the output lead from the signal generator to the control grid (pin No. 4) of first i-f amplifier Tube JAN–6SK7 (VT–117), through a 0.1-mf capacitor.

(2) Adjust inductor screws 74–3 and 74–4 (fig. 8) for maximum output. Reduce signal generator output and check settings of inductor screws 74–3 and 74–4 once more.

c. First Detector Stage. (1) Connect the output lead from the signal generator to grid No. 3 (pin No. 8) of first detector Tube JAN–6SA7 (VT–150), through a 0.1-mf capacitor.

(2) Adjust inductor screws 74–1 and 74–2 (fig. 8) for maximum output. Reduce output from signal generator and check settings of inductor screws 74–1 and 74–2 again.

18. Alignment of Continuous-wave Oscillator for 805-kc Intermediate Frequency

Leaving all connections and adjustments as in paragraph 17*c*, remove the modulation from the signal generator. Plug phones into HEADSET NO. 1 jack. Turn C.W. OSC. switch ON. Adjust inductor screw 76 (fig. 8) until a beat note of approximately 1,000 cycles is heard in the phones. Tighten locknut while listening to note. Turn C.W. OSC. switch OFF. This completes the alignment of the 805-kc i-f channel.

19. Alignment of High-frequency Oscillator Circuits

a. 11,500- to 18,000-kc Band. (1) Remove the jumper previously connected across the h-f oscillator tuning capacitor (1D). Connect the high side of the signal generator through a 0.1-mf capacitor to grid No. 3 (pin No. 8) of first detector Tube JAN–6SA7 (VT–150). Accurately set the signal generator to 18,000 kc with 400-cycle, 30-percent modulation. Set the receiver BAND SELECTOR to the 11,500- to 18,000-kc band. Set the receiver FREQUENCY SELECTOR to 18,000 kc. Adjust shunt trimmer screw 3–22 (fig. 8) for maximum output. If two trimmer settings for maximum output can be obtained, the desired setting is the one which has the smallest capacity. When the red paint on one side of screw 3–22 is toward the panel, the trimmer is set at minimum capacity.

(2) No low-frequency adjustment is provided for this band.

b. 6,500- to 11,500-kc Band. (1) Set the signal generator to 11,500 kc. Set the receiver BAND SELECTOR to the 6,500- to 11,500-kc band. Set the receiver FREQUENCY SELECTOR to 11,500 kc. Adjust shunt trimmer

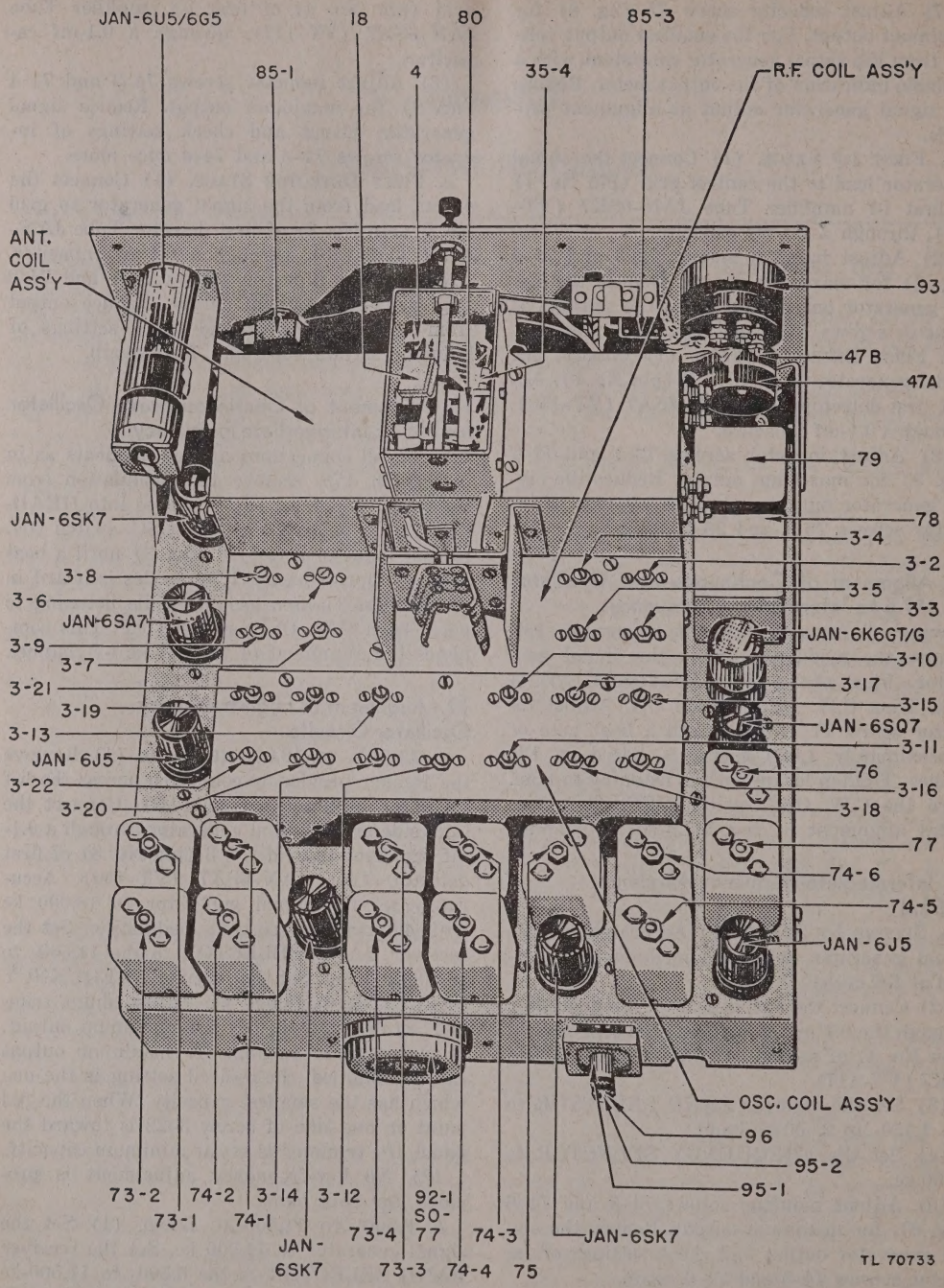


Figure 8. Parts location, top view of chassis, Radio Receiver and Loop Rotator BC–470–(*).

screw 3–21 (fig. 8) for maximum output. If two trimmer settings for maximum output can be obtained, the desired setting is the one which has the smallest capacity. When the red paint on one side of trimmer screw 3–21 is toward the panel, the trimmer is set at minimum capacity.

(2) No low-frequency adjustment is provided on this band.

c. 3,600- TO 6,500-KC BAND. (1) Set the signal generator to 6,500 kc. Set the receiver BAND SELECTOR to the 3,600- to 6,500-kc band. Set the receiver FREQUENCY SELECTOR to 6,500 kc. Adjust shunt trimmer screw 3–20 (fig. 8) for maximum output. If two trimmer settings for maximum output can be obtained, the desired setting is the one which has the smallest capacity. When the red paint on one side of trimmer screw 3–20 is toward the panel, the trimmer is set at minimum capacity.

(2) Set the signal generator to 3,600 kc. Set the receiver FREQUENCY SELECTOR to 3,600 kc. Adjust series padder screw 3–14 (fig. 8) for maximum output.

d. 2-000- TO 3,600-KC BAND. (1) Set the signal generator to 3,600 kc. Set the receiver BAND SELECTOR to the 2,000- to 3,600-kc band. Set the receiver FREQUENCY SELECTOR to 3,600 kc. Adjust shunt trimmer screw 3–19 (fig. 8) for maximum output.

(2) Set the signal generator to 2,000 kc. Set the receiver FREQUENCY SELECTOR to 2,000 kc. Adjust series padder screw 3–13 (fig. 8) for maximum output.

e. 1,150- TO 2,000-KC BAND. (1) Set the signal generator to 2,000 kc. Set the receiver BAND SELECTOR to the 1,150- to 2,000-kc band. Set the receiver FREQUENCY SELECTOR to 2,000 kc. Adjust shunt trimmer screw 3–18 (fig. 8) for maximum output.

(2) Set the signal generator to 1,150 kc. Set the receiver FREQUENCY SELECTOR to 1,150 kc. Adjust series padder screw 3–12 (fig. 8) for maximum output.

f. 650- TO 1,150-KC BAND. (1) Set the signal generator to 1,150 kc. Set the receiver BAND SELECTOR to the 650- to 1,150-kc band. Set the receiver FREQUENCY SELECTOR to 1,150 kc. Adjust shunt trimmer screw 3–17 (fig. 8) for maximum output.

(2) No low-frequency adjustment is provided for this band.

g. 360- TO 650-KC BAND. (1) Set the signal generator to 650 kc. Set the receiver BAND SELECTOR to the 360- to 650-kc band. Set the receiver FREQUENCY SELECTOR to 650 kc. Adjust shunt trimmer screw 3–16 (fig. 8) for maximum output.

(2) Set the signal generator to 360 kc. Set the receiver FREQUENCY SELECTOR to 360 kc. Adjust series padder screw 3–11 (fig. 8) for maximum output.

h. 200- TO 360-KC BAND. (1) Set the signal generator to 360 kc. Set the receiver BAND SELECTOR to the 200- to 360-kc band. Set the receiver FREQUENCY SELECTOR to 360 kc. Adjust shunt trimmer screw 3–15 (fig. 8) for maximum output.

(2) Set the signal generator to 200 kc. Set the receiver FREQUENCY SELECTOR to 200 kc. Adjust series padder screw 3–10 (fig. 8) for maximum output.

20. Alignment of Radio-frequency Amplifier Circuits

a. 11,500- TO 18,000-KC BAND. Connect the high side of the signal generator to the control grid (pin No. 4) of the r-f amplifier Tube JAN–6SK7 (VT–117), through a 0.1-mf capacitor. Set the signal generator to 18,000 kc with 400-cycle, 30-percent modulation. Set the receiver BAND SELECTOR to the 11,500- to 18,000-kc band. Set the receiver FREQUENCY SELECTOR to 18,000 kc. Adjust r-f trimmer screw 3–9 (fig. 8) for maximum output. Use the smallest signal from the signal generator which will give a readable indication on the output meter.

b. 6,500- TO 11,500-KC BAND. Set the signal generator to 11,500 kc. Set the receiver BAND SELECTOR to the 6,500- to 11,500-kc band. Set the receiver FREQUENCY SELECTOR to 11,500 kc. Adjust r-f trimmer screw 3–8 (fig. 8) for maximum output.

c. 3,600- TO 6,500-KC BAND. Set the signal generator to 6,500 kc. Set the receiver BAND SELECTOR to the 3,600- to 6,500-kc band. Set the receiver FREQUENCY SELECTOR to 6,500 kc. Adjust r-f trimmer screw 3–7 (fig. 8) for maximum output.

d. 2,000- TO 3,600-KC BAND. Set the signal generator to 3,600 kc. Set the receiver BAND SELECTOR to the 2,000- to 3,600-kc band. Set the receiver FREQUENCY SELECTOR to 3,600 kc. Adjust r-f trimmer screw 3–6 (fig. 8) for maximum output.

e. 1,150- TO 2,000-KC BAND. Set the signal

generator to 2,000 kc. Set the receiver BAND SELECTOR to the 1,150- to 2,000-kc band. Set the receiver FREQUENCY SELECTOR to 2,000 kc. Adjust r-f trimmer screw 3–5 (fig. 8) for maximum output.

f. 650- TO 1,150-KC BAND. Set the signal generator to 1,150 kc. Set the receiver BAND SELECTOR to the 650- to 1,150-kc band. Set the receiver FREQUENCY SELECTOR to 1,150 kc. Adjust r-f trimmer screw 3–4 (fig. 8) for maximum output.

g. 360- TO 650-KC BAND. Set the signal generator to 650 kc. Set the receiver BAND SELECTOR to the 360- to 650-kc band. Set the receiver FREQUENCY SELECTOR to 650 kc. Adjust r-f trimmer screw 3–3 (fig. 8) for maximum output.

h. 200- TO 360-KC BAND. Set the signal generator to 360 kc. Set the receiver BAND SELECTOR to the 200- to 360-kc band. Set the receiver FREQUENCY SELECTOR to 360 kc. Adjust r-f trimmer screw 3–2 (fig. 8) for maximum output.

21. Alignment of Loop and Collector Circuits

a. PREPARATION. (1) After alignment has been completed, turn off the set and the signal generator, disconnect the signal generator, output meter, ground connection, power plug, and loop collector spring interconnection.

(2) Check to see that the loop balancer capacitor (4) (fig. 8) has its rotor plates completely meshed with the right-hand stator plates when the BALANCE dial is set to plus 15 and completely meshed with the left-hand stator plates when the BALANCE dial is set to minus 15. Readjust the position of the BALANCE dial hub with respect to its shaft, if necessary, to obtain these conditions.

(3) Push the chassis into the case and fasten it to the case with the eight thumbscrews on front of panel. Fasten knurled socket mounting nut on the rear of the case over Socket SO–77. Replace the four slotted thumbscrews holding the front cover stays to front panel. Remove the two side covers located at the sides of the receiver case by unscrewing the thumbscrews.

(4) With a 0- to 5-megohm ohmmeter determine which two pins of the loop receptacle are open to ground, with the receiver BAND SELECTOR set to the 3,600- to 6,500-kc band, the receiver FREQUENCY SELECTOR set to 6,500 kc, the receiver BALANCE control set to 0, and the set turned OFF. Use a capacitance bridge to measure the capacitance from each of these two pins to ground (chassis). Adjust trimmer screw 3–1 (available through the right-hand circular opening at the side of the receiver case) until both of these circuits have the same capacitance to ground. Disconnect capacitance bridge.

(5) Plug the loop antenna into place. Connect the power cable to the set. Connect the output meter to the line (L) terminals at the rear of the receiver. Plug phones into HEADSET NO. 1 jack. Connect the ground wire to the ground (GND) terminal at the rear of the set.

(6) Set the SET OFF M.V.C.-A.V.C. switch to M.V.C., the RADIO switch to ON LINE, the C.W. OSC. switch to OFF, the VISUAL INDICATOR switch to OFF, and HEADSET NO. 1 switch to ON LINE. Turn the VOLUME control, TONE control, and LINE SIGNAL control to their maximum clockwise positions. Set the BALANCE control to 0.

(7) Ground the low side of the signal generator and connect a short wire to its output terminal. Place the signal generator a few feet away from the loop. Turn the signal generator on.

b. ALIGNMENT PROCEDURE. (1) *11,500- to 18,000-kc band.* Set the signal generator to 18,000 kc with 30 percent, modulation at 400 cycles. Set the receiver BAND SELECTOR to the 11,500- to 18,000-kc band. Set the receiver FREQUENCY SELECTOR to 18,000 kc. Set the BALANCE capacitor dial on the panel to 0. Adjust trimmer screw 2–8 (available through right-hand side hole) for maximum output.

(2) *6,500- to 11,500-kc band.* Set the signal generator to 11,500 kc. Set the receiver BAND SELECTOR to the 6,500- to 11,500-kc band. Set the receiver FREQUENCY SELECTOR to 11,500 kc. Adjust trimmer screw 2–7 (available through right-hand side hole) for maximum output.

(3) *3,600- to 6,500-kc band.* Set the signal generator to 6,500 kc. Set the receiver BAND SELECTOR to the 3,600- to 6,500-kc band. Set the receiver FREQUENCY SELECTOR to 6,500 kc. Adjust trimmer screw 2–6 (available through right-hand side hole) for maximum output.

(4) *2,000- to 3,600-kc band.* Set the signal generator to 3,600 kc. Set the receiver BAND SELECTOR to the 2,000- to 3,600-kc band. Set the receiver FREQUENCY SELECTOR to

3,600 kc. Adjust trimmer screw 2–5 (available through right-hand side hole) for maximum output.

(5) *1,150- to 2,000-kc band.* Set the signal generator to 2,000 kc. Set the receiver BAND SELECTOR to the 1,150- to 2,000-kc band. Set the receiver FREQUENCY SELECTOR to 2,000 kc. Adjust trimmer screw 2–4 (available through left-hand side hole) for maximum output.

(6) *650- to 1,150-kc band.* Set the signal generator to 1,150 kc. Set the receiver BAND SELECTOR to the 650- to 1,150-kc band. Set the receiver FREQUENCY SELECTOR to 1,150 kc. Adjust trimmer screw 2–3 (available through left-hand side hole) for maximum output.

(7) *360- to 650-kc band.* Set the signal generator to 650 kc. Set the receiver BAND SELECTOR to the 360- to 650-kc band. Set the receiver FREQUENCY SELECTOR to 650 kc. Adjust trimmer screw 2–2 (available through left-hand side hole) for maximum output.

(8) *200- to 360-kc band.* Set the signal generator to 360 kc. Set the receiver BAND SELECTOR to the 200- to 360-kc band. Set the receiver FREQUENCY SELECTOR to 360 kc. Adjust trimmer screw 2–1 (available through left-hand side hole) for maximum output.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

22. Preparation of Set

Place the receiver chassis on a metal top table or bench. Connect ground to the receiver chassis ground (GND) terminal and to the metal table top. Short the three uppermost loop collector springs together with a jumper. Turn the SET OFF M.V.C.-A.V.C. switch to the OFF position. Connect the power supply to the set. Connect a 4,000-ohm output meter to the line (L) terminals at the rear of the chassis. Set the RADIO switch to ON LINE. Set the HEADSET NO. 1 switch to ON LINE. Set the C.W. OSC. switch to OFF. Set the VISUAL INDICATOR switch to OFF. Turn the VOLUME, TONE, and LINE SIGNAL controls to their maximum clockwise positions.

23. Checking Audio Circuit

a. PRELIMINARY. (1) Connect the 400-cycle audio oscillator to the control grid (pin No. 2) of the second detector Tube JAN–6SQ7 (VT–103), through a 0.1-mf capacitor.

(2) Ground the low side of the audio oscillator and turn the audio oscillator on.

(3) Set the SET OFF M.V.C.-A.V.C. switch to M.V.C.

b. INDICATION. (1) The input voltage should be not more than 1 volt for 5.8-volt output on the output meter.

(2) Plug a set of earphones into the HEADSET NO. 1 jack and check the quality of the audio signal by listening with the phones. If no signal is indicated, shift the audio oscillator output lead to the control grid of the second a-f amplifier Tube JAN–6K6GT/G (VT–152) (pin No. 5). Increase the output of the audio oscillator.

(*a*) If a signal is indicated, the first a-f amplifier stage is defective.

