TM 11-4037

WAR DEPARTMENT TECHNICAL MANUAL

DUPLICATE COPY

RADIO TRANSMITTERS BC-684-A, -B, AND -BM

REPAIR INSTRUCTIONS

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Chief of Staff

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Refer to FM 21–6 for explanation of distribution formula.

CONTENTS

		Paragraph	Page
SECTION I.	DESCRIPTION OF RADIO TRANSMITTERS BC–684–A, –B, AND –BM.		
	General	1	1
	Performance characteristics	2	1
	Condensed circuit analysis	3	1
II.	DIFFERENCES BETWEEN MODELS.		
	Operational differences	4	6
	Design differences	5	6
III.	INITIAL REPAIR PROCEDURES.		
	Description	6	7
	General	7	7
	Removal of vacuum tubes	8	7
	Removal of chassis parts	9	10
	Cleaning, inspecting, and lubricating chassis assembly	10	10
	Cleaning, inspecting, and testing removed parts	11	16
IV.	PRELIMINARY TROUBLE-SHOOTING PROCEDURES.		
	General	12	20
	Power input plug continuity test	13	20
	Dynamotor continuity test	14	20
	Installation of removed parts	15	20
	Connecting power supply	16	22
	Turning on transmitter	17	22
	Voltage and resistance tests	18	22
V.	ALIGNMENT PROCEDURE.		
	General	19	23
	Crystal and switch adjustments	20	23
	Unlocking channel selector	21	23
	Metering circuit test	22	23
	Alignment of first r-f amplifier	23	24
	Alignment of rectifier	24	25
	Alignment of tripler	25	26
	Alignment of doubler	26	26
	Installation of bottom cover	27	27
	Alignment of power amplifier	28	27
	Presetting push buttons	29	28
	Coupling to antenna circuit	30	28
VI.	DETAILED TROUBLE-SHOOTING PROCEDURES.		
	Signal tracing in audio stages	31	29
VII.	FINAL TESTING.		
	General	32	30
	R-f power output and d-c power input test	33	30
	Audio output test	34	31
	Modulation capability test	35	31
	Moistureproofing, fungiproofing, and refinishing	36	32
	Operational check	37	32
	Alignment check	38	32
	R-f power output and d-c power input check	39	32
	Audio output check	40	32
	Modulation capability check	41	32
	Operational test	42	33
VIII.	INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA.		
	General	43	34
	Parts list for oscillator stage V107	44	36
	Parts list for first r-f amplifier V101	45	37
	Parts list for modulation section	46	38
	Parts list for rectifier stage V102	47	40
	Parts list for tripler stage V108	48	42
	Parts list for doubler stage V103	49	44
	Parts list for power-amplifier stage V104	50	46
	Parts list for antenna circuit	51	48
	Parts list for first audio amplifier stage	52	49
	Parts list for second audio amplifier stage	53	50
IX.	SUPPLEMENTARY DATA.		
	Parts identification	54	52

WARNING

HIGH VOLTAGE

is used in the operation
of this equipment.

DEATH ON CONTACT

may result if safety precautions
are not observed.

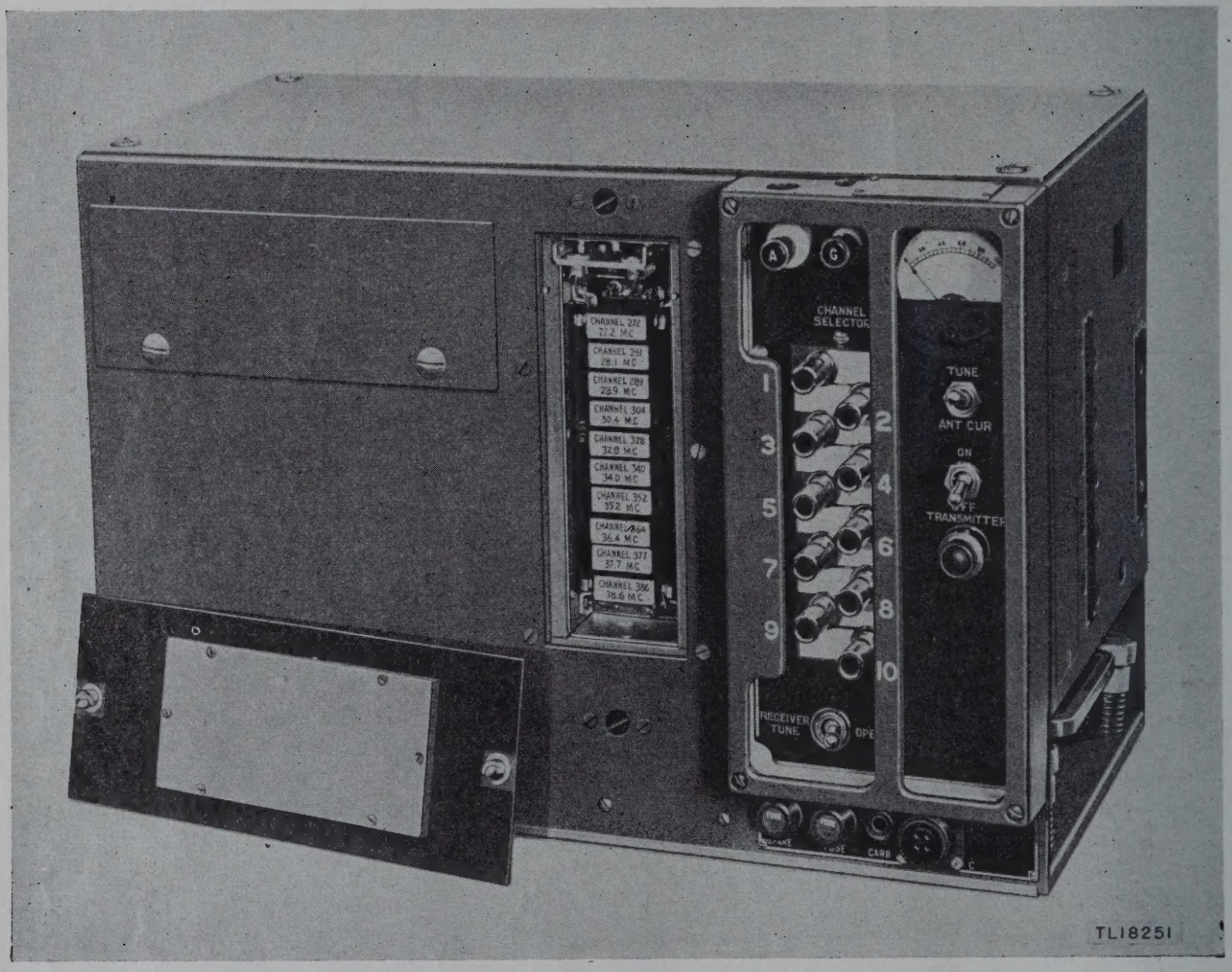


Figure 1. Radio Transmitter BC–684–A, front view, crystal compartment open.

SECTION I

DESCRIPTION OF RADIO TRANSMITTERS BC–684–A, –B, AND –BM[1]

1. General

Radio Transmitter BC–684–(*) is a component of Radio Sets SCR–608–(*) and SCR–628–(*). The transmitter provides frequency-modulated (f-m) radiotelephone transmitting facilities for antiaircraft and antitank warning and control nets, for base stations at battalion command posts for fire control and fire direction nets, and for intrabattalion communication. The radio sets may be installed and operated in combat vehicles such as command cars, half-tracks, or any other authorized vehicle. Official nomenclature followed by (*) is used to indicate all models of the item of equipment included in this manual. Thus Radio Transmitter BC–684–(*) represents Radio Transmitters BC–684–A, –B, and –BM, which are treated together in this manual.

2. Performance Characteristics

Nominal power output	20 watts
Nominal frequency deviation	±40 kc
Crystal frequency	275.000 to 540.277 kc
Transmitter frequency range	27.0 to 38.9 mc
Frequency multiplication	72
Battery drain, 12-volt supply	20 amperes
Battery drain, 24-volt supply	12 amperes
Interphone output (BC–684–B)	3 watts

3. Condensed Circuit Analysis

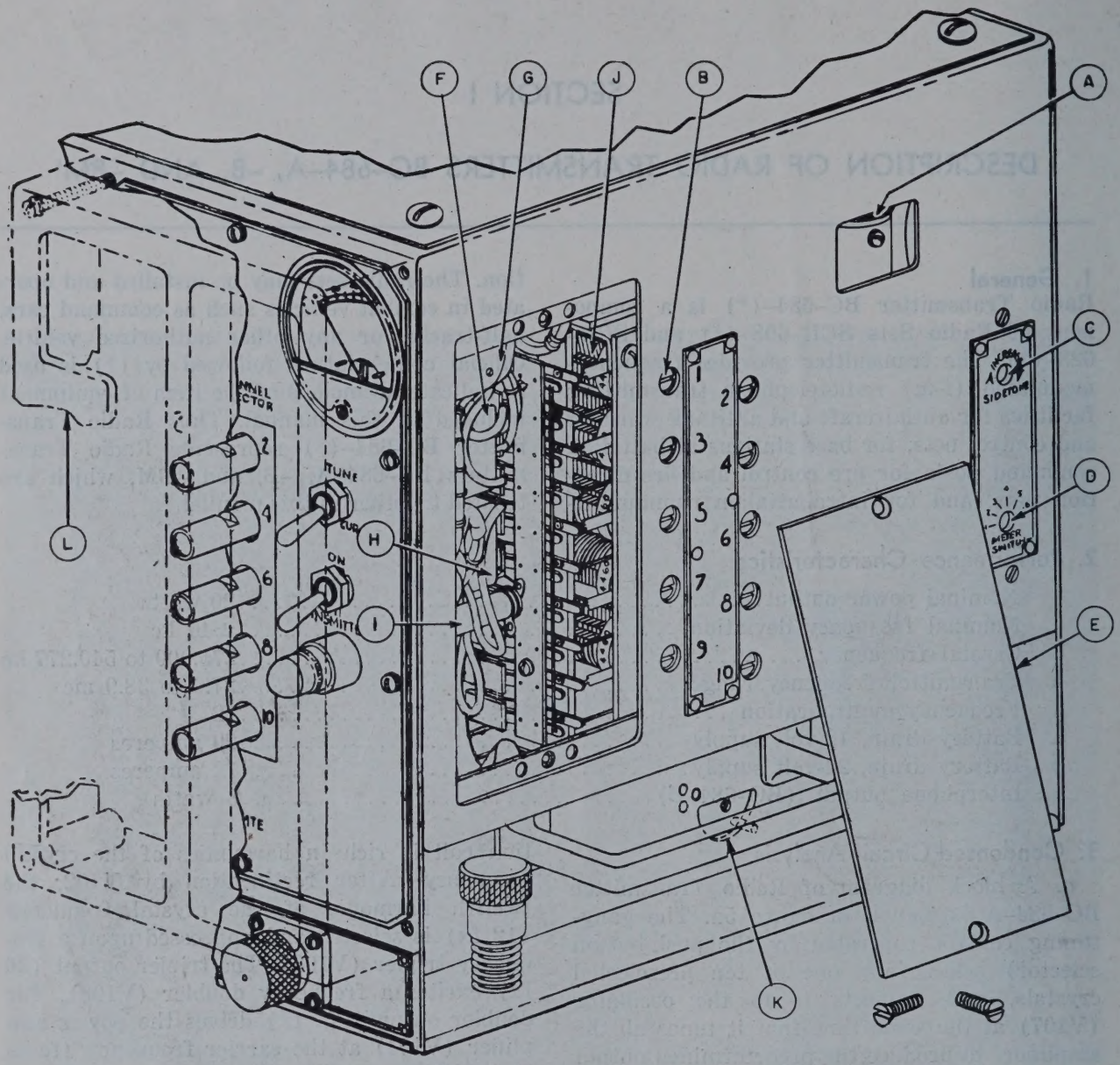
a. A block diagram of Radio Transmitter BC–684–A is shown in figure 5a. The gang-tuning control (operated by the push-button selector) selects any one of ten preselected crystals, and connects it to the oscillator (V107) at the same time that it tunes all the amplifiers to produce the predetermined output frequency at the antenna. The oscillator output frequency (fx) is amplified by the first radio-frequency (r-f) amplifier (V101) and, along with the audio-frequency (a-f) signals, is impressed upon a parallel resonant circuit, one component of which is an iron core coil (MOD COIL L104).

b. The output of the second a-f amplifier (V106) is fed through an output transformer (T102) to the modulation coil (L104) which phase-modulates the signal from the first r-f amplifier (V101). The output of the modulation coil is rich in harmonics of the crystal frequency. After rectification by V102, the twelfth harmonic of the crystal frequency (12 fx) is selected and impressed upon a frequency tripler (V108). The tripler output (36 fx) excites a frequency doubler (V103). The doubler output (72 fx) drives the power amplifier (V104) at the carrier frequency (fc = 72 fx). The proper one of ten pretuned antenna coupling circuits is selected by the gang-tuning control and feeds a signal to the antenna.

c. Speech signals from a microphone associated with the transmitter are amplified by a two-stage a-f amplifier (V105 and V106).

d. A small amount of audio output from V106 is caused to pass through the headset circuit. This is called sidetone. It enables the commander to hear all that goes out from his radio transmitter, and prevents confusion where two people have microphones for the same trans-

[1]See TM 11–620 for installation, operation, and other maintenance data on this equipment.



PARTS LIST	
A	ANTENNA TUNING KNOB
B	ANTENNA TRIMMER SCREW
C	SIDETONE VOLUME CONTROL
D	METER SWITCH
E	SIDE ACCESS PANEL
F	TOGGLE SWITCH
G	METER
H	TOGGLE SWITCH
I	PILOT LIGHT
J	ANTENNA TRIMMER CAPACITORS
K	GANG TUNING CAPACITOR CRANK
L	PANEL GUARD

TL 18252

Figure 2. Radio Transmitter BC–684–A, oblique right-end view.

mitting set. Also, when the operator's ears are covered by a headset he does not have the normal sensation of hearing himself talk unless sidetone is provided.

e. A block diagram of Radio Transmitter BC–684–B is shown in figure 5b. The differences between the two models are described in section II; however, the above discussion applies equally to both the A and B models of the transmitter.

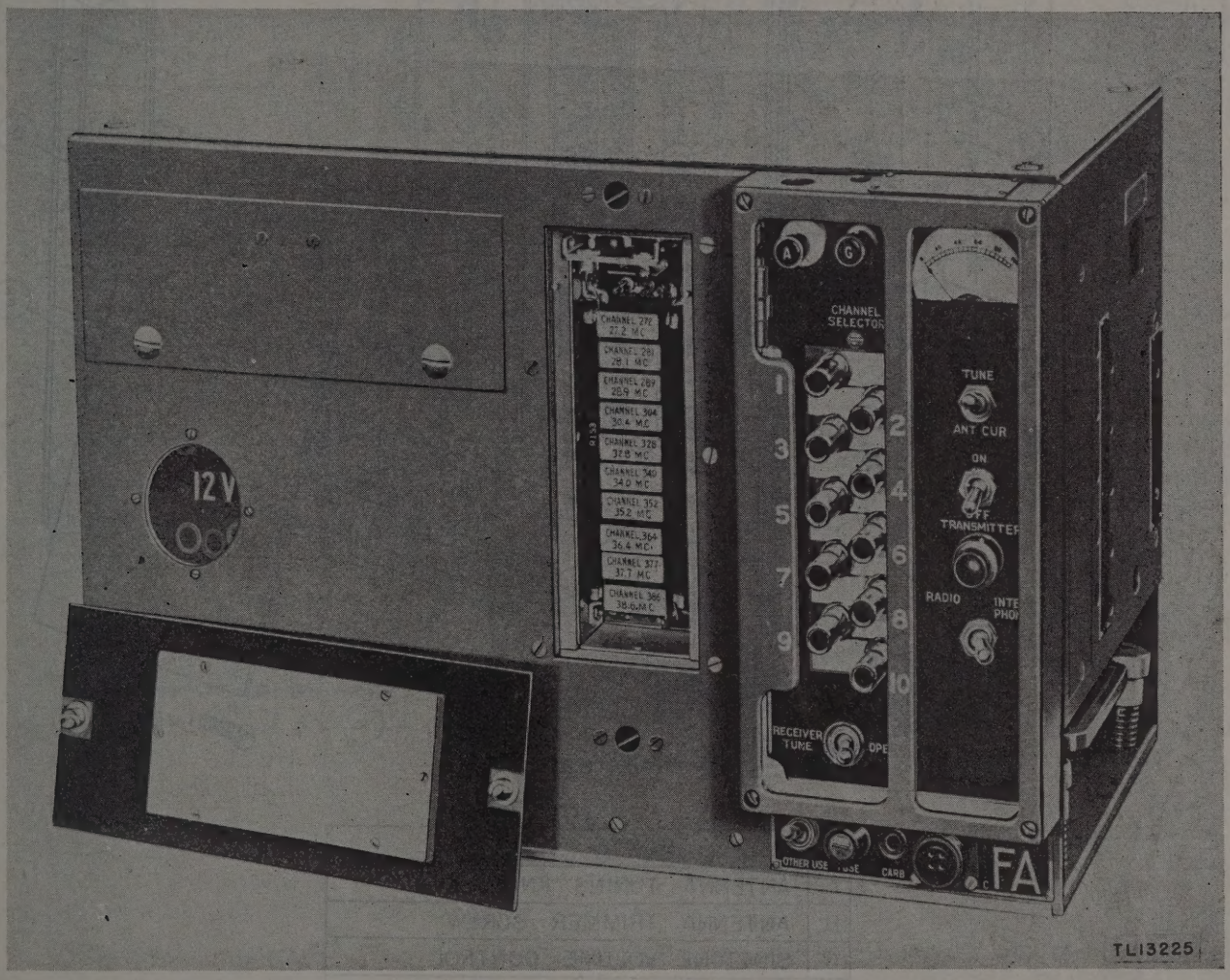
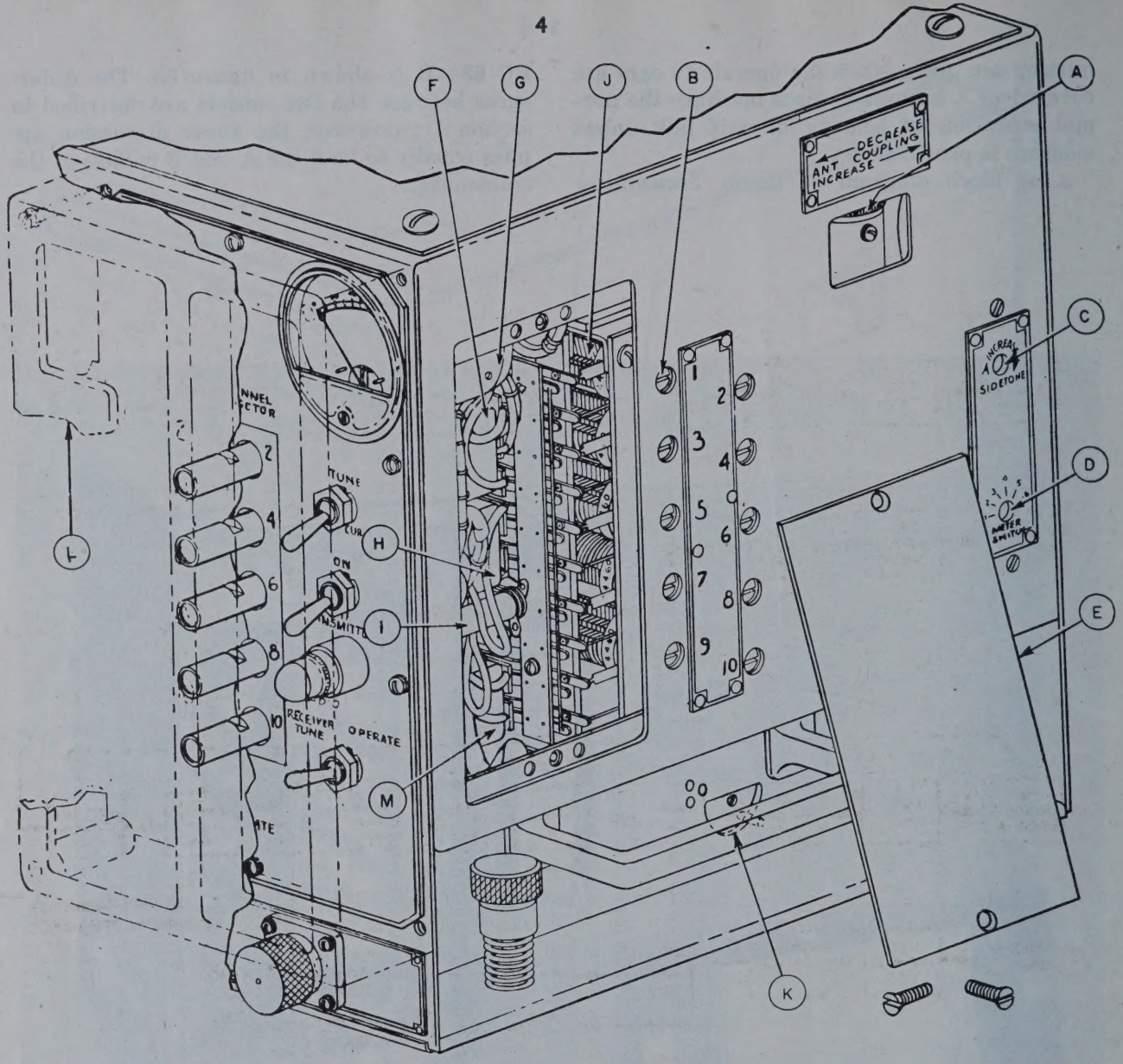


Figure 3. Radio Transmitter BC–684–B, front view, crystal oven open.



PARTS LIST	
A	ANTENNA TUNING KNOB
B	ANTENNA TRIMMER SCREW
C	SIDETONE VOLUME CONTROL
D	METER SWITCH
E	SIDE ACCESS PANEL
F	TOGGLE SWITCH
G	METER
H	TOGGLE SWITCH
I	PILOT LIGHT
J	ANTENNA TRIMMER CAPACITORS
K	GANG TUNING CAPACITOR CRANK
L	PANEL GUARD
M	RADIO INTER-PHONE SWITCH

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Figure 4. Radio Transmitter BC–684–B, oblique right-end view.

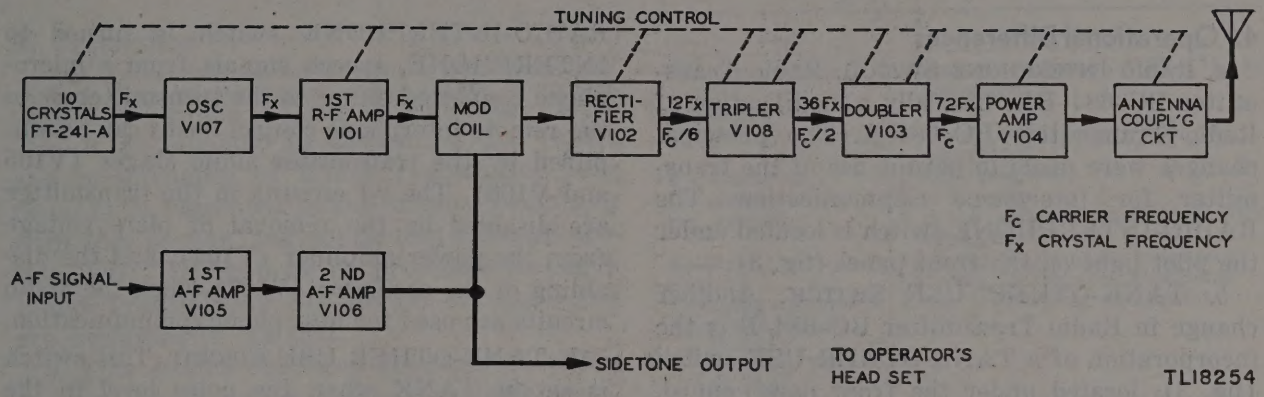


Figure 5a. Radio Transmitter BC–684–A, block diagram.

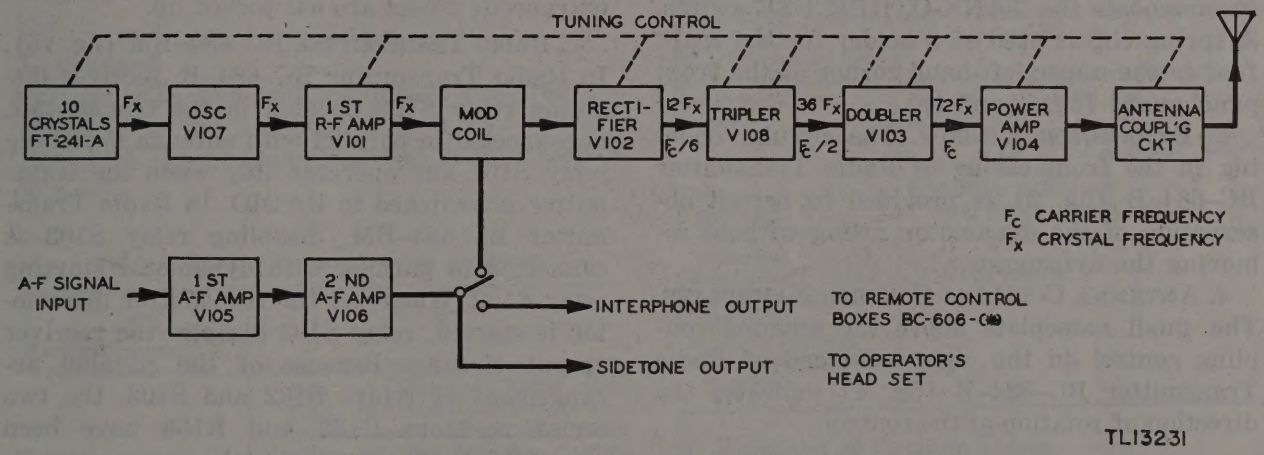


Figure 5b. Radio Transmitter BC–684–B, block diagram.

SECTION II

DIFFERENCES BETWEEN MODELS

4. Operational Differences

a. RADIO INTERPHONE SWITCH. Radio Transmitter BC–684–B is basically a modification of Radio Transmitter BC–684–A. The principal changes were made to permit use of the transmitter for interphone communication. The RADIO-INTERPHONE switch is located under the pilot light on the front panel (fig. 3).

b. TANK-OTHER USE SWITCH. Another change in Radio Transmitter BC–684–B is the incorporation of a TANK-OTHER USE switch (fig. 3), located under the front panel guard.

c. SPARE FUSE. The spare fuse holder was eliminated on Radio Transmitter BC–684–B to accommodate the TANK-OTHER USE switch. A spring clip is used as a holder for the spare fuse in the upper left-hand corner of the front panel guard (figs. 3 and 4).

d. DYNAMOTOR WINDOW. The circular opening in the front casing of Radio Transmitter BC–684–B (fig. 3) is provided to permit observation of the dynamotor rating without removing the dynamotor.

e. ANTENNA COUPLING CONTROL NAMEPLATE. The small nameplate above the antenna coupling control on the right-hand end of Radio Transmitter BC–684–B (fig. 4) indicates the direction of rotation of the control.