(*b*) If no signal is indicated, the second a-f amplifier stage is defective.

(3) Disconnect the headset and audio oscillator. Turn the receiver SET OFF M.V.C.-A.V.C. switch to OFF.

c. LOCALIZATION. If a stage is defective, see the information covering the stage in section VIII. Trace the trouble to the defective part or parts by resistance and voltage checks.

24. Signal Substitution for Intermediate-frequency Stages

a. PRELIMINARY. If the audio stages are operative—

(1) Connect the signal generator output lead to the stage under test as indicated in column 1 of table II, through a 0.1-mf capacitor.

(2) Connect the low side of the signal generator to ground.

(3) Turn the signal generator on.

(4) Set the signal generator attenuator to the value indicated in column 2 of table II.

(5) Set the frequency control of the signal generator to the frequency indicated in column 3 of table II.

(6) Turn the receiver SET OFF M.V.C.-A.V.C. switch to M.V.C.

(7) Set the receiver BAND SELECTOR to the band indicated in column 4 of table II.

(8) Set the receiver FREQUENCY SELECTOR to the frequency indicated in column 5 of table II.

b. INDICATION. The indication on the 4,000-ohm output meter should be above 5.8 volts. If low or no output is obtained, see column 6 of table II for the defective stage. Repeat this procedure for the remaining stages as indicated in table II until the defective stage is located.

Table II. Signal substitution for i-f stages.

1	2	3	4	5	6
Sig gen connected to—	Sig gen output (microvolts)	Sig gen frequency (kc)	Receiver BAND SELECTOR setting (kc)	Receiver FREQUENCY SELECTOR setting (kc)	Defective stage if no output is indicated
Second i-f grid VT–117 (pin No. 4).	30,000	805	1,150 to 2,000	2,000	Second i-f amplr stage.
	30,000	147.5	200 to 360	360	
First i-f grid VT–117 (pin No. 4).	1,000	147.5	200 to 360	360	First i-f amplr stage.
	1,400	805	1,150 to 2,000	2,000	
First det grid VT–150 (pin No. 8).	400	805	1,150 to 2,000	2,000	First det stage.
	140	147.5	200 to 360	360	

c. LOCALIZATION. If a stage is defective, see the information covering the stage in section VIII. Trace the trouble to the defective part or parts by resistance and voltage checks.

25. Continuous-wave Oscillator

If in the alignment of the c-w oscillator no tone is heard, check the c-w oscillator stage in section VIII.

26. Signal Substitution for Radio-frequency Amplifier and High-frequency Oscillator Stages

a. PRELIMINARY. If the i-f amplifier is operative—

(1) Connect the signal generator output lead to the stage under test as indicated in column 1 of table III, through a 0.1-mf capacitor.

(2) Connect the low side of the signal generator to ground.

(3) Turn the signal generator on.

(4) Set the signal generator attenuator to the value indicated in column 2 of table III.

(5) Set the frequency of the signal generator to the frequency indicated in column 3 of table III.

(6) Turn the receiver SET OFF M.V.C.-A.V.C. switch to the M.V.C. position.

(7) Set the receiver BAND SELECTOR to the band indicated in column 4 of table III. Set the receiver FREQUENCY SELECTOR to the frequency indicated in column 5 of table III.

b. INDICATION. The reading on the 4,000-ohm output meter should be about 5.8 volts. If no output is indicated, see column 6 of table III for the defective stage. Repeat this procedure for the remaining stages as indicated in table III until the defective stage is located.

Table III. Signal Substitution for r-f and h-f oscillator stages.

1	2	3	4	5	6
Sig gen connected to —	Sig gen output (microvolts)	Sig gen frequency (kc)	Receiver BAND SELECTOR setting (kc)	Receiver FREQUENCY SELECTOR setting (kc)	Defective stage if no output is indicated
First det grid No. 3 VT–150 (pin. No. 8).	160	360	200 to 360	360	H-f osc
	300	650	360 to 650	650	
	500	1,150	650 to 1,150	1,150	
	450	2,000	1,150 to 2,000	2,000	
	450	3,600	2,000 to 3,600	3,600	
	250	6,500	3,600 to 6,500	6,500	
	185	11,500	6,500 to 11,500	11,500	
	215	18,000	11,500 to 18,000	18,000	
R-f amplr grid VT–117 (pin No. 4).	13	360	200 to 360	360	R-f amplr
	2	650	360 to 650	650	
	8	1,150	650 to 1,150	1,150	
	10	2,000	1,150 to 2,000	2,000	
	8	3,600	2,000 to 3,600	3,600	
	5	6,500	3,600 to 6,500	6,500	
	5	11,500	6,500 to 11,500	11,500	
	15	18,000	11,500 to 18,000	18,000	

c. LOCALIZATION. If a stage has faulty operation on only one band, check its transformers for that particular band. If it has faulty operation on all bands, give the stage an over-all voltage and resistance check. See stage data in section VIII.

27. Loop and Collector Circuits

If the receiver functions normally on all bands with the test signal injected into the grid of r-f amplifier Tube JAN–6SK7 (VT–117), as indicated in table III, the receiver should be tested on all bands as outlined in paragraph 21. If no output is obtainable, the loop or collector circuits are at fault. (See sec. VIII.)

28. Moistureproofing, Fungiproofing, and Refinishing

After repairs have been completed on the receiver, check the date of last moistureproofing and fungiproofing treatment. If a new treatment is required see TB SIG 13 for method of application. If the receiver case has been scarred or chipped, remove any rough spots with fine sandpaper and apply paint to spots with small brush. If the case is sufficiently scarred or scratched to warrant complete finishing, remove chassis from case and remove all dirt and rust with dry-cleaning solvent (SD) when necessary. Spray entire case with the proper paint authorized by existing regulations.

SECTION VII

FINAL TESTING

29. Alignment Check

Although the unit was correctly aligned during the repair procedure, a recheck of the alignment is necessary after moistureproofing and fungiproofing have been completed. Check alignment as given in section V.

30. Over-all Performance Tests

a. TESTS. After alignment has been checked, the following performance tests are to be made:

Sensitivity and noise.

Operational test.

b. SENSITIVITY AND NOISE. (1) *Description of test room required.* The test on over-all performance of the receiver must be made in a room which is double-shielded from stray external signal responses. The room should be 15 feet or more in length. Set up well shielded signal generator at the end of an overhead transmission line and against the wall of the shielded room. Set up the receiver in the center of the room. With the receiver tuned to the generator's signal at approximately 15.0 megacycle (mc), and with the generator ground grounded at the nearest point of the shielded room, but disconnected from the transmission line, the receiver should receive no signal from the generator with the VOLUME control set at maximum, as the loop is rotated through 360°.

(2) *Transmission line required.* The transmission line is a single wire using the shielded room as the return path. The wire is placed horizontally near the ceiling, parallel with the longest wall, and through the center of the room. The signal generator output terminal is connected to one end of the wire. The ground terminal on the signal generator is grounded to the room shield at the nearest point. The other end of the wire is grounded to the nearest point of the room shield through a carbon (noninductive) resistor equal to the characteristic impedance of the line. The value of resistance to be used is determined by the diameter of the wire and the distance of the wire from the ceiling. If No. 11 wire is used, and it is supported by insulators 10 inches from the ceiling, the characteristic impedance of the line (and the value of the resistor) is approximately 370 ohms. The correctness of this value can be checked by measuring the voltage along the line with a vacuum-tube voltmeter. When the line is terminated with the correct value resistor, the voltage will be the same between any point along the line and the nearest ground point. If it is not, change the value of the resistor until this voltage is constant over the entire length of the line.

(3) *Field strength calculations.* The field strength at the center of the loop for any frequency can be determined as follows:

$$\text{Field strength (microvolts per meter)} = \frac{\text{Signal generator output (microvolts)}}{\frac{N}{Z_0}}$$

$$N = \frac{}{2360\left(\frac{1}{D_1} + \frac{1}{2D_2 - D_1} - \frac{1}{2D_3 - D_1}\right)}$$

Z_0 = line characteristic impedance (or value of R). (See *b* (2) above.)

D_1 = distance from line to center of the loop in inches.

D_2 = distance from line to conducting floor in inches.

D_3 = distance from line to conducting ceiling in inches.

(4) *Sensitivities.* The maximum allowable field strengths are tabulated in the table below.

Table IV. Over-all sensitivities.

Band	Maximum allowable field strength (microvolts per meter)
1 (200 to 260 kc)	500
2 (360 to 650 kc)	400
3 (650 to 1,150 kc)	350
4 (1,150 to 2,000 kc)	250
5 (2,000 to 3,600 kc)	160
6 (3,600 to 6,500 kc)	100
7 (6,500 to 11,500 kc)	130
8 (11,500 to 18,000 kc)	300

In making these measurements, proceed as follows:

(*a*) Place the set in the center of the shielded room directly under the center of the transmission line, connected as described in *b* (2) above.

(*b*) Set the plane of the loop parallel to the transmission line.

(*c*) Connect the output of the signal generator to one end of the transmission line. Connect a resistor of the value equal to the characteristic impedance of the line from the other end to ground. Check for proper line matching using the procedure described in *b* (2) above.

(*d*) Calculate the field strength using the formula in *b* (3) above.

(*e*) Set the SET OFF M.V.C.-A.V.C. switch to the M.V.C. position.

(*f*) Turn the TONE control to the full clockwise position.

(*g*) Set the C.W. OSC. switch to OFF.

(*h*) Connect the 4,000-ohm output meter to the line binding posts marked L at the rear of the receiver.

(*i*) Set the LINE SIGNAL attenuator in the maximum clockwise position.

(*j*) When the signal generator modulation is 30 percent at 400 cycles per second, the standard output will be 5.8 volts indicated on the output meter.

(*k*) Set the VOLUME control to a point where a signal-to-noise ratio of 15 to 1 is obtained as follows: Turn the VOLUME control counterclockwise starting at the clockwise position. An assistant should keep the output constant at standard output by adjusting the attenuator on the signal generator. Periodically switch off the modulation at the generator and note the output reading. The correct VOLUME control setting for any one particular frequency is the one where the modulated output reading is 5.8 volts and the unmodulated output reading is 1.5 volts (signal-to-noise ratio of 15 to 1). This adjustment of the VOLUME control must be made for each frequency indicated.

(*l*) The greatest allowable sensitivity (in microvolts per meter) in table IV, is twice as great as the original factory sensitivity limit to allow for normal variation with time, due to tube aging and similar factors.

(*m*) At the conclusion of the sensitivity and noise test, turn the SET OFF M.V.C.-A.V.C. switch to OFF. Disconnect the power supply. Turn off and disconnect the signal generator.

c. OPERATIONAL TEST. (1) Set up the receiver in a location free from overhead wires, buried pipes, or large metallic objects. The ideal location for operation of the direction finder is on a flat, open field, free from the obstructions mentioned.

(2) Plug in the loop and one section of rod antenna.

(3) Connect the power supply.

(4) Turn the SET OFF M.V.C.-A.V.C. switch to the M.V.C. position.

(5) Set the PILOT LIGHTS switch to the ON position. All three pilot lamps should light.

(6) The panel voltmeter should read between 5.1 and 6 volts. When the meter button is depressed, the voltmeter should read between 105 and 125 volts.

(7) Plug phones into HEADSET NO. 2 jack.

(8) Set the VISUAL INDICATOR switch to the ON position. A green fluorescent glow should appear on the tuning indicator tube.

(9) Turn the VOLUME control in the full clockwise position.

(10) Turn the BALANCE control to 0.

(11) Set the C.W. OSC. switch to the ON position.

(12) Turn the TONE control fully clockwise.

(13) Set the RADIO switch to the OFF LINE position.

(14) Set the BAND SELECTOR switch to the 650- to 1,150-kc position.

(15) Rotate the FREQUENCY SELECTOR knob until a whistle is heard in the phones. Rotate the loop for maximum signal response.

(16) Turn the C.W. OSC. switch to the OFF position. The whistle should disappear and clear signals should be heard.

(17) Readjust the FREQUENCY SELECTOR control for maximum response in the phones and adjust the VOLUME control so that the phones are not overloaded.

(18) Rotate the loop until two null points (points of minimum signal) are obtained. These two points should be 180° apart as read on the azimuth scale of the loop rotator mechanism. If these points are not 180° apart, rotate the BALANCE control until they are.

(19) Press the SENSE button and hold it depressed while the loop is being rotated through 360°. One point of maximum signal response should be obtained. If this is not possible, add another section of rod antenna and repeat the procedure.

(20) Release the SENSE button. Vary the

setting of the TONE control. The intensity of the high notes of the signal should be diminished as the TONE control is turned in a counterclockwise direction.

(21) Plug the phones in HEADSET NO. 1 jack, set the RADIO switch in ON LINE position and the LINE SIGNAL control in the full clockwise position. The signal should again be heard in the phones. The volume should be diminished as the LINE SIGNAL control is turned counterclockwise.

(22) Set the SET OFF M.V.C.-A.V.C. switch in the A.V.C. position. As the FREQUENCY CONTROL is rotated through resonance, the shadow of the tuning indicator tube should vary in width, being narrowest at resonance.

(23) Rotate the VOLUME control fully counterclockwise. Plug the microphone into the MICRO jack. Have someone talk into the microphone. The output of the microphone should be heard in the phones, and the volume should vary as the LINE SIGNAL control is rotated.

(24) Check the performance for all modes of operation on all eight bands.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

31. Radio-frequency Amplifier Stage

a. STAGE DATA. (1) Radio-frequency stage schematic shown in figure 11.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6SK7, shown on stage schematic.

(3) Antenna coil box, figure 9.

(4) R-F coil box, figure 10.

(5) Parts data for r-f amplifier stage, table VI.

b. TROUBLE LOCATION. (1) *Loop and collector circuits.* If the loop and collector circuits cannot be aligned, the antenna coil circuits should be checked. The primaries may be checked by measuring the resistance between the first and third loop collector springs (counting from the top). Less than 1 ohm should be indicated on all bands except bands 5 and 6 on which an open circuit exists when the loop is not connected. The secondaries may be checked by measuring the resistance between the stators of the ganged capacitor sections 1A and 1B. The resistance should be less than 18 ohms on all bands except bands 5 and 6 on which an open circuit exists when the loop is not connected.

(2) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(3) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The resistance at terminal 4 of the r-f amplifier tube socket varies with the positions of the BAND SELECTOR and SET OFF M.V.C.-A.V.C. switches as shown in table V. Check this resistance with these switches in their various positions.

*Table V. Resistance to ground of terminal 4 of r-f amplifier socket.**

Note. Disconnect power supply when making the following measurements:

BAND SELECTOR switch at—	SET OFF M.V.C.-A.V.C. switch at— A.V.C.	M.V.C.
200 to 360	2.8 megohms	500,000 ohms
360 to 650	2.8 megohms	500,000 ohms
650 to 1,150	2.8 megohms	500,000 ohms
1,150 to 2,000	2.8 megohms	500,000 ohms
2,000 to 3,600	3.3 megohms	1 megohm
3,600 to 6,500	3.3 megohms	1 megohm
6,500 to 11,500	3.3 megohms	1 megohm
11,500 to 18,000	3.3 megohms	1 megohm

*The three uppermost loop brushes are connected to each other by jumpers during this test.

Make one of the resistance checks of table V with the FREQUENCY SELECTOR control in various positions, thus checking for shorts between rotor and stator plates. Measure the resistance from terminal 8 of r-f amplifier tube to ground with the BAND SELECTOR switch in all its positions. Also make this resistance measurement with various positions of the FREQUENCY SELECTOR control, thus checking for shorts between rotor and stator plates. The voltage at terminal 4 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

c. REMOVAL OF PARTS. (1) Antenna coil box. (See par. 44*a*.)

(2) R-f coil box. (See par. 43*a*).

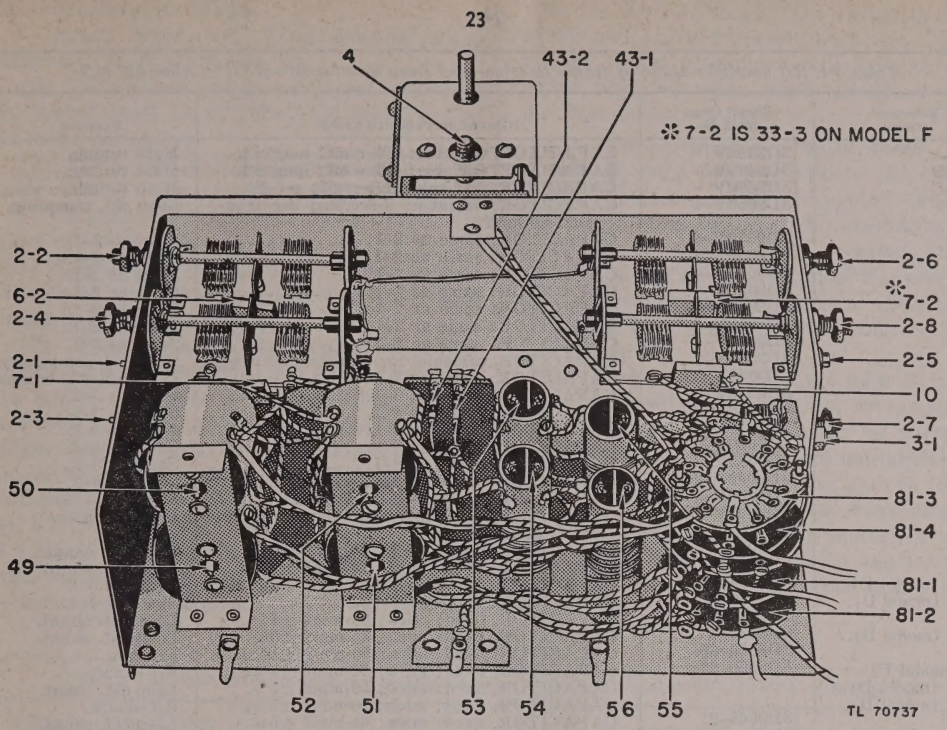


Figure 9. Antenna coil assembly, Radio Receiver and Loop Rotator BC–470–(*).

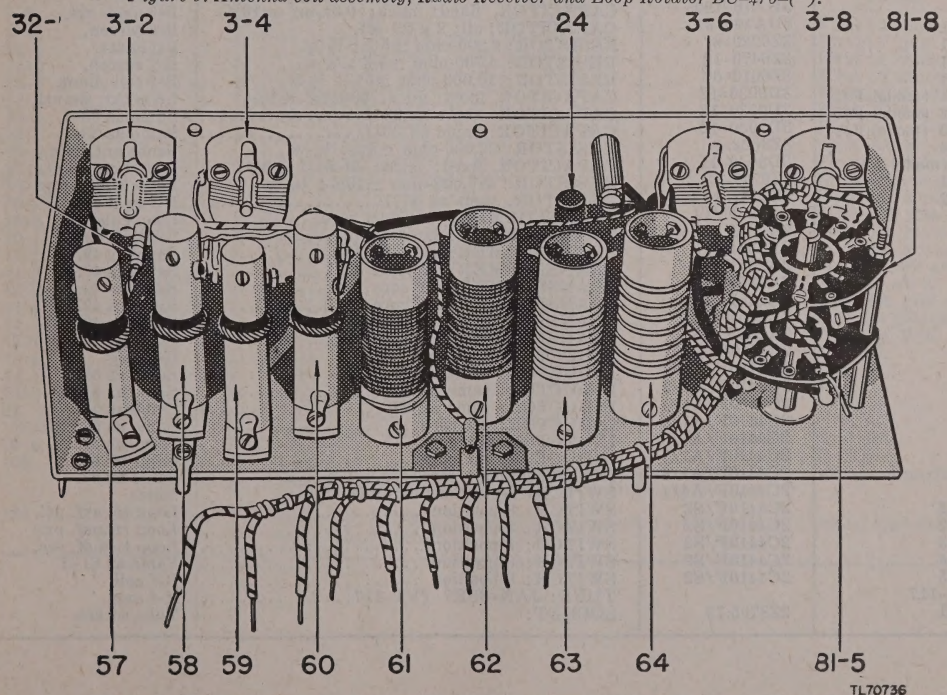


Figure 10. Radio-frequency coil assembly, Radio Receiver and Loop Rotator BC–470–(*).

Table VI. R-f amplifier stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 11.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
1–A	3D9492V	CAPACITOR, variable: 492-mmf; loop ckt.	Main tuning.
1–B	3D9492V	CAPACITOR, variable: 492-mmf; loop ckt.	Main tuning.
1–C	3D9492V	CAPACITOR, variable: 175-mmf; r-f ckt.	Main tuning.
2–1	3D9050V–4	CAPACITOR, variable: 2-section; air trimmer; 50-mmf.	Loop ckt. trimming.
2–2	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
2–3	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
2–4	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
2–5	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
2–6	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
2–7	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
2–8	3D9050V–4	CAPACITOR: same as 2–1	Same as 2–1.
3–1	3D9050V–3	CAPACITOR, variable: air trimmer; 50-mmf.	R-f grid compensator.
3–2	3D9050V–3	CAPACITOR: same as 3–1	R-f plate ckt. trimmer.
3–3	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
3–4	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
3–5	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
3–6	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
3–7	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
3–8	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
3–9	3D9050V–3	CAPACITOR: same as 3–1	Same as 3–2.
4	3D9025V–18	CAPACITOR, variable: air trimmer; 25-mmf; dual stator.	Loop balancer.
6–1	3D9020–9	CAPACITOR, fixed: mica; 20-mmf ±5%.	Loop ckt. shunt.
6–2	3D9020–9	CAPACITOR, fixed: mica; 20-mmf ±5%.	Loop ckt. shunt.
6–3 (model D).	3D9020–9	CAPACITOR: same as 6–1	Same as 6–1.
6–4 (model D).	3D9020–9	CAPACITOR: same as 6–1	Same as 6–1.
7–1	3D9035–4	CAPACITOR, fixed: mica; 35-mmf ±5%.	Loop ckt. shunt.
7–2 (model D).	3D9035–4	CAPACITOR, fixed: mica; 35-mmf ±5%.	Loop ckt. shunt.
8–1	3D9050–66	CAPACITOR, fixed: mica; 50-mmf ±10%.	R-f cplg.
9 (model F).	3D9050–67	CAPACITOR, fixed: mica; 50-mmf ±5%.	R-f shunt.
9–1 (model D).		CAPACITOR, fixed: mica; 50-mmf ±5%.	Loop ckt. shunt.
9–2 (model D).		CAPACITOR, fixed: mica; 50-mmf ±5%.	R-f shunt.
10	3D9065–2	CAPACITOR, fixed: mica; 65-mmf ±5%.	Loop ckt. shunt.
18	3DA1–83	CAPACITOR, fixed: mica; 0.001-mf ±10%.	Sense ant.
24	3DA10–129	CAPACITOR, fixed: mica; 0.01-mf ±10%.	R-f plate ckt.
26–1	3DA100–91	CAPACITOR: oil; 2 x 0.1-mf.	R-f screen.
29–1	3Z6220–6	RESISTOR: 2,200-ohm ±5%; ½-w.	R-f plate.
31–1	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	R-f screen.
32–1	3Z6610–67	RESISTOR: 10,000-ohm ±5%; ½-w.	R-f coil shunt.
33–1 (model F).	3D9030–12	CAPACITOR, fixed: mica; 30-mmf ±1%.	Loop ckt. shunt.
33–2 (model F).	3D9030–12	CAPACITOR: same as 33–1	Same as 33–1.
33–3 (model F).	3D9030–12	CAPACITOR: same as 33–1	Same as 33–1.
35–4	3Z6622–9	RESISTOR: 22,000-ohm ±5%; ½-w.	Sense ant. cplg.
38 (model F).	3D9040–11	CAPACITOR, fixed: mica; 40-mmf ±5%.	Loop ckt. shunt.
43–1	3Z6747–13	RESISTOR: 470,000-ohm ±10%; ½-w.	Loop center tap.
43–2	3Z6747–13	RESISTOR: same as 43–1	R-f grid ckt.
49	2A235F/T1	TRANSFORMER: iron dust core.	Loop cplg.
50	2A235F/T2	TRANSFORMER: same as 49	Same as 49.
51	2A235F/T3	TRANSFORMER: same as 49	Same as 49.
52	2A235F/T4	TRANSFORMER: same as 49	Same as 49.
53	2A235F/T5	TRANSFORMER: air core	Same as 49.
54	2A235F/T6	TRANSFORMER: air core	Same as 49.
55	2A235F/T7	TRANSFORMER: air core	Same as 49.
56	2A235F/T8	TRANSFORMER: air core	Same as 49.
57	2C4410F/A1/1	INDUCTOR: iron dust core.	R-f cplg.
58	2C4410F/A1/2	INDUCTOR: same as 57	Same as 57.
59	2C4410F/A1/3	INDUCTOR: same as 57	Same as 57.
60	2C4410F/A1/4	INDUCTOR: same as 57	Same as 57.
61	2C4410F/A1/5	INDUCTOR: air core	Same as 57.
62	2C4410F/A1/6	INDUCTOR: air core	Same as 57.
63	2C4410F/A1/7	INDUCTOR: air core	Same as 57.
64	2C4410F/A1/8	INDUCTOR: air core	Same as 57.
80	2C4410F/A4/1	SWITCH: 2-position; ceramic.	Sense.
81–1	2C4410F/S2	SWITCH: 8-position	Loop transf. pri.
81–2	2C4410F/S2	SWITCH: 8-position	Loop transf. pri.
81–3	2C4410F/S2	SWITCH: 8-position	Loop transf. sec.
81–4	2C4410F/S2	SWITCH: 8-position	Same as 81–3.
81–5	2C4410F/S2	SWITCH: 8-position	R-f coil.
VT–117		TUBE: JAN–6SK7 (VT–117)	R-f amp.
90–1	2Z8795.73	SOCKET:	Tube socket.

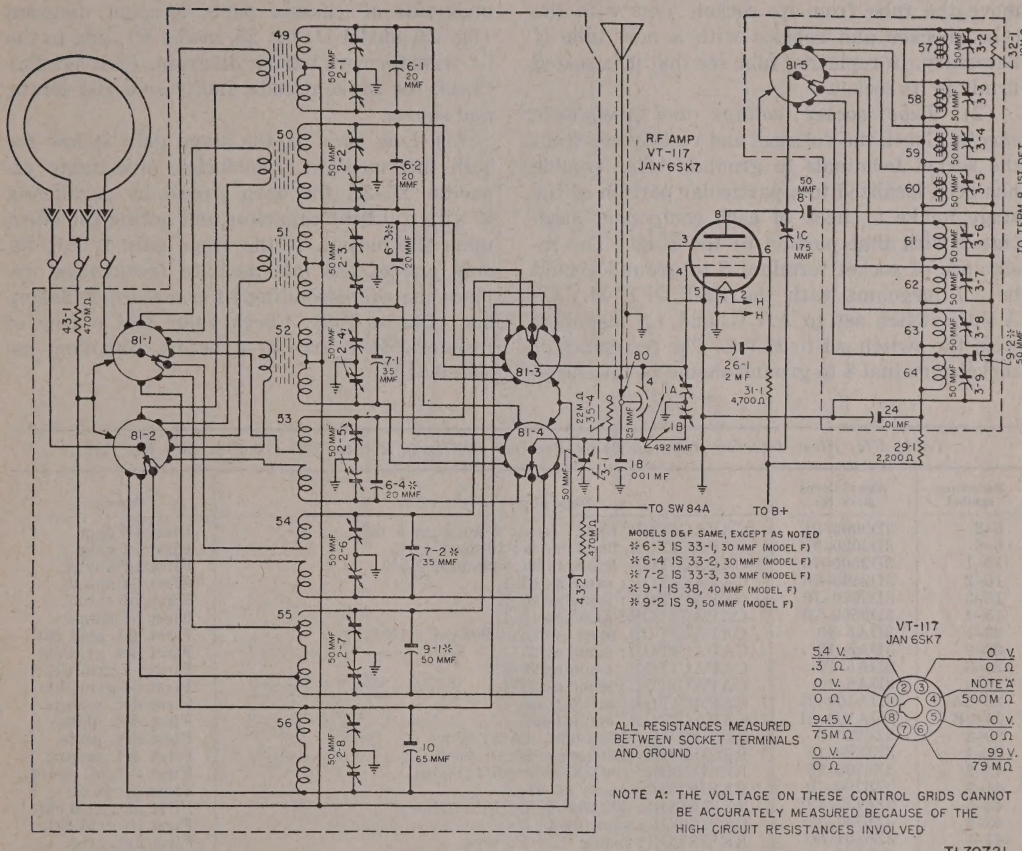


Figure 11. Radio-frequency stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

32. First Detector Stage

a. STAGE DATA. (1) First detector stage schematic shown in figure 12.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6SA7, shown on stage schematic.

(3) Parts data for the first detector stage, table VII.

b. TROUBLE LOCATION. (1) *Tube Check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The resistance of socket terminal 8 to ground should be 3.7 megohms with the SET OFF M.V.C.-A.V.C. switch set to A.V.C. and 1.5 megohms with the switch set to M.V.C. The resistance of socket terminal 3 to ground should be measured with the BAND SELECTOR switch in the 200 to 360 and 11,500 to 18,000 positions. The voltage of socket terminal 8 will have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, to the underside of chassis parts location diagram (fig. 24, model D; fig. 25, model F), and to the i-f transformers wiring diagram. (See fig. 23.) Check for broken leads, faulty soldered joints, and shorts.

(4) *Low gain.* If the stage gain is low for both intermediate frequencies, investigate capacitor 26–2A for open circuit by paralleling it with a 0.1-mf capacitor and noting the effect upon the output. If the stage gain is low for only one of the intermediate frequencies, replace the corresponding i-f transformer assembly (105 or 108). Check value and wiring of resistors 41–2 and 41–3 before removing assembly 105.

Table VII. First detector stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 12.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
5–2	3D9005–21	CAPACITOR, fixed: mica; 5-mmf ±0.5 mf.	First i-f cplg.
6–6	3D9020–9	CAPACITOR, fixed: mica; 20-mmf ±5%.	First i-f cplg.
15–1	3D9500–70	CAPACITOR, fixed: mica; 500-mmf ±5%.	First i-f shunt.
15–2	3D9500–70	CAPACITOR: same as 15–1.	First i-f shunt.
15–3	3D9500–70	CAPACITOR: same as 15–1.	First i-f shunt.
15–4	3D9500–70	CAPACITOR: same as 15–1.	First i-f shunt.
23–1	3DA5–10	CAPACITOR, fixed: mica; 0.005-mf ±10%.	First det. grid ckt
23–2	3DA5–10	CAPACITOR: same as 23–1.	First det. grid ckt
23–3	3DA5–10	CAPACITOR: same as 23–1.	First i-f grid ckt.
23–4	3DA5–10	CAPACITOR: same as 23–1.	First i-f grid ckt.
26–2A	3DA100–91	CAPACITOR: oil; 0.1-mf.	First det. screen.
26–2B	3DA100–91	CAPACITOR: oil; 0.1-mf.	First det. plate.
29–2	3Z6220–6	RESISTOR: 2,200-ohm ±5%; ½-w.	First det. plate.
30–1	3Z6330–10	RESISTOR: 3,300-ohm ±5%; ½-w.	First det. screen.
41–2	3Z6700–70	RESISTOR: 100,000-ohm ±5%; ½-w.	First i-f coil shunt.
41–3	3Z6700–70	RESISTOR: same as 41–2.	Same as 41–2.
43–3	3Z6747–13	RESISTOR: 470,000-ohm ±10%; ½-w.	First det. grid ckt.
43–4	3Z6747–13	RESISTOR: same as 43–3.	First i-f grid ckt.
44–1	3Z6801–39	RESISTOR: 1-meg ±10%; ½-w.	First det. grid.
73–1	3C1075	INDUCTOR: adjustable; iron core.	First i-f.
73–2	3C1075	INDUCTOR: same as 73–1.	First i-f.
74–1	3C1075–1	INDUCTOR: adjustable; iron core.	First i-f.
74–2	3C1075–1	INDUCTOR: same as 74–1.	First i-f.
82	2C4410F/S3	SWITCH: 2-position	First i-f.
VT–150		TUBE: JAN–6SA7(VT–150)	First det.
90–2	2Z8795.73	SOCKET:	First det.
105	2Z9937–4	FIRST I-F ASSEMBLY: includes capacitors 6–6, 15–1, and 15–2; resistors 41–2 and 41–3; inductors 73–1 and 73–2.	147.5-kc transformer.
108	2Z9937–6	FIRST I-F ASSEMBLY: includes capacitors 5–2, 15–3, and 15–4; inductors 74–1 and 74–2.	805-kc transformer.

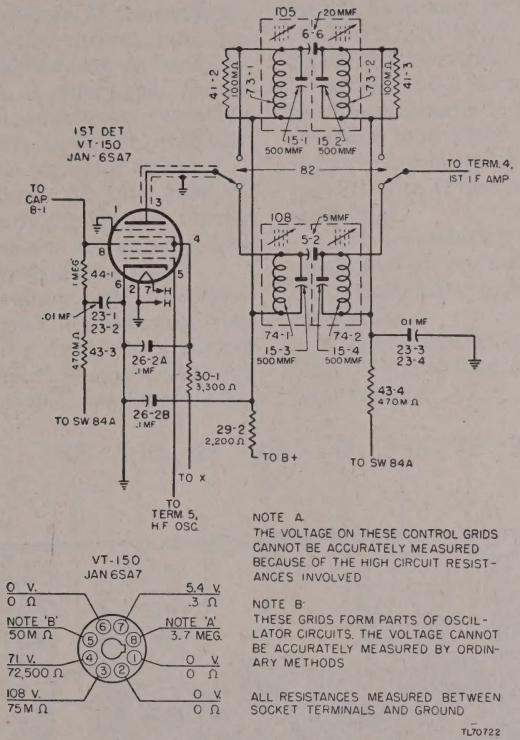


Figure 12. First detector stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

33. High-frequency Oscillator Stage

a. STAGE DATA. (1) H-f oscillator stage schematic shown in figure 14.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6J5, shown on stage schematic.

(3) H-f coil box, figure 13.

(4) Parts data for h-f oscillator stage, table VIII.

b. TROUBLE LOCATION. (1) *Test for oscillation.* Insert a 0- to 1-milliammeter in series with resistor 39–1 and chassis. If the oscillator is operating properly, the current indicated should be at least 0.1 milliampere on band No. 8 and 0.2 milliampere on all other bands. Values lower than these indicate insufficient amplitude of oscillation. In this case, check for continuity and short circuits in the oscillator circuit.

(2) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(3) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The voltage of terminal No. 5 will have an appreciable negative value, when measured with a d-c vacuum-tube voltmeter, if the stage is oscillating. Check the resistance of socket terminal No. 3 to ground with all positions of the BAND SELECTOR switch.

(4) *No oscillation on any band.* Check wiring of capacitor 8–3 for continuity. Check capacitor 8–3 for open or short. Check to see that the resistance from the stator plates of capacitor 1D to ground is infinite with all positions of the FREQUENCY SELECTOR and BAND SELECTOR controls. Check to see that one end of capacitor 25–1 is grounded and that the other end has continuity to terminal No. 3 of the h-f oscillator tube. Check capacitor 25–1 for open circuit by connecting a 0.05-mf capacitor in parallel with it and noting the effect upon the oscillation.

(5) *No oscillation on one band.* Perform a point-to-point continuity check of the wiring to the h-f oscillator coils for the particular band in question.

c. REPLACEMENT OF PARTS. See paragraph 42*a*, for the method of removing the h-f oscillator coil box.