5. Design Differences

a. INTERPHONE CIRCUIT. The output of the second audio stage (V106) in Radio Transmitter BC–684–B (fig. 29) can be switched either to the modulation coil (MOD. COIL) or to the associated interphone equipment. When the RADIO-INTERPHONE switch is turned to INTERPHONE, speech signals from a microphone connected either to the transmitter or to the remote interphone control boxes can be amplified by the transmitter audio stages (V105 and V106). The r-f circuits in the transmitter are disabled by the removal of plate voltage from the power amplifier (V104), and the disabling of the oscillator (V107) when the audio circuits are used for interphone communication.

b. TANK-OTHER USE CIRCUIT. This switch is set at TANK when the noise level in the vehicle is high. The sensitivity of the carbon microphone is reduced, in this position, so that extraneous noises are not picked up.

c. RADIO TRANSMITTER BC–684–BM (fig. 45). In Radio Transmitter BC–684–B, receiver disabling relay S103, located in the transmitter, is connected in parallel with antenna switching relay S101 and operates only when the transmitter is switched to RADIO. In Radio Transmitter BC–684–BM, disabling relay S103 is connected in parallel with dynamotor starting relay S102. Whenever the transmitter dynamotor is started, relay S103 disables the receiver output circuits. Because of the parallel arrangement of relays S102 and S103, the two series resistors R133 and R135 have been changed in value to provide the necessary voltage drop for proper operation of the relays. Resistor R133 was an 80-ohm resistor, and R135 a 30-ohm resistor. These two values are now 40 ohms and 45 ohms respectively. Some modified transmitters use 50-ohm resistors for R133 and R135.

SECTION III

INITIAL REPAIR PROCEDURES

6. Description

Note. Before making any repairs or adjustments, all authorized modification work orders should be applied. See FM 21–6 for list of applicable Model Work Orders.

a. A step-by-step procedure for the repair and maintenance of Radio Transmitter BC–684–(*) is presented in this manual beginning with this section and continuing through section VIII. Differences in procedure between Radio Transmitters BC–684–A, –B, and –BM are explained in the text.

b. This section describes the removal, cleaning, and testing of the easily removable parts, and the cleaning, inspecting, and lubricating of the chassis, casing, and attached parts.

7. General

All the tools and test equipment required are included in the list below. Each tool is mentioned in the procedure at the point where it is used.

Table I. Tool, test, and cleaning equipment

Item	Description
Audio-frequency oscillator	50 to 5000 cps, 0- to 5-volt output, such as General Radio type 608A, for modulation tests and measurement of audio stage gains, set for 500-ohm output.
Oscilloscope	Modulation monitor oscilloscope, such as Dumont Oscilloscope, for modulation capability test, or for measurement of audio stage gains.
Tube tester	Static or dynamic tester, such as the one included in Test Set I–56–(*).
Sensitive precision wavemeter	4- to 40-megacycle range.
Electronic volt-ohmmeter	RCA Voltohmyst, or equivalent voltohmmeter multitester.
Output meter	0 to 15 volts with scales marked in db and volts, such as General Radio type 583A, for measuring the audio stage gains.
A-c voltmeter	0 to 5 volts rectifier type, such as General Radio type 463F.
Input circuit attenuator	0 to 30 db (500 ohms), such as Western Electric type 1A.
Dummy antenna	Phantom Antenna A–83–(*), or equivalent.
Distortion noise meter	General Radio type 732B, or equivalent.
D-c ammeter	0 to 30 amperes.
D-c voltmeter	0 to 30 volts.
R-f ammeter	0 to 1.0 amperes, such as Weston type 425.
Battery	12 volts, 26 amperes maximum.
Battery	24 volts, 18 amperes maximum.
Charging equipment	Battery charging equipment.
Auxiliary Cord CD–786 Mounting FT–237–(*).	
Radio transmitter	A good transmitter, such as Radio Transmitter BC–684–(*) for testing the crystals.
Microphone	T–17, T–30, T–33, or T–45.
Burnishing tool	Any commercial type, or a thin flat piece of metal.
Fine thin metal file.	
Socket wrench	Insulated ¼-inch hexagonal.
Soldering iron	100-watt, medium tip.
Solder	Rosin core: *Note.* Never use acid cord solder in the repair of the equipment described in this manual.
Rule	6-inch by 2/10-inch.
Hand tools	Pliers, screw driver, etc.
Solvent, Dry-cleaning.	
Camel's-hair brush	½-inch, round.
Heavy brushes.	
Clean cloth.	
Oil, Lubricating, Preservative, Special.	

8. Removal of Vacuum Tubes

The first step in servicing the transmitter is removal of the vacuum tubes.

a. Place the transmitter on a clean bench.

b. Unfasten the Dzus fasteners in the top cover by turning about one quarter turn counterclockwise; then remove the top cover (fig. 9) from the transmitter casing.

c. Disengage the clip from the cap on the power-amplifier (p-a) tube (V104 in fig. 6). Loosen the holding clamp at the base of the tube with a screw driver and carefully remove the tube from its socket.

d. Loosen the locking tabs at the other seven tubes with a screw driver; then remove the tubes carefully from their sockets.

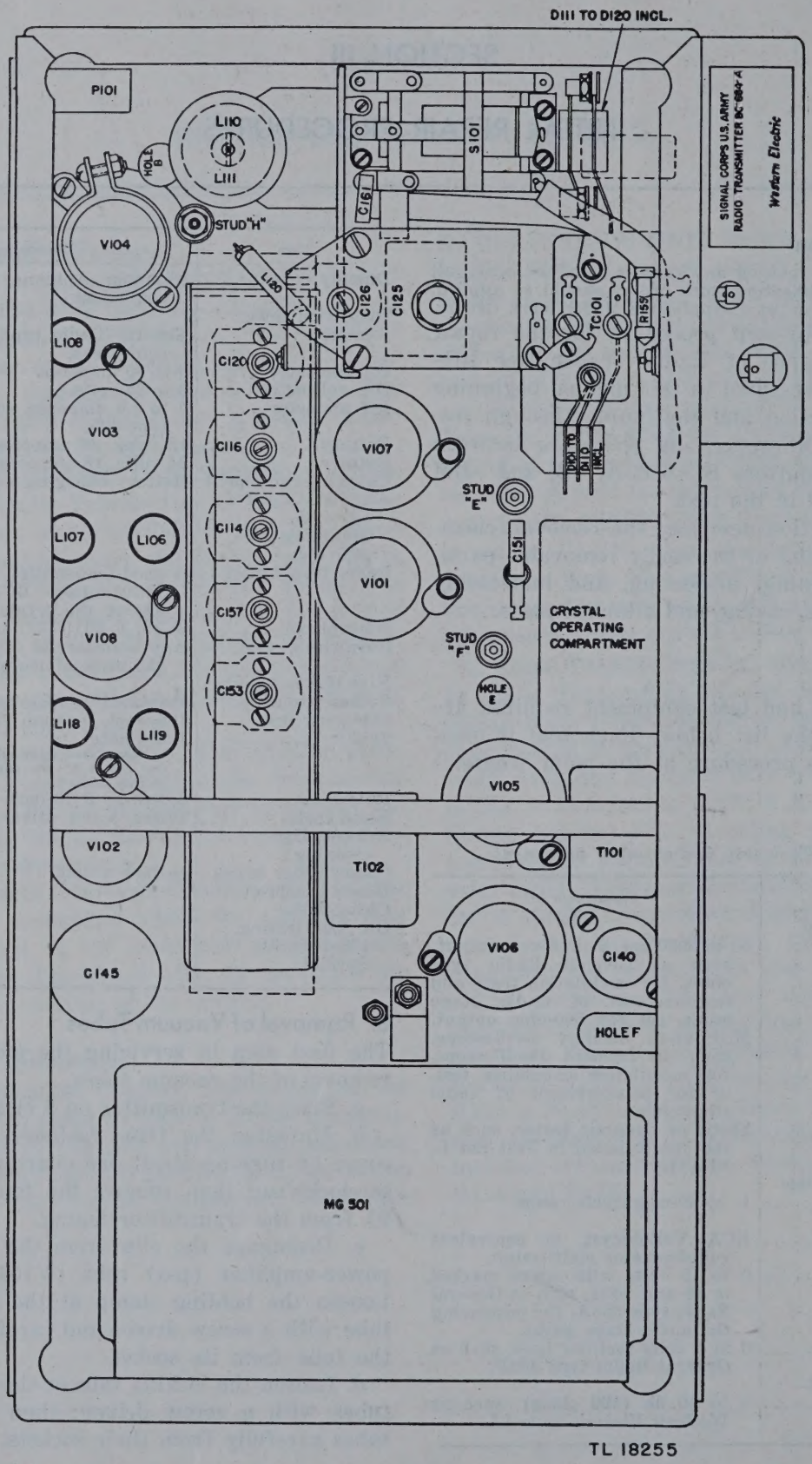


Figure 6. Radio Transmitter BC–684–A, apparatus location diagram, top view.

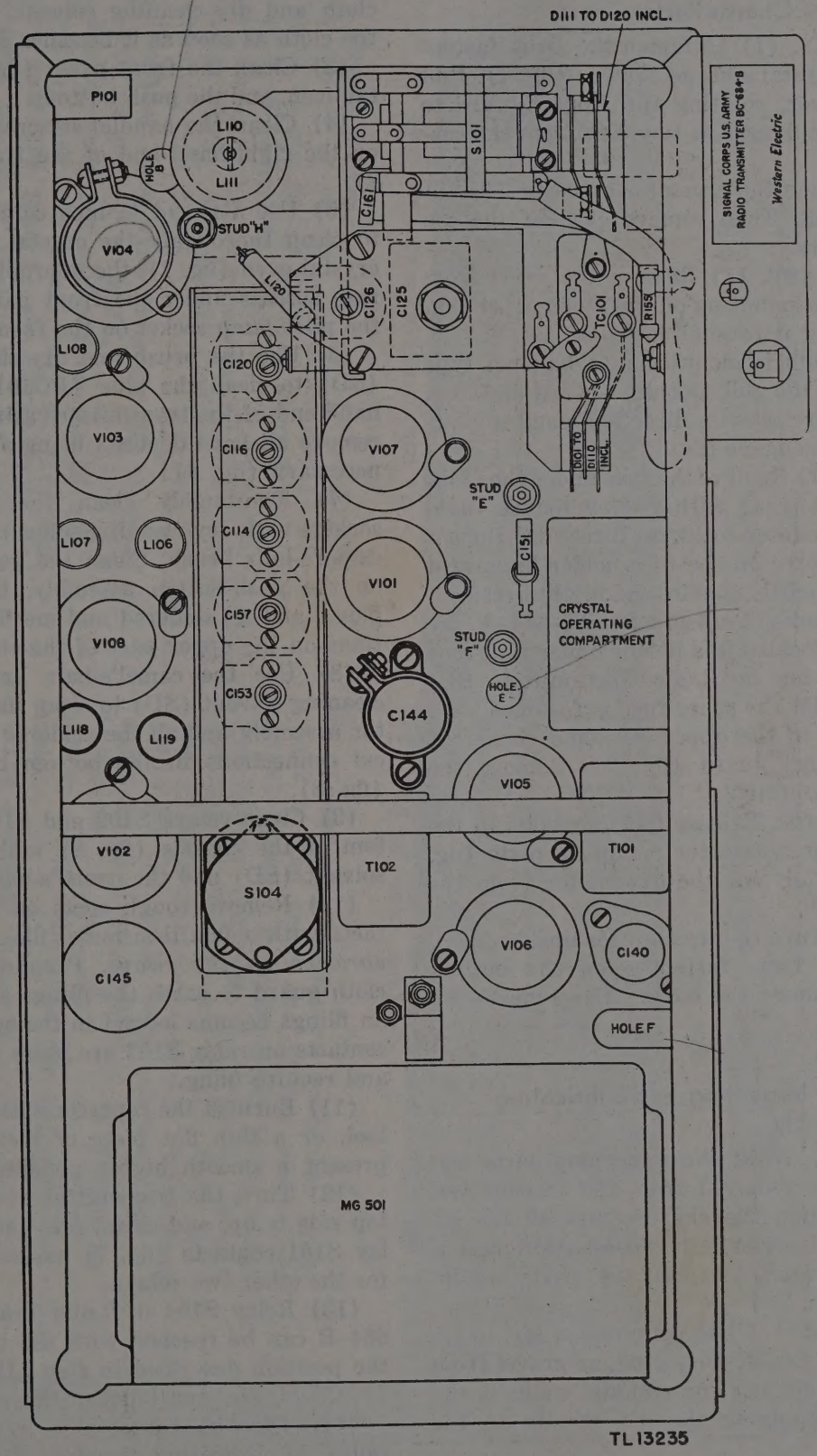


Figure 7. Radio Transmitter BC–684–B, apparatus location diagram, top view.

9. Removal of Chassis Parts

a. CRYSTALS. (1) Unfasten the Dzus fasteners on the crystal storage drawer (fig. 1). Pull out the drawer, rotating the front upward to disengage the flanges at the back from the casing.

(2) Unfasten the crystal oven cover (fig. 1) and remove it. Then remove each of the ten crystal holders.

b. PILOT LAMP. (1) Remove the jewel from the pilot-lamp mounting on the front panel (fig. 1) by turning it counterclockwise.

(2) The bulb is mounted in a bayonet type socket. Press the bulb slightly inward and turn it in a counterclockwise direction about a quarter turn to disengage it.

c. FUSES. (1) Remove the fuse under the front panel guard (fig. 1) with a screw driver, turning it in a counterclockwise direction. Do not exert great force on the fuse holder because it is made of a brittle plastic, and might break.

(2) On Radio Transmitter BC–684–A the spare fuse is located in a holder under the front panel guard, but on Radio Transmitters BC–684–B and –BM the spare fuse is fastened with a spring clip in the upper left-hand corner of the front panel guard (fig. 3). Remove the spare fuse carefully.

d. DYNAMOTOR. Release the four bolts in the corners of the dynamotor mounting plate (fig. 9), and carefully lift the dynamotor from the chassis.

e. COVERS. Turn the transmitter upside down, unfasten the Dzus fasteners on the bottom cover, and remove the cover. Also remove the back cover.

10. Cleaning, Inspecting, and Lubricating Chassis Assembly

a. GENERAL. While the removable parts and the covers are removed from the transmitter, clean the casing, the chassis, and all the attached parts. Lubricate the push-button mechanism, and visually inspect the parts as instructed below.

b. CLEANING. (1) Use compressed air, to remove any loose dust, dirt, sand, or gravel from the chassis. Blow out any residual water in the hose before applying the air stream to the transmitter.

(2) Remove grease, oil, corrosion, and all hard deposits of foreign matter from the casing, the chassis, and the apparatus with a clean cloth and dry-cleaning solvent (SD). Discard the cloth as soon as it becomes dirty.

(3) Clean the front panel (fig. 1), the crystal oven, and the push buttons.

(4) Clean the handle, setscrews, and panels on the right-hand end of the transmitter (fig. 2).

(5) Use a round ¼-inch camel's-hair brush to clean thoroughly the crystal sockets in the crystal oven (fig. 1), the microphone jacks and fuse sockets under the front panel guard, and the pilot lamp socket on the front panel.

(6) Use the brush and dry-cleaning solvent (SD) to clean the plug (PG101) in the left-hand end of the transmitter casing. Completely remove all hard deposits using a smooth file if necessary (fig. 8).

(7) Thoroughly clean the vacuum tube sockets with dry-cleaning solvent (SD) and the camel's-hair brush. Clean the gears and racks on the push-button assembly, the two Jones plugs, and all soldered and mechanical connections on the upper part of the chassis (fig. 9).

(8) Use the camel's-hair brush and dry-cleaning solvent (SD) to clean the gang capacitor assembly and all the soldered and mechanical connections in the bottom of the chassis (fig. 8).

(9) Clean relays S102 and S103 in the bottom of the chassis (fig. 8) with dry-cleaning solvent (SD) and the camel's-hair brush.

(10) Remove rough spots on the relay contacts with a fine thin metal file. *Never use an abrasive on the relays.* Prepare a paper or cloth guard to catch the filings and make sure no filings become lodged in the apparatus. The contacts on relay S102 are more likely to burn and require filing.

(11) Burnish the contacts with a burnishing tool, or a thin flat piece of metal, until they present a smooth highly polished appearance.

(12) Turn the transmitter over so that the top side is up, and clean, file, and burnish Relay S101 contacts (fig. 7) as instructed above for the other two relays.

(13) Relay S104 in Radio Transmitter BC–684–B can be reached with the transmitter in the position described in step (12) above (fig. 7). Clean, file, and burnish the relay contacts.

(14) Dirt on contacts is a very common cause of operating trouble. Make sure all sockets, plugs, and open contacts are clean. Make sure that no hard deposits of foreign material are left on the contacts.

(went to pin #6 of #121). Connect it (9-1) and 24-9 (saved in step 19) in parallel and connect the pair between pins #5 and 6 inside #121. Re-install, but do not reconnect, unit #121.

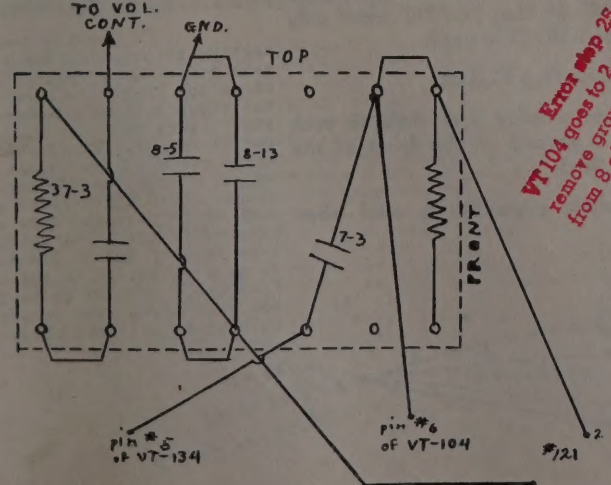
23. Resolder bare wire from pin #8 of rear VT-209 to pin #1 of #121.

24. Remove both red wires from pin #6 of VT-104. Resolder remaining red wire and bare resistor lead to pin #2 of #121. Connect pin #4 of VT-134 directly to pin #2 of #121.

25. Filament rewiring: Ground pin #7 of front VT-209. Connect pin #8 of VT-104 to pin #8 of front VT-133 and remove bare jumper wire to ground. Remove wire between pin #2 of VT-134 and pin #7 of rear VT-133. Move wire from pin #8 of rear VT-133 to pin #2. Connect pair of brown-red wires, left soldered together in step 8, through hole, to nearest terminal of blue resistor (50) mounted in step 10. Connect other terminal of blue resistor to terminal #2 of socket installed in step 11. Ground terminal #7 of this socket. Remove all wires from the two VT-133 sockets which were not connected above except the wire between pins #7.

26. At the left rear corner of the top, drill a 3/8 inch hole which will be halfway between the aluminum shield and the rear wall and the same distance from the left edge as is the shaft of the tuning condenser (see step 13). In this hole mount a 1/2 megohm potentiometer. Connect the center terminal to pin #2 of VT-104. Ground one of the outside terminals.

27. Cut away all jumpers and wiring from the small terminal board except those shown in revised circuit (Fig. 28). Counting from front of small terminal board, remove parts #2, 3, 4, 5, 7.



Error in step 25: 8 of VT104 goes to 2 of VT133; remove ground jumper from 8 of VT 133.

minal board. From terminal board which was inside aluminum compartment, unsolder the two condensers (8-13, 8-5) and the 39,000 resistor (37-3). Reconnect these on the small terminal board as shown in Fig. 28. Do rest of wiring as indicated if Fig. 28.

29. Plug a 6H6 tube into the front VT-1 socket.

30. Plug a 6X5-GT tube into the rear VT 133 socket.

31. Rewire the 6H6 as shown in Fig. 31.

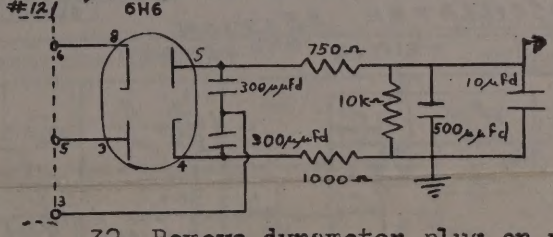


Fig. 3

32. Remove dynamoter plug on rear deck.

33. Install, on back wall so that wires enter set near 6X5-GT socket, a power transformer having the following rati 250-0-250 v. @ 50 ma; 5 v. @ 2 a.; 6. @ 2 a. Connect 6.3 v. and 5 v. windi in series so that total is 11.3 volts (use voltmeter to make sure). Solder of the 11.3 volt wires to pin #2 of t 6X5-GT and the other 11.3 volt wire t pin #8 of 6H6. Ground the HV centert Connect one HV wire to pin #3 of 6X5- the other to pin #5. Connect pin #8 the 6X5-GT to pin #4 of the output transformer 82.

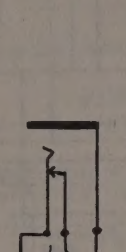


Fig. 34

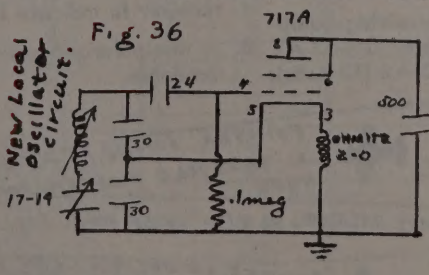
34. Mount the test jack (now a 'phone j in some convenient location and wire as shown in Fig. 34.

35. Remove condenser 1-1 from RF coil upper-front corner. Using an insulat wire running along upper edge, connec left end of this coil to hot side of section of tuning condenser (see step

36. Connect hot side of middle section shown in Fig. 36. NOTE: 30 mmfd. con densers are those saved in step 18.

37. Remove condenser 1-2 from coil 62-1 Connect hot side of lower section to feed-through connector using a piece of insulated wire to do so.

Fig. 36



38. Attach line cord power transformer stalled in step 33

39. Replace aluminum shield lid, 717A t and covers.

40. Almost any short enna will work: di single wire, etc.

9. Removal of Chassis Parts

a. CRYSTALS. (1) Unfasten the Dzus fasteners on the crystal storage drawer (fig. 1). Pull out the drawer, rotating the front upward to disengage the flanges at the back from the casing.

(2) Unfasten the crystal oven cover (fig. 1) and remove it. Then remove each of the ten crystal holders.

b. PILOT LAMP. (1) Remove the jewel from the pilot-lamp mounting on the front panel (fig. 1) by turning it counterclockwise.

(2) The bulb is mounted in a bayonet type socket. Press the bulb slightly inward and turn it in a counterclockwise direction about a quarter turn to disengage it.

c. FUSES. (1) Remove the fuse under the front panel guard (fig. 1) with a screw driver, turning it in a counterclockwise direction. Do not exert great force on the fuse holder because it is made of a brittle plastic, and might break.

(2) On Radio Transmitter BC–684–A the spare fuse is located in a holder under the front panel guard, but on Radio Transmitters BC–684–B and –BM the spare fuse is fastened with a spring clip in the upper left-hand corner of the front panel guard (fig. 3). Remove the spare fuse carefully.

d. DYNAMOTOR. Release the four bolts in the corners of the dynamotor mounting plate (fig. 9), and carefully lift the dynamotor from the chassis.

e. COVERS. Turn the transmitter upside down, unfasten the Dzus fasteners on the bottom cover, and remove the cover. Also remove the back cover.

10. Cleaning, Inspecting, and Lubricating Chassis Assembly

a. GENERAL. While the removable parts and the covers are removed from the transmitter, clean the casing, the chassis, and all the attached parts. Lubricate the push-button mechanism, and visually inspect the parts as instructed below.

b. CLEANING. (1) Use compressed air, to remove any loose dust, dirt, sand, or gravel from the chassis. Blow out any residual water in the hose before applying the air stream to the transmitter.

(2) Remove grease, oil, corrosion, and all hard deposits of foreign matter from the casing, the chassis, and the apparatus with a clean cloth and dry-cleaning solvent (SD). Discard the cloth as soon as it becomes dirty.

(3) Clean the front panel (fig. 1), the crystal oven, and the push buttons.

(4) Clean the handle, setscrews, and panels on the right-hand end of the transmitter (fig. 2).

(5) Use a round ¼-inch camel's-hair brush to clean thoroughly the crystal sockets in the crystal oven (fig. 1), the microphone jacks and fuse sockets under the front panel guard, and the pilot lamp socket on the front panel.

(6) Use the brush and dry-cleaning solvent (SD) to clean the plug (PG101) in the left-hand end of the transmitter casing. Completely remove all hard deposits using a smooth file if necessary (fig. 8).

(7) Thoroughly clean the vacuum tube sockets with dry-cleaning solvent (SD) and the camel's-hair brush. Clean the gears and racks on the push-button assembly, the two Jones plugs, and all soldered and mechanical connections on the upper part of the chassis (fig. 9).

(8) Use the camel's-hair brush and dry-cleaning solvent (SD) to clean the gang capacitor assembly and all the soldered and mechanical connections in the bottom of the chassis (fig. 8).

(9) Clean relays S102 and S103 in the bottom of the chassis (fig. 8) with dry-cleaning solvent (SD) and the camel's-hair brush.

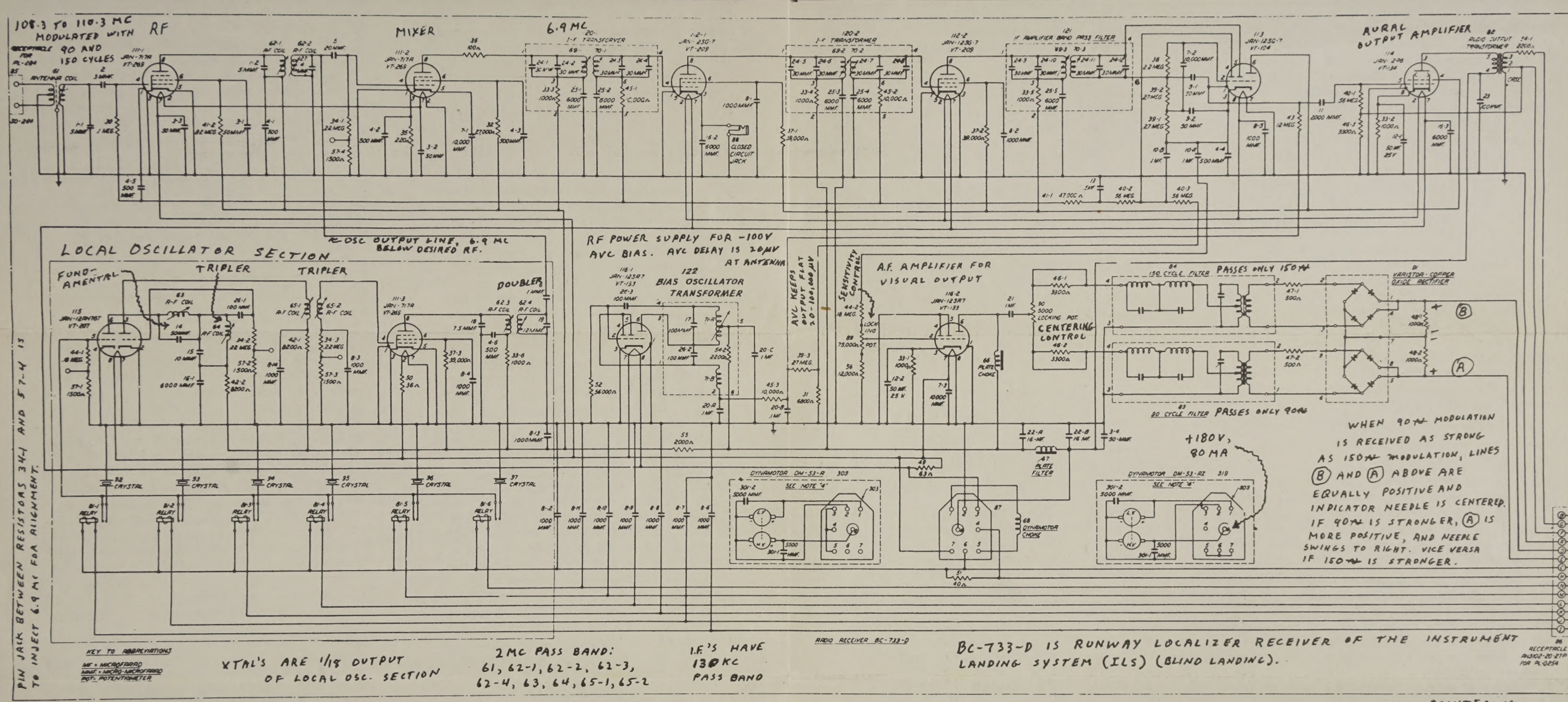
(10) Remove rough spots on the relay contacts with a fine thin metal file. *Never use an abrasive on the relays.* Prepare a paper or cloth guard to catch the filings and make sure no filings become lodged in the apparatus. The contacts on relay S102 are more likely to burn and require filing.