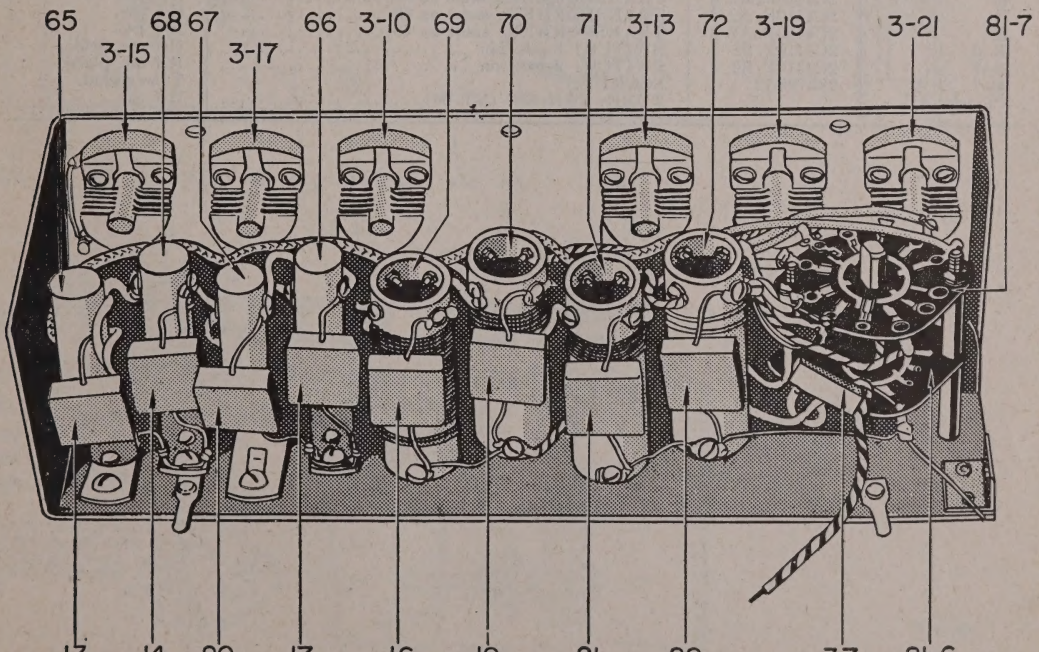


Figure 13. Oscillator coil assembly, Radio Receiver and Loop Rotator BC–470–(*). TL70738

Table VIII. H-f oscillator stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 14)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
1D	3D9492V	CAPACITOR, variable: r-f ckt; 175-mmf.	Main tuning.
3–10	3D9050V–3	CAPACITOR, variable: air trimmer; 50-mmf.	Osc. series trimmer.
3–11	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–10.
3–12	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–10.
3–13	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–10.
3–14	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–10.
3–15	3D9050V–3	CAPACITOR: same as 3–10	Osc. shunt trimmer.
3–16	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
3–17	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
3–18	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
3–19	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
3–20	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
3–21	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
3–22	3D9050V–3	CAPACITOR: same as 3–10	Same as 3–15.
6–5 (model D).		CAPACITOR, fixed: mica; 20-mmf ±5%.	Osc. ckt. shunt.
7–2 (model F).	3D9035–4	CAPACITOR, fixed: mica; 35-mmf ±5%.	H-f osc. shunt.
8–3	3D9050–66	CAPACITOR, fixed: mica; 50-mmf ±10%.	H-f osc. grid.
13	3D9375–1	CAPACITOR, fixed: mica; 375-mmf ±2%.	H-f osc. series.
14 (model F).	3D9400–17	CAPACITOR, fixed: mica; 400-mmf ±2%.	H-f osc. series.
14 (model D).		CAPACITOR, fixed: mica; 410-mmf ±2%.	H-f osc. series.
16	3D9540	CAPACITOR, fixed: mica; 540-mmf ±2%.	H-f osc. series.
17	3D9575	CAPACITOR, fixed: mica; 575-mmf ±2%.	H-f osc. series.
19	3DA1.030	CAPACITOR, fixed: mica; 1,030-mmf ±2%.	H-f osc. series.
20	3DA1.065	CAPACITOR, fixed: mica; 1,065-mmf ±2%.	H-f osc. series.
21	3DA1.800	CAPACITOR, fixed: mica; 1,800-mmf ±2%.	H-f osc. series.
22	3DA1.690	CAPACITOR, fixed: mica; 1,690-mmf ±2%.	H-f osc. series.
25–1	3DA50–23	CAPACITOR: oil; 0.05-mf	H-f osc. plate ckt.
31–3	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	H-f osc. plate.
37	3D9350–6	CAPACITOR, fixed: mica; 350-mmf ±2%.	H-f osc. series.
39–1	3Z6647–10	RESISTOR: 47,000-ohm ±5%; ½-w.	H-f osc. grid.
65	2C4410F/A2/1	TRANSFORMER: iron dust core.	H-f osc.
66	2C4410F/A2/2	TRANSFORMER: same as 66	H-f osc.
67	2C4410F/A2/3	TRANSFORMER: same as 66	H-f osc.
68	2C4410F/A2/4	TRANSFORMER: same as 66	H-f osc.
69	2C4410F/A2/5	TRANSFORMER: air core	H-f osc.
70	2C4410F/A2/6	TRANSFORMER: same as 69	H-f osc.
71	2C4410F/A2/7	TRANSFORMER: same as 69	H-f osc.
72	2C4410F/A2/8	TRANSFORMER: same as 69	H-f osc.
81–6	2C4410F/S2	SWITCH: 8-position	H-f osc. grid.
81–7	2C4410F/S2	SWITCH: 8-position	H-f osc. plate.
90–7	2Z8795.73	SOCKET:	Tube socket.
VT–94		TUBE: JAN–6J5 (VT–94)	H-f osc.

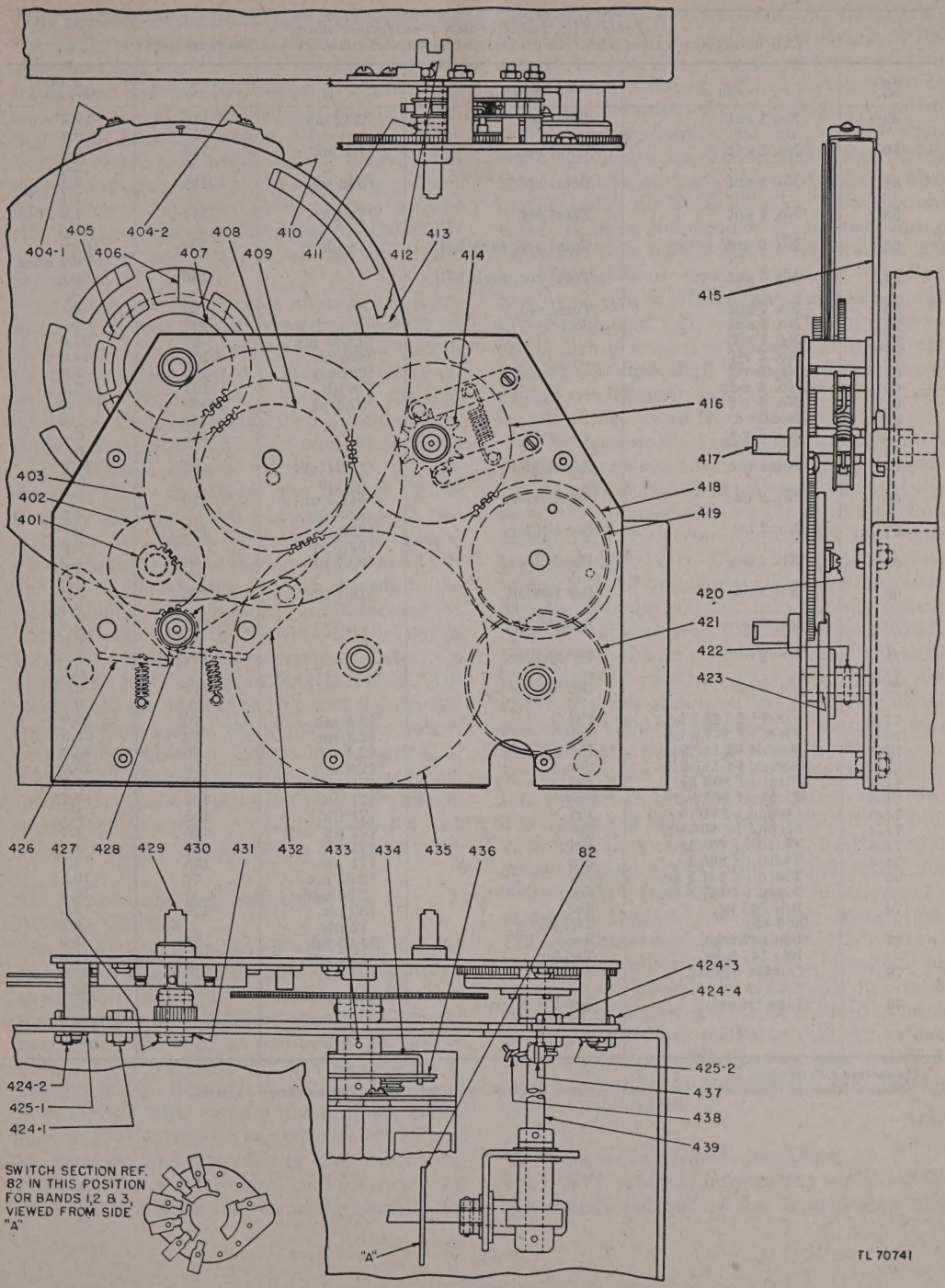


Figure 22. Dial and mask assembly, Radio Receiver and Loop Rotator BC–470–(*).

Table XVI. Inductor and transformer data.
(All inductance values under 10 μh omitted because of inaccuracy of measurement)

Ref. No.	Coil	Winding	L	Q ±20%	R DC (See note)
49	No. 1 ant	Total sec	*2.32 mh	113	19.5
					9.0
50	No. 2 ant	Total sec	*1.1 mh	195	4.0
					2.0
51	No. 3 ant	Total sec	*302 μh	195	2.3
					1.1
52	No. 4 ant	Total sec	*77 μh	174	1.0
					0.5
53	No. 5 ant	Total sec, each half	*18 μh	124	Open
					0.2 ohm
54	No. 6 ant	Total sec, each half		150	Open
					0.
55	No. 7 ant	Total sec		160	0.
56	No. 8 ant	Sec.		107	0.
57	No. 1 r-f		*3.888 mh	80	27.0
58	No. 2 r-f		*825 μh	102	14.0
59	No. 3 r-f		*291 μh	125	3.2
60	No. 4 r-f		*78 μh	104	1.8
61	No. 5 r-f		*27.5 μh	130	.8
62	No. 6 r-f			157	.2
63	No. 7 r-f			163	0.
64	No. 8 r-f			117	0.
65	No. 1 osc	Sec tickler.	*1.394 mh	92	17.0
			93 mh		3.3
66	No. 2 osc	Sec tickler.	*549.5 μh	110	9.0
			82.3 μh		3.2
67	No. 3 osc	Sec tickler.	*200 μh	102	2.7
			53.7 μh		0.6
68	No. 4 osc	Sec tickler.	*39.7 μh	54	4.0
					0.3
69	No. 5 osc	Sec tickler.	*18.7 μh	126	0.6
					1.3
70	No. 6 osc	Sec tickler.		150	0.
					0.8
71	No. 7 osc	Sec tickler.		157	0.
					0.1
72	No. 8 osc	Sec tickler.		116	0.
					0.
73–1	First i-f 147.5 kc.	Pri	†2.4 mh	70	25.0
73–2	First i-f 147.5 kc.	Sec	†2.4 mh	70	25.0
73–3	Second i-f 147.5 kc.	Pri	†2.4 mh	70	25.0
73–4	Second i-f 147.5 kc.	Sec	†2.4 mh	70	25.0
74–1	First i-f 805 kc.	Pri	†71 μh	135	1.7
74–2	First i-f 805 kc.	Sec	†71 μh	135	1.7
74–3	Second i-f 805 kc.	Pri	†71 μh	135	1.7
74–4	Second i-f 805 kc.	Sec	†71 μh	135	1.7
74–5	Third i-f 805 kc.	Pri	†71 μh	135	1.7
74–6	Third i-f 805 kc.	Sec	†71 μh	135	1.7
75	Third i-f 147.5 kc.	Pri	†2.67 mh	70	10.5
	Third i-f 147.5 kc.	Sec	2.30 mh		10.5
76	Bfo 805 kc.	Sec	†35 μh	135	1.0
	805 bfo	Tickler	12 μh		0.5
77	Bfo 147.5 kc.	Sec	†1.65 mh	70	5.0
	Bfo 147.5 kc.	Tickler	1.97 μh		19.0
78	Output transf.	Sec Pri			650.0
					770.0
79	Line transf.	Sec Pri Micro			38.0
					410.0
					19.0

*Tolerance ±10 percent.
†Nominal value, to be aligned by iron slug. Resistance tolerance ±0.5 ohm or 10 percent, whichever is greater.

TOR shaft in r-f coil box. Lift that section of the shaft free of the ring. Turn the unit on its end. Mark and trace all wires coming out of the r-f coil box through the bottom of chassis and unsolder them at their terminals. Mark the terminals for easy reassembly. Remove two nuts holding screw lugs which extend through the chassis and are welded to the side of the r-f coil box. Remove nut from screw holding ground clip just behind socket for Tube VT–150. Turn unit upright and lift r-f coil box from the chassis.

b. REPLACEMENT. Replace all defective parts in the r-f coil box, removing good elements from faulty part and resoldering them to new part in the proper locations. If it is necessary to adjust an inductor, do not turn the screw on the iron core more than one-eighth turn. Clean and remove excess solder from all unsoldered wires and terminals. Replace r-f coil box into the chassis after threading the proper wires through the holes in the chassis. Fasten two nuts on screw lugs in the bottom of the chassis. Fasten four screws on the top of the r-f coil box and one on the left side. Tighten the nut on the screw holding the ground clip behind socket for Tube VT–150. Resolder all wires leading out of r-f coil box to their proper terminals. Lower the end of the shaft section of BAND SELECTOR switch into the slot in the ring and tighten setscrew in ring against the shaft. Replace output transformer with four screws in the bottom of the chassis. Resolder wires to the proper transformer terminals. Replace the oscillator coil box as outlined in paragraph 42*b*. Replace the loop circuit assembly as outlined in paragraph 41*b*.

44. Removal and Replacement of Antenna Coil Box

a. REMOVAL. Turn BALANCE knob to +15 and loosen two setscrews just behind panel on knob shaft attached to coupling in front of series switch and balancer assembly. Remove loop circuit assembly as outlined in paragraph 41*a*. Remove oscillator coil box as outlined in paragraph 42*a*. Remove r-f coil box as outlined in paragraph 43*a*. Remove line coupling transformer (79) located on the left side of the unit by marking and unsoldering the wires connected to its six terminals and by removing four screws holding the can to the chassis. Remove two screws on the left side and one on the right side of the antenna coil box. Turn the unit on its end. Trace, mark, and unsolder all wires leaving antenna coil box and mark their terminals. Remove two nuts from screws which extend through chassis, and which hold the antenna coil box to the chassis. Remove nut from screw holding ground clip to chassis located behind socket for Tube VT–117. Turn unit upright. Remove connections to ganged tuning capacitor. Turn BAND SELECTOR knob to 200 to 360 position. Loosen setscrew on ring holding section of shaft in antenna coil box and lift shaft out of ring slot. Pull top of antenna coil box away from front panel so as to separate BALANCE knob shaft from coupling to sense switch and balancer assembly, and then lift antenna coil box away from the chassis.

b. REPLACEMENT. Replace all defective parts in the antenna coil box, removing good elements from faulty part and resoldering them to new part. If it is necessary to adjust an inductor, do not turn the screw on the iron core more than one-eighth turn. Clean and remove excess solder from all unsoldered wires and terminals. Replace antenna coil box into chassis, placing ring of coupling over BALANCE knob shaft. Fasten two nuts on screw lugs in the bottom of the chassis, fasten two screws on the left side and fasten one screen on the right side of the coil box. Tighten setscrew in coupling ring against BALANCE knob shaft. Lower the end of shaft section of BAND SELECTOR switch into the slot in the ring and tighten setscrews in ring against shaft. Turn BAND SELECTOR knob to 6,500 to 11,500 position. Fasten nut on screw holding ground clip behind socket for Tube VT–117. Resolder all wires to their proper terminals. Replace line coupling transformer (79) on the chassis by fastening four screws holding the can to the chassis. Resolder all wires to the proper terminals of the transformer. Replace r-f coil box as outlined in paragraph 43*b*. Replace oscillator coil box as outlined in paragraph 42*b*. Replace loop circuit assembly as outlined in paragraph 41*b*. Replace vertical patch plate.

45. Inductor and Transformer Data

Table XVI, contains information useful for the adjustment and test of the components listed.

SECTION IX

SUPPLEMENTARY DATA

41. Removal and Replacement of Loop Circuit Assembly

a. REMOVAL. Unsolder red-white lead (which passes through tubing of loop circuit assembly) from terminal in sense switch and balancer assembly. Unsolder and remove three leads (which come from antenna coil box) from the terminals of the ring collector brushes. Remove three screws holding loop circuit assembly to antenna coil box and remove loop circuit assembly.

b. REPLACEMENT. Replace defective part in loop circuit assembly. Clean solder off unsoldered wires and terminals. Insert metal tube of loop circuit assembly into its recess in the sense switch and balancer assembly and fasten loop circuit assembly to the antenna coil box by three screws. Resolder three wires to proper terminals of three collector ring brushes and the red-white lead to its terminal in the sense switch and balancer assembly.

42. Removal and Replacement of High-frequency Oscillator Coil Box

a. REMOVAL. Remove Tubes VT–117, VT–150, VT–94, and VT–103 on right side of chassis (as viewed from the panel). Remove five screws holding vertical patch plate located on the right side of chassis behind removed tubes. Remove patch plate. Turn BAND SELECTOR switch to 6,500 to 11,500 position. The setscrew on shaft ring assembly in oscillator coil box is now accessible. (See fig. 22.) Loosen setscrew with an Allen wrench. Lift that portion of the shaft in the oscillator coil box from its shaft ring. Remove three screws on top of oscillator coil box and one on left side near socket for Tube VT–103. Turn the unit on its end and from the bottom of the chassis, remove two nuts holding screw lugs which extend through the chassis and are welded to the side of the oscillator coil box. Trace, mark, and unsolder all wires which lead out of the oscillator coil box assembly from their terminals below the chassis. Loosen nut from screw holding ground clip just behind tube socket for Tube VT–94. Turn unit upright and lift out oscillator coil box.

b. REPLACEMENT. Replace all defective parts in the oscillator coil box, removing all good elements from the faulty part and soldering them to the new part in the proper locations. If it is necessary to adjust an inductor, do not turn the screw on the iron core more than one-eighth turn. Clean and remove excess solder from all unsoldered wires and terminals. Replace oscillator coil box into the chassis after threading the proper wires through holes in the chassis. Fasten two nuts to screw lugs in the bottom of the chassis; fasten three screws to the top of the coil box, one on the side near socket for Tube VT–103, and fasten nut on screw holding ground clip behind socket for Tube VT–99. Lower the end of shaft section of BAND SELECTOR switch into the slot in the ring and tighten setscrew in ring against the shaft. Resolder terminals of all wires leading out of oscillator coil box to their proper terminals. Replace vertical patch plate with five screws and replace Tubes VT–117, VT–150, VT–94, and VT–103.

43. Removal and Replacement of Radio-frequency Coil Box

a. REMOVAL. Remove oscillator coil box as outlined in paragraph 42*a*. Remove loop circuit assembly as outlined in paragraph 41*a*. Remove four screws on top of r-f coil box. Remove output transformer on left of chassis next to Tube VT–152 by unsoldering and marking the wires connected to its terminals and by removing the four screws holding the can to the chassis. Remove the transformer (78). Remove the screw on the left side of the r-f coil box located behind the space originally occupied by the output transformer. With an Allen loosen setscrew in shaft ring holding section of BAND SELEC-

40. Power Circuit Stage

a. STAGE DATA. (1) Power circuit stage schematic shown in figure 21.

(2) Voltage and resistance values to ground for terminals of Socket SO–77 shown on stage schematic.

(3) Parts data for power circuit stage, table XV.

b. TROUBLE LOCATION. (1) *Power socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. Make all resistance measurements with the power cable unplugged.

(2) *Point-to-point continuity check.* If the preceding step fails to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the underside of chassis parts location drawing (fig. 24 for model D and fig. 25, model F). Check the switches in all positions. Check for broken leads, faulty soldered joints, and shorts.

Table XV. Power Circuit Stage. (See fig. 21.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
31–2	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	Screen volt. divider.
40–1	3Z6668–8	RESISTOR: 68,000-ohm ±5%; ½-w.	Screen volt. divider.
84–C	2C4410F/S5	SWITCH: toggle; 3-position.	Battery.
85–3	3Z8139	SWITCH: toggle; SPST	Dial lights.
92–1	2Z8777	SOCKET: SO–77	Chassis battery box.
93	3F8200–2	METER: 0 to 8, 0 to 200	A and B volt.
94–1	2Z5927	LAMP: type 44	Dial light.
94–2	2Z5927	LAMP: type 44	Dial light.
94–3	2Z5927	LAMP: type 44	Azimuth.

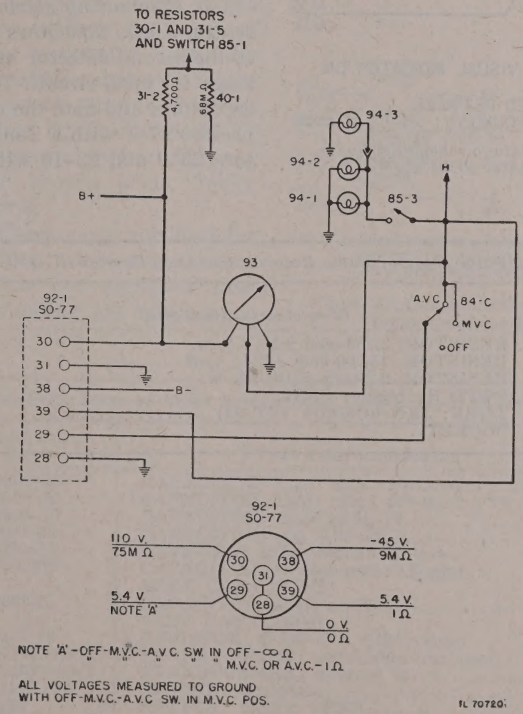


Figure 21. Power supply circuit schematic, Radio Receiver and Loop Rotator BC–470–(*).

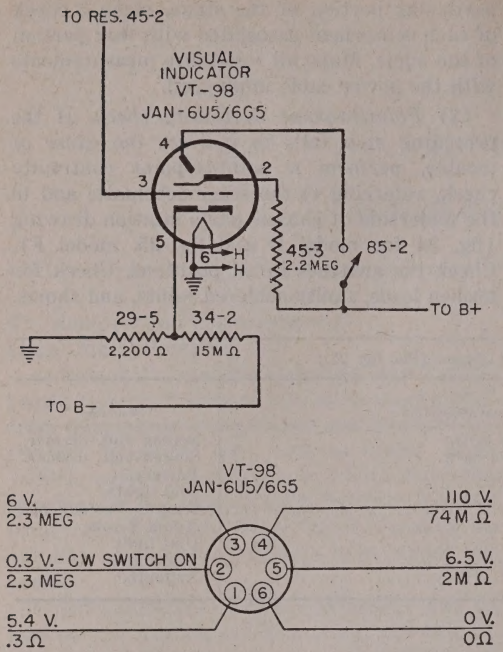


Figure 20. Visual indicator stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

39. Visual Indicator Stage

a. STAGE DATA. (1) Visual indicator stage schematic shown in figure 20.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6U5/6G5 shown on stage schematic.

(3) Parts data for visual indicator stage, table XIV.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket .

(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check. Check for broken leads, faulty soldered joints, and shorts.

(4) *Fluctuating shadow.* If the shadow fluctuates, check capacitors 23–9, 23–10, and 27–1 of the second detector and first audio amplifier stage for open circuit. Test the wiring to these capacitors and note the effect of paralleling capacitor 27–1 with a 2-mf capacitor and capacitors 23–9 and 23–10 with a 0.01-mf capacitor.

Table XIV. Visual indicator stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 20.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
29–5	3Z6220–6	RESISTOR: 2,200-ohm ±5%; ½-w.	Visual ind. cathode.
34–2	3Z6615–37	RESISTOR: 15,000-ohm ±5%; ½-w.	Visual ind. cathode.
45–3	3Z6802A2–8	RESISTOR: 2.2-meg ±10%; ½-w.	Visual ind. plate.
85–2	3Z8139	SWITCH: toggle; SPST	Visual ind.
VT–98		TUBE: JAN–6U5/6G5 (VT–98)	Tuning ind.
91	2Z8797–1	SOCKET:	Tube socket.

38. Continuous-wave Oscillator Stage

a. STAGE DATA. (1) C-W oscillator stage schematic shown in figure 19.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6J5 shown on stage schematic.

(3) Parts data for c-w oscillator stage, table XIII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The resistance of socket terminal 8 should be 20 ohms with the BAND SELECTOR switch in the 200 to 360 position and 1 ohm with this switch in the 11,500 to 18,000 position.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, to the underside of chassis parts location diagram (fig. 24 for model D and fig. 25 for model F) and to the i-f transformers wiring diagram, figure 23. Check for broken leads, faulty soldered joints, and shorts.

(4) *No oscillation.* Check capacitor 25–2 for open circuit by connecting a 0.05-mf capacitor from terminal 3 of the c-w oscillator tube socket to ground and noting the effect upon the oscillation. Check capacitor 12–1 for open circuit by connecting a 250-micromicrofarad (mmf) capacitor across it. Check capacitor 12–1 for short circuit by replacing it with a 250-mmf capacitor. If oscillation fails to occur for only one intermediate frequency, replace assembly III.

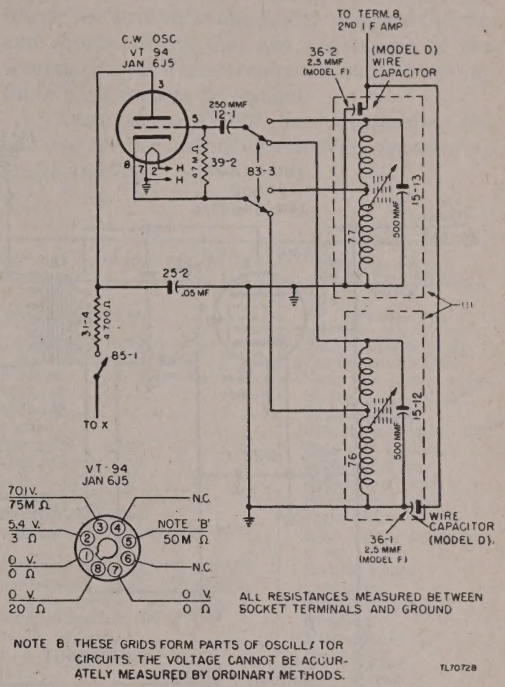


Figure 19. C-w oscillator stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

Table XIII. C-w oscillator stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 19.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
12–1	3D9250–36	CAPACITOR, fixed: mica; 250-mmf ±10%.	C-w osc. grid.
15–12	3D9500–70	CAPACITOR, fixed: mica; 500-mmf ±5%.	Third i-f shunt.
15–13	3D9500–70	CAPACITOR: same as 15–12	C-w osc. shunt.
25–2	3DA50–23	CAPACITOR: oil; 0.05-mf	C-w osc. plate ckt.
31–4	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	C-w osc. plate.
36–1 (model F).	3D9002E5	CAPACITOR: twisted wire; 2.5-mmf.	Bfo shunt.
(model D)		WIRE CAPACITOR:	Bfo shunt.
36–2 (model F).	3D9002E5	CAPACITOR: same as 36–1	Bfo shunt.
(model D)		WIRE CAPACITOR:	Bfo shunt.
39–2	3Z6647–10	RESISTOR: 47,000-ohm ±5%; ½-w.	C-w osc. grid.
76	2C4410F/A3/1	TRANSFORMER: adjustable iron core.	C-w osc.
77	2C4410F/A3/2	TRANSFORMER: same as 76	C-w osc.
83–3	2C4410F/S4	SWITCH: 2-position	C-w osc.
85–1	3Z8139	SWITCH: toggle; SPST	C-w osc.
VT–94		TUBE: JAN–6J5 (VT–94)	C-w osc.
90–8	2Z8795.73	SOCKET:	Tube socket.

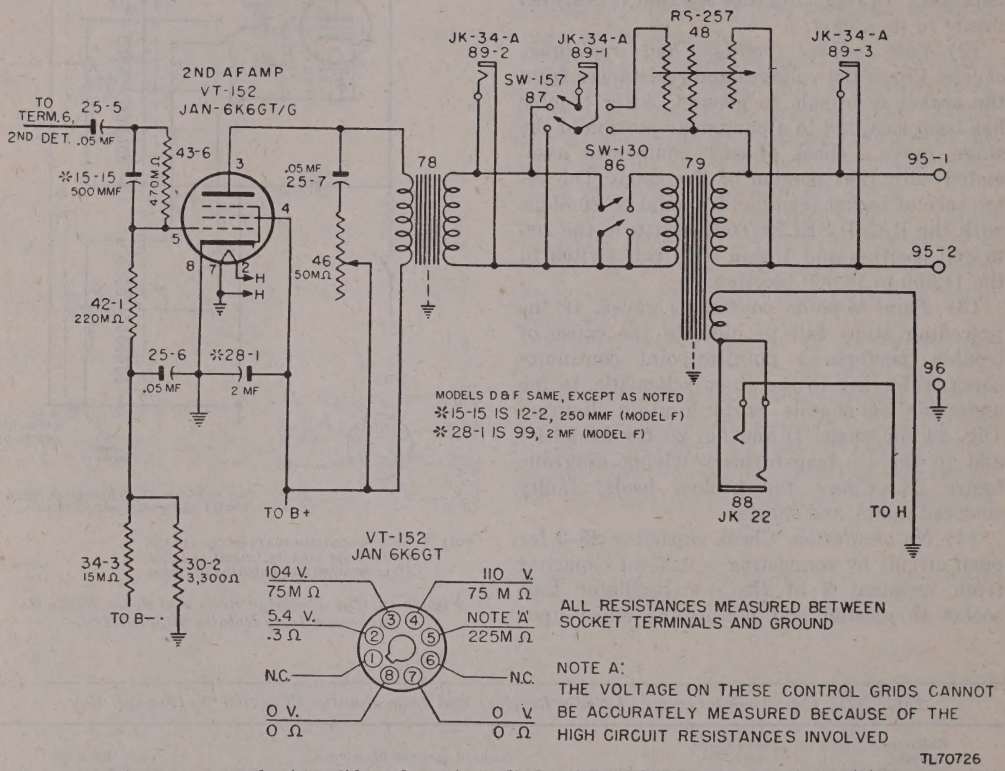


Figure 18. Second a-f amplifier schematic, Radio Receiver and Loop Rotator BC–470–(*).

37. Second Audio-frequency Amplifier Stage

a. STAGE DATA. (1) A-f p-a stage schematic shown in figure 18.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6K6GT/G.

(3) Parts data for a-f p-a stage, table XII.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the underside of chassis parts location diagram (fig. 24 for model D and fig. 25 for model F). Check for broken leads, faulty soldered joints, and shorts. Check that the resistances of the secondaries of transformers 78 and 79 are infinite with respect to ground.

c. REMOVAL OF PARTS. See paragraphs 43*a* and 44*a* for the method of removing transformers 78 and 79.

Table XII. Second a-f amplifier stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 18.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
12–2 (model F).	3D9250–36	CAPACITOR, fixed: mica; 250-mmf ±10%.	Second audio grid.
15–15 (model D).		CAPACITOR, fixed: mica; 500-mmf ±5%.	Second audio grid.
25–5	3DA50–23	CAPACITOR: oil; 0.05-mf	Second a-f grid cplg.
25–6	3DA50–23	CAPACITOR: oil; 0.05-mf	Second a-f grid ckt.
25–7	3DA50–23	CAPACITOR: oil; 0.05-mf	Tone control.
28–1 (model D).		CAPACITOR: oil; 2-mf	Second a-f plate ckt.
30–2	3Z6330–10	RESISTOR: 3,300-ohm ±5%; ½-w.	Second a-f bias.
34–3	3Z6615–37	RESISTOR: 15,000-ohm ±5%; ½-w.	Second a-f bias.
42–1	3Z6722–10	RESISTOR: 220,000-ohm ±5%; ½-w.	Second a-f grid.
43–6	3Z6747–13	RESISTOR: 470,000-ohm ±10%; ½-w.	Second a-f grid.
46	2Z7276.1	RESISTOR: adjustable; 50,000-ohm.	Tone control.
48	3Z7257	RHEOSTAT: adjustable triple, T-pad; (RS–257).	Line signal attenuator.
78	2Z9632.6	TRANSFORMER: laminated iron; (T–45252).	Output cplg.
79	2Z9637	TRANSFORMER: laminated iron; (T–45253).	Line cplg.
86	3Z8130	SWITCH: SW–130; toggle switch, DPST.	Radio on line.
87	3Z8157	SWITCH: SW–157; toggle switch, DPDT.	Headset.
88	2Z5522	JACK: JK–22	Microphone.
89–1	2Z5534A	JACK: JK–34–A	Headset 1.
89–2	2Z5534A	JACK: JK–34–A	Headset 2.
89–3	2Z5534A	JACK: JK–34–A	Line.
VT–152		TUBE: 6K6GT/G (VT–152)	Output.
90–6	2Z8795.73	SOCKET:	Tube socket.
95–1	3Z635–5	BINDING POST: engraved L	Line.
95–2	3Z635–5	BINDING POST: engraved L	Line.
96	3Z635–6	BINDING POST: engraved GND	Ground.
99 (model F).	3DB2.600	CAPACITOR: oil; 2-mf	Audio plate ckt.

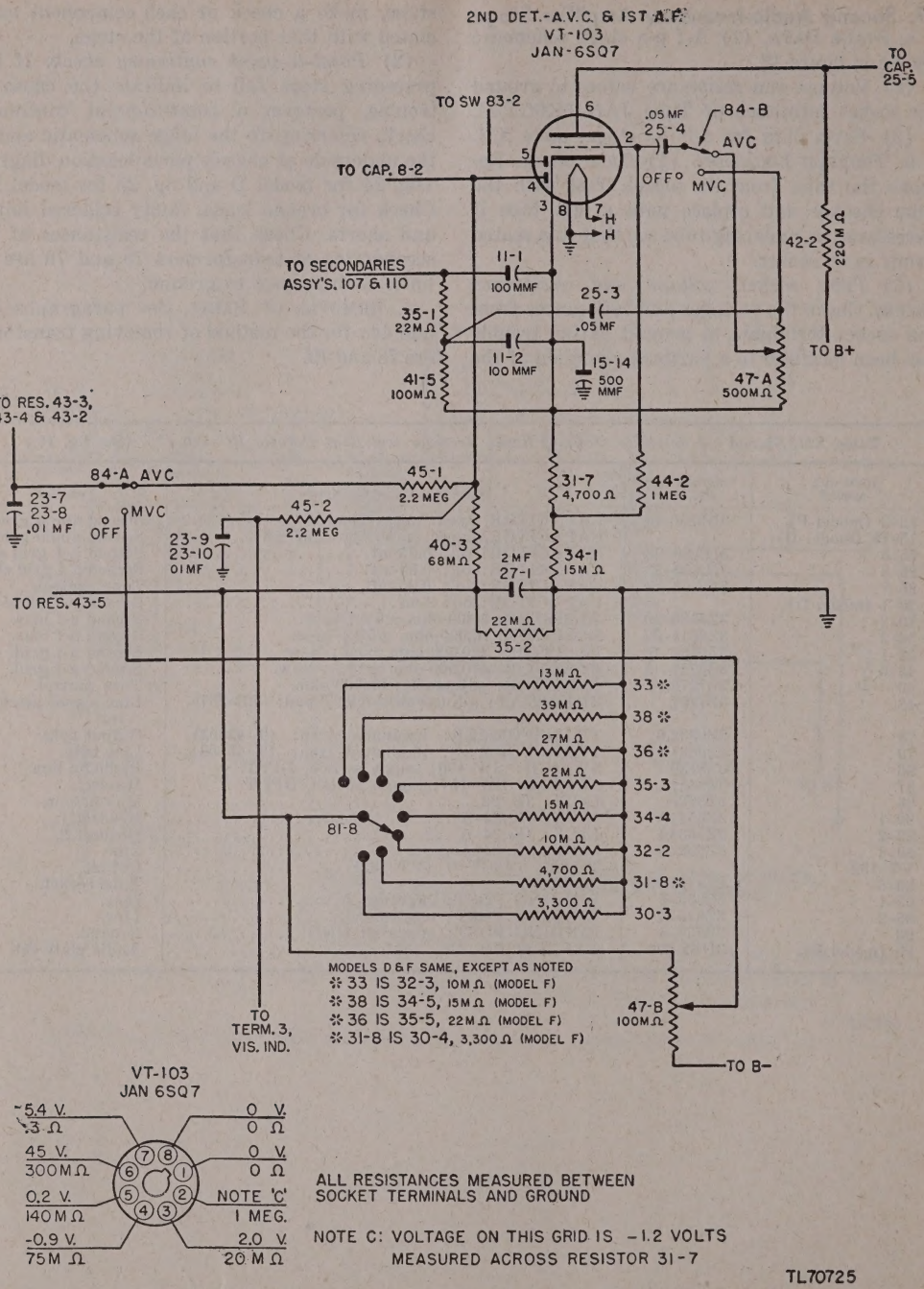


Figure 17. Second detector, a-v-c, and first a-f amplifier stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

36. Second Detector, Automatic-volume-control, and First Audio-Frequency Amplifier Stage

a. STAGE DATA. (1) Second detector and first audio amplifier stage schematic shown in figure 17.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6SQ7 shown on stage schematic.

(3) R-f coil box, figure 10.