(11) Burnish the contacts with a burnishing tool, or a thin flat piece of metal, until they present a smooth highly polished appearance.

(12) Turn the transmitter over so that the top side is up, and clean, file, and burnish Relay S101 contacts (fig. 7) as instructed above for the other two relays.

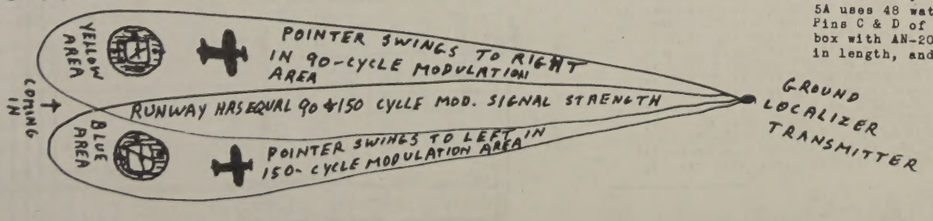
(13) Relay S104 in Radio Transmitter BC–684–B can be reached with the transmitter in the position described in step (12) above (fig. 7). Clean, file, and burnish the relay contacts.

(14) Dirt on contacts is a very common cause of operating trouble. Make sure all sockets, plugs, and open contacts are clean. Make sure that no hard deposits of foreign material are left on the contacts.



NOTES

1. Connect to terminal "F" for 300-ohm output circuit, and to terminal "G" for 4000-ohm output circuit.
2. Connect to terminal "C" for 12-volt system, and to terminal "H" for 24-volt system.
3. A 10-ampere fuse is employed in both 12- and 24-volt installations.
4. Use Dynamotor DM-53-A for Radio Receiving Equipment RC-103-A (24 volts) and Dynamotor DM-53-AZ for Radio Receiving Equipment RC-103-AZ (12 volts).
5. Place a 1000-ohm resistor across the wires that lead to terminals "A" and "B" of Plug PL-P257 when only one Indicator I-101-C or I-101-D is used.
6. Plug PL-P257 is the same as Plug PL-190.
7. Some installations do not employ 6 crystals. In such cases a warning plate is placed on the front of the receiver to indicate this fact.
8. A non-polarized electrolytic capacitor is used when available.

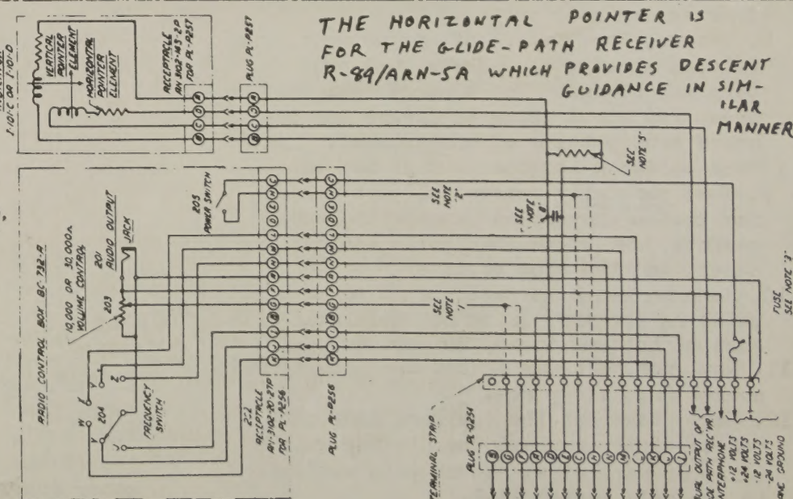


ORIGINAL

Radio Receiving Equipment RC-103-A—Schematic Diagram

To provide complete interconnecting information for ILS in aircraft, note below: RG-22/U or WC-551 cable connects the dual-coax terminals of both receivers to their terminals at the antenna (short rods for R-89, ram's horn for BC-733-D). Shielded AN-20 wire connects pin F of BC-732-A in parallel with output of the command receiver in the plane. Pin C of BC-732-A goes to +24v with AN-18 wire and fuse or circuit breaker in the line; total line resistance to stay under .1 ohm. Fuse: AN/ARN-5A uses 48 watts; RC-103 uses 62.4 watts. Pins C & D of R-89 go to the junction box with AN-20 wire not exceeding 1 ohm in length, and from there go respectively to C & D of I-101-C or I-101-D with AN-20 wire not exceeding 1 ohm in length. In the J-box, shunt with a 1250 mfd non-polarized electrolytic capacitor to damp the needle swing; if only one indicator is used, shunt also with a 1000 ohm, ½ W resistor. Exactly the same wiring and shunting goes from pins D & E of BC-733-D, through the J-box, to pins A & B respectively of the indicator. Pins A of R-89, 733, and 732 each go to a common ground point in the J-box with AN-18 wire; length may be up to .1 ohm from R-89 and from 733, and .25 ohm from 732. Pin B of R-89 uses .1 ohm or less of AN-18 to J-box; thence with AN-18 wire .1 ohm or less to pin H of 733 and pin H of 732. All following wires are AN-20 and may each be up to 1 ohm from the units to the J-box: E of R-89 to I of 733 & 732; F, R-89, to J, 733, J, 732; G, R-89, to K, 733 & 732. H, R-89 to L, 733 & 732; I, R-89, to M, 733 & 732; J, R-89, to N, 733 & 732. This completes cabling.

THE HORIZONTAL POINTER IS FOR THE GLIDE-PATH RECEIVER R-89/ARN-5A WHICH PROVIDES DESCENT GUIDANCE IN SIMILAR MANNER



The BC-733D receiver was used as a six-channel v.h.f. AM receiver. It was designed to be operated by a remote control box (BC-732) using interconnecting cable and relays for switching. The purpose of this conversion is to provide local full-band tuning and to adapt the detector for FM. During this conversion much difficulty will be avoided if all steps are followed precisely and in order.

During the conversion there are three things to remember:

1. When an operation is entitled 'Remove', all wires which were connected to the removed unit should be cut away at both ends and discarded, unless otherwise directed.
2. When an operation is entitled 'Unsolder' or 'Disconnect', do not remove any wiring.
3. Save all parts removed until conversion is completed. Many of them, even the smallest ones, will be used in later steps.

NOTE: Positioning mentioned throughout the text, such as left or right, front or back, is as viewed from front panel with set in normal upright position.

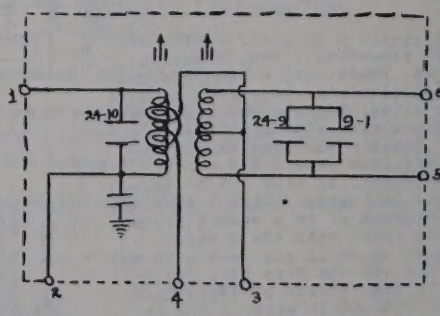
Now begin with step-by-step conversion.

Materials required: See steps #13, 20, 26, 29, 30, 31, 33, 37, 38.

1. Take off both lids. Save screws.
2. Remove, from left side of set, parts #21, 91, 10, and 68 (round potted unit).
3. Using a razor blade, cut the lacing around thick cable next to where the parts just removed were.
4. Remove two potentiometers, #89 & 90 next to plug PL-Q254. Remove PL-Q254.
5. Remove units #83 and 84.
6. Move red wire on unit #66 to terminal of #67 which is connected by red wire, cutting bare jumper wire in the same operation. Remove unit #66.
7. Remove aluminum shield lid by removing four screws holding it.
8. Remove, from inside of compartment, six relays, three xtal sockets, and two terminal boards. Don't remove the pair of brown-red wires going to larger terminal board from outside of compartment. Leave them soldered together but do not tape.
9. Now, carefully remove all parts remaining inside compartment except the tube sockets, one of the two coils nearest front panel, and the blue resistor.
10. Remount the blue resistor, with terminals pointing forward, in center hole near left edge of bottom side of compartment.
11. Now, remove brown socket and move ceramic socket into its place.
12. Next, take out the one remaining coil and carefully replace the winding with 8 turns of bare wire. Mount this new coil in the hole marked 65-2.
13. Mount, on the front wall of compartment, a midget triple section variable condenser of 3 or 4 plates per section (17 or 19 mmfd; a torn-down BUD or equivalent).
14. Remove unit #122 and condenser #20 (with resistor left on it) and large blue resistor (51) near it.
15. Remove test jack from front panel and blue resistor (49) near it. Ground pin #3 of front VT-209.
16. Cut away and remove portion of long terminal board (along with its resistors) between front side of middle bracket and front end. From the piece cut off, at the end which was cut, disconnect one of the 3300 ohm resistors and resolder it between the lug on top of bathtub condenser 12-2 and lug at mounting screw (ground). Move the blue wire from pin #3 of front VT-133 to pin 3 of VT-104. Remove wires going to the front four resistors on the remaining portion of the long terminal board.

Now comes the most difficult work, which must be done slowly and carefully. The IF frequency will be changed from 6.9 mc. to 9.1 mc.

17. Carefully disconnect and lift out units #120-1, 120-2, and 121, noting closely which came from where and which wires went where.
18. Remove, and save, one 30 mmfd. condenser from both primary and secondary of both units #120-1 and 120-2. Replace these two units in set.
19. Open unit #121. Remove 1000 ohm resistor. Remove, from same side (primary), one 30 mmfd. condenser (and save). Connect bottom side (not pin #1 side) directly to pin #2.
20. From the secondary of #121 remove everything except the coil form. Rewind this coil (secondary) with 20 turns, center-tapped, of #28 d.c.c. wire. Connect the center-tap to pin #3 with the ends going to pins #5 & 6.



REVISED #121

21. Wind, directly on top of the primary, using the same size wire as above, a 6 turn coil. Connect one end to the center-tap of the secondary (pin #3) and the other end to pin #4.

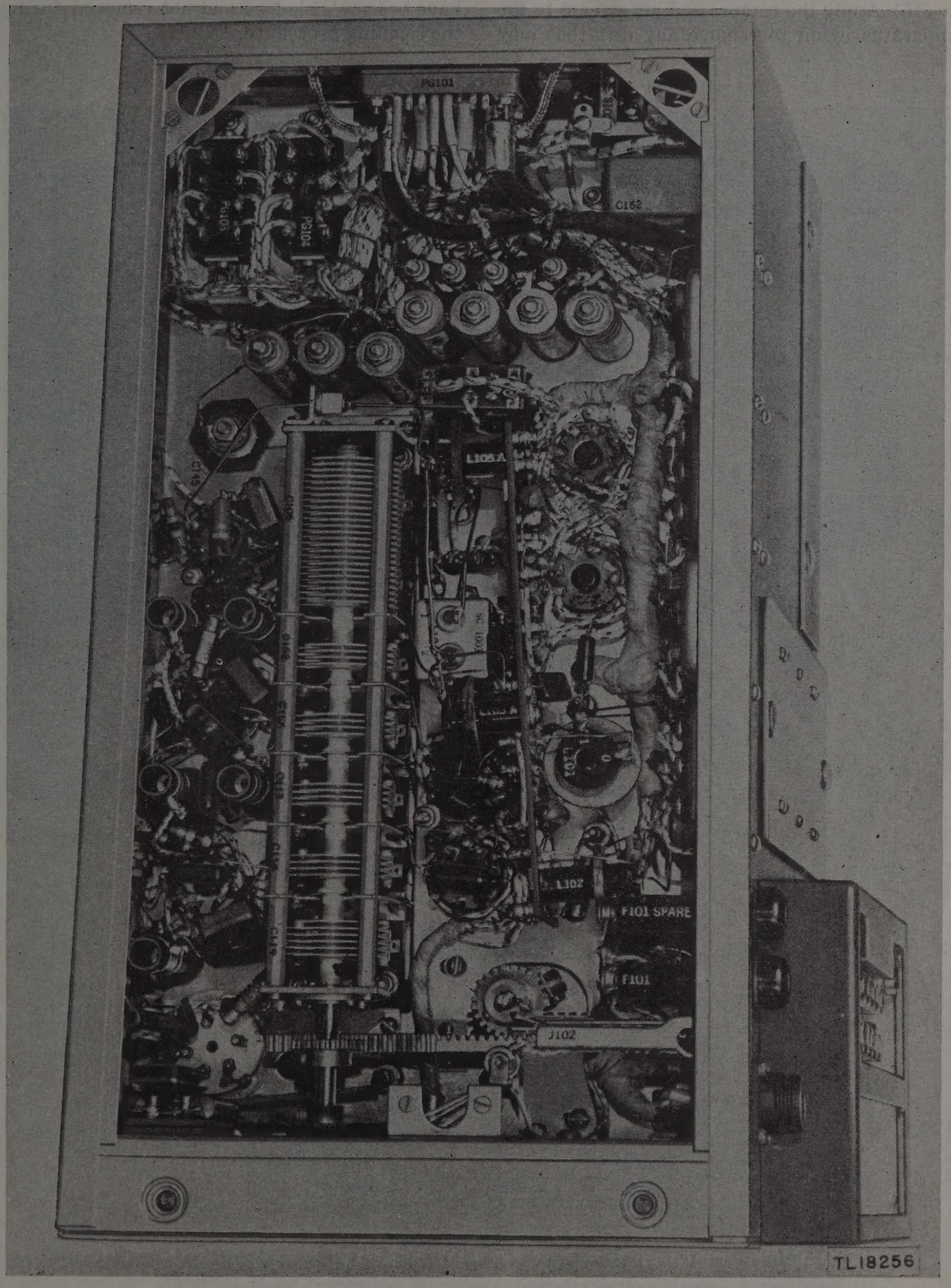


Figure 8. Radio Transmitter BC–684–A, interior view, bottom cover removed.

(15) Apply the compressed air stream to the apparatus again to remove any dirt that may have become dislodged and not removed during the cleaning procedure.

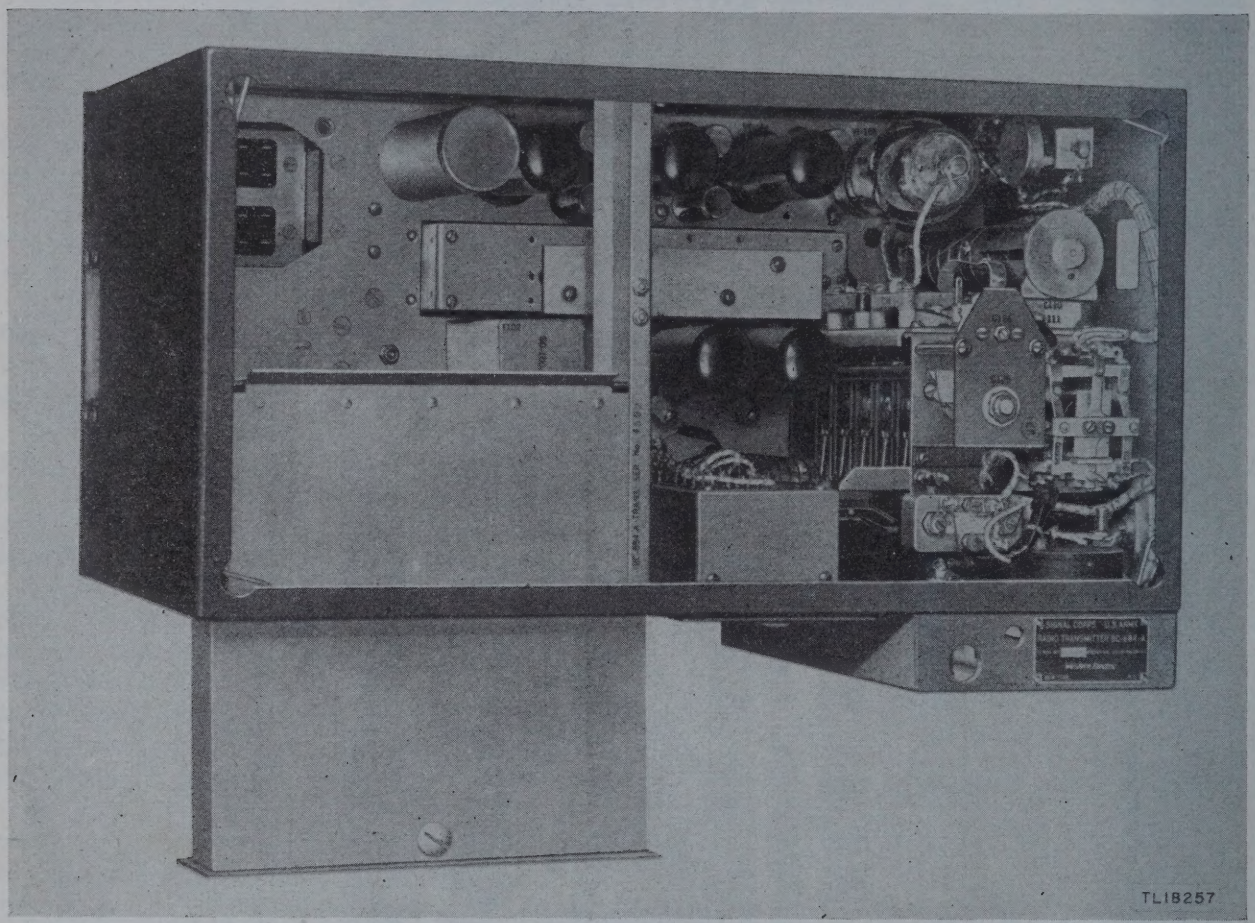
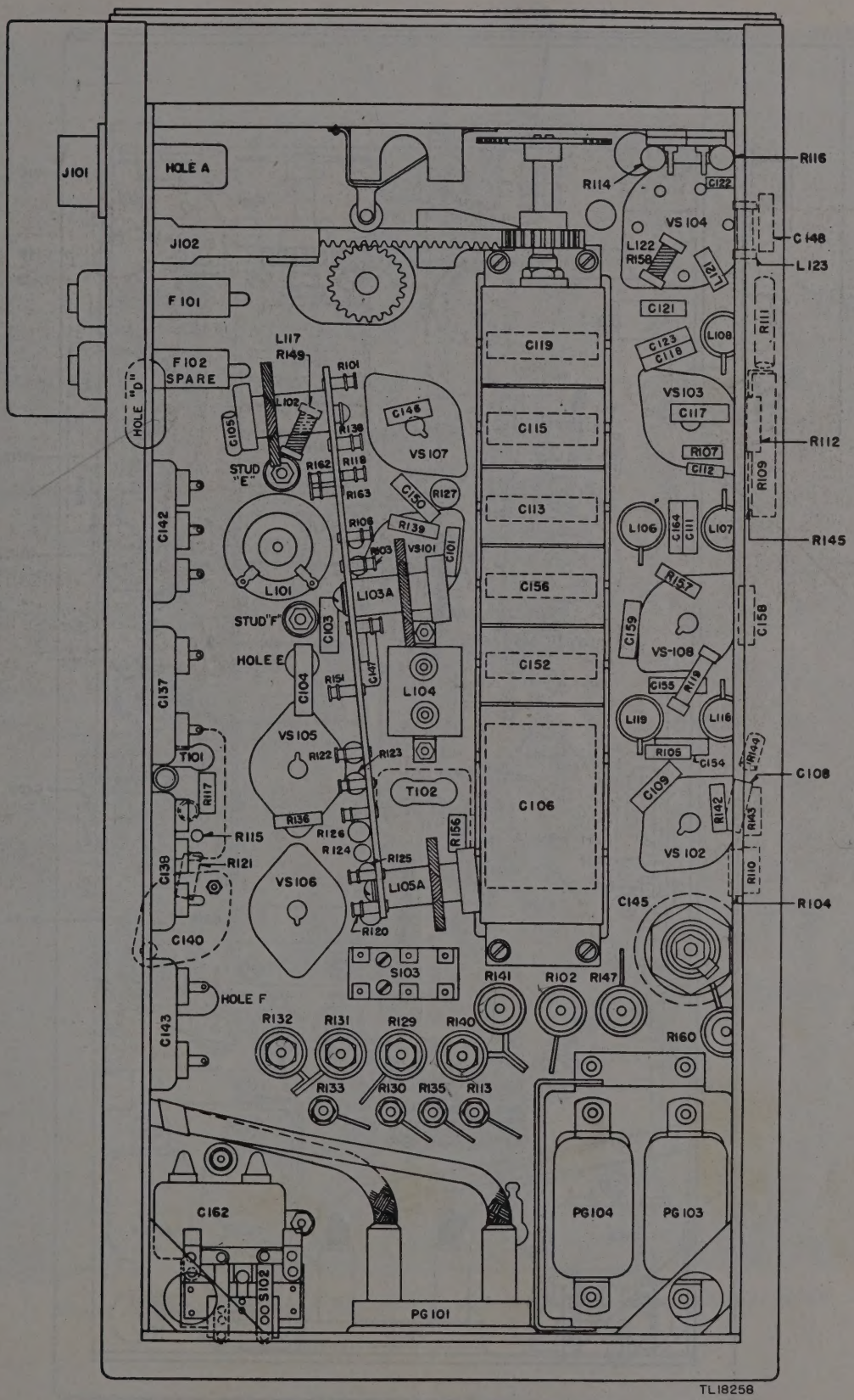


Figure 9. Radio Transmitter BC–684–A, interior view, top cover removed.



TL18258

Figure 10. Radio Transmitter BC–684–A, apparatus location diagram, bottom view.

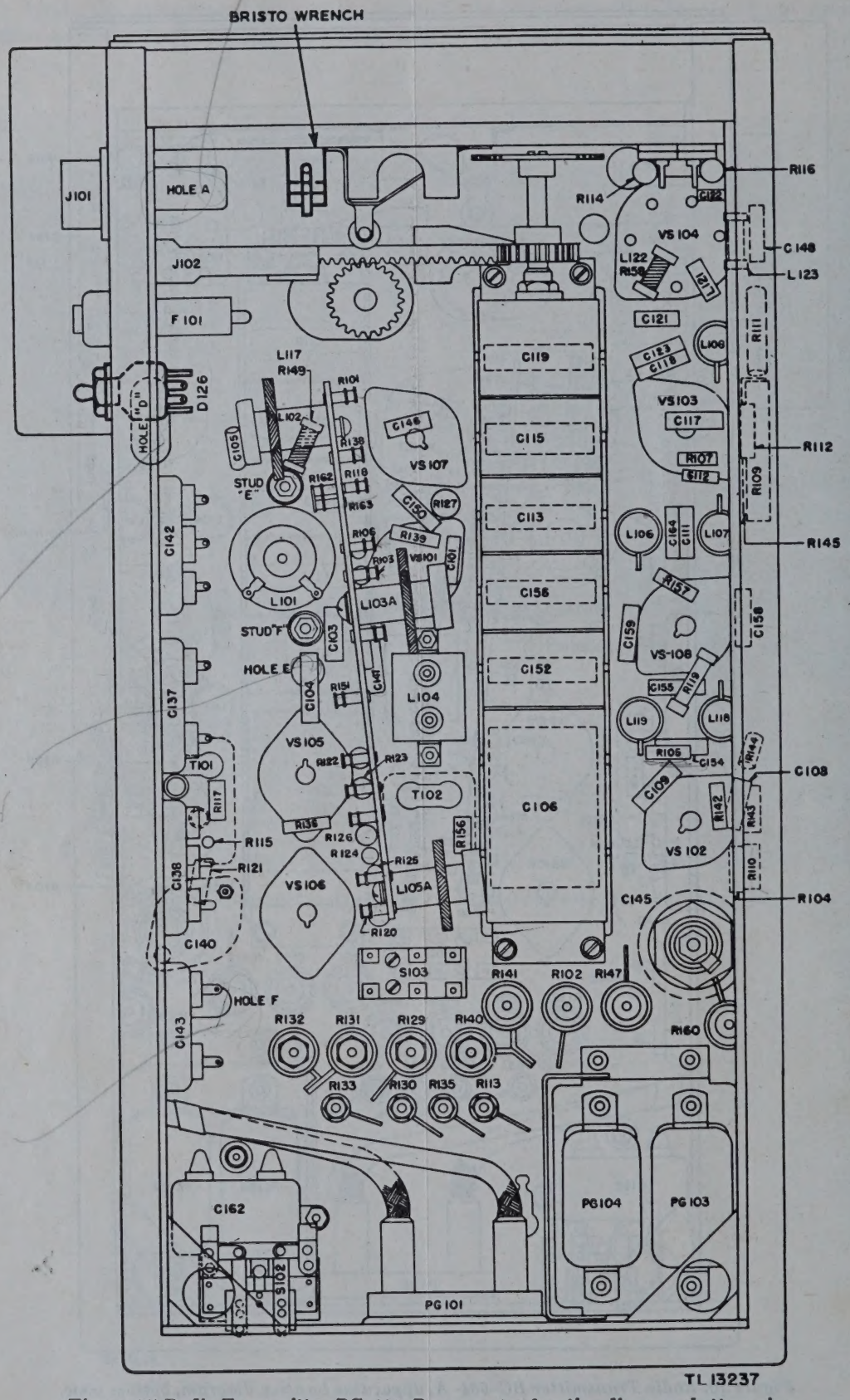


Figure 11. Radio Transmitter BC–684–B, apparatus location diagram, bottom view.