(4) Parts data for second detector and first audio-amplifier stage table XI.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The voltages on socket terminals 4 and 5 may vary considerably, depending upon the measuring instrument used and the signal input to the receiver.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic and to the underside of chassis parts location drawing (fig. 24 for model D and fig. 25 for model F). (Switch 81–8 and its associated resistors and located inside the r-f coil box.) Check the resistance from the junction of resistors 40–3 and 35–2 to ground with the BAND SELECTOR switch in all positions. Check for broken leads, faulty soldered joints, and shorts.

(4) *Low gain.* If capacitor 27–1 is disconnected from the circuit, lowered gain will result. Check the connections to this capacitor. If capacitor 15–14 is disconnected from the circuit, lowered stage gain will result when the BAND SELECTOR switch is set for the upper intermediate-frequency.

Table XI.
Second detector, a-v-c, and first a-f amplifier stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 17.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
11–1	3D9100–68	CAPACITOR, fixed: mica; 100-mmf ±10.	Diode filter.
11–2	3D9100–68	CAPACITOR: same as 11–1	Diode filter.
15–14	3D9500–70	CAPACITOR, fixed: mica; 500-mmf ±5%.	First audio cathode.
23–7	3DA5–10	CAPACITOR, fixed: mica; 0.005-mf ±10%.	A-v-c line.
23–8	3DA5–10	CAPACITOR: same as 23–7	A-v-c line.
23–9	3DA5–10	CAPACITOR: same as 23–7	Visual ind. filter.
23–10	3DA5–10	CAPACITOR: same as 23–7	Visual ind. filter.
25–3	3DA50–23	CAPACITOR: oil; 0.05-mf	Volume control cplg.
25–4	3DA50–23	CAPACITOR: oil; 0.05-mf	First a-f grid cplg.
27–1	3DB1.6110	CAPACITOR: oil; 2x1-mf	Bias resistor bypass.
30–3	3Z6330–10	RESISTOR: 3,300-ohm ±5%; ½-w.	Bias adjusting.
30–4 (model F).	3Z6330–10	RESISTOR: same as 30–3	Bias adjusting.
31–7	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	Second det. cathode.
31–8 (model D).		RESISTOR: same as 31–7	Bias adjusting.
32–2	3Z6610–67	RESISTOR: 10,000-ohm ±5%; ½-w.	Bias adjusting.
32–3 (model F).	3Z6610–67	RESISTOR: same as 32–2	Bias adjusting.
33 (model D).		RESISTOR: 13,000-ohm ±5%; ½-w.	Bias adjusting.
34–1	3Z6615–37	RESISTOR: 15,000-ohm ±5%; ½-w.	Second det. cathode.
34–4	3Z6615–37	RESISTOR: same as 34–1	Bias adjusting.
34–5 (model F).	3Z6615–37	RESISTOR: same as 34–1	Bias adjusting.
35–1	3Z6622–9	RESISTOR: 22,000-ohm ±5%; ½-w.	Diode filter.
35–2	3Z6622–9	RESISTOR: same as 35–1	R-f bias.
35–3	3Z6622–9	RESISTOR: same as 35–1	Bias adjusting.
35–5 (model F).	3Z6622–9	RESISTOR: same as 35–1	Bias adjusting.
36 (model D).		RESISTOP 27,000-ohm ±5%; ½-w.	Bias adjusting.
38 (model D).		RESISTOR: 39,000-ohm ±5%; ½-w.	Bias adjusting.
40–3	3Z6668–8	RESISTOR: 68,000-ohm ±5%; ½-w.	A-v-c diode.
41–5	3Z6700–70	RESISTOR: 100,000-ohm ±5%; ½-w.	Audio diode.
42–2	3Z6722–10	RESISTOR: 220,000-ohm ±5%; ½-w.	First a-f plate.
44–2	3Z6801–39	RESISTOR: 1-meg ±10%; ½-w.	First a-f grid.
45–1	3Z6802A2–8	RESISTOR: 2.2-meg ±10%; ½-w.	A-v-c line.
45–2	3Z6802A2–8	RESISTOR: same as 45–1	Visual ind. filter.
47–A	2Z7284–4	RESISTOR: adjustable dual; 500,000-ohm.	Volume control.
47–B	2Z7284–4	RESISTOR: adjustable dual; 100,000-ohm.	Volume control.
81–8	2C4410F/S2	SWITCH: 8-position	Bias adjusting.
84–A	2C4410F/S5	SWITCH: 3-position with toggle.	Off a-v-c, m-v-c bias.
84–B	2C4410F/S5	SWITCH: same as 84–A	First a-f grid.
VT–103		TUBE: JAN–6SQ7 (VT–103)	Second detector, first audio.
90–5	2Z8795.73	SOCKET:	Tube socket.

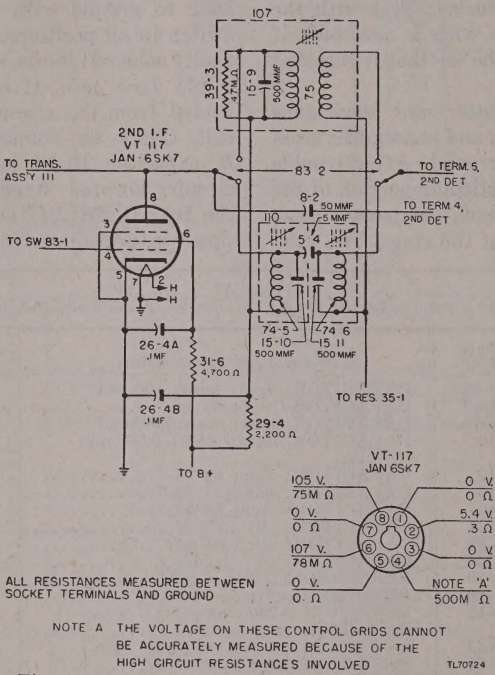


Figure 16. Second intermediate-frequency stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

35. Second Intermediate-frequency Amplifier Stage

a. STAGE DATA. (1) Second i-f amplifier stage schematic shown in figure 16.

(2) Voltage and resistance values to ground for socket terminals of Tube JAN–6SK7 shown on stage schematic.

(3) Parts data for second i-f amplifier stage shown in table X.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube, see that it is seated firmly in its socket.

(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The voltage of terminal 4 may have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, to the underside of chassis parts location drawing (fig. 24 for model D and fig. 25 for model F), and to the i-f transformers wiring diagram. (See fig. 23.) Check the switches in all positions. Check for broken leads, faulty soldered joints, and shorts.

(4) *Low gain.* If the stage gain is low for both intermediate frequencies check capacitor 26–4A for open circuit by noting the effect upon the stage gain when a 0.1-mf capacitor is connected in parallel with capacitor 26–4A. If the stage gain is low for only one of the intermediate frequencies, replace the corresponding i-f transformer assembly (107 or 110). Check capacitor 15–14 and its wiring in the second detector stage before replacing transformer assembly 110.

Table X. Second i-f amplifier stage Radio Receiver and Loop Rotator BC–470–(*). (See fig. 16.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
5–4	3D9005–21	CAPACITOR, fixed: mica; 5-mmf ±0.5-mmf.	Third i-f cplg.
8–2	3D9050–66	CAPACITOR, fixed: mica; 50-mmf ±10%.	Diode cplg.
15–9	3D9500–70	CAPACITOR, fixed: mica; 500-mmf ±5%.	Third i-f shunt.
15–10	3D9500–70	CAPACITOR: same as 15–9	Third i-f shunt.
15–11	3D9500–70	CAPACITOR: same as 15–9	Third i-f shunt.
26–4A	3DA100–91	CAPACITOR: oil; 0.1-mf	Second i-f screen.
26–4B	3DA100–91	CAPACITOR: oil; 0.1-mf	Second i-f plate.
29–4	3Z6220–6	RESISTOR: 2,200-ohm ±5%; ½-w.	Second i-f plate.
31–6	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	Second i-f screen.
39–3	3Z6647–10	RESISTOR: 47,000-ohm ±5%; ½-w.	Third i-f coil shunt.
74–5	3C1075–1	INDUCTOR: adjustable iron core.	Third i-f.
74–6	3C1075–1	INDUCTOR: same as 74–5	Third i-f.
75	2Z9937–5/1	TRANSFORMER: adjustable iron core.	Third i-f.
83–2	2C4410F/S4	SWITCH: 2-position	Third i-f.
VT–117		TUBE: JAN–6SK7 (VT–117)	Second i-f.
90–4	2Z8795.73	SOCKET:	Tube socket.
107	2Z9937–5	THIRD I-F ASSEMBLY: includes capacitor 15–9; resistor 39–3; transformer 75.	147.5-kc transformer.
110	2Z9937–6	THIRD I-F ASSEMBLY: includes 5–4, 15–10, 15–11; 74–5, 74–6.	805-kc transformer.

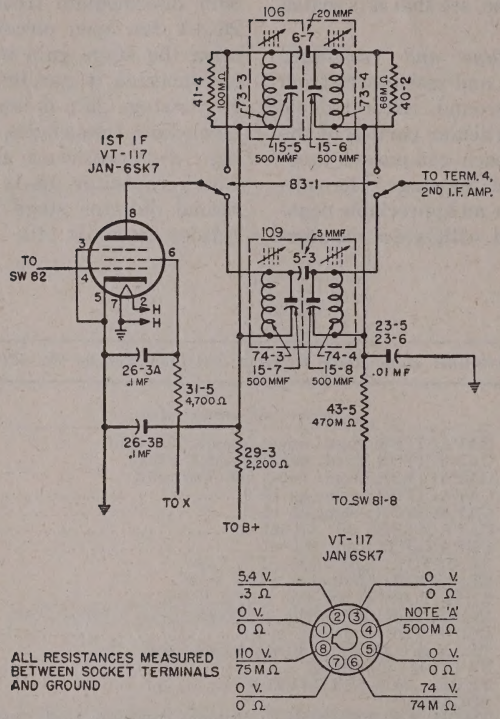


Figure 15. First intermediate-frequency stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

34. First Intermediate-frequency Amplifier Stage

a. STAGE DATA. (1) First intermediate-frequency stage schematic shown in figure 15.

(2) Voltage and resistance values to ground for socket terminals of tube JAN–6SK7, shown on stage schematic.

(3) Parts data for first i-f amplifier stage, table IX.

b. TROUBLE LOCATION. (1) *Tube check.* Remove the tube from its socket. Test with the tube checker and replace with a new tube if necessary. In replacing tube see that it is seated firmly in its socket.

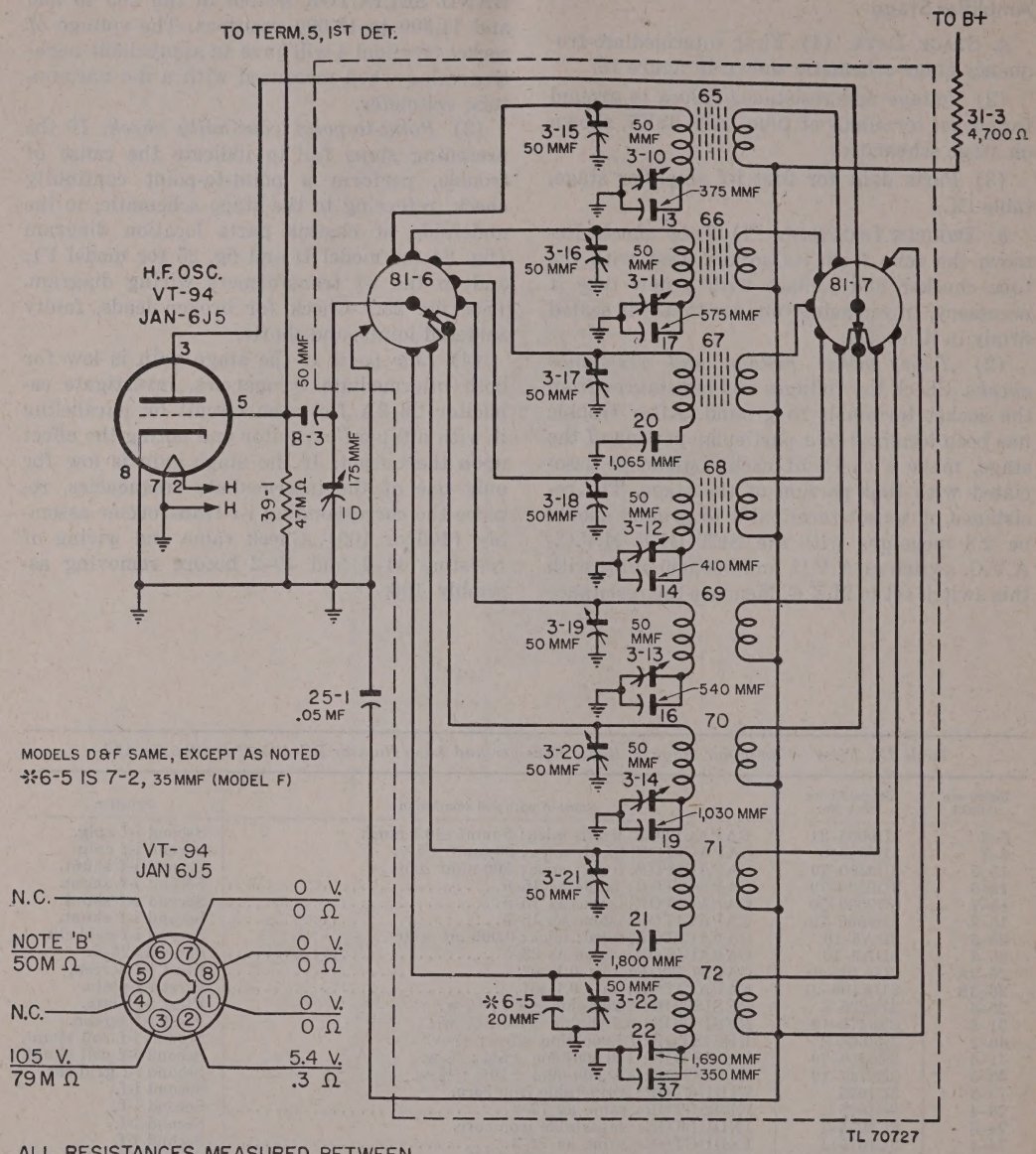
(2) *Tube socket voltage and resistance checks.* Check the voltages and resistances from the socket terminals to ground. After trouble has been localized to a particular portion of the stage, make a check of each component associated with that portion of the stage. The resistance of socket terminal 4 to ground should be 2.8 megohms with the SET OFF M.V.C.-A.V.C. switch at A.V.C. and 500,000 ohms with this switch set to M.V.C. Measure the resistance of socket terminals 4 and 8 to ground with the BAND SELECTOR switch in the 200 to 360 and 11,500 to 18,000 positions. The voltage of socket terminal 4 will have an appreciable negative value when measured with a d-c vacuum-tube voltmeter.

(3) *Point-to-point continuity check.* If the preceding steps fail to indicate the cause of trouble, perform a point-to-point continuity check, referring to the stage schematic, to the underside of chassis parts location diagram (fig. 24 for model D and fig. 25 for model F), and to the i-f transformers wiring diagram. (See fig. 23.) Check for broken leads, faulty soldered joints, and shorts.

(4) *Low gain.* If the stage gain is low for both intermediate frequencies, investigate capacitor 26–3A for open circuit by paralleling it with a 0.1-mf capacitor and noting the effect upon the output. If the stage gain is low for only one of the intermediate frequencies, replace the corresponding i-f transformer assembly (106 or 109). Check value and wiring of resistors 41–4 and 40–2 before removing assembly 106.

Table IX. First i-f amplifier stage of Radio Receiver and Loop Rotator BC–470–(*). (See fig. 15.)

Reference symbol	Signal Corps stock No.	Name of part and description	Function
5–3	3D9005–21	CAPACITOR, fixed: mica; 5-mmf ±0.5 mmf.	Second i-f cplg.
6–7	3D9020–9	CAPACITOR, fixed: mica; 20-mmf ±5%.	Second i-f cplg.
15–5	3D9500–70	CAPACITOR, fixed: mica; 500-mmf ±5%.	Second i-f shunt.
15–6	3D9500–70	CAPACITOR: same as 15–5	Second i-f shunt.
15–7	3D9500–70	CAPACITOR: same as 15–5	Second i-f shunt.
15–8	3D9500–70	CAPACITOR: same as 15–5	Second i-f shunt.
23–5	3DA5–10	CAPACITOR, fixed: mica; 0.005-mf ±10%.	Second i-f grid ckt.
23–6	3DA5–10	CAPACITOR: same as 23–5	Same as 23–5.
26–3A	3DA100–91	CAPACITOR: oil; 0.1 mf	First i-f screen.
26–3B	3DA100–91	CAPACITOR: oil; 0.1 mf	First i-f plate.
29–3	3Z6220–6	RESISTOR: 2,200-ohm ±5%; ½-w.	First i-f plate.
31–5	3Z6470–12	RESISTOR: 4,700-ohm ±5%; ½-w.	First i-f screen.
40–2	3Z6668–8	RESISTOR: 68,000-ohm ±5%; ½-w.	Second i-f coil shunt.
41–4	3Z6700–70	RESISTOR: 100,000-ohm ±5%; ½-w.	Second i-f coil shunt.
43–5	3Z6747–13	RESISTOR: 470,000-ohm ±10%; ½-w.	Second i-f grid ckt.
73–3	3C1075	INDUCTOR: adjustable iron core.	Second i-f.
73–4	3C1075	INDUCTOR: same as 73–3	Second i-f.
74–3	3C1075–1	INDUCTOR: adjustable iron core.	Second i-f.
74–4	3C1075–1	INDUCTOR: same as 74–3	Second i-f.
83–1	2C4410F/S4	SWITCH: 2-position; (22567–H).	Second i-f.
VT–117		TUBE: JAN–6SK7 (VT–117)	First i-f.
90–3	2Z8795.73	SOCKET:	First i-f.
106	2Z9937–4	SECOND I-F ASSEMBLY: includes capacitors 6–7, 15–5, 15–6; resistors 40–2 and 41–4; inductors 73–3 and 73–4.	147.5-kc transformer.
109	2Z9937–6	SECOND I-F ASSEMBLY: includes capacitors 5–3, 15–7, 15–8; inductors 74–3 and 74–4.	805-kc transformer.