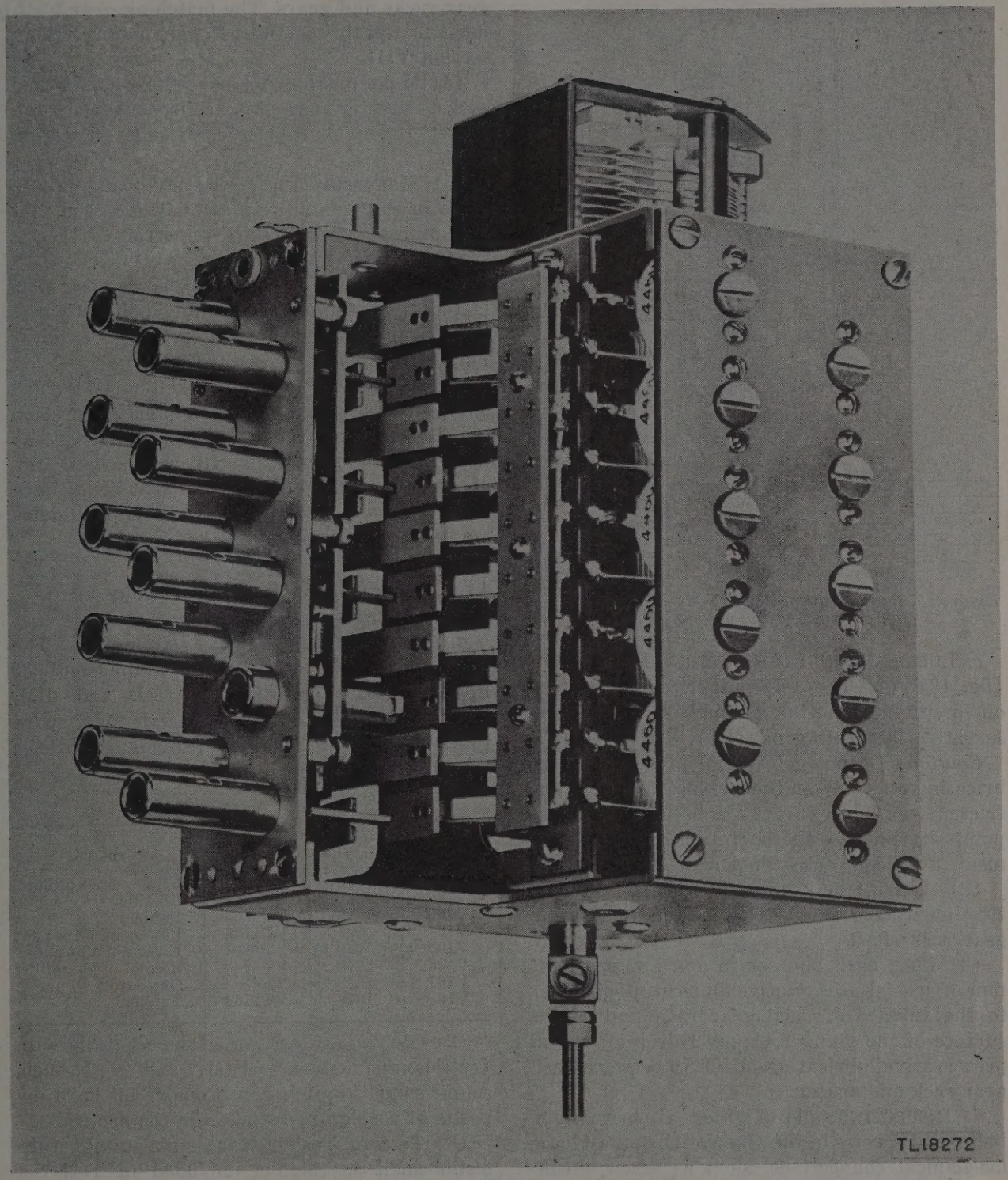
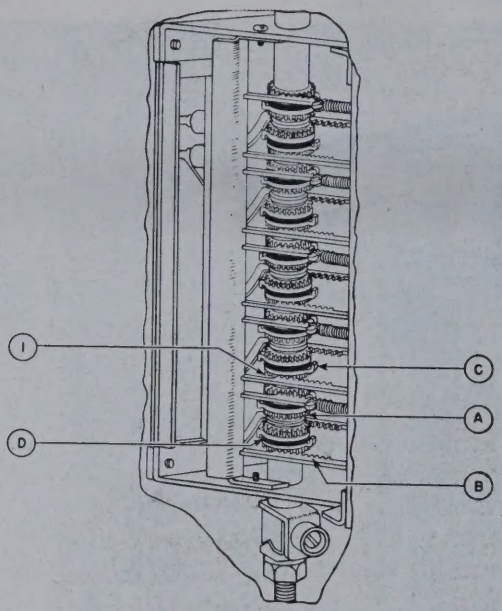


Figure 12. Radio Transmitter BC–684–(*), push-button mechanism, right-side view.



PARTS LIST	
A	GEAR
B	GEAR RACK
C	LOCKING WEDGE
D	FRICTION WASHER

SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	APPLY ONE DROP OF OIL BETWEEN EACH OF THE TWENTY RACKS & GEARS

TL 18273

Figure 13. Radio Transmitter BC–684–(*), lubrication of the push-button mechanism.

c. LUBRICATING PUSH-BUTTON MECHANISM (fig. 13). (1) The only authorized lubricating oil for the push-button assembly is special preservative lubricating oil (PS).

Caution: Do not get special preservative lubricating oil (PS) on the locking wedges or the friction washers (fig. 13), because at these points it will stop the operation of the mechanism. Lubricate only when necessary.

(2) Apply 1 or 2 drops of special preservative lubricating oil (PS) to the top and bottom gear rack shafts.

(3) Push each plunger in and apply a light film of special preservative lubricating oil (PS) to the surface of each gear rack and to the surface of the plunger. Apply 1 drop of special preservative lubricating oil (PS) between each gear rack and spacer.

d. INSPECTING. (1) Tighten all loose nuts, bolts, and screws in the apparatus, and all loose mechanical connections, such as screw terminals.

(2) Inspect the alignment of the spring and roller guides that hold the gang capacitor gear rack in place (fig. 10). There should be no play in the assembly. Consult section VIII for detailed information on repairing this assembly.

(3) Inspect the alignment of the push-button gear racks and gears. The matching gear teeth must fit tightly together. Repair as directed in section VIII.

(4) Make particularly sure the vacuum-tube sockets are tight. If pins are loose, replace the socket. Repair or replace as directed in section VIII.

(5) Make sure the socket strip and heater units in the crystal oven are not damaged. Repair or replace as directed in section VIII.

(6) Replace broken panels.

(7) Plug PG101 should have some play. If it is too tight, loosen the holding bolts slightly. The bolt holes are somewhat oversized to allow play of the plug.

(8) Inspect visually for broken parts, burned out resistors, shorted or open capacitors, coils, etc. Before removing them, test the circuit as described in paragraph 18, and locate any shorted wires or other defects that could have caused the affected part to fail. Repair all damage in the circuit.

11. Cleaning, Inspecting, and Testing Removed Parts

a. VACUUM TUBES. (1) *Description.* The chart below shows the tube complement of Radio Transmitters BC–684–A, –B, and –BM. One spare Tube JAN 1624 and four spare tubes JAN 1619 must be provided with the transmitter.

Circuit designation	JAN designation	Signal Corps designation	Function
V101	1619	VT–164	First r-f amplifier
V102	1619	VT–164	Rectifier
V103	1619	VT–164	Doubler
V104	1624	VT–165	Power amplifier
V105	1619	VT–164	First a-f amplifier
V106	1619	VT–164	Second a-f amplifier
V107	1619	VT–164	Oscillator
V108	1619	VT–164	Tripler

(2) *Cleaning.* Clean each tube carefully with dry-cleaning solvent (SD), and a ½-inch, round camel's-hair brush. Remove all hard deposits of foreign material from the prongs.

(3) *Testing.* Test each tube in a suitable tube tester such as the one included in Test Set I–56–(*). Examine the prongs; if they are loose discard the tube.

b. CRYSTALS. The crystals are contained in individual holders (FT–241–A) that *must not be opened.*

(1) *Description.* One crystal must be supplied with the transmitter for each of the 120

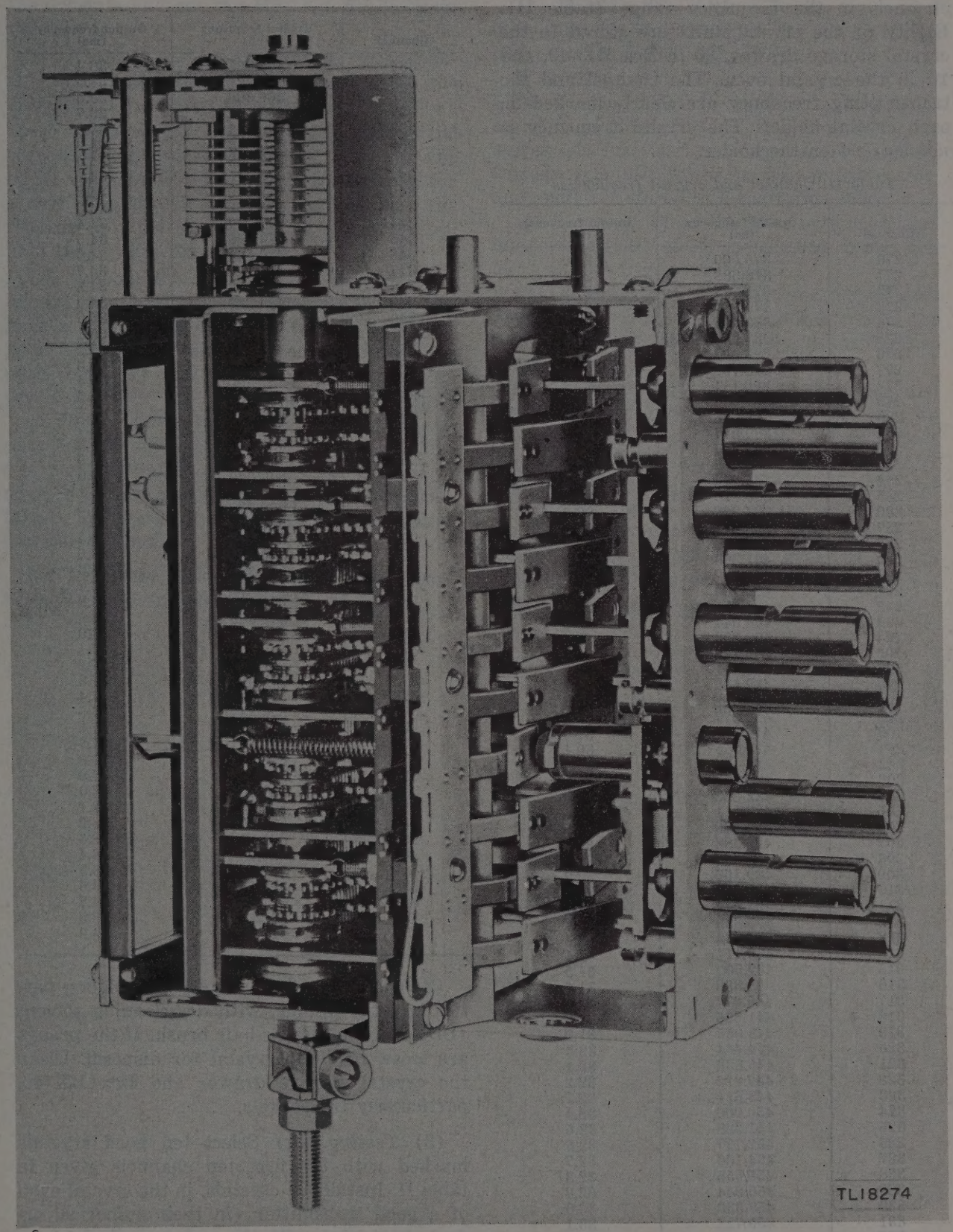


Figure 14. Radio Transmitter BC–684–(*), push-button mechanism, left-side view.

channels in the frequency range (table II). Eighty of the crystal units are stored in the crystal storage drawer, 30 in Box BX–40, and 10 in the crystal oven. The channel and the transmitting frequency are clearly marked on each crystal holder. The crystal frequency is *not marked* on the holder.

Table II. Channel and crystal frequencies

Channel	Crystal frequency (kc)	Output frequency (mc)
270	375.000	27.0
271	376.388	27.1
272	377.777	27.2
273	379.166	27.3
274	380.555	27.4
275	381.944	27.5
276	383.333	27.6
277	384.722	27.7
278	386.111	27.8
279	387.500	27.9
280	388.888	28.0
281	390.277	28.1
282	391.666	28.2
283	393.055	28.3
284	394.444	28.4
285	395.833	28.5
286	397.222	28.6
287	398.611	28.7
288	400.000	28.8
289	401.388	28.9
290	402.777	29.0
291	404.166	29.1
292	405.555	29.2
293	406.944	29.3
294	408.333	29.4
295	409.722	29.5
296	411.111	29.6
297	412.500	29.7
298	413.888	29.8
299	415.277	29.9
300	416.666	30.0
301	418.055	30.1
302	419.444	30.2
303	420.833	30.3
304	422.222	30.4
305	423.611	30.5
306	425.000	30.6
307	426.388	30.7
308	427.777	30.8
309	429.166	30.9
310	430.555	31.0
311	431.944	31.1
312	433.333	31.2
313	434.722	31.3
314	436.111	31.4
315	437.500	31.5
316	438.888	31.6
317	440.277	31.7
318	441.666	31.8
319	443.055	31.9
320	444.444	32.0
321	445.833	32.1
322	447.222	32.2
323	448.611	32.3
324	450.000	32.4
325	451.388	32.5
326	452.777	32.6
327	454.166	32.7
328	455.555	32.8
329	456.944	32.9
330	458.333	33.0
331	459.722	33.1
332	461.111	33.2
333	462.500	33.3
334	463.888	33.4
335	465.277	33.5
336	466.666	33.6
337	468.055	33.7
338	469.444	33.8
339	470.833	33.9
340	472.222	34.0
341	473.611	34.1
342	475.000	34.2
343	476.388	34.3
344	477.777	34.4
345	479.166	34.5
346	480.555	34.6
347	481.944	34.7
348	483.333	34.8
349	484.722	34.9
350	486.111	35.0
351	487.500	35.1
352	488.888	35.2
353	490.277	35.3
354	491.666	35.4
355	493.055	35.5
356	494.444	35.6
357	495.833	35.7
358	497.222	35.8
359	498.611	35.9
360	500.000	36.0
361	501.388	36.1
362	502.777	36.2
363	504.166	36.3
364	505.555	36.4
365	506.944	36.5
366	508.333	36.6
367	509.722	36.7
368	511.111	36.8
369	512.500	36.9
370	513.888	37.0
371	515.277	37.1
372	516.666	37.2
373	518.055	37.3
374	519.444	37.4
375	520.833	37.5
376	522.222	37.6
377	523.611	37.7
378	525.000	37.8
379	526.388	37.9
380	527.777	38.0
381	529.166	38.1
382	530.555	38.2
383	531.944	38.3
384	533.333	38.4
385	534.722	38.5
386	536.111	38.6
387	537.500	38.7
388	538.888	38.8
389	540.277	38.9

(2) *Cleaning.* Clean the crystal holders, particularly the prongs, with dry-cleaning solvent (SD) and the camel's-hair brush. If the prongs are loose, hold the crystal for disposal. Clean the crystal storage drawer and Box BX–40, particularly the sockets.

(3) *Testing.* (*a*) Select ten good crystals marked with the first ten channels given in table II. Install the crystals, in the crystal oven of a good transmitter (in their numerical order), beginning with the socket marked 1.

(*b*) Set the push buttons to correspond with

the crystals and set the METER SWITCH in position 2.

(*c*) Operate the transmitter in each channel, and record the reading obtained on the front panel meter for each crystal.

(*d*) Remove the good crystals, install the corresponding untested crystals, and note the meter readings for each one. If the reading for a crystal is zero, or substantially less than the reading for the corresponding good crystal, hold the crystal for disposal.

(*e*) Remove the crystal under test from the crystal oven and install good crystals for the next ten channels listed in table II. Set the push buttons for the new frequencies and repeat steps (*c*) and (*d*) above. Continue this procedure until 120 crystals have been tested.

c. PILOT LAMP BULB AND JEWEL. (1) *Description.* Lamp LM–38 (E101) is a 28-volt, 0.17-ampere, 651-base, T1–¾ light bulb. Two spare bulbs are furnished in a spare bulb container. The jewel is a protective cover and window for the bulb.

(2) *Cleaning.* Clean the bulb and the jewel with dry-cleaning solvent (SD).

(3) *Testing.* Test each bulb in a test socket to be sure it lights. Examine the jewel; if it is broken or damaged, discard it.

d. FUSES. (1) *Description.* Fuse FU–64 (F101) is a 1,000-volt, ½-ampere, fuse. It is sealed in a plastic holder. The transmitter requires one fuse, and nine spares are supplied. One spare is installed in the transmitter casing, and eight are stored in a spare fuse bag.

(2) *Cleaning.* Clean the fuses with dry-cleaning solvent (SD) and a camel's-hair brush. Remove all dirt from the contacts.

(3) *Testing.* Put an ohmmeter across each fuse. A very low, or zero, reading means the fuse is good. An infinite reading means the fuse is defective. Discard it.

e. DYNAMOTOR. Clean, inspect, lubricate and repair, when required, in accordance with instructions contained in TB SIG 134 or Repair Instructions for Dynamotors, section R–434.01 (the latter may be obtained from fourth- and fifth-echelon Signal Corps repairs shops). Test the dynamotor for proper operation with dynamotor Test Set I–199 (or equivalent). If the dynamotor is found defective, repair it or replace it with a good one.

SECTION IV

PRELIMINARY TROUBLE-SHOOTING PROCEDURES

12. General

a. The alignment procedure (sec. V) is to be used for stage-by-stage trouble location. The steps in this section are preparatory to alignment. They include installing the parts previously removed, connecting the power supply, a look, listen, smell, touch inspection, and a voltage and resistance test.

b. A test of the power input plug (PG103) is essential before turning the transmitter on, because the tubes and other replaced parts may be damaged if the plug is defective. Dynamotor continuity must also be checked.

13. Power Input Plug Continuity Test

a. Plug PG103 is located on the dynamotor mounting in the chassis (fig. 10).

b. Connect an ohmmeter across terminals 4 and 8 (fig. 10). A reading between 4,500 and 5,500 ohms must be obtained. Do not install the dynamotor until the correct resistance is obtained at these terminals.

14. Dynamotor Continuity Test

Because of variations in methods of manufacturing, widely varying terminal to terminal internal resistance measurements are found in various dynamotors of the same type. In many cases shorted turns in choke coils and armature windings are not revealed by continuity tests. For these reasons, the customary ohmmeter continuity tests cannot be relied upon to indicate the true operating condition of a dynamotor. Therefore, test the operation of the dynamotor with a dynamotor Test Set I–199 (or equivalent) to determine its operating condition. See TB SIG 134 or Repair Instructions for Dynamotors, section R–434.01 for assistance if repairs are required.

15. Installation of Removed Parts

a. Inspect each part and its receptacle in the chassis to be sure both are clean and free from mechanical defects before installing the part into the transmitter.

b. The transmitter is assumed to have its top, bottom, and back covers removed as directed in section III.

c. Hold the tested dynamotor over its mounting in the chassis (fig. 9); line up the two Jones plug jacks with the matching Jones plugs in the chassis; and carefully lower the dynamotor into place on its mounting. The jacks should fit snugly over the plugs.

Note. Either Dynamotor DM–35–(*) or Dynamotor DM–37–(*), whichever is appropriate for the battery available, must be used with Radio Transmitter BC–684–(*).

d. Tighten the four mounting bolts in the corners of the dynamotor mounting plate with a screw driver.

e. Install a good power-amplifier Tube JAN 1624 (fig. 9) in the socket marked VT–165 on the chassis. Both the Signal Corps designation and the JAN designation are marked on the chassis near the socket. Do not use the tube if it is loose in its socket. Tighten the holding clamp at the base of the tube with a screw driver, and attach the connecting clip to the cap of the tube.

f. Install seven good vacuum Tubes JAN 1619 in the seven remaining tube sockets (fig. 9) in the chassis. Do not use a tube if it is loose in its socket. Tighten the locking tab at the base of each tube with a screw driver.

g. Install one good ½-ampere, 1,000-volt fuse (F101) in the FUSE socket under the front panel guard. Do not tighten the fuse excessively.

h. On Radio Transmitter BC–684–A install the spare fuse in the SPARE socket under the front panel guard (fig. 1). On Radio Transmitter BC–684–B, install the spare fuse in the upper left-hand corner of the front panel guard (fig. 3).

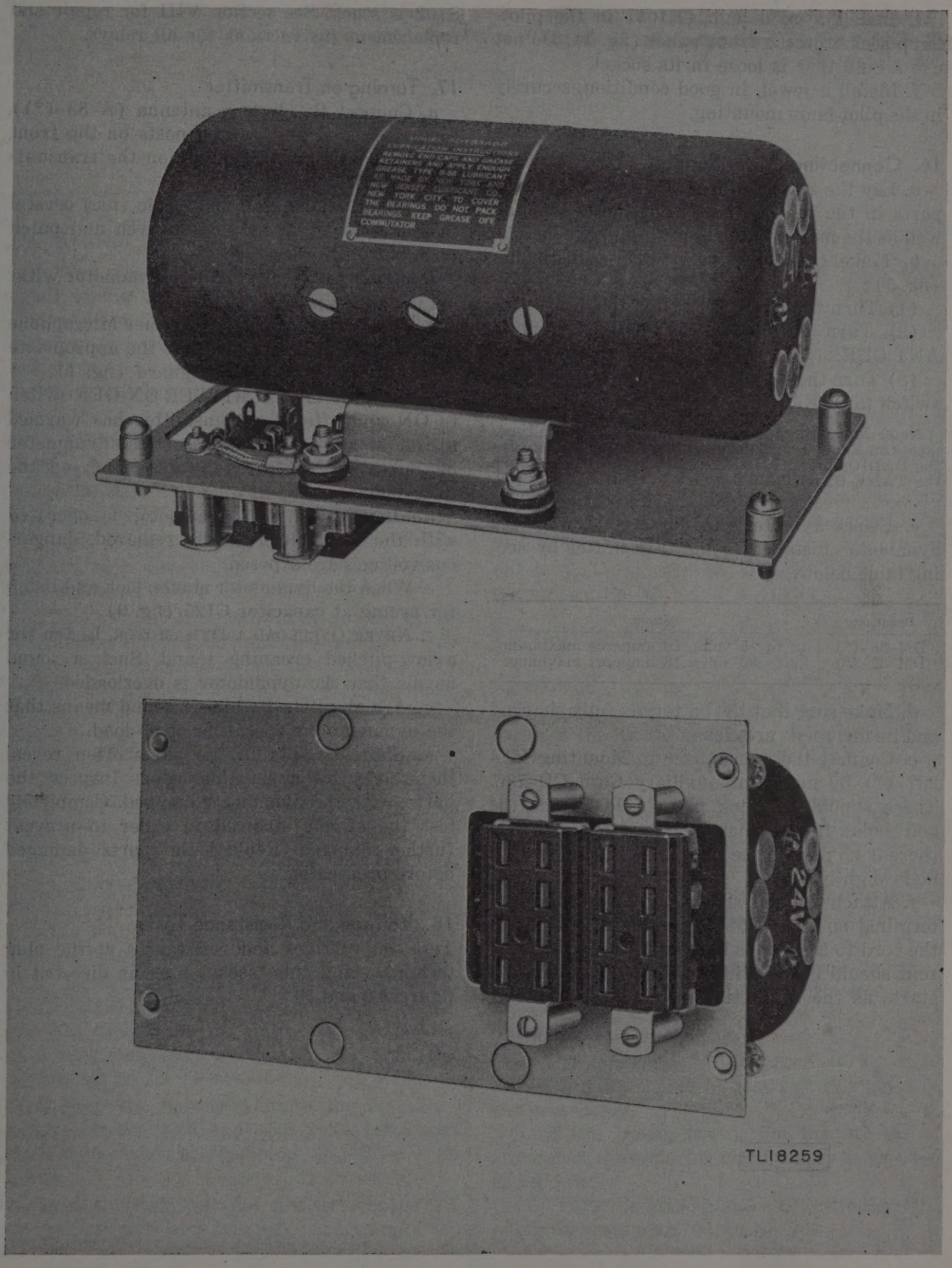


Figure 15. Dynamotor DM–35–(*) or DM–37–(*) side and subbase view.

i. Install a good bulb (E101) in the pilot-lamp socket on the front panel (fig. 1). Do not use a bulb that is loose in its socket.

j. Install a jewel, in good condition, securely in the pilot-lamp mounting.

16. Connecting Power Supply

a. Lay the transmitter on its back so that the parts in the top and bottom of the chassis, as well as the meter on the front panel, are visible.

b. Make the following switch adjustments (fig. 1):

(1) Turn the ON-OFF switch to OFF.

(2) Turn the TUNE-ANT CUR switch to ANT CUR.

(3) Turn the RECEIVER TUNE-OPERATE switch to OPERATE.

Note. Make the following additional switch adjustments on Radio Transmitters BC–684–B and –BM: turn the RADIO-INTERPHONE switch to RADIO and turn the TANK-OTHER USE switch to OTHER USE (fig. 3).

c. Select a battery to correspond with the dynamotor installed in the transmitter by seeing table below.

Dynamotor	Battery
DM–35–(*)	12 to 15 volts, 26 amperes maximum
DM–37–(*)	22 to 30 volts, 18 amperes maximum

d. Make sure that the battery is fully charged and its terminals are clean.

e. Connect the transmitter to Mounting FT–237–(*) by means of auxiliary Cord CD–786. There should be some play in PG101 as the bolt holes in the mounting are oversized. If there is no play in the plug loosen the mounting bolts slightly.

f. Attach the plus side of the cord to the plus terminal on the battery and the minus side of the cord to the minus battery terminal. No current should flow at this time. If the dynamotor starts as the connection is being made, Relay S102 is stuck. See section VIII for repair and replacement instructions for all relays.

17. Turning on Transmitter

a. Connect the dummy antenna (A–83–(*)) to the antenna and ground posts on the front panel (fig. 1) before turning on the transmitter.

b. Install a good 27.0 megacycle (mc) crystal in socket No. 1 in the crystal oven and patch push button No. 1.

Remember: Never start the dynamotor without latching a push button.

c. Plug a good microphone, either Microphone T–17, T–30, T–33, or T–45 into the appropriate jack under the front panel guard (fig. 1).

d. Turn the TRANSMITTER ON-OFF switch to ON and after the transmitter has warmed up for at least 5 seconds, start the dynamotor by operating the press-to-talk switch on the microphone.

Caution: When the dynamotor is operated with the transmitter covers removed, dangerous voltages are exposed.

e. When the dynamotor starts, look and listen for arcing at capacitor C125 (fig. 9).

f. NEVER OVERLOAD A DYNAMOTOR. Listen for a low-pitched groaning sound. Such a sound means that the dynamotor is overloaded.

g. A high-pitched whining sound means that the dynamotor is operating at no load.

h. Short circuits in the parts often reveal themselves by a burning odor. Inspect the parts, with the dynamotor stopped. Completely test the circuit involved in order to prevent further damage. Replace the parts damaged before proceeding.

18. Voltage and Resistance Tests

Test the voltages and resistances at the plug terminals and tube socket pins as directed in figures 39 and 40.

SECTION V

ALIGNMENT PROCEDURE

19. General

a. Trouble in the r-f circuits is readily located during the alignment procedure, because the required frequency and current cannot be obtained in a stage if the component parts do not function properly. All the data needed for locating trouble within a stage is given in section VIII.

b. The location of adjustable coils and capacitors provided for aligning the transmitter are shown in figure 41.

c. The panel meter is used during alignment to indicate circuit resonance. The meter needle deflects to a maximum reading at resonance and decreases either side of resonance.

d. The amount of current at resonance varies in different transmitters and in the same transmitter with different tubes, and crystals. The values shown on the chart (fig. 41), therefore, are only rough approximations to the meter readings that may be expected in the circuits. The power output of a stage is satisfactory, if the meter readings obtained during alignment approximate those found in the table in figure 41.

e. The actual meter readings obtained during alignment must be recorded, as directed in the text below, for use in locating trouble. Make a blank chart for this purpose similar to the chart in figure 41.

f. Operate the dynamotor by means of the RECEIVER TUNE-OPERATE switch. *Do not run the dynamotor for more than 5 minutes at a time and, after a 5-minute run, turn the dynamotor off for 15 minutes.*

g. Keep the battery voltage, during alignment, between 11.5 and 13.5 volts (23.5 and 25.5 volts when Dynamotor DM–37–(*) is used).

Caution: High voltages are present on all the tuning coils and trimmer capacitors.

20. Crystal and Switch Adjustments

a. Turn the TRANSMITTER ON - OFF switch to OFF.

b. Turn the TUNE-ANT CUR switch to TUNE.

c. Turn the RECEIVER TUNE-OPERATE switch to OPERATE.

Note. When aligning Radio Transmitters BC–684–B and –BM, turn the RADIO-INTERPHONE switch to RADIO and the TANK-OTHER USE switch to OTHER USE.

d. Install the 27.0 mc crystal holder into socket No. 1 in the crystal oven, and install the 38.9 mc crystal holder into socket No. 10. If either of these crystals is unavailable, use a crystal within 0.5 mc of it (table II).

21. Unlocking Channel Selector

a. If a push button is latched, release it by partially depressing an adjacent push button.

b. The selector locking screw is reached through the small circular opening just above the handle on the right-hand end of the casing (fig. 41).

Note. The Bristo wrench inside the right-hand end of the casing is used for adjusting the selector locking screw on Radio Transmitters BC–684–B and –BM.

Turn the tuning capacitor (fig. 41) as far as it will go in a clockwise direction in order to expose the selector locking screw. Loosen the screw by turning in a clockwise direction. Then turn the gang tuning capacitor back as far as it will go in a counterclockwise direction.

22. Metering Circuit Test

a. A simple check of the meter and its associated circuits should be made at this point in the procedure.

b. If the transmitter is not too far out of alignment, the metering circuits may be checked as follows:

(1) Turn the TRANSMITTER switch to ON.

(2) Depress push button No. 10.

(3) Turn the dynamotor on by turning the REC TUNE-OPERATE switch to REC TUNE.

(4) Turn the METER SWITCH (fig. 41) to position No. 2.

(5) If there is a meter reading turn the switch from position No. 1 through position No. 6.

c. The presence of a reading on all positions of the switch indicates that the meter and its associated circuits are functioning properly.

d. If the meter should read on position No. 6 *only,* this may indicate that the transmitter is misaligned too much.

e. In such a case, check the circuits as follows:

(1) Connect a vacuum-tube voltmeter to the two center terminals on the back of the meter positioning switch (fig. 2).

(2) Change the TUNE-ANT CUR switch to ANT CUR. (Panel meter out of the circuit.)

(3) With the vacuum-tube voltmeter on the 0–30V scale, note the presence of a reading on positions 1 to 5. If none is obtained, change to a 0 to 10V scale or lower.

f. If neither of these tests are satisfactory, make a continuity test of the circuit with the aid of the metering circuit diagram (fig. 16).

23. Alignment of First R-f Amplifier

a. Turn the METER SWITCH (fig. 41) to position No. 2.

b. Latch push button No. 10 by depressing it until it catches.

c. Turn the TRANSMITTER ON-OFF switch to ON and after the tubes have warmed up for at least 5 seconds, start the dynamotor by turning the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE.

Caution: Dangerous voltages are exposed when the dynamotor is operated with the transmitter covers removed.

d. As soon as the dynamotor starts, the panel meter needle should deflect, showing current in the oscillator stage (V107).

e. Turn the METER SWITCH to the position No. 3. The needle should again deflect showing grid current in the rectifier (V102).

f. Align the first r-f amplifier as follows:

(1) With the push button No. 10 still latched (pushed in), turn the gang tuning capacitor (fig. 41) slowly in a clockwise direction until resonance is reached. The rotor in the gang tuning capacitor should be near the *minimum* capacitance position.

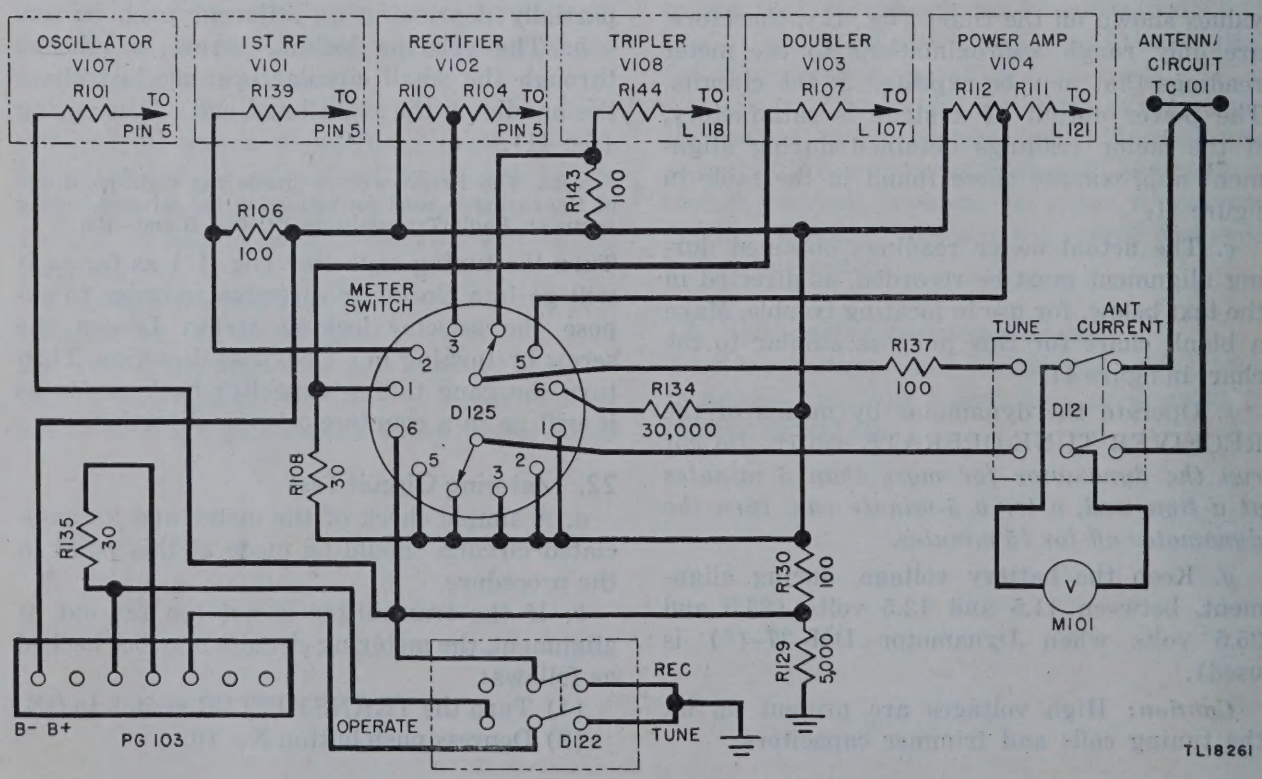


Figure 16. Radio Transmitter BC–684–(*), metering circuit diagram.

(2) Latch push button No. 1 and continue turning the crank (fig. 41) until resonance is again reached. The rotor should now be near the *maximum* capacitance setting.

(3) Rotor travel between the two resonant points must be at least 75 percent of the total possible travel.

(4) Stop the dynamotor and release push button No. 1. Then turn the gang tuning capacitor, as far as it will go in a clockwise direction, to expose the selector locking screw. Lock the channel selector by turning the screw in a counterclockwise direction.

g. Latch push button No. 10 and start the dynamotor.

h. Check the push button setting by turning the gang tuning capacitor slightly back and forth against the restoring force of the springs. The panel meter needle should dip (move back toward zero) as the crank is moved in either direction, showing that resonance occurs with the gang capacitor at the setting selected by the push button. If there is an increased reading when the capacitor is moved against the springs, repeat instructions given in subparagraph *e* above. Record the meter reading for reference in locating trouble. Be careful not to rotate the capacitor more than a few degrees in either direction while making this check.

i. Latch push button No. 1 and repeat instructions given in *h* above.

j. Stop the dynamotor.

k. For trouble location see the voltage-resistance diagrams (figs. 39 or 40). Also see the schematic (fig. 21) and parts list for the first r-f stage V–101.

24. Alignment of Rectifier

a. Insert a narrow blade, 6-inch rule into coil L118 (fig. 41), and measure the distance from the top of the coil to the top of the tuning slug. The distance should be ¾ inch. Procure a ⅛-inch insulated screw driver, or a long-handle, insulated hexagonal, socket wrench to adjust the slug.

b. Adjust the tuning slug in coil L119 (fig. 41) to ¾ inch from the top of the coil.

c. Adjust the trimmer capacitors C153 and C157 (fig. 41) to the midcapacitance position using the same tool.

d. Procure a sensitive precision wavemeter (4- to 40-mc range) and adjust it to 6.48 megacycles. This is the resonant frequency of the tripler circuit with the 38.9 mc crystal connected. If a different crystal has been installed in socket No. 10, set the wavemeter at ⅙ the frequency marked on the crystal holder actually installed in the socket.

e. Turn the METER SWITCH to position No. 4, latch push button No. 10, and start the dynamotor. The panel meter needle should deflect showing grid current in the tripler.

f. Trim C153 and C157 with the insulated screw driver or wrench until a resonance is obtained. Be careful of high voltage on capacitors.

g. Place the wavemeter pick-up coil within coupling distance of L118 and L119. Do not couple the wavemeter too closely with the coils or the tuning of the coils will be affected.

h. As soon as the wavemeter is coupled with the coils, the panel meter needle should dip showing that the wavemeter is drawing energy from the circuit. Trim C153 and C157 to obtain the greatest possible needle dip.

i. The circuit is nearly in resonance when the capacitors are set to give the greatest needle dip on the panel meter. It is necessary, however, to bring the circuit precisely to resonance by using the wavemeter as directed below.

(1) Adjust the wavemeter to a frequency a few hundredths of a megacycle above the resonant frequency of the circuit (⅙ of the frequency marked on the crystal containing holder connected with the circuit). Couple the pick-up coil with coils L118 and L119 and note the dip of the panel meter needle. Then readjust the wavemeter to a frequency a few hundredths of a megacycle below the resonant frequency of the circuit and note the needle dip when the coils are coupled.

(2) The maximum needle dip must occur with the wavemeter set at the resonant frequency of the circuit. Adjust C153, C157, L118, and L119 as required to obtain this condition. The circuit is then in resnonance on the push button No. 10 position.

j. Latch push button No. 1 and tune coils L118 and L119 until the circuit approaches resonance. Then use the wavemeter as above and bring the circuit into resonance by adjusting only the two coils (L118 and L119). The resonant frequency is 4.50 megacycles with the 27.0 mc crystal in the socket No. 1, or ⅙ the frequency marked on the crystal holder actually installed in the socket.

k. The alignment on push button No. 10 may have been changed somewhat by the adjust-

ments of L118 and L119 on push button No. 1. Finish aligning the rectifier by latching push button No. 10 and adjusting only the trimmer capacitors C153 and C157 until the circuit is again in resonance as checked by the wavemeter.

l. Should it prove impossible to obtain exactly the resonant frequency on either push button, divide the difference equally between them by adjusting only the coils (L118 and L119) on push button No. 1 and only the capacitors (C153 and C157) on push button No. 10.

m. Record the current reading at the resonant frequency on each push button for use in locating trouble.

n. In cases where the resonance cannot be obtained on push button No. 1 (step *j* above), resonate the circuit near the middle of the band, as directed below, in order to get the coils near their correct tuning positions.

(1) Install a crystal of a frequency, near the middle of the band (33 megacycles) in socket No. 5.

(2) Turn the METER SWITCH to position No. 3.

(3) Unlock the CHANNEL SELECTOR (par. 21), latch push button No. 5, and obtain resonance by adjusting L118, L119, C153, and C157. Then carefully release push button No. 5 by depressing an adjacent button and retarding push button No. 5 with one finger so that it does not snap back with enough force to disturb the setting of the gang tuning capacitor. After releasing the push button, lock the CHANNEL SELECTOR.

(4) Latch push button No. 5 and bring the circuit into resonance by adjusting L118, L119, C153, and C157, using the wavemeter as described above. The resonant frequency of the circuit with the 33 mc crystal is 5.50 megacycles, or 1/6 the frequency marked on the crystal holder actually installed in socket No. 5.

(5) Latch push button No. 10 and bring the circuit into resonance by adjusting only C153 and C157. The resonant frequency on push button No. 10 is 6.48 megacycles (1/6 the frequency marked on the crystal holder in socket No. 10).

(6) If the exact resonant frequency cannot be obtained on either push button, divide the difference in meter readings equally between them by adjusting L118, L119, C153, and C157 on push button No. 5 and only C153 and C157 on push button No. 10.

(7) Turn the METER SWITCH back to position No. 4 and align on push buttons No. 1 and 10 as directed above in steps *j*, *k*, and *l*.

o. For trouble location refer to the voltage-resistance diagrams (figs. 39 or 40) and also to the schematic (fig. 23) and parts list for the rectifier stage V–102.

25. Alignment of Tripler

a. Stop the dynamotor and set the METER SWITCH in position No. 1.

b. Adjust the tuning slugs in L106 and L107 (fig. 41) to 3/4 inch from the top of the coil.

c. Set C114 and C116 (fig. 41) in the mid-capacitance position.

d. Latch push button No. 10 and start the dynamotor. The panel meter needle should deflect showing current in the doubler circuit.

e. Trim C114 and C116 until resonance is obtained. Then couple the wavemeter pick-up coil with L106 and bring the circuit into resonance, using the wavemeter at 19.45 megacycles (one-half the transmitting frequency of the crystal in socket No. 10), by adjusting L106, L107, C114, and C116.

f. Latch push button No. 1 and tune L106 and L107 for resonance. Then bring the circuit into resonance at 13.5 megacycles (one-half the output frequency of the crystal in socket No. 1) using the wavemeter, and adjusting L106 and L107 only. If this proves impossible, realign the rectifier stage as directed in paragraph 24 above.

g. Latch push button No. 10, and again bring the frequency to the desired value by adjusting C114 and C116 only. Then latch push button No. 1 and check the frequency to be sure it is still at the desired level. When the exact frequency desired cannot be obtained on both push buttons, divide the difference in meter reading equally between them by adjusting only L106 and L107 on push button No. 1 and C114 and C116 only on push button No. 10.

h. Record the meter reading on each push button.

i. For trouble location refer to the voltage-resistance diagrams (figs. 39 or 40) and also to the schematic (fig. 24) and parts list for the tripler stage (V–108).

26. Alignment of Doubler

a. Stop the dynamotor and set the METER SWITCH on position No. 5.

b. Adjust the tuning slug in L108 (fig. 41) to ¾ inch from the top of the coil.

c. Latch push button No. 10 and start the dynamotor. The panel meter needle should deflect showing grid current in the power amplifier.

d. Frequency measurements with the wavemeter are not required in this stage of the alignment. Trim C120 (fig. 41) until resonance is obtained. If resonance cannot be obtained, change the adjustment of L108.

e. Latch push button No. 1 and tune L108. Then adjust only C120 on push button No. 1 until resonance on each push button position is found.

f. Record the meter reading at resonance on each push-button position.

g. For trouble location see the voltage-resistance diagrams (figs. 39 or 40), and to the schematic (fig. 25) and parts list for the doubler stage (V–103).

27. Installation of Bottom Cover

a. Stop the dynamotor and install the bottom cover on the transmitter casing.

b. Repeat the alignment procedure above (pars. 23, 24, and 25) making the minor adjustments required to obtain maximum current in each stage. The bottom cover changes the circuit constants somewhat, so realignment of the stages is essential for the most satisfactory performance of the transmitter and for prolonging tube life.

28. Alignment of Power Amplifier

a. Stop the dynamotor and turn the METER SWITCH to position No. 6. Set REC-TUNE-OPERATE switch at OPERATE.

b. Adjust the coupling between L110 and L111 by turning the knurled antenna coupling finger wheel (figs. 4 and 41) until the center of L111 is opposite the top of L110 as viewed through the vertical slot in L110.

c. Latch push button No. 10, and plug a good microphone (T–17, T–30, T–33, or T–45) into the appropriate jack under the front panel guard. Start the dynamotor by operating the press-to-talk switch on the microphone, and immediately trim C126 (fig. 41) for *minimum* deflection of the panel meter needle. The meter measures the screen and plate current of the rectifier, doubler, tripler, and power amplifier in position No. 6. Then turn the TUNE-ANT CUR switch (fig. 1) to ANT CUR and trim C136, by means of antenna trimmer No. 10 (fig. 41) for maximum needle deflection. The current in the antenna circuit is measured by the meter with the TUNE-ANT CUR switch at ANT CUR and the METER SWITCH in position No. 6.

d. With push button No. 10 still latched, turn the TUNE-ANT CUR switch to TUNE, and adjust the coupling between L110 and L111 by turning the antenna coupling finger wheel until maximum deflection of the panel meter needle is obtained. Then readjust the coupling to give about 60 percent of the maximum reading. Turn the TUNE-ANT CUR switch back to ANT CUR and trim C136, by means of antenna trimmer No. 10, for maximum needle deflection.

e. Latch push button No. 1 and turn the TUNE-ANT CUR switch to TUNE. Tune coil L110 for minimum current by operating the coil tuning wheel (fig. 41) with a screw driver. Then turn the TUNE-ANT CUR switch back to ANT CUR and trim C127, by means of antenna trimmer No. 1 for maximum current.

f. Finish aligning the stage by shifting alternately from push button No. 1 to push button No. 10. Tune L110 for minimum current (TUNE-ANT CUR switch at TUNE), and C127 for maximum current (TUNE-ANT CUR switch at ANT CUR). On push buttons No. 1 and 10 trim C126 for minimum current (TUNE-ANT CUR switch at TUNE) and trim C136 for maximum current, (TUNE-ANT CUR switch at ANT CUR) until the same maximum current is obtainable on both push buttons.

g. Record the maximum reading on each push button, and remove the microphone.

h. When the minimum meter readings are not well defined, it is often easier to trim C126 for minimum reading on both push buttons during the procedure above (*f* above). Turn the tuning slug in L110 (by means of the coil tuning wheel) a few turns one way or the other on push button No. 1. Obtain minimum current by trimming C126, until a position is found where minimum current is obtained with C126 in the same position on both push buttons.

i. For trouble location see the voltage-resistance diagrams (figs. 39 or 40) and to the schematic (fig. 27) and parts list for power amplifier stage (V–104).

29. Presetting Push Buttons

a. Preset the push buttons before coupling to the antenna circuit. Select seven good crystals from the crystal storage drawer and install them in the crystal oven in numerical order of their frequencies beginning with the socket No. 2. Leave the 27.0, 33.0, and 38.9 mc crystals in sockets No. 1, 5, and 10.

b. Install the cover on the crystal oven.

c. If one of the push buttons is latched, release it.

d. Turn the gang tuning capacitor (fig. 2) as far as it will go in a clockwise direction. Insert a screw driver in the access opening to the selector locking screw (fig. 2), and loosen the screw by turning it to the left until it binds slightly, then give it a one-half turn to the right. Turn the gang capacitor crank back as far as it will go in a counterclockwise direction.

Note. Use the Bristo wrench to unlock the channel selector when working on Radio Transmitters BC–684–B and –BM.

e. Set the TUNE-ANT CUR switch at TUNE and latch push button No. 10.

f. Set the METER SWITCH at the position No. 3 and start the dynamotor by turning the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE.

Note. Make sure the TRANSMITTER switch has been set at ON for at least 5 minutes before presetting the push buttons. Frequency deviations as high as 1 megacycle occur during operation, if the push buttons are preset before the transmitter has been properly warmed up.

g. Slowly turn the gang tuning capacitor in a clockwise direction until resonance is reached. If more than one resonant point is located, set the crank for the highest one.

h. Turn the METER SWITCH to position No. 1 and again turn the gang tuning capacitor until the resonance is found. The tuning adjustment here is very critical and the capacitor requires little or no change.

i. Stop the dynamotor and release push button No. 10. Retard the released push button so that it does not disturb the capacitor setting.

j. Repeat steps *f*, *g*, *h*, and *i* above on each push button beginning with number 9 and going to the next lower frequency each time. After releasing the last push button, turn the gang tuning capacitor as far as it will go in a clockwise direction and tighten the selector locking screw.

k. Check each push button as follows:

(1) Turn the METER SWITCH to position No. 1.

(2) Latch the push button.

(3) Start the dynamotor.

(4) Move the gang tuning capacitor slightly back and forth. Do not attempt to turn the crank more than a few degrees in either direction. Turning the crank in either direction should decrease the reading on the panel meter. If the reading increases as the crank is turned, reset the push button by repeating steps *c* through *j* above.

30. Coupling to Antenna Circuit

a. Set the METER SWITCH to position No. 6, the RECEIVER TUNE-OPERATE switch at OPERATE, and the TUNE-ANT CUR switch at ANT CUR.

b. Plug in the microphone, latch push button No. 1 and start the dynamotor by operating the press-to-talk switch at ANT CUR.

c. Trim C127 by means of the No. 1 antenna trimmer (figs. 41 or 42) until the maximum reading is obtained on the panel meter.

d. Adjust the knurled antenna coupling finger wheel (figs. 41 or 42) for maximum meter reading.

e. Readjust C127 for maximum meter reading.

f. Latch the remaining push buttons, one at a time, and adjust the antenna trimmer of corresponding number (figs. 41 or 42) for maximum current on each push button. Do not readjust the knurled antenna coupling finger wheel.

g. Remove the microphone and turn the TRANSMITTER switch to OFF.

h. For trouble location, see the voltage-resistance diagrams (figs. 39 or 40) and to the schematic (fig. 27) and parts list for the antenna circuit.

SECTION VI

DETAILED TROUBLE-SHOOTING PROCEDURES

31. Signal Tracing in Audio Stages

Two methods of signal tracing applicable to trouble location in the audio stages (V105 and V106) are given in this paragraph. Trouble in these stages may also be located by the use of the voltage-resistance diagrams (figs. 39 and 40) and the schematic diagrams of the audio stages (figs. 28 and 29) which are referred to below.

a. The first method of signal tracing for trouble location is described below.

(1) Connect the test equipment to the transmitter as described in paragraph 34.

(2) Remove the leads connecting the output of the attenuator to the magnetic microphone jack and substitute two test leads.

(3) Ground one test lead to the frame at the transmitter, and use the other as a probe.

(4) Turn the equipment on, and after a suitable warm-up time, proceed in the following manner, working from the *output* of the audio towards the *input.*

(*a*) Touch the test probe to the following points (figs. 28 and 29): The output transformer (terminals 2, 3, and 6); the plate of V106 (terminal 3); the grid of V106 (terminal 5); both sides of capacitor C141; the plate of V105 (terminal 3); the grid of V105 (terminal 5); the input transformer (terminals 5 and 3); the magnetic microphone jack (terminal C), and the carbon microphone jack (ring).

(*b*) Note that the reading on the output meter increases as the attenuator probe is moved back towards the input of the audio section. The reading obtained at the grid of V106 should be approximately 10 times that obtained at the plate of V106. There should be little or no change in reading as the probe is moved from the grid of V106 across capacitor C141 to the plate of V105. The reading at the grid of V105 should be three times the reading at the plate of V105.

(5) If the above procedure is followed, trouble is readily located. At the point where the signal disappears (that is, there is no reading on the output meter) a voltage-resistance check (figs. 39 and 40) will quickly determine the faulty part.

b. Another alternative procedure, essentially the same as the above, involves the use of an oscilloscope in the following manner:

(1) Remove the output meter.

(2) Connect the output of the attenuator to the magnetic microphone jack.

(3) Trace the signal from the *input* towards the *output* with the oscilloscope as follows: Starting at the output of the attenuator, adjust the vertical gain of the oscilloscope to give about 1 inch deflection, then move the probe successively to the carbon microphone jack (ring), the input transformer (terminals 3 and 5), the grid of V105 (terminal 5), the plate of V105 (terminal 3), both sides of capacitor C141, the grid of V106 (terminal 5), the plate of V106 (terminal 3), the output transformer (terminals 6, 2, and 3), and terminal 20 (BC–684–B), and 21 (BC–684–(*)) on PG101.

(4) Note that the deflection on the oscilloscope screen varies in the same manner as the readings on the output meter in the first part of this paragraph.

(5) The oscilloscope also shows the distortion present in the amplifier. A fairly clean sine wave should be obtained at all points. Be careful not to overdrive the stages with too much signal input. Usually 0.2 and 0.4 volts (unattenuated) will be sufficient for the audio oscillator output.

SECTION VII

FINAL TESTING

32. General

a. After the transmitter has been properly aligned, and the antenna satisfactorily coupled to the power amplifier, test the performance characteristics as directed below. See the individual stage and circuit repair data in section VIII for the data needed to locate and repair any trouble found.

b. Before the tests can be made, the battery must be connected with the transmitter, and the phantom antenna must be connected with binding posts A and G on the front panel. The 27, 33, and 38.9 mc crystal holders must be placed in the sockets No. 1, 5, and 10 respectively, and the push buttons must be preset.

c. At the beginning of the testing procedure the switches must be set as follows:

(1) TRANSMITTER ON-OFF switch at OFF.

(2) TUNE-ANT CUR switch at TUNE.

(3) RECEIVER TUNE-OPERATE switch at OPERATE.

(4) METER SWITCH in position 6.

Note. When testing Radio Transmitter BC–684–B and –BM, turn the RADIO-INTERPHONE switch to RADIO, and the TANK-OTHER USE switch to OTHER USE.

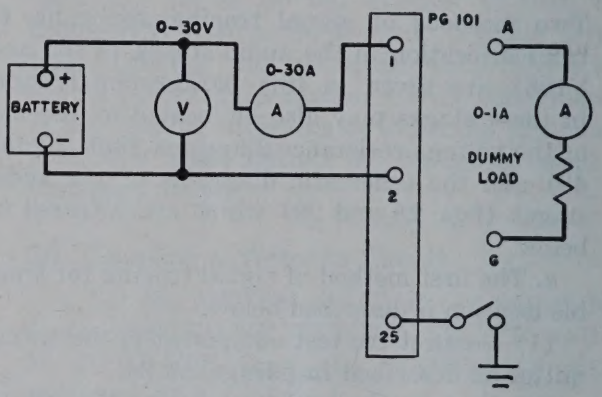
d. The text for the following tests is written as a step by step procedure; that is, the test equipment connected with the transmitter, and the switch adjustments at the beginning of a test are assumed to be the same as those at the end of the preceding test.

33. R-f Power Output and D-c Power Input Test

a. The data required for making this test is given in figure 17.

b. Connect a direct-current (d-c) ammeter (0 to 30 amperes) in series with the battery (fig. 17), observing polarity in making the connection.

R. F. POWER OUTPUT - D. C. POWER INPUT TEST CONNECTIONS



TEST DATA							
SELECTOR BUTTON	FREQ. MC	ANT. CUR.	BATTERY CURRENT			POWER OUTPUT	POWER INPUT
			RADIO	INTERPHONE	FIL		
1	27	.5	24A		5A		
5	32.8	.5					
10	38.9	.5					

TL18275

Figure 17. Radio Transmitter BC–684–(*), r-f power output and d-c power input test diagram.

c. Latch push button No. 1, turn the TRANSMITTER ON-OFF switch to ON. After the tubes have warmed up for at least 5 seconds, start the dynamotor by turning the RECEIVER TUNE-OPERATE switch to RECEIVER TUNE.

d. Turn the TUNE-ANT CUR switch to ANT CUR and compare the readings obtained on the panel meter with those in the table in figure 17 for the three crystals as selected by push buttons No. 1, 5, and 10.

e. Note the input current value as read by

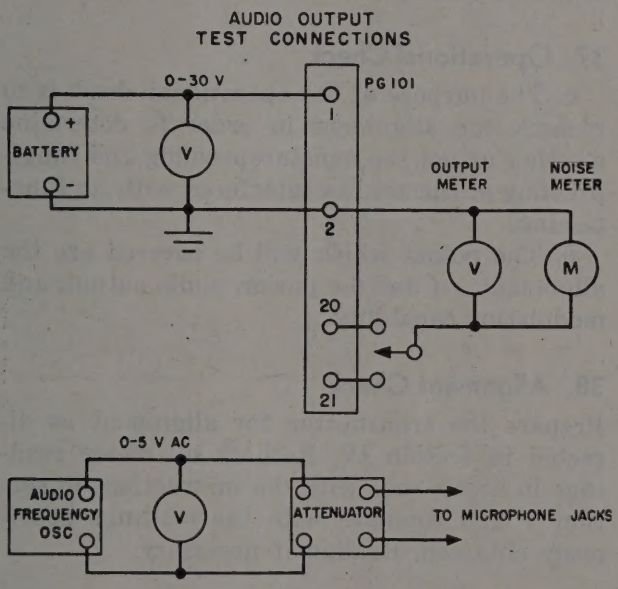
the 0 to 30 amperes d-c ammeter with the dynamotor running, and compare this reading with that given for RADIO in the table in figure 17.

f. When testing Radio Transmitter BC–684–B and –BM, turn the RADIO-INTERPHONE switch to INTERPHONE and note the ammeter reading with the dynamotor running. Compare it with the value given in figure 17 for battery drain on INTERPHONE.

g. Stop the dynamotor and again compare the reading with that given in the table in figure 17 for battery drain on FILAMENTS.