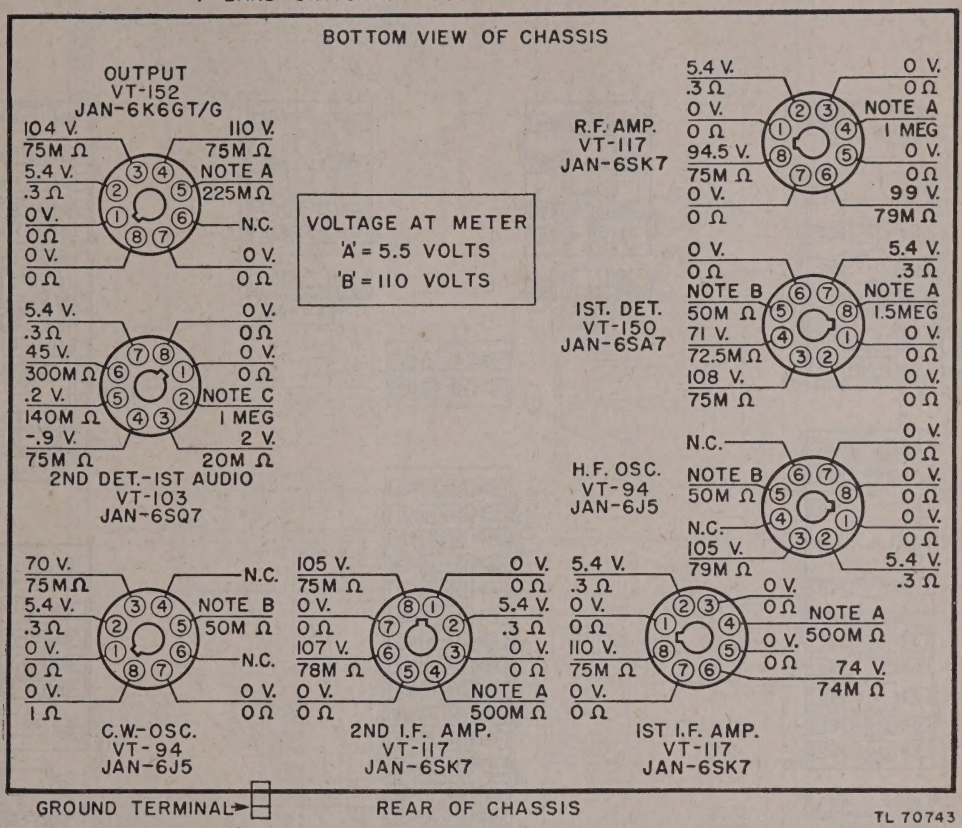
ALL RESISTANCES MEASURED BETWEEN SOCKET TERMINALS AND GROUND

NOTE B: THESE GRIDS FORM PARTS OF OSCILLATOR CIRCUITS. THE VOLTAGE CANNOT BE ACCURATELY MEASURED BY ORDINARY METHODS.

Figure 14. High-frequency oscillator stage schematic, Radio Receiver and Loop Rotator BC–470–(*).

THESE CONDITIONS MUST EXIST WHEN MAKING VOLTAGE AND RESISTANCE MEASUREMENTS:

1 VOLUME CONTROL IN MAXIMUM POSITION
2 OFF—MVC—AVC SWITCH IN MVC POSITION
3 C.W.—OSC. SWITCH IN ON POSITION
4 BAND SWITCH IN 3600 TO 6500KC POSITION



NOTE A: THE VOLTAGE ON THESE CONTROL GRIDS CANNOT BE ACCURATELY MEASURED BECAUSE OF THE HIGH CIRCUIT RESISTANCES INVOLVED.
NOTE B: THESE GRIDS FORM PARTS OF OSCILLATOR CIRCUITS. THE VOLTAGE CANNOT BE ACCURATELY MEASURED BY ORDINARY METHODS.
NOTE C: VOLTAGE ON THIS GRID IS -1.2 VOLTS MEASURED ACROSS RESISTOR 31-7

ALL VOLTAGES ARE D.C.—VOLTAGES AND RESISTANCES ARE MEASURED BETWEEN SOCKET TERMINALS AND GROUND TERMINAL.

Figure 30. Tube socket voltages and resistances, Radio Receiver and Loop Rotator BC-470-(*).

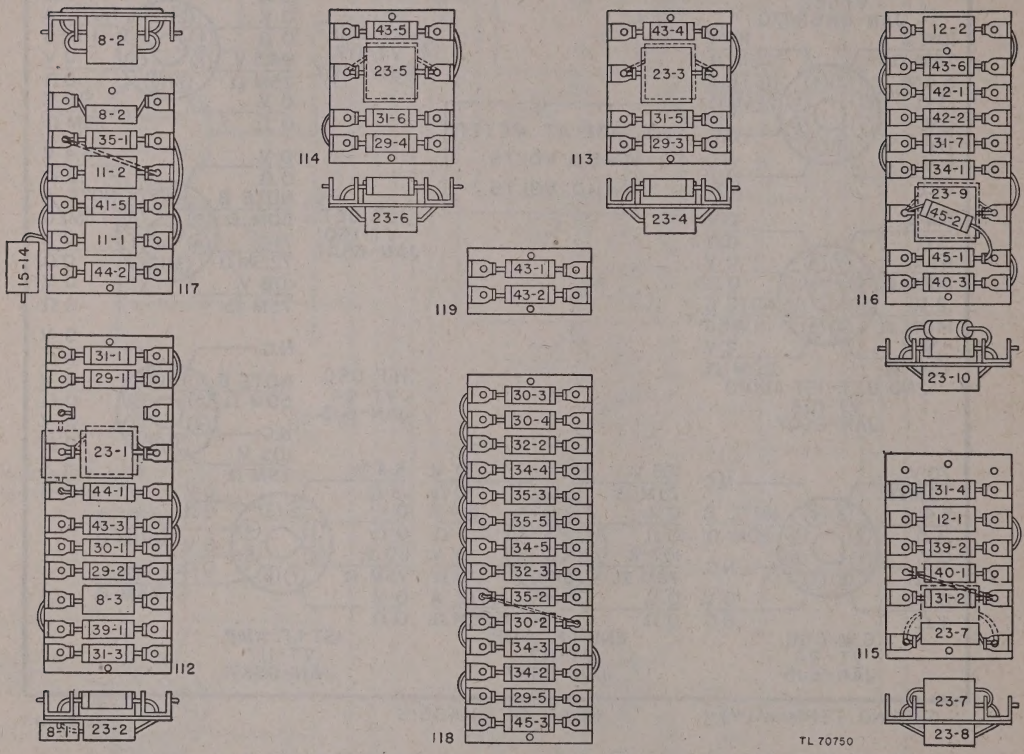


Figure 29. Resistor Boards wiring diagram, Radio Receiver and Loop Rotator BC–470–F.

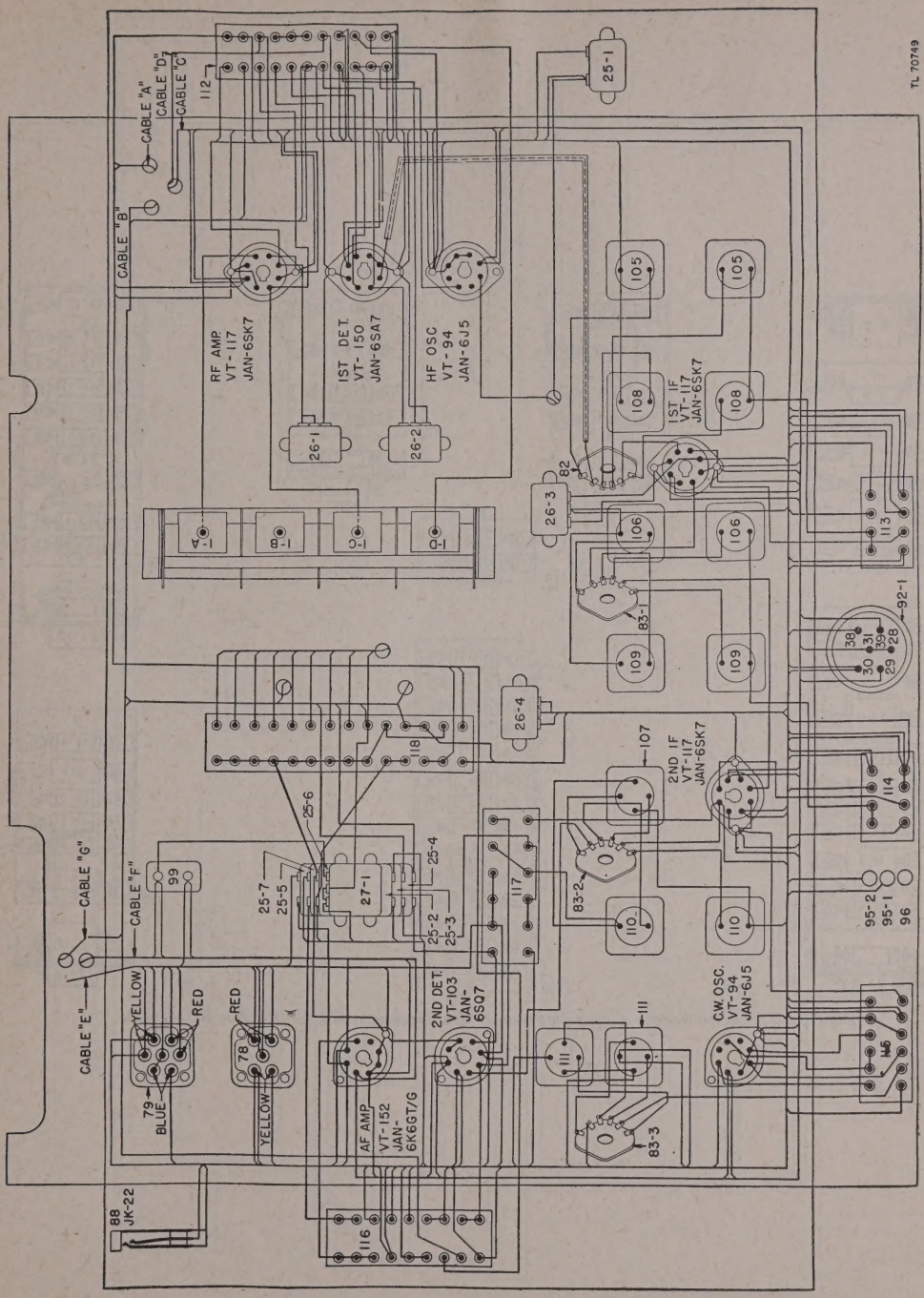


Figure 28. Chassis wiring diagram, Radio Receiver and Loop Rotator BC–470–F.

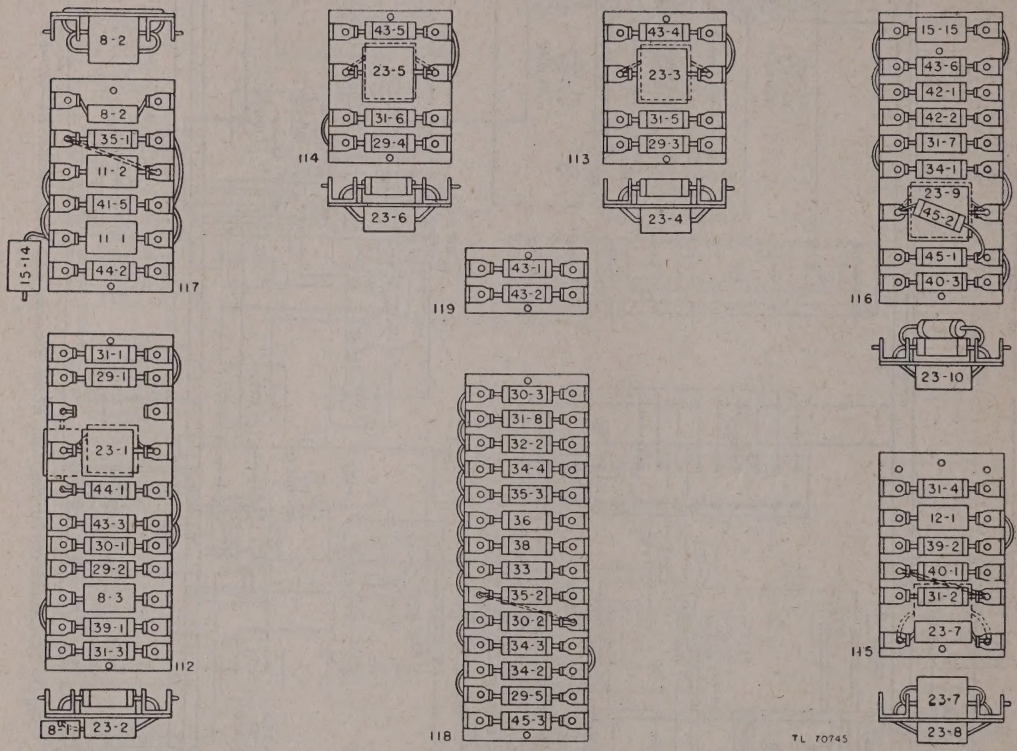


Figure 27. Resistor Boards wiring diagram, Radio Receiver and Loop Rotator BC–470–D.

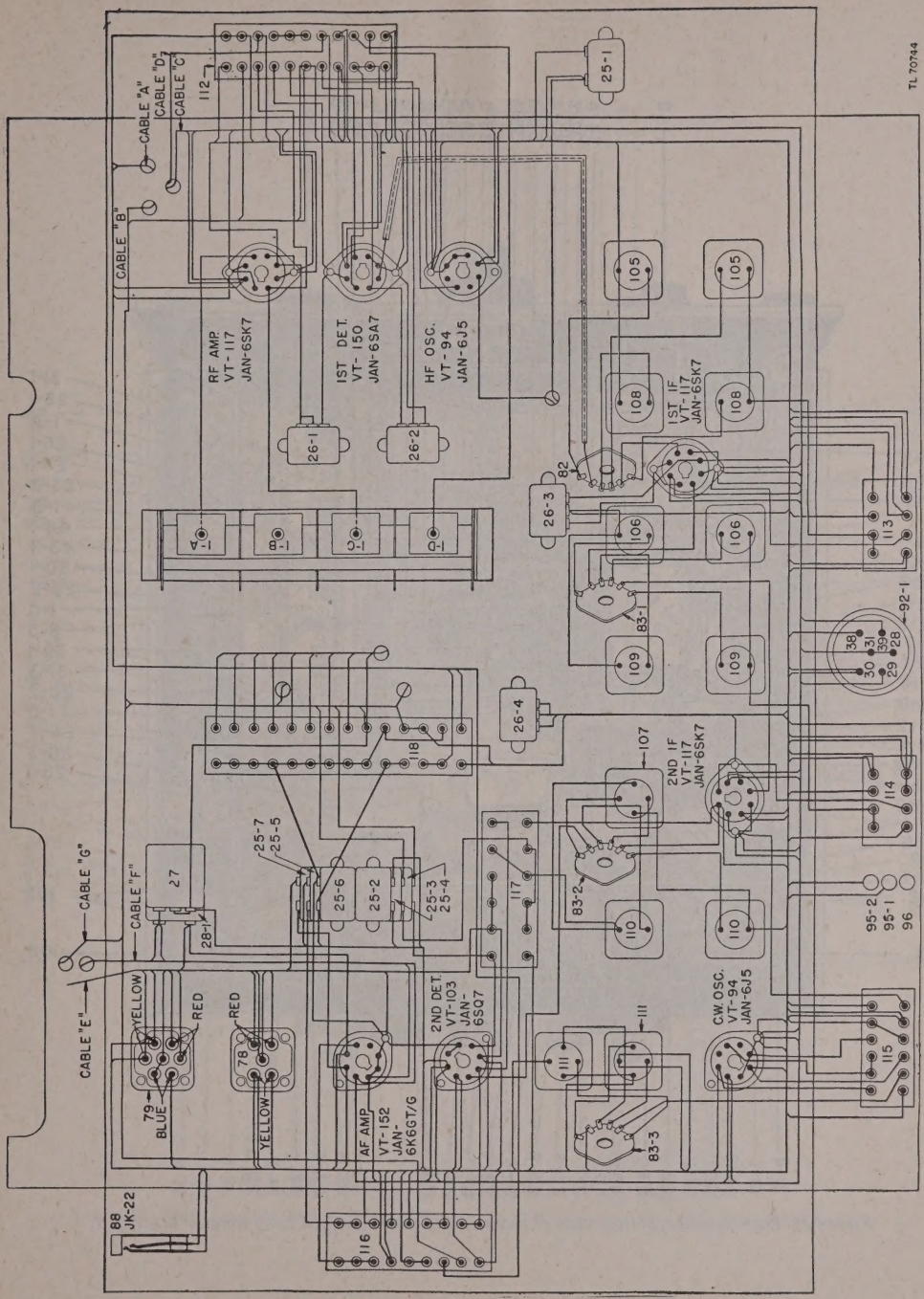


Figure 26. Chassis wiring diagram, Radio Receiver and Loop Rotator BC-470-D.