34. Audio Output Test

a. The data required for making this test is given in figure 18.



TEST DATA

AUDIO OUTPUT VOLTS	ATTENUATION DB	INTERPHONE			SIDETONE OUTPUT DB	TEST
		OUTPUT DB	NOISE %	DIST. DB		
1.73	−20	4	12	25	15	PART 1
4.0	0	4	12	25		PART 2

TL18276

Figure 18. Radio Transmitter BC–684–(*), audio output test diagram.

b. Procure the test equipment specified in table I. Turn the TRANSMITTER ON-OFF switch to OFF, and connect the equipment with the transmitter as follows:

(1) Connect the output of the audio oscillator with the input of the calibrated attenuator. Do not ground either lead of the audio oscillator.

(2) Connect the output of the attenuator with terminals C and D of the magnetic microphone jack (J–101) through a suitable plug (PL–118).

(3) Connect the alternating-current (a-c) voltmeter (0 to 5 volts) across the output of the audio oscillator.

(4) Adjust the load on the output meter to 8,000 ohms. When testing Radio Transmitter BC–684–A connect the meter with terminals 2 and 21 on plug PG–101. When testing Radio Transmitter BC–684–B and –BM, connect the meter with terminals 2 and 20 on PG–101.

c. Test the audio output of the transmitter as follows:

(1) Turn the a-f oscillator on and set the frequency to 400 cycles per second. Set the output control to give 1.73 volts as read by the 0- 5-volt a-c meter.

(2) Set the calibrated attenuator to 20 decibels (db).

(3) Set the SIDETONE CONTROL (fig. 2) to maximum.

(4) Turn the transmitter on, latch push buttons No. 1, 5, or 10, and after the tubes have warmed up for at least 5 seconds, start the dynamotor.

(5) The output and noise and distortion meters should now indicate approximately the readings given in figure 18. Record the readings obtained.

(6) Stop the dynamotor.

d. Test the audio output of the transmitter (carbon microphone input jack) as follows:

(1) Change the attenuator connection from the magnetic microphone jack to the carbon microphone jack (J–102) using plug PL–68 instead of plug PL–118.

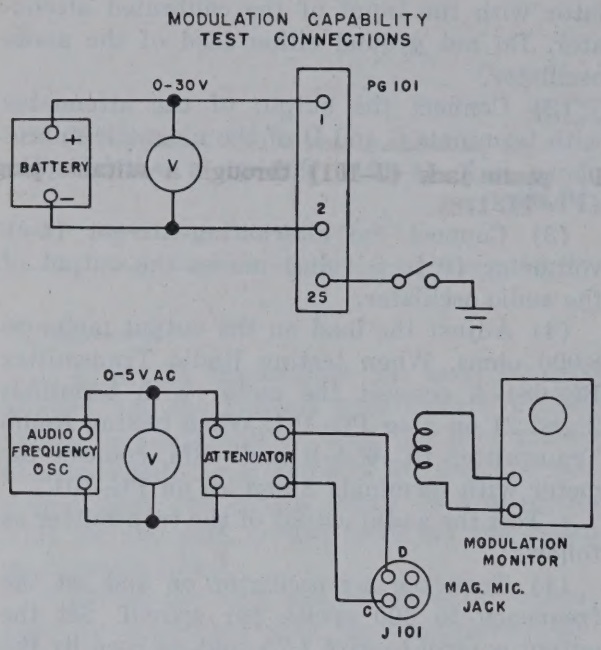
(2) Change the audio oscillator output to 4 volts, and change the attenuator to 0 db.

(3) Start the dynamotor. The output and noise and distortion meter readings should be approximately the same as those in the table in figure 18.

35. Modulation Capability Test

a. The data required for making this test is given in figure 19.

b. Stop the dynamotor and disconnect the output meter and the noise and distortion meter.



TEST DATA				
TRANSMITTER FREQ.	AUDIO FREQ.	% MOD	TRACE HEIGHT	AUDIO INPUT
32.8 MC	400 CPS	100	2 IN	1V-4V

TL18277

Figure 19. Radio Transmitter BC–684–(*), modulation capability test diagram.

c. Change the audio oscillator output to the minimum setting. Leave the frequency at 400 cycles per second.

d. Turn on the modulation monitor and place its pick-up coil near the transmitter antenna coupling coil (L–110). Latch push button No. 5 and start the dynamotor. Then adjust the coupling distance between L–110 and the pick-up coil to obtain about 2 inches deflection on the modulation monitor oscillograph.

e. Gradually increase the output of the audio oscillator until a series of dots just begins to appear along the zero carrier (base) line on the oscilloscope. The dots indicate 100 percent amplitude modulation.

f. Adjust the sweep frequency of the oscilloscope until the dots are clearly defined.

g. The correct audio oscillator voltage (as read by the 0 to 5 volt a-c meter) is that which just causes the dots to appear at the base line of the oscilloscope.

h. Compare this voltage with that given in the table on figure 19.

36. Moistureproofing, Fungiproofing, and Refinishing

a. See TB Sig 13 for general information concerning moistureproofing and fungiproofing.

b. Specific instructions for moistureproofing and fungiproofing of Radio Transmitter BC–684–(*) are contained in changes No. 1 TM 11–620.

c. If the transmitter case has been scarred or chipped, remove any rough spots with #00 or #000 sandpaper and apply paint to the spots with a small brush. If the case is sufficiently scarred and scratched to warrant complete refinishing, remove the transmitter chassis from its case, remove all nameplates, cover parts that are not to be painted, and remove all rust and dirt. Spray the entire case with the properly authorized paint.

37. Operational Check

a. The purpose of the operational check is to recheck the alignment in order to determine whether or not the moistureproofing and fungiproofing of the set has interfered with its functioning.

b. The points which will be covered are the alignment, r-f and d-c power, audio output, and modulation capability.

38. Alignment Check

Prepare the transmitter for alignment as directed in section IV. Recheck all meter readings in accordance with the instructions in section V and compare with the readings previously obtained. Realign if necessary.

39. R-f Power Output and D-c Power Input Check

See section VI, and recheck the performance of the transmitter in accordance with the instructions given in this section and the data given in figure 17.

40. Audio Output Check

See section VI, and recheck the audio output of the transmitter in accordance with the instructions given in that section and the data given in figure 18.

41. Modulation Capability Check

See section VI, and recheck the modulation capability of the transmitter in accordance with

the instructions given in that section and the data given in figure 19.

42. Operational Test

a. After the foregoing tests have been made, the transmitter should operate correctly. If any further trouble is encountered, such as reduced power output, poor modulation, frequency drift, low audio or sidetone output, or heavy power drain, see sections V and VI, for alignment instructions and performance characteristics. Recheck all the tests covered in this section until satisfactory performance is obtained.

b. In order to determine whether or not the transmitter will operate properly with an associated receiver, it is necessary to check the operation of the receiver disabling relay (S103) (fig. 10). When the press-to-talk switch on the microphone is operated, the relay should close, grounding terminals 7 and 22 on PG101. Correct relay operation may be determined by placing an ohmmeter between terminals 7 and ground (frame of set) and 22 and ground.

SECTION VIII

INDIVIDUAL STAGE AND CIRCUIT REPAIR DATA

43. General

This section presents information and data for the repair of individual stages and circuits, for the location of parts, and for the servicing and replacement of parts requiring special techniques.

a. The following operations must be performed in replacing a push-button selector unit in Radio Transmitter BC–684–(*):

(1) Unsolder the short and long coaxial cables at Antenna Post A on the rear of the front panel. Also unsolder R155 from this post (figs. 30a and 30b).

(2) Unsolder the short coaxial cable at antenna relay S101 (figs. 30a and 30b).

(3) At the relay (S101), unsolder the capacitor (C161) which connects a long coaxial cable to this relay (figs. 30a and 30b).

(4) At the relay, unsolder the bare wire which connects the top of coil L111 to the antenna relay (figs. 30a and 30b).

(5) At the bottom of the output coil L110 unsolder the bare wire (covered with varnished tubing) which leads to the power-amplifier screen resistor (R114) located in the bottom compartment of the chassis. Also unsolder the black-red wire leading from the coil to the local cable of the transmitter (figs. 30a and 30b).

(6) At the insulated stud E, unsolder the bare wire leading to the bottom of the left-hand tuner contact spring assembly (figs. 30a and 30b).

(7) At the crystal oven, unsolder the ten electrical connections to the tuner spring contact assembly (figs. 30a and 30b).

(8) Remove the screw on top of the selector to release the ground terminal lug and wire leading to ground post C on the rear of the front panel (figs. 30a and 30b).

b. The following operations must be performed in replacing a push-button selector unit in Radio Transmitter BC–684–(*):

(1) Unsolder the short and long coaxial cables at Antenna Post A on the rear of the front panel. Also unsolder R155 from this post (figs. 30a and 30b).

(2) Unsolder the short coaxial cable at antenna relay S101 (figs. 30a and 30b).

(3) At the relay (S101), unsolder the capacitor (C161) which connects a long coaxial cable to this relay (figs. 30a and 30b).

(4) At the relay, unsolder the bare wire which connects the top of coil L111 to the antenna relay (figs. 30a and 30b).

(5) At the bottom of the output coil, L110 unsolder the bare wire (covered with varnished tubing) which leads to the power-amplifier screen resistor (R114) located in the bottom compartment of the chassis. Also unsolder the black-red wire leading from the coil to the local cable of the transmitter (figs. 30a and 30b).

(6) At the insulated stud E, unsolder the bare wire leading to the bottom of the left-hand tuner contact spring assembly (figs. 30a and 30b).

(7) At the crystal oven, unsolder the ten electrical connections to the tuner spring contact assembly (figs. 30a and 30b).

(8) Remove the screw on top of the selector to release the ground terminal lug and wire leading to ground post C on the rear of the front panel (figs. 30a and 30b).

(9) Remove six screws from the thermocouple, releasing it from its electrical connections and mounting (figs. 30a and 30b).

(10) Remove the screw which secures the ground lug to the top of the tuner. The ground lug is connected to the ground wires which lead to the ferrules of the short and long coaxial cables (figs. 30a and 30b).

(11) Remove the screw from the top of the tuner, releasing the clamp that holds the long coaxial cable in place across the top of the unit. Carefully bend this cable to the left so that it will not interfere with the vertical movement of the tuner (figs. 30a and 30b).

(12) Remove four screws, releasing the antenna relay (S101) from its location. Rotate the relay upward and to the right (figs. 30a and 30b).

(13) Remove the gear from the bottom end of the tuner shaft by loosening the setscrew with the Bristo wrench, and remove the rack connecting the tuner to the 6-gang capacitor (fig. 30b).

(14) Remove the three screws at the base of the tuner, releasing it from the chassis (fig. 30b).

(15) Remove the four screws in the panel guard and remove the guard; unscrew the seven front panel screws and rotate the panel about its right-hand edge (where cables are located) to remove the panel apparatus from the panel opening. Lift the channel selector unit out through the top opening of the transmitter.

c. The following operations must be performed in replacing a panel meter in Radio Transmitter BC–684–(*).

(1) Remove the front panel guard by removing the four panel guard screws (fig. 1).

(2) Remove the top coverplate and the side access panel (fig. 2).

(3) There are three machine screws with associated elastic stop nuts holding the meter to the front panel. Remove the screws with a screw driver holding the stop nuts with a pair of long-nose pliers or an offset hexagon wrench. Since there is very little working room for this operation, care should be exercised in order to prevent damaging any of the adjacent parts.

(4) Remove the two nuts on the meter binding posts, and pull the meter out of the panel.

44. Parts List for Oscillator Stage V107 (fig. 20)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
R149	3Z6005–9	RESISTOR: 50 ohms ±10%; ½ w with L117.	Grid Anti-sing
L117	2C6494A/C16	COIL, wound on R149.....	Grid Anti-sing
R101	3Z4550	RESISTOR: 100,000 ohms ± 10%; ½w.	Grid return
C151	3D9050–53	CAPACITOR: 0.00005 mf, ± 5%; 800 volts; direct current.	Grid bypass
C150	3DA1–72	CAPACITOR, 0.001 mf, 800 volts; direct current.	Plate coupling
C105	3D9015–2	CAPACITOR: 15 mf, ± 10%; 500 volts; direct current.	Plate tuning
L102	2C6494A/C9	COIL: 1 mh duolateral.	Plate choke
R118	3Z6700–12	RESISTOR: 100,000 ohms ± 10%; 2 w.	Plate load
R162	3Z6700–12	RESISTOR: 100,000 ohms ± 10%; 2 w.	Plate load
R163	3Z6700–12	RESISTOR: 100,000 ohms ± 10%; 2 w.	Plate load
C104	3D9500–20	CAPACITOR: 0.0005 mf, 800 volts; direct current.	Plate bypass
R138	3Z4531	RESISTOR: 50,000 ohms ± 10%; ½ w.	Screen supply
C146	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Screen bypass

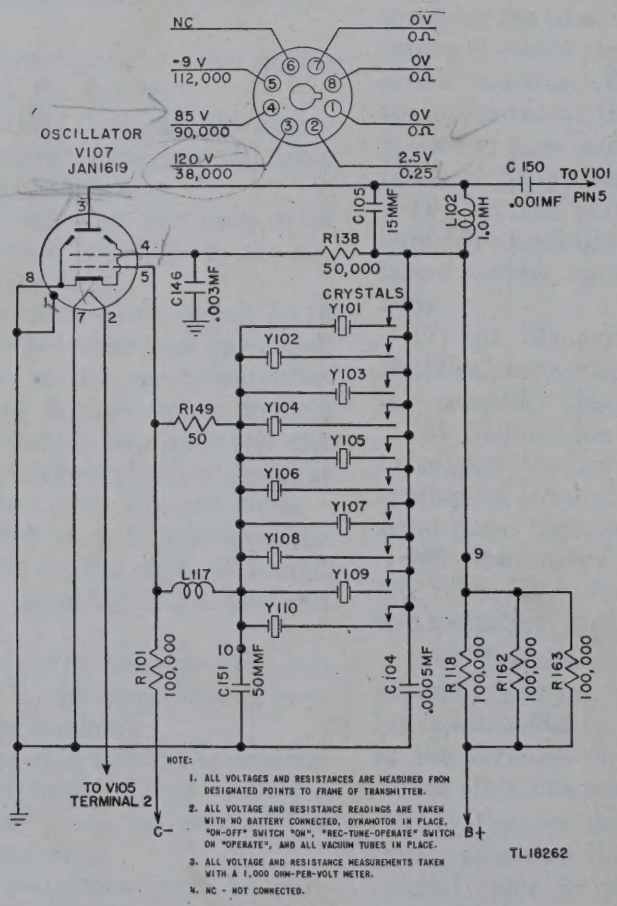


Figure 20. Radio Transmitter BC–684–(*), oscillator V107, schematic diagram.

45. Parts List for First R-f Amplifier V101 (fig. 21)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
R139	3Z4550	RESISTOR: 100,000 ohms ± 10%; ½ w.	Grid return
R127	3Z4801–1	RESISTOR: 1 ohm ± 5%; ¾ inch.	Filament dropping
C103	3D9100–21	CAPACITOR: 0.0001 mf, ± 5%; 800 volts; direct current.	Plate coupling
L101	2C6494A/C8	COIL: 3 mh duolateral.	Plate choke
R103	3Z6725–5	RESISTOR: 250,000 ohms ±10%; 1 w.	Screen supply
C101	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Screen bypass

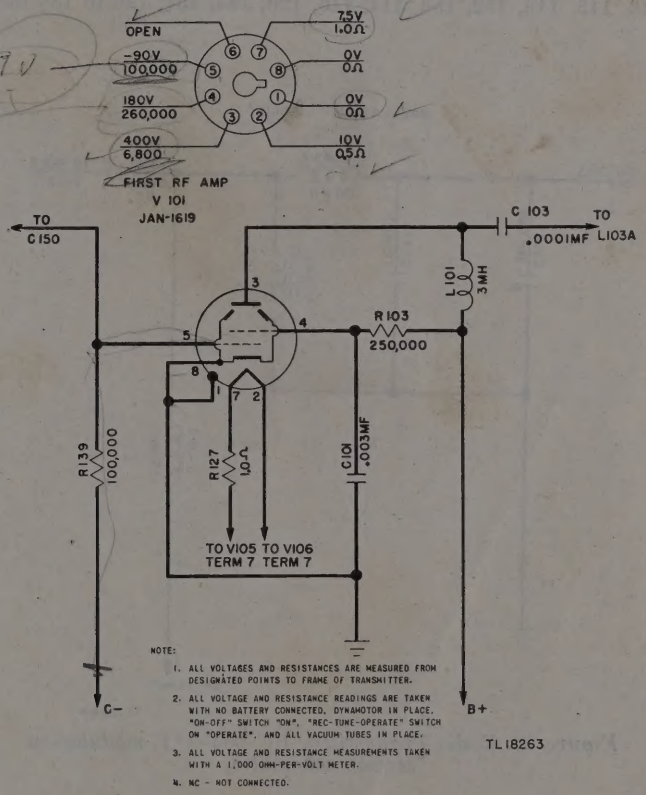


Figure 21. Radio Transmitter BC–684–(*), first r-f amplifier V101, schematic diagram.

46. Parts List for Modulation Section (fig. 22)

Ref symbol	Signal Corps stock No.	Name and part of description	Function
L103	2C6530684A/C10	COIL: 0.38 mh duolateral.	1st r-f plate tuning
C106	See NOTE	VARIABLE AIR CAPACITOR, 350 mf. Part of push-button tuner capacitor assembly.	Rectifier grid tuning
C147	3D9175–5	CAPACITOR: 175 mf, ± 2%; 800 volts; direct current.	1st r-f plate padding
C108	3D9500–20	CAPACITOR: 0.0005 mf; 800 volts; direct current.	Rectifier grid coupling
L104A	2C6494A/C11	RETARDATION COIL (sc–1003).	Modulation coil
L105A	2C6530684A/C12	COIL: 0.38 mh duolateral.	Second audio choke

Note. Capacitors 106, 113, 115, 119, 152, 156, 114, 116, 120, 153, 157, 125 to 136 inclusive, furnished as part of tuner assembly.

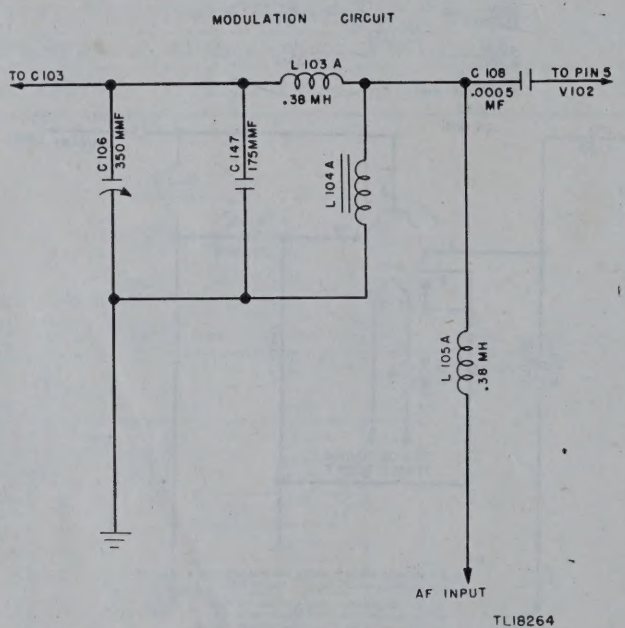


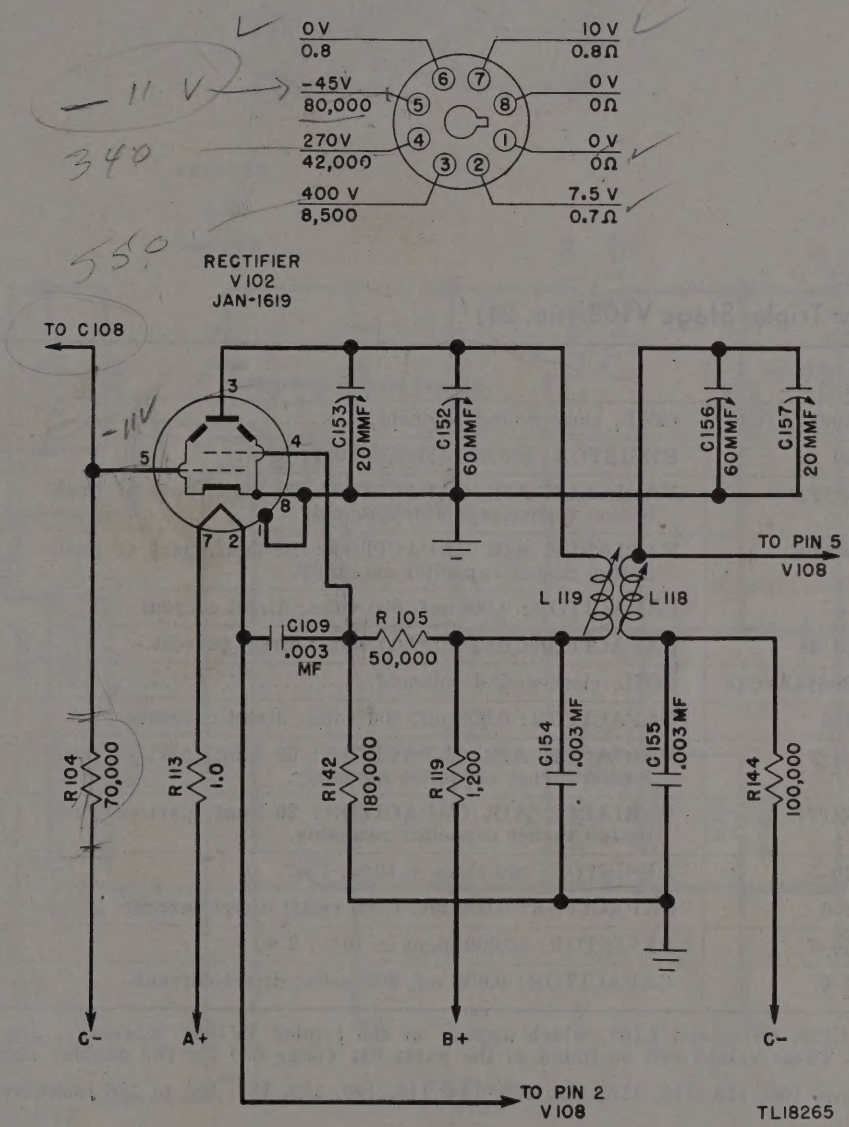
Figure 22. Radio Transmitter BC–684–(*), modulation section schematic.

47. Parts List for Rectifier Stage V102 (fig. 23)[1]

Ref symbol	Signal Corps stock No.	Name of part and description	Function
R104	3Z6670–1	RESISTOR: 70,000 ohms ± 10%; ½ w.	Grid return
R113	3Z4801–1	RESISTOR: 1 ohm ± 5%; 1¾ in.	Filament dropping
L119	2C6530684A/C17	COIL, close-wound solenoid.	Plate tuning
C153	See NOTE	VARIABLE AIR CAPACITOR: 20 mmf, part of push-button tuner, capacitor assembly.	Plate trimmer
C152	See NOTE	VARIABLE AIR CAPACITOR: 60 mmf, part of push-button tuner, capacitor assembly.	Plate tuning
R119	3Z6120–1	RESISTOR: 1,200 ohms ± 10%; ½ w.	Plate
C154	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Plate bypass
R105	3Z4531	RESISTOR: 50,000 ohms ± 10%; ½ w.	Screen dropping
R142	3Z6718–1	RESISTOR: 80,000 ohms ± 10%; 1 w.	Screen shunt
C109	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Screen bypass

[1]L118, C156, C157, C155 and R144, which appear on the rectifier (V102) schematic, are repeated from the tripler schematic. These values will be found in the parts list (page 61) for the tripler schematic.

Note. Capacitors 106, 113, 115, 119, 152, 156, 114, 116, 120, 157, 125 to 136 inclusive, furnished as part tuner assembly.



NOTE:

1. ALL VOLTAGES AND RESISTANCES ARE MEASURED FROM DESIGNATED POINTS TO FRAME OF TRANSMITTER.
2. ALL VOLTAGE AND RESISTANCE READINGS ARE TAKEN WITH NO BATTERY CONNECTED, DYNAMOTOR IN PLACE, "ON-OFF" SWITCH "ON", "REC-TUNE-OPERATE" SWITCH ON "OPERATE", AND ALL VACUUM TUBES IN PLACE.
3. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH A 1,000 OHM-PER-VOLT METER.
4. NC - NOT CONNECTED

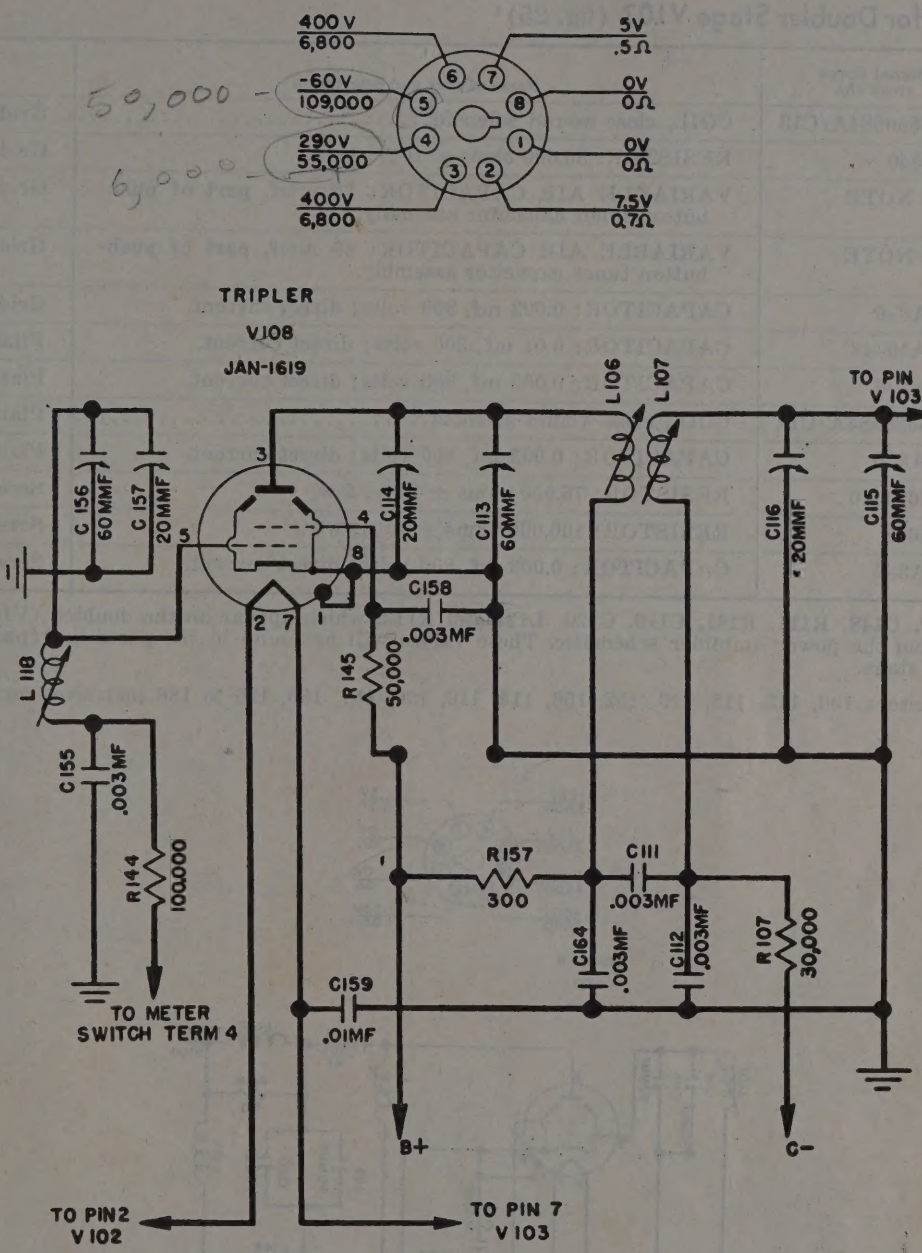
Figure 23. Radio Transmitter BC-684-(*), Rectifier V102, schematic diagram.

48. Parts List for Tripler Stage V108 (fig. 24)[1]

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L118	2C6530684A/C17	COIL, close-wound solenoid	Grid tuning
R144	3Z4550	RESISTOR: 100,000 ohms ± 10%; ½ w.	Grid return
C156	See NOTE	VARIABLE AIR CAPACITOR: 60 mmf, part of push-button turner capacitor assembly.	Grid tuning
C157	See NOTE	VARIABLE AIR CAPACITOR: 20 mmf, part of push-button turner capacitor assembly.	Grid trimmer
C155	3DA–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Grid bypass
C159	3DA10–48	CAPACITOR: 0.01 mf, 300 volts; direct current.	Filament bypass
L106	2C6530684A/C13	COIL, close-wound solenoid	Plate tuning
C111	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Plate bypass
C113	See NOTE	VARIABLE AIR CAPACITOR: 60 mmf, part of push-button turner capacitor assembly.	Plate tuning
C114	See NOTE	VARIABLE AIR CAPACITOR: 20 mmf, part of push-button turner capacitor assembly.	Plate trimmer
R157	3Z6030–5	RESISTOR: 300 ohms ± 10%; 1 w.	Plate filter
C164	3DA3–6	CAPACITOR: 0.003 mf, 1,000 volts; direct current.	Plate bypass
R145	3Z6650–7	RESISTOR: 50,000 ohms ± 10%; 2 w.	Screen supply
C158	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Screen bypass

[1]C112, R107, C115, C116, and L107, which appear on the tripler (V108) schematic, are repeated from the doubler schematic. These values will be found in the parts list (page 63) for the doubler stage.

Note. Capacitors 106, 113, 119, 115, 152, 156, 114, 116, 120, 153, 157, 125 to 136 inclusive, furnished as part tuner assembly.



NOTE:

1. ALL VOLTAGES AND RESISTANCES ARE MEASURED FROM DESIGNATED POINTS TO FRAME OF TRANSMITTER.
2. ALL VOLTAGE AND RESISTANCE READINGS ARE TAKEN WITH NO BATTERY CONNECTED, DYNAMOTOR IN PLACE, "ON-OFF" SWITCH "ON", "REC-TUNE-OPERATE" SWITCH ON "OPERATE", AND ALL VACUUM TUBES IN PLACE.
3. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH A 1,000 OHM-PER-VOLT METER.
4. NC - NOT CONNECTED.

TL 18266

Figure 24. Radio Transmitter BC-684-(*), Tripler V108, schematic diagram.

49. Parts List for Doubler Stage V103 (fig. 25)[1]

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L107	2C6530684A/C13	COIL, close-wound solenoid.....	Grid tuning
R107	3Z4540	RESISTOR: 30,000 ohms ± 10%; ½ w.	Grid trimmer
C116	See NOTE	VARIABLE AIR CAPACITOR: 20 mmf, part of push-button tuner capacitor assembly.	Grid trimmer
C115	See NOTE	VARIABLE AIR CAPACITOR: 60 mmf, part of push-button tuner capacitor assembly.	Grid tuning
C112	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Grid bypass
C123	3DA10–48	CAPACITOR: 0.01 mf, 300 volts; direct current.	Filament bypass
C121	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Plate coupling
L108	2C6530684A/C14	COIL, close-wound solenoid.....	Plate tuning
C118	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Plate bypass
R109	3Z6675–10	RESISTOR: 75,000 ohms ± 10%; 2 w.	Screen supply
R159	3Z4608	RESISTOR: 100,000 ohms ± 10%; 1 w.	Screen shunt
C117	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Screen bypass

[1]R158, L122, C148, R111, R161, C119, C120, L121 and R112, which appear on the doubler (V103) schematic, are repeated from the power amplifier schematic. These values will be found in the parts list (page 65) for the power-amplifier stage.

Note. Capacitors 106, 113, 115, 119, 152, 156, 114, 116, 120, 157, 153, 125 to 136 inclusive, furnished as part tuner assembly.

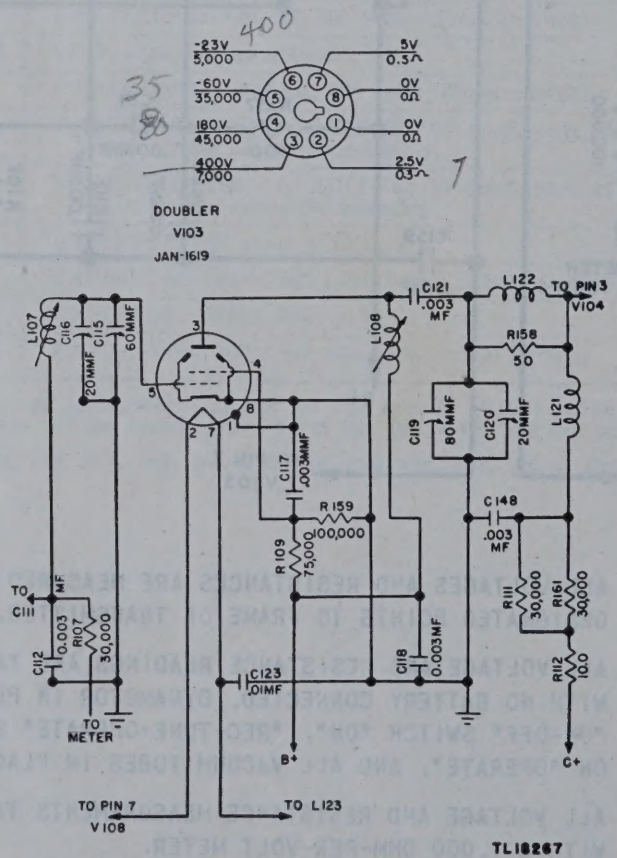


Figure 25. Radio Transmitter BC–684–(*), doubler V103, schematic diagram.

50. Parts List for Power-Amplifier Stage V104 (fig. 26)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L122	2C6494A/C16	COIL, wound on R158	Grid anti-sing
R158	3Z6005–9	RESISTOR: 50 ohms ± 10%; ½ w with L122.	Grid anti-sing
R161	3Z6630–8	RESISTOR: 30,000 ohms ± 10%; 1 w.	Grid return
R112	3Z6001–2	RESISTOR: 10 ohms ± 10%; ½ w.	Grid metering
R111	3Z6630–8	RESISTOR: 30,000 ohms ± 10%; 1 w.	Grid return
L121	2C6530684A/C1	COIL, Z1 Choke	Grid choke
C119	See NOTE	VARIABLE AIR CAPACITOR: 80 mmf, part of push-button capacitor.	Grid tuning
C120	See NOTE	VARIABLE AIR CAPACITOR: 20 mmf, part of push-button capacitor.	Grid tuning
C148	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Grid bypass
L123		Filament choke.	Filament choke
C149	3DA1–21	CAPACITOR: 0.001 mf, 1,200 volts; direct current.	Plate coupling
C125	See NOTE	VARIABLE AIR CAPACITOR: 60 mmf, part of push-button capacitor.	Plate trimmer
C126	See NOTE	VARIABLE AIR CAPACITOR: 20 mmf, part of push-button capacitor.	Plate trimmer
R116	3Z6630–7	RESISTOR: 30,000 ohms ± 10%; 2 w.	Screen supply
R114	3Z6630–7	RESISTOR: 30,000 ohms ± 10%; 2 w.	Screen supply
C122	3DA3–6	CAPACITOR: 0.003 mf, 800 volts; direct current.	Screen bypass
L110	2C6530684A/C15	COIL, space-wound solenoid	Plate tuning
L120	2C6530684A/C1	COIL, Z1 choke	Plate choke
C124	3DA2–34	CAPACITOR: 0.002 mf, 1,200 volts; direct current.	Plate bypass

Note. Capacitors 106, 113, 115, 119, 152, 156, 114, 116, 120, 157, 153, 125 to 136 inclusive, furnished as part tuner assembly.

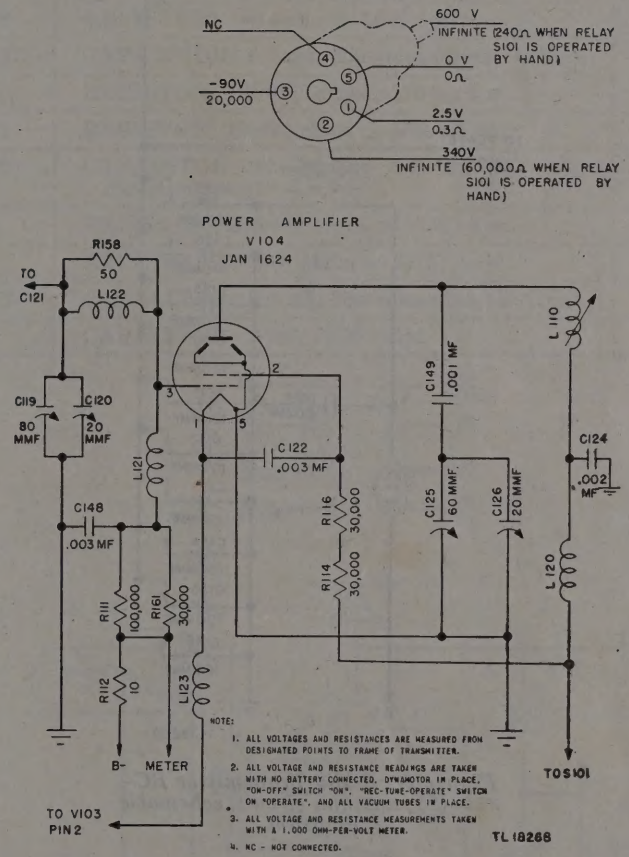


Figure 26. Radio Transmitter BC-684-(*), power amplifier V104, schematic diagram.

51. Parts List for Antenna Circuit (fig. 27)[1]

Ref symbol	Signal Corps stock No.	Name of part and description	Function
L111	2C6530684A/C15	COIL, space-wound solenoid.	Antenna coupling
C127	to C136 See NOTE	100 mmf,	Antenna tuning

[1]L110, L120, and C124, which appear on the antenna schematic, are repeated from the power-amplifier schematic. These values will be found in the parts list (page 65) for the power-amplifier stage.

Note. Capacitors 106, 113, 115, 119, 152, 156, 114, 116, 120, 153, 157, 125 to 136 inclusive, furnished as part of tuner assembly.

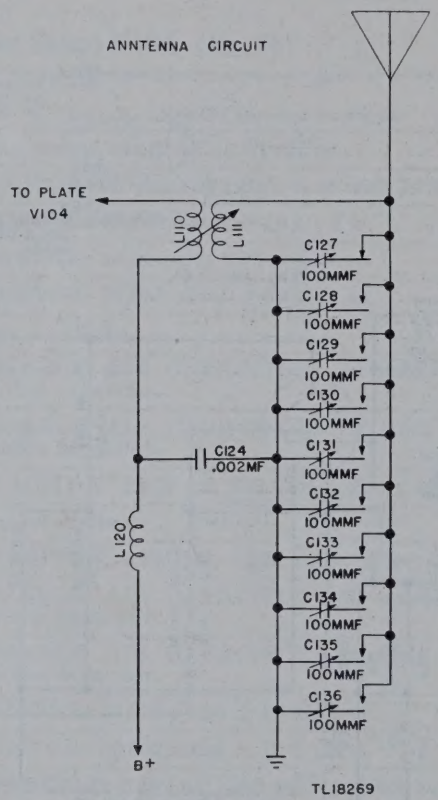
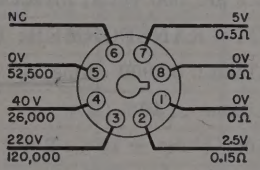


Figure 27. Radio Transmitter BC–884–(*), antenna circuit, schematic diagram.

52. Parts List for First Audio Amplifier Stage (fig. 28)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
T101	2C6494A/T2	AUDIO INPUT TRANSFORMER: (si–1005).	Microphone input
R115	3Z4550	RESISTOR: 100,000 ± 10%; ½ w.	Grid loading
C138.1 & 138.2	3DA100–28	CAPACITOR: two sections; cath. 0.1 mf; 600 volts direct current.	Carbon microphone coupling
R117	3Z4531	RESISTOR: 50,000 ohms ± 10%; ½ w.	Grid filter
C137	3DA500–27	CAPACITOR: 0.5 mf, 600 volts direct current.	Grid bypass
J102	2Z5575	JACK with nickel plate sleeve.	Carbon microphone
R120	3Z6020–9	RESISTOR: 200 ohms ± 10%; 1 w.	Carbon microphone series
C140	2C6494A/C6	ELECTROLYTIC CAPACITOR: 30 mf, 500 volts direct current.	Carbon microphone filter
R121	3Z6010–18	RESISTOR: 100 ohms ± 10%; ½ w.	Carbon microphone filter
C141	3DA500–27	CAPACITOR: 0.5 mf, 600 volts direct current.	Plate coupling
R151	3Z4608	RESISTOR: 100,000 ohms ± 10%; 1 w.	Plate supply
R123	3Z6610–11	RESISTOR: 10,000 ohms ± 10%; 1 w.	Plate filter
C1422	3DA100–28	CAPACITOR: two-section 0.1 mf, 600 volts direct current.	Plate bypass
R122	3Z6725–5	RESISTOR: 250,000 ohms ± 10%; 1 w.	Screen supply
R136	3Z4540	RESISTOR: 30,000 ohms ± 10%; ½ w.	Screen shunt
C139	3DA500–27	CAPACITOR: 0.5 mf, 600 volts direct current.	Screen bypass
C145	3DB2–21	CAPACITOR: 2 mf, 1,000 volts.	Plate supply filter



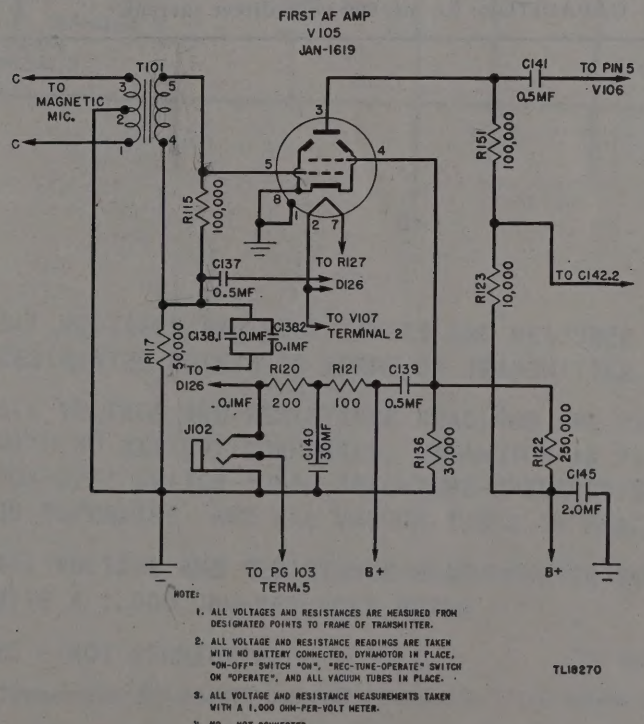
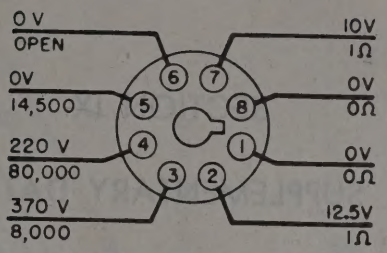
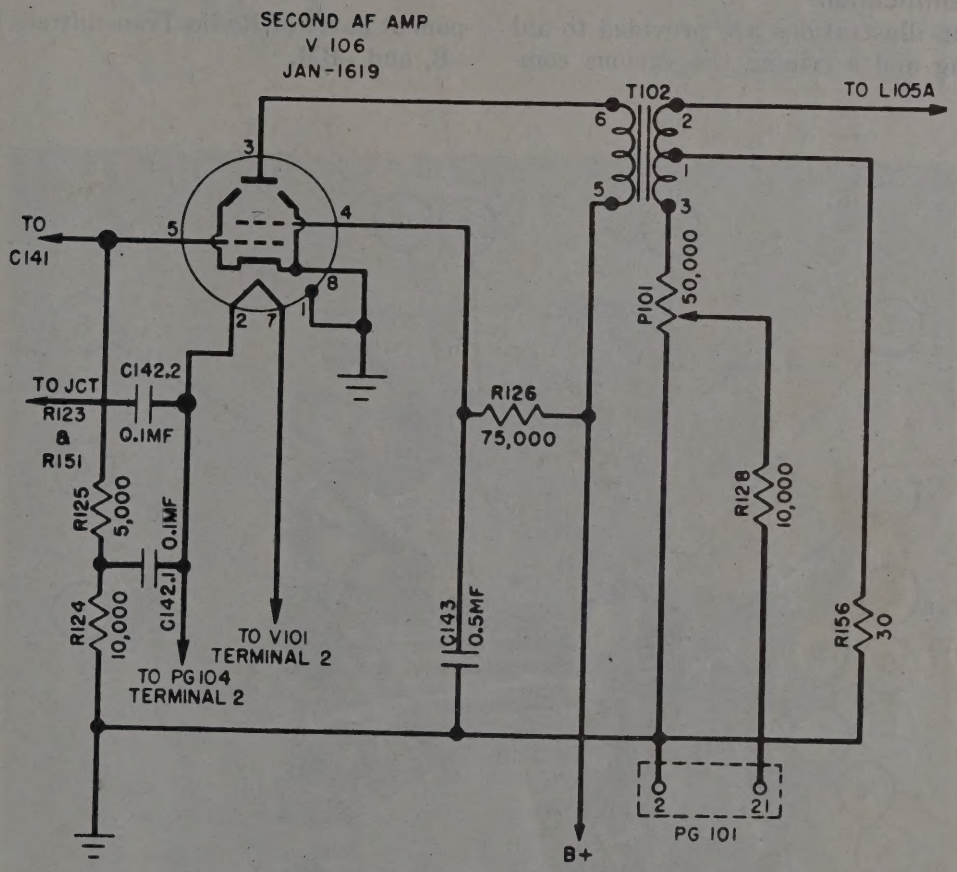


Figure 28. Radio Transmitter BC–684–(*), first a-f amplifier V105, schematic diagram.

53. Parts List for Second Audio Amplifier Stage (fig. 29)

Ref symbol	Signal Corps stock No.	Name of part and description	Function
R125	3Z4528	RESISTOR: 5,000 ohms ± 10%; ½ w.	Grid return
R124	3Z4529	RESISTOR: 10,000 ohms ± 10%; ½ w.	Grid filter
C142.1	3DA100–28	CAPACITOR: 0.1 mf, 600 volts; direct current.	Grid bypass
T102	266494A/T3	AUDIO OUTPUT TRANSFORMER: (so–1006).	Audio output
P101	2Z288–3	POTENTIOMETER: 50,000 ohms.....	Sidetone control
R156	3Z6003–4	RESISTOR: 30 ohms ± 10%; 1 w.	A-f load
R128	3Z4529	RESISTOR: 10,000 ohms ± 10%; 2 w.	Sidetone dropping
R126	3Z6675–10	RESISTOR: 75,000 ohms ± 10%; 2 w.	Sidetone supply
C143	3DA500–27	CAPACITOR: 0.5 mf, 600 volts direct current.	Screen bypass





NOTE:

1. ALL VOLTAGES AND RESISTANCES ARE MEASURED FROM DESIGNATED POINTS TO FRAME OF TRANSMITTER.
2. ALL VOLTAGE AND RESISTANCE READINGS ARE TAKEN WITH NO BATTERY CONNECTED, DYNAMOTOR IN PLACE, "ON-OFF" SWITCH "ON", "REC-TUNE-OPERATE" SWITCH ON "OPERATE", AND ALL VACUUM TUBES IN PLACE.
3. ALL VOLTAGE AND RESISTANCE MEASUREMENTS TAKEN WITH A 1,000 OHM-PER-VOLT METER.
4. NC - NOT CONNECTED.

TL 18271

Figure 29. Radio Transmitter BC-684-(*), second a-f amplifier V106, schematic diagram.

SECTION IX

SUPPLEMENTARY DATA

54. Parts Identification

The following illustrations are provided to aid in identifying and servicing the various component parts of Radio Transmitters BC–684–A, –B, and –BM.

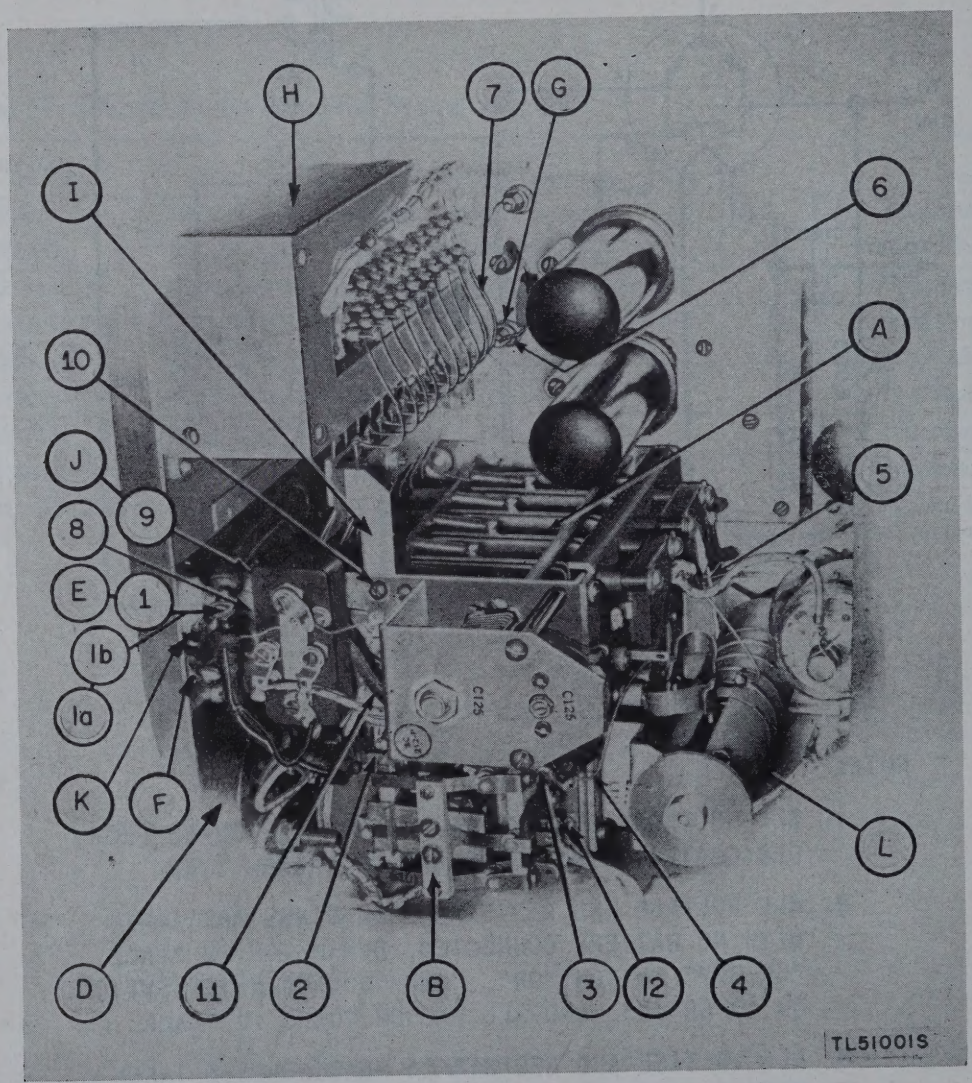
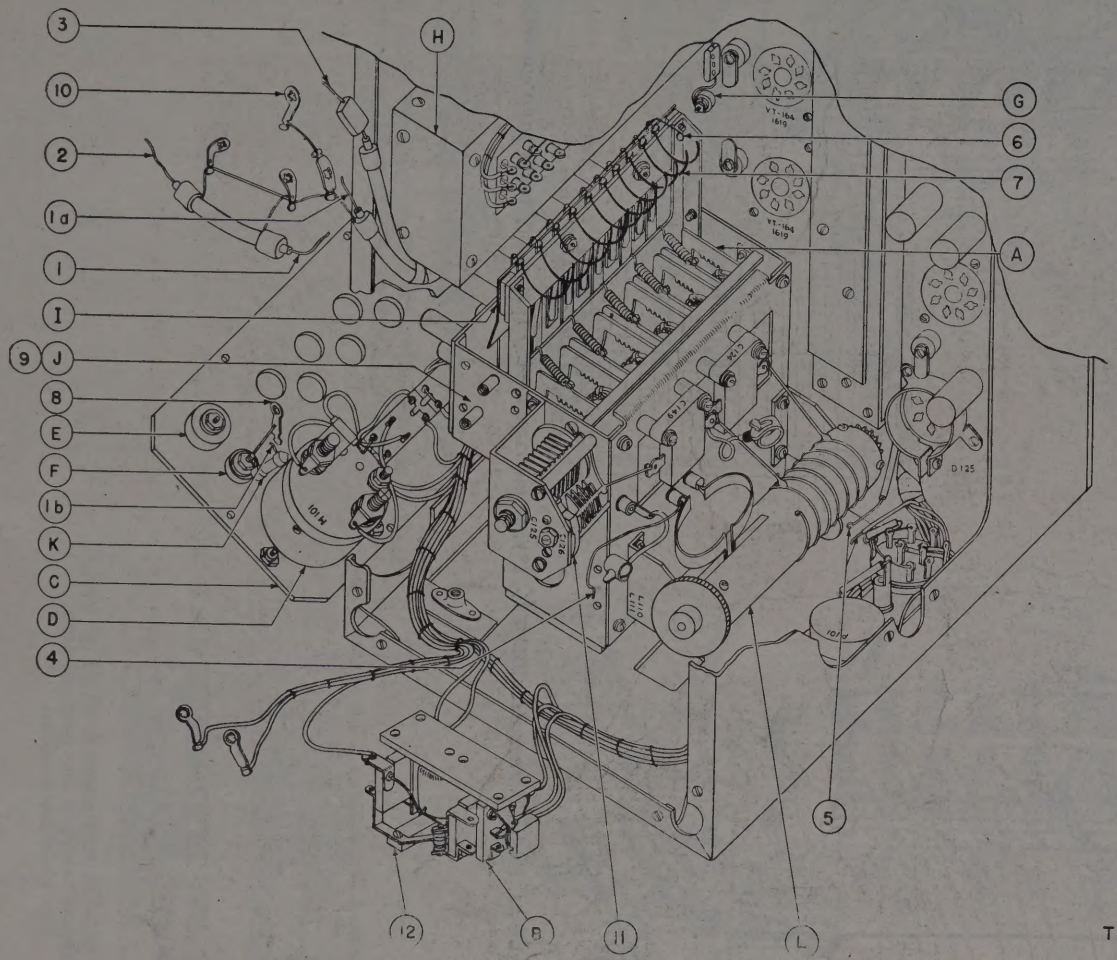
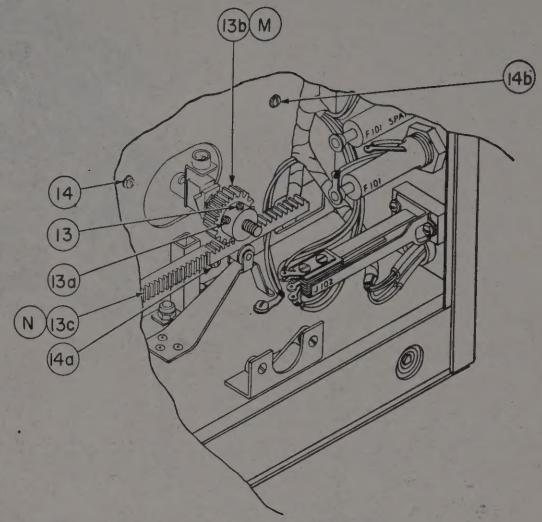


Figure 30a. Radio Transmitter BC–684–(*), push-button assembly.