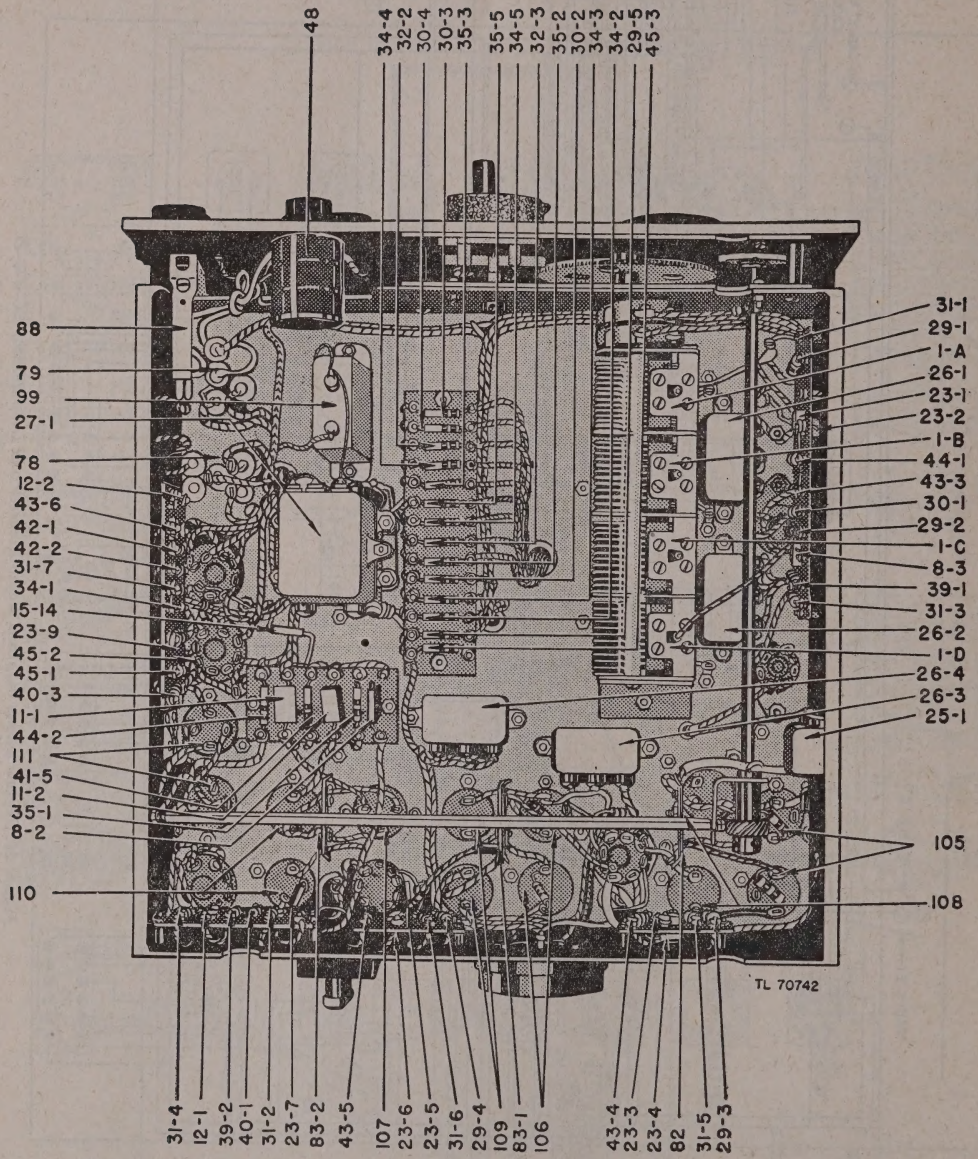


Figure 25. Parts location, bottom view of chassis, Radio Receiver and Loop Rotator BC–470–F.

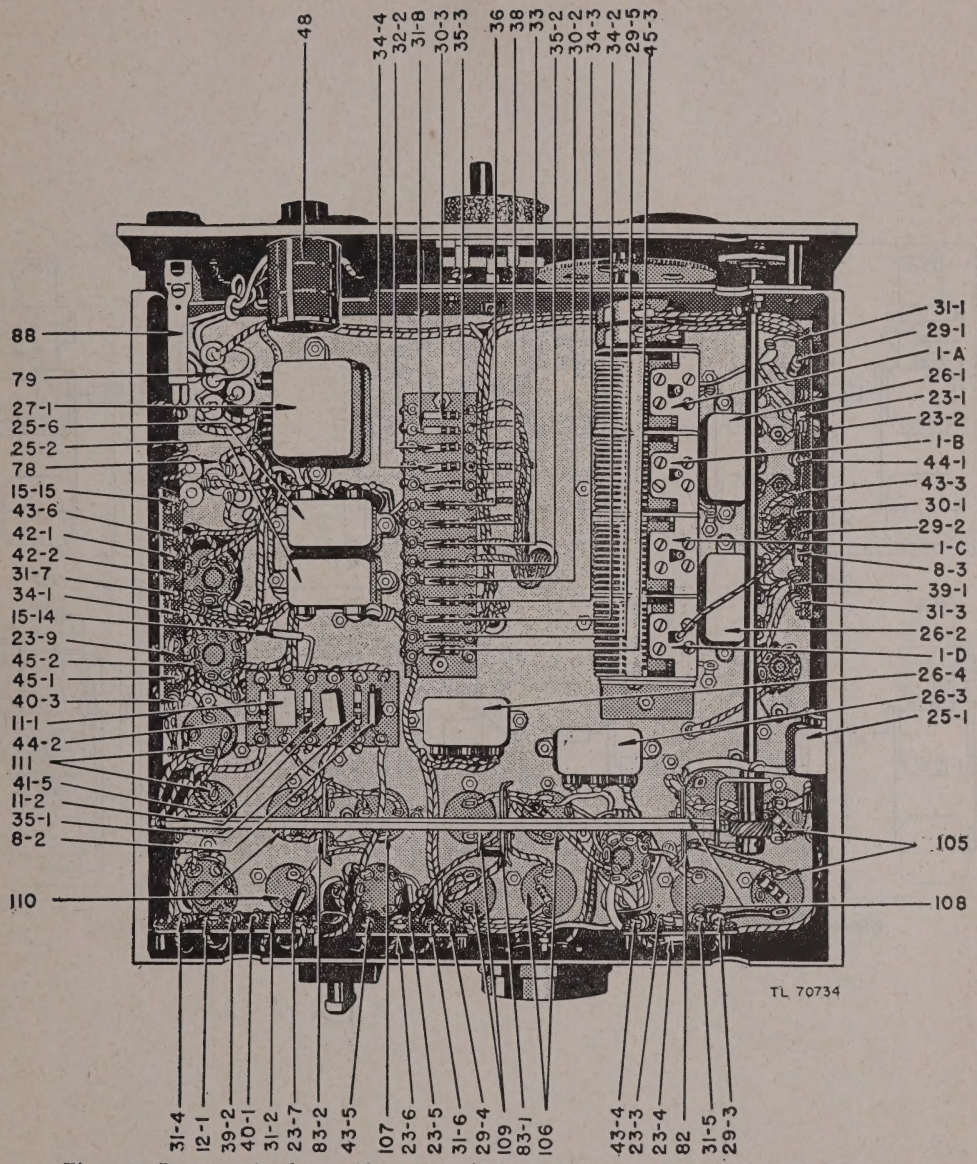


Figure 24. Parts location, bottom view of chassis, Radio Receiver and Loop Rotator BC–470–D.

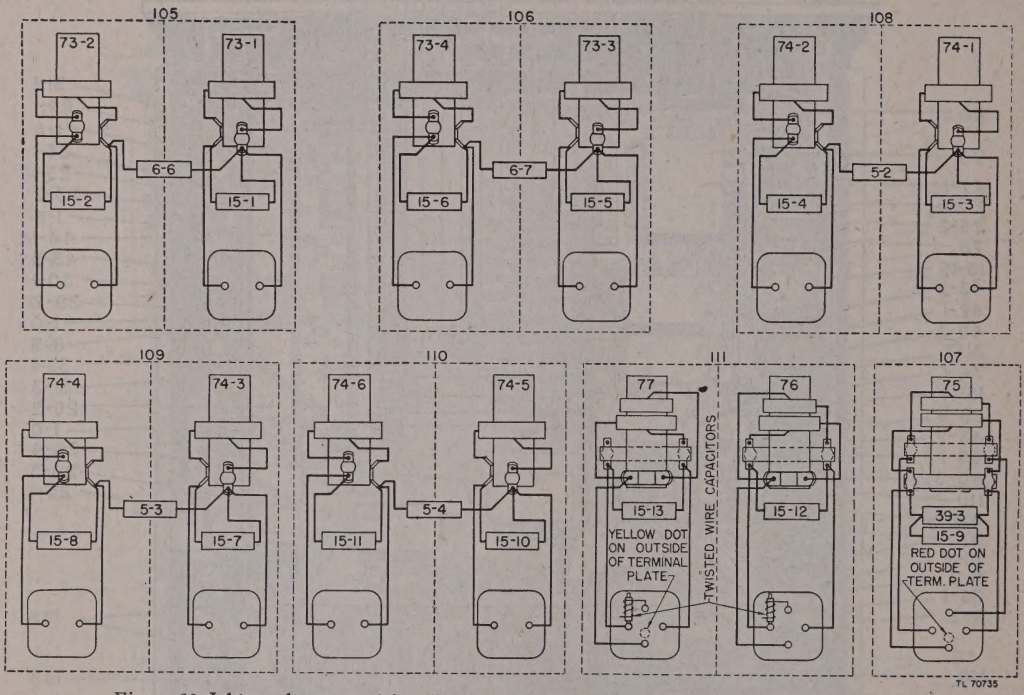


Figure 23. I-f transformers, wiring diagram, Radio Receiver and Loop Rotator BC-470-(*).

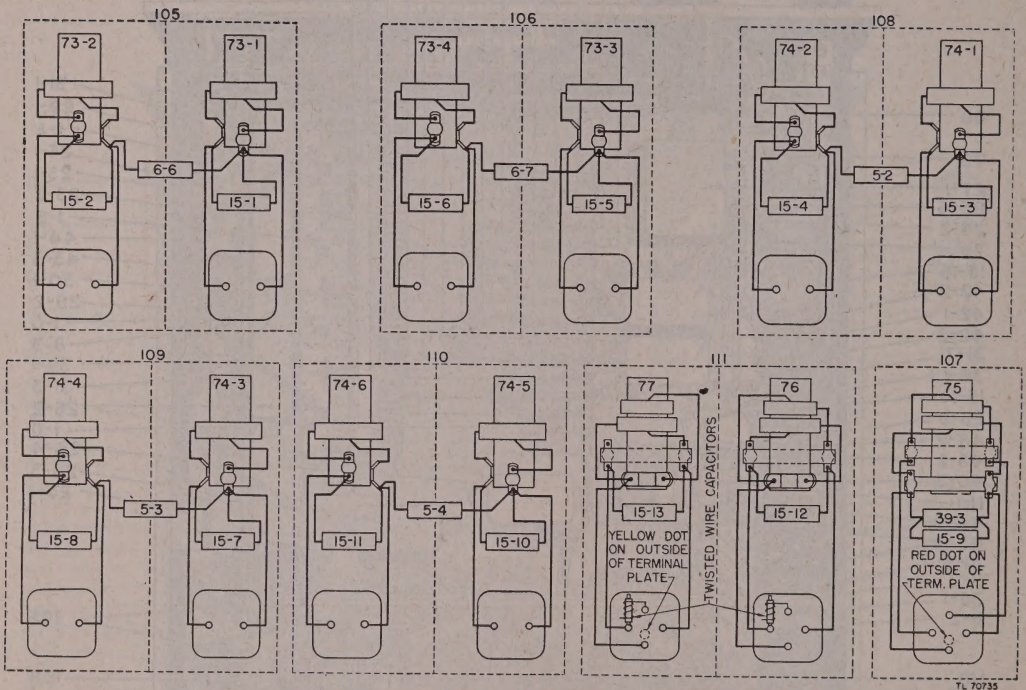


Figure 23. I-f transformers, wiring diagram, Radio Receiver and Loop Rotator BC–470–(*).

REF. NO. MODEL D	REF. NO. MODEL F	VALUE MODEL D	VALUE MODEL F
6-3	33-1	20 MMF	30 MMF
6-4	33-2	20 MMF	30 MMF
6-5	7-2	20 MMF	35 MMF
7-2	33-3	35 MMF	30 MMF
9-1	38	50 MMF	40 MMF
9-2	9	50 MMF	50 MMF
15-15	12-2	500 MMF	250 MMF
28-1	99	2 MF	2 MF
WIRE CAP	36-1	———	2.5 MMF
WIRE CAP	36-2	———	2.5 MMF
31-8	30-4	4700 Ω	3300 Ω
33	32-3	13 MΩ	10 MΩ
36	35-5	27 MΩ	22 MΩ
38	34-5	39 MΩ	15 MΩ

REF. NO. MODEL D&F	VALUE MODEL D&F
1A	492 MMF
1B	492 MMF
1C	175 MMF
1D	175 MMF
2-1	50 MMF
2-2	50 MMF
2-3	50 MMF
2-4	50 MMF
2-5	50 MMF
2-6	50 MMF
2-7	50 MMF
2-8	50 MMF
3-1	50 MMF
3-2	50 MMF
3-3	50 MMF
3-4	50 MMF
3-5	50 MMF
3-6	50 MMF
3-7	50 MMF
3-8	50 MMF
3-9	50 MMF
3-10	50 MMF
3-11	50 MMF
3-12	50 MMF
3-13	50 MMF
3-14	50 MMF
3-15	50 MMF
3-16	50 MMF
3-17	50 MMF
3-18	50 MMF
3-19	50 MMF
3-20	50 MMF
3-21	50 MMF
3-22	50 MMF
4	25 MMF
5-2	5 MMF
5-3	5 MMF
5-4	5 MMF
6-1	20 MMF
6-2	20 MMF
6-6	20 MMF
6-7	20 MMF
7-1	35 MMF
8-1	50 MMF
8-2	50 MMF
8-3	50 MMF
10	65 MMF
11-1	100 MMF
11-2	100 MMF
12-1	250 MMF
13	375 MMF

REF. NO. MODEL D&F	VALUE MODEL D&F
14	410 MMF
15-1	500 MMF
15-2	500 MMF
15-3	500 MMF
15-4	500 MMF
15-5	500 MMF
15-6	500 MMF
15-7	500 MMF
15-8	500 MMF
15-9	500 MMF
15-10	500 MMF
15-11	500 MMF
15-12	500 MMF
15-13	500 MMF
15-14	500 MMF
16	540 MMF
17	575 MMF
18	.001 MF
19	1030 MMF
20	1065 MMF
21	1800 MMF
22	1690 MMF
23-1	.005 MF
23-2	.005 MF
23-3	.005 MF
23-4	.005 MF
23-5	.005 MF
23-6	.005 MF
23-7	.005 MF
23-8	.005 MF
23-9	.005 MF
23-10	.005 MF
24	.01 MF
25-1	.05 MF
25-2	.05 MF
25-3	.05 MF
25-4	.05 MF
25-5	.05 MF
25-6	.05 MF
25-7	.05 MF
26-1	.2 MF
26-2A	.1 MF
26-2B	.1 MF
26-3A	.1 MF
26-3B	.1 MF
26-4A	.1 MF
26-4B	.1 MF
27-1	.2 MF
29-1	2200 Ω
29-2	2200 Ω
29-3	2200 Ω

REF. NO. MODEL D&F	VALUE MODEL D&F
29-4	2200 Ω
29-5	2200 Ω
30-1	3300 Ω
30-2	3300 Ω
30-3	3300 Ω
31-1	4700 Ω
31-2	4700 Ω
31-3	4700 Ω
31-4	4700 Ω
31-5	4700 Ω
31-6	4700 Ω
31-7	4700 Ω
32-1	10 MΩ
32-2	10 MΩ
34-1	15 MΩ
34-2	15 MΩ
34-3	15 MΩ
34-4	15 MΩ
35-1	22 MΩ
35-2	22 MΩ
35-3	22 MΩ
35-4	22 MΩ
37	350 MMF
39-1	47 MΩ
39-2	47 MΩ
39-3	47 MΩ
40-1	68 MΩ
40-2	68 MΩ
40-3	68 MΩ
41-2	100 MΩ
41-3	100 MΩ
41-4	100 MΩ
41-5	100 MΩ
42-1	220 MΩ
42-2	220 MΩ
43-1	470 MΩ
43-2	470 MΩ
43-3	470 MΩ
43-4	470 MΩ
43-5	470 MΩ
43-6	470 MΩ
44-1	1 MEG
44-2	1 MEG
45-1	2.2 MEG
45-2	2.2 MEG
45-3	2.2 MEG
46	50 MΩ
47-A	500 MΩ
47-B	100 MΩ

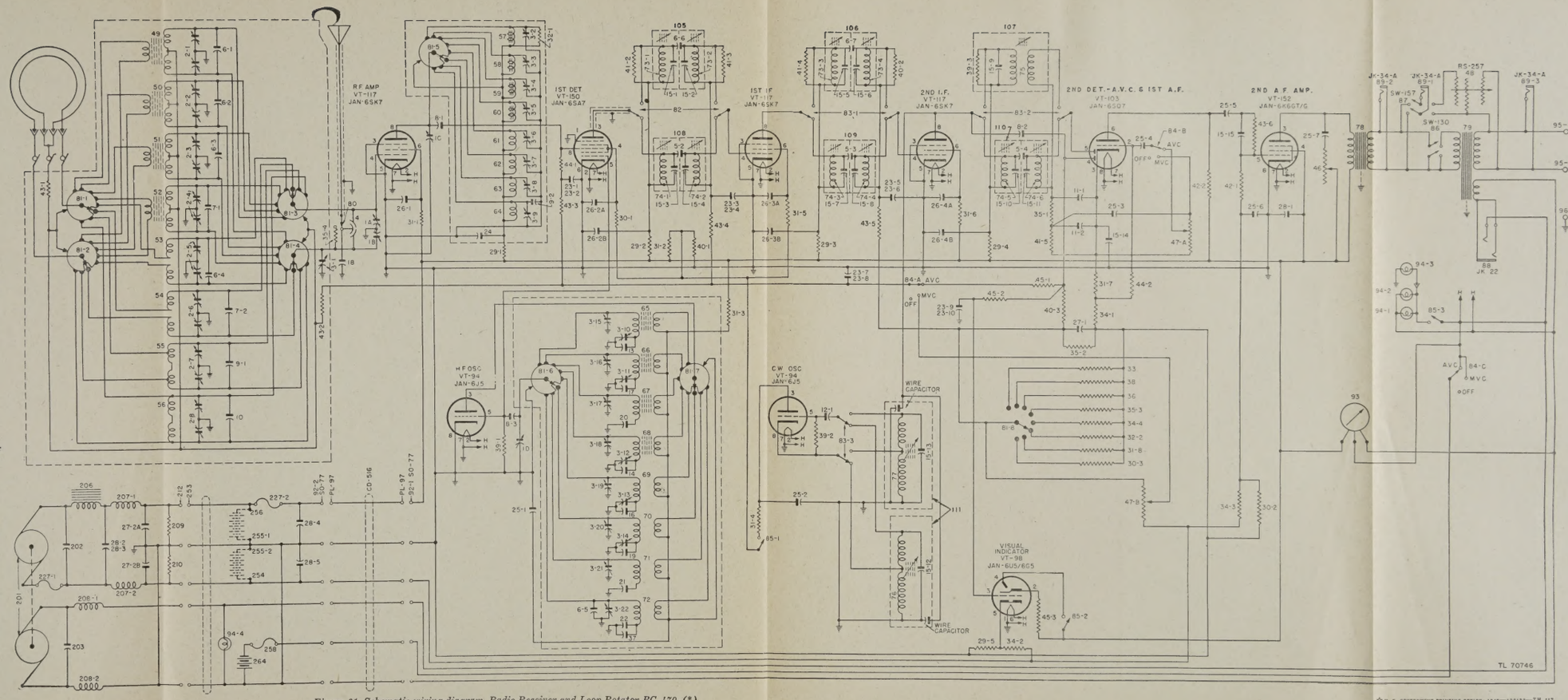


Figure 31. Schematic wiring diagram, Radio Receiver and Loop Rotator BC-470-(*).

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