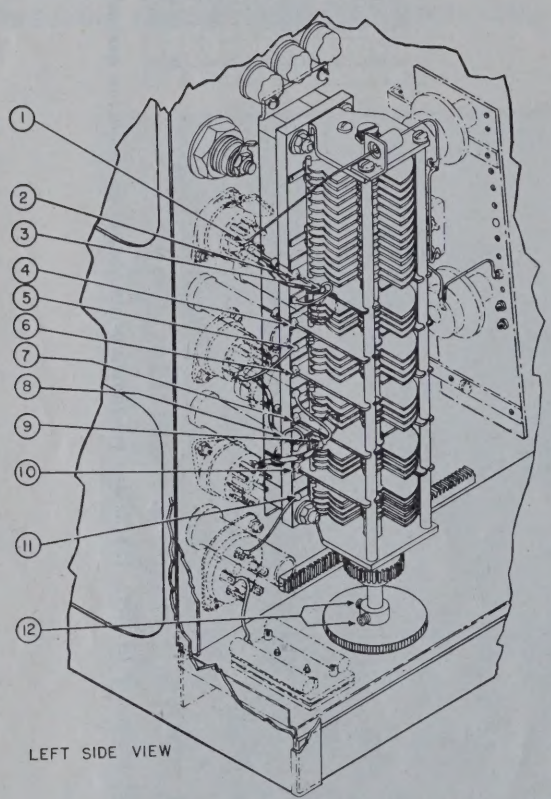


UNDER-CHASSIS VIEW

TL 18278

PARTS LIST	
A	PUSH BUTTON MECHANISM
B	S101 ANTENNA RELAY
C	FRONT PANEL
D	M101 METER
E	ANTENNA POST "A"
F	GROUND POST "G"
G	INSULATED STUD "E"
H	CRYSTAL OVEN
I	TUNER SPRING CONTACT ASSEMBLY
J	THERMOCOUPLE SEE FIGURE #35
K	RESISTOR 155
L	ANTENNA COUPLING UNIT
M	GEAR
N	RACK

Figure 30b. Radio Transmitter BC-684-(*), isometric showing removal of push-button assembly.



SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	UNSOLDER WIRE
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	REMOVE TWO (2) SET SCREWS
13	UNSOLDER WIRE
14	
15	
16	
17	
18	
19	
20	REMOVE TWO (2) ELASTIC STOP NUTS AND WASHERS
21	REMOVE TWO (2) ELASTIC STOP NUTS AND WASHERS

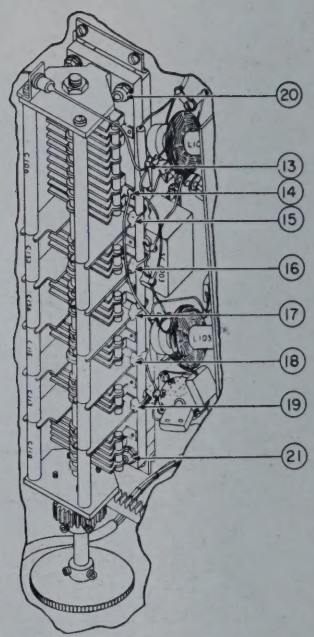
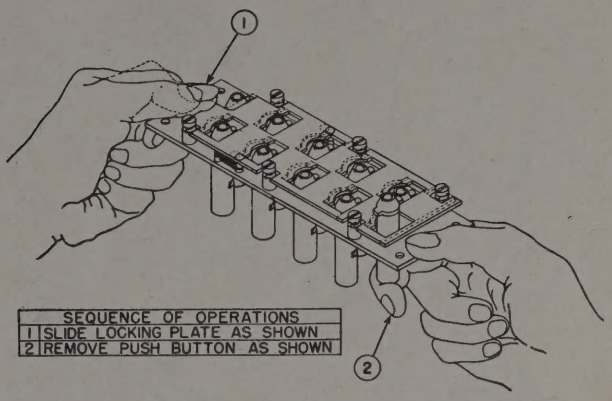


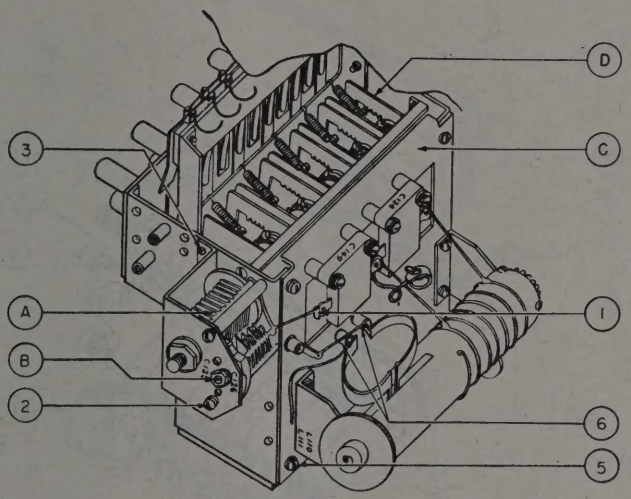
Figure 31. Radio Transmitter BC–684–(*), isometric showing removal of main gang capacitor.



SEQUENCE OF OPERATIONS
1 SLIDE LOCKING PLATE AS SHOWN
2 REMOVE PUSH BUTTON AS SHOWN

TL 18210

Figure 33. Radio Transmitter BC–684–(*), isometric showing removal of individual push-buttons.



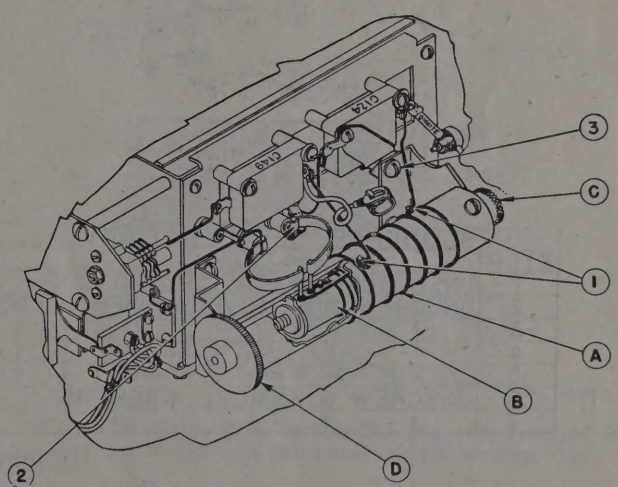
PARTS LIST	
A	POWER AMPLIFIER TUNING CAPACITOR
B	POWER AMPLIFIER TRIMMER CAPACITOR
C	ANTENNA COUPLING SUPPORT
D	PUSH BUTTON SELECTOR

REMOVAL OF POWER AMPLIFIER V103 TUNING CAPACITOR	
SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	UNSOLDER WIRE
2	REMOVE TWO (2) SCREWS & WASHERS
3	REMOVE TWO (2) SCREWS & WASHERS

REMOVAL OF ANTENNA COUPLING SUPPORT	
SEQUENCE OF OPERATIONS	
STEP	OPERATION
4	REMOVE PUSH BUTTON SELECTOR FROM CHASSIS AS DESCRIBED IN SECTION XIII - FIGURE 30
5	REMOVE FOUR (4) SCREWS & WASHERS
6	UNSOLDER TWO (2) WIRES BEHIND PART C

TL 18280

Figure 32. Radio Transmitter BC–684–(*), isometric showing removal of parts from push-button assembly.

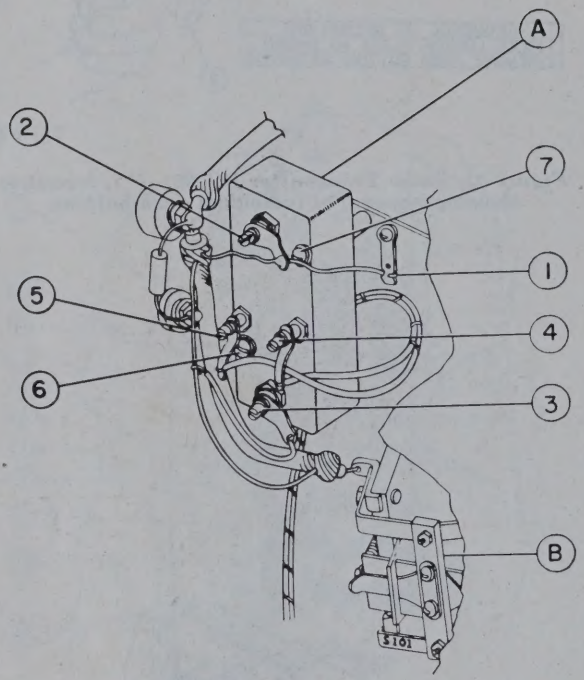


PARTS LIST	
A	POWER AMPLIFIER COIL
B	ANTENNA COUPLING COIL
C	GEAR FOR POWER AMPLIFIER SLUG UNIT
D	ANTENNA COIL TUNING KNOB

SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	UNSOLDER & REMOVE TWO (2) WIRES
2	UNSOLDER SPRINGS
3	REMOVE FOUR (4) SCREWS

TL 18282

Figure 34. Radio Transmitter BC–684–(*), isometric showing removal of power amplifier and antenna coupling coil.

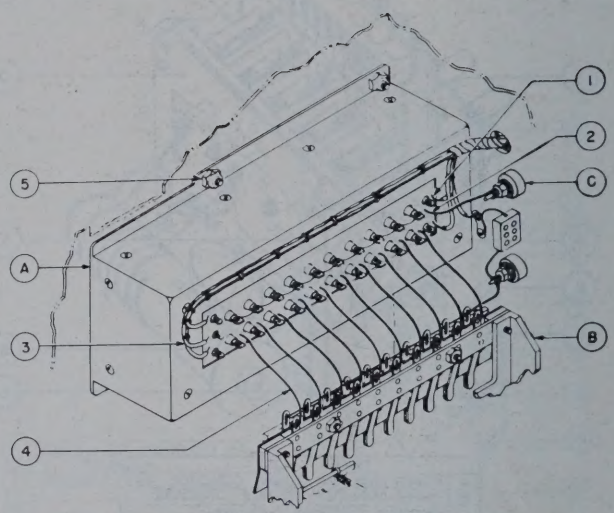


PARTS LIST	
A	THERMOCOUPLE
B	ANTENNA RELAY

SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	UNSOLDER WIRE AT GROUND LUG
2	UNSCREW & REMOVE WASHER & LUG
3	↓ ↓ ↓ ↓ ↓ ↓
4	↓ ↓ ↓ ↓ ↓ ↓
5	↓ ↓ ↓ ↓ ↓ ↓
6	UNSCREW & REMOVE WASHERS
7	↓ ↓ ↓ ↓

TL 18283

Figure 35. Radio Transmitter BC–684–(*), isometric showing removal of thermocouple.

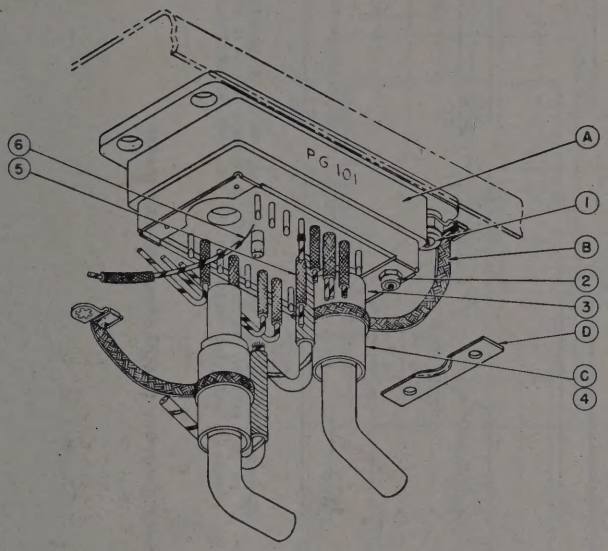


PARTS LIST	
A	CRYSTAL OVEN
B	PUSH BUTTON ASSEMBLY
C	INSUALTED STUD

SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	UNSOLDER TWO (2) WIRES
2	UNSOLDER BARE WIRE
3	UNSOLDER THREE (3) WIRES
4	UNSOLDER TEN (10) BARE WIRES
5	REMOVE FIVE (5) ELASTIC STOP NUTS

TL 18284

Figure 36. Radio Transmitter BC–684–(*), isometric showing removal of crystal compartment.



PARTS LIST	
A	PG 101 CONNECTOR
B	GROUNDING LINE
C	COAXIAL LINE CONNECTOR
D	COAXIAL LOCKING PLATE

FOR REMOVAL OF PG 101 CONNECTOR SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	REMOVE FOUR (4) ELASTIC STOP NUTS AND SLEEVES

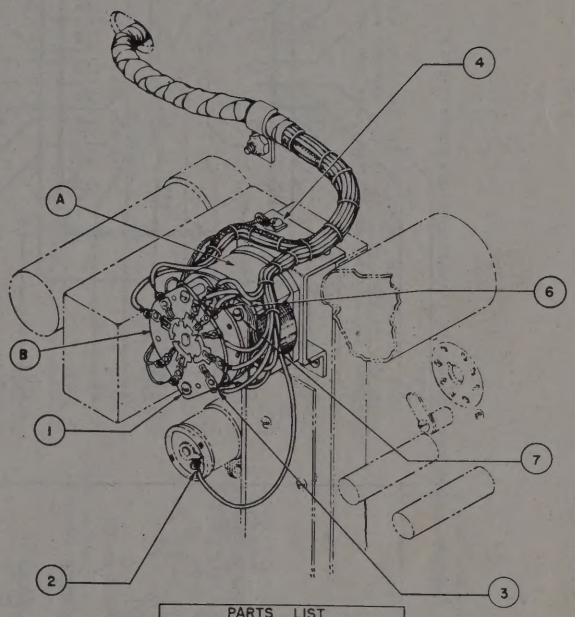
FOR REMOVAL OF COAXIAL CABLE SEQUENCE OF OPERATIONS	
STEP	OPERATION
2	REMOVE TWO (2) ELASTIC STOP NUTS
3	REMOVE COAXIAL CONNECTOR LOCKING PLATE
4	REMOVE COAXIAL CONNECTOR

FOR REMOVAL OF WIRES SEQUENCE OF OPERATIONS	
STEP	OPERATION
5	PULL BACK WIRE SLEEVING
6	UNSOLDER AS SHOWN

TRANSMITTERS		
BC-604	BC-684A	BC-684B
FIG. M-385	FIG. M-487	FIG. M-608
REMOVAL OF INPUT PLUG PG 101		

TL 18285

Figure 37. Radio Transmitter BC-684-(*), isometric showing removal of coaxial cables and wires from power input plug PG101.



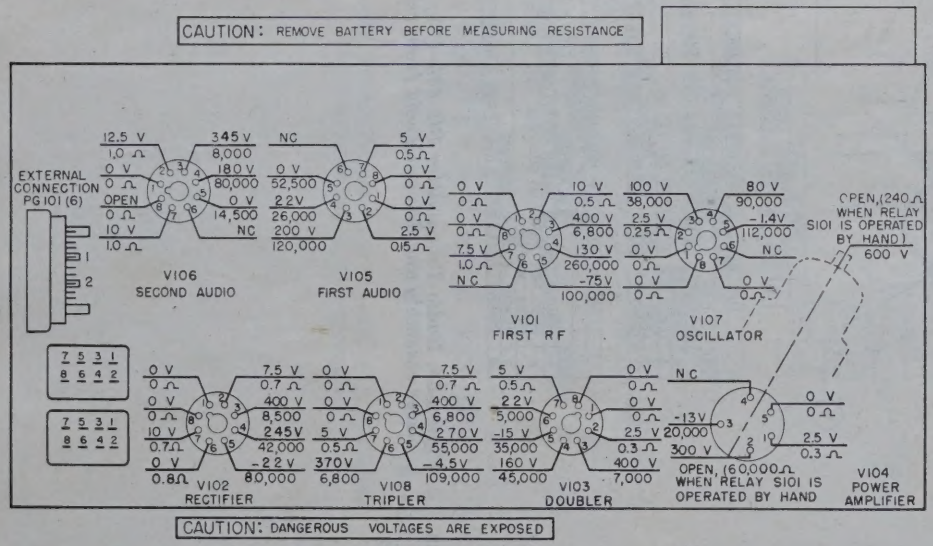
PARTS LIST	
A	S104 SOLENOID DRIVE
B	S104 WAFER ASSEMBLY

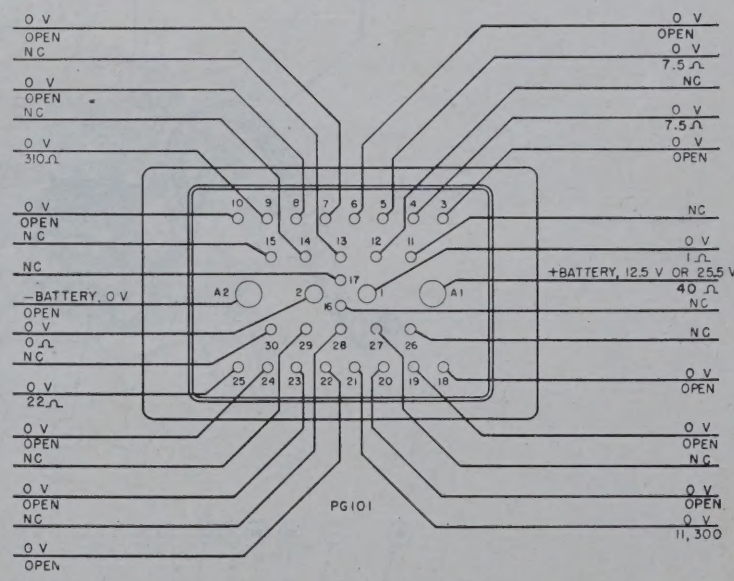
FOR REMOVAL OF WAFER ASSEMBLY SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	REMOVE TWO (2) WAFER MOUNTING SCREWS
2	UNSOLDER
3	UNSOLDER FOURTEEN (14) LEADS
4	REMOVE SCREW AND GROUND LUG
5	REMOVE WAFER ASSEMBLY FROM CABINET

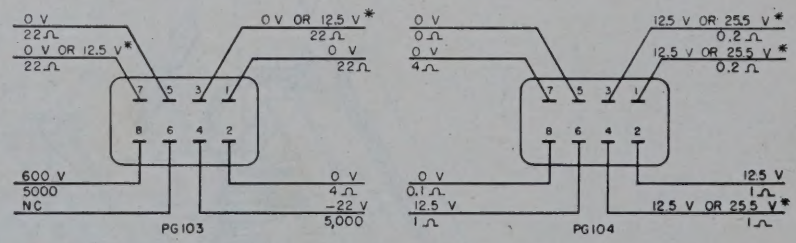
FOR REMOVAL OF SOLENOID DRIVE SEQUENCE OF OPERATIONS	
STEP	OPERATION
1	REMOVE TWO (2) WAFER MOUNTING SCREW
6	UNSOLDER THREE (3) SOLENOID COIL LEADS FROM WAFER
7	REMOVE FOUR (4) SCREWS
8	REMOVE SOLENOID DRIVE FROM CABINET

TL 18296

Figure 38. Radio Transmitter BC-684-(*), removal of water assembly and drive solenoid from relay S104.







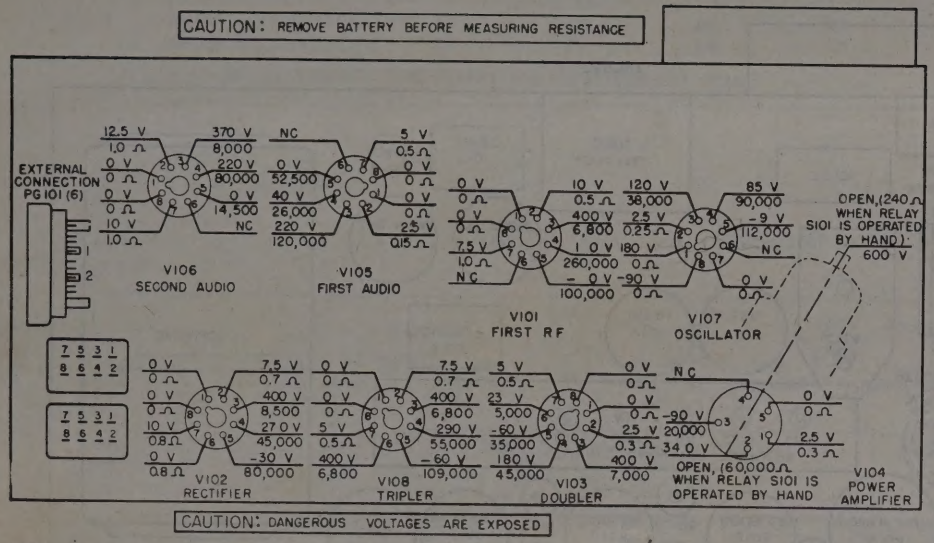
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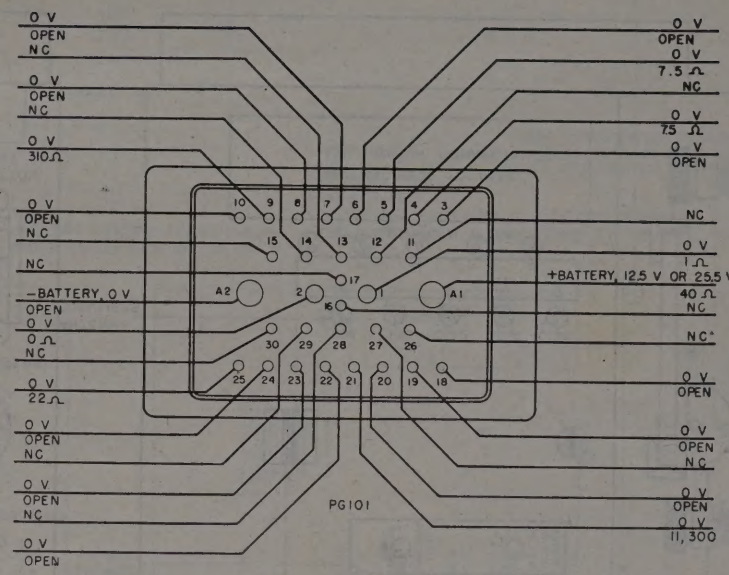
1. LAYOUT CORRESPONDS WITH BOTTOM OF TRANSMITTER. DATA TAKEN WHILE TRANSMITTER IS IN OPERATION ON CHANNEL 79 INTO A PHANTOM ANTENNA. ALL VOLTAGES ARE MEASURED FROM DESIGNATED POINTS TO FRAME OF TRANSMITTER.
2. OBSERVED METER READINGS MAY EXCEED THE VALUES SHOWN BECAUSE OF RF VOLTAGE SUPERIMPOSED ON DC VOLTAGE AT SOME TERMINALS.
3. MEASUREMENTS TO BE MADE WITH CRYSTAL OVEN THERMOSTAT UNOPERATED.
4. FOR VOLTAGE MEASUREMENTS, USE VOLTMETER SCALES AS FOLLOWS: 0–3V 3 VOLT SCALE, 3–30V 30 VOLT SCALE, 30–300 V 300 VOLT SCALE, 300–600 V 600 VOLT SCALE.
5. ALL RESISTANCE READINGS ARE TAKEN BETWEEN THE POINT DESIGNATED AND THE FRAME OF THE SET. NO BATTERY CONNECTED, DYNAMOTOR IN PLACE, "ON-OFF" SWITCH "ON", "REC-TUNE-OPERATE" SWITCH ON "OPERATE", ALL VACUUM TUBES IN PLACE.
6. ALL VOLTAGE MEASUREMENT TAKEN WITH A 1000 OHMS-PER-VOLT METER.
7. NC-NOT CONNECTED

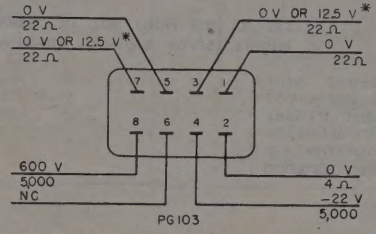
* WHERE TWO VOLTAGE VALUES ARE GIVEN, THE VALUE MARKED * IS OBTAINED WITH A 24 VOLT BATTERY. THE OTHER VALUE IS OBTAINED WITH A 12 VOLT BATTERY. WHERE ONLY ONE VALUE IS GIVEN, THE READINGS ARE THE SAME REGARDLESS OF THE BATTERY VOLTAGE.

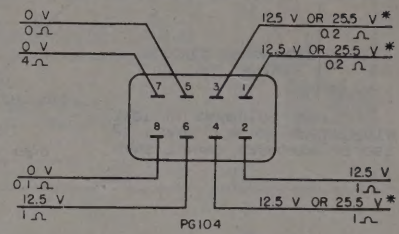
TL 18287

Figure 39. Radio Transmitter BC-684-(*), voltage-resistance diagram (1,000 ohm-per-volt meter).









NOTE:

1. LAYOUT CORRESPONDS WITH BOTTOM OF TRANSMITTER. DATA TAKEN WHILE TRANSMITTER IS IN OPERATION ON CHANNEL 79 INTO A PHANTOM ANTENNA. ALL VOLTAGES ARE MEASURED FROM DESIGNATED POINTS TO FRAME OF TRANSMITTER.
2. OBSERVED METER READINGS MAY EXCEED THE VALUES SHOWN BECAUSE OF RF VOLTAGE SUPERIMPOSED ON DC VOLTAGE AT SOME TERMINALS.
3. MEASUREMENTS TO BE MADE WITH CRYSTAL OVEN THERMOSTAT UNOPERATED.
4. FOR VOLTAGE MEASUREMENTS, USE VOLTMETER SCALES AS FOLLOWS: 0-3V 3 VOLT SCALE, 3-30V 30 VOLT SCALE, 30-300 V 300 VOLT SCALE, 300-600 V 1,000 VOLT SCALE.
5. ALL RESISTANCE READINGS ARE TAKEN BETWEEN THE POINT DESIGNATED AND THE FRAME OF THE SET. NO BATTERY CONNECTED, DYNAMOTOR IN PLACE, "ON-OFF" SWITCH "ON", "REC-TUNE-OPERATE" SWITCH ON "OPERATE", ALL VACUUM TUBES IN PLACE.
6. ALL VOLTAGE MEASUREMENT TAKEN WITH AN ELECTRONIC VOLTOHMMETER
7. NC - NOT CONNECTED

* WHERE TWO VOLTAGE VALUES ARE GIVEN, THE VALUE MARKED * IS OBTAINED WITH A 24 VOLT BATTERY. THE OTHER VALUE IS OBTAINED WITH A 12 VOLT BATTERY. WHERE ONLY ONE VALUE IS GIVEN, THE READINGS ARE THE SAME REGARDLESS OF THE BATTERY VOLTAGE.

TL18288

Figure 40. Radio Transmitter BC-684-(*), voltage-resistance diagram (electronic voltohmmeter).

TABLE VI. METER SWITCH READINGS*

SWITCH POSITION	1	2	3	4	5	6
CIRCUIT	DOUBLER GRID	FIRST R-F GRID	RECTIFIER GRID	TRIPLER GRID	POWER AMPLIFIER GRID	TOTAL PLATE AND SCREEN
METER READING (27.0 MC)	30	30	20	20	30	30
METER READING (38.9 MC)	20	25	25	25	30	30

*TRANSMITTER RECEIVER TUNE-OPERATE SWITCH AT RECEIVER TUNE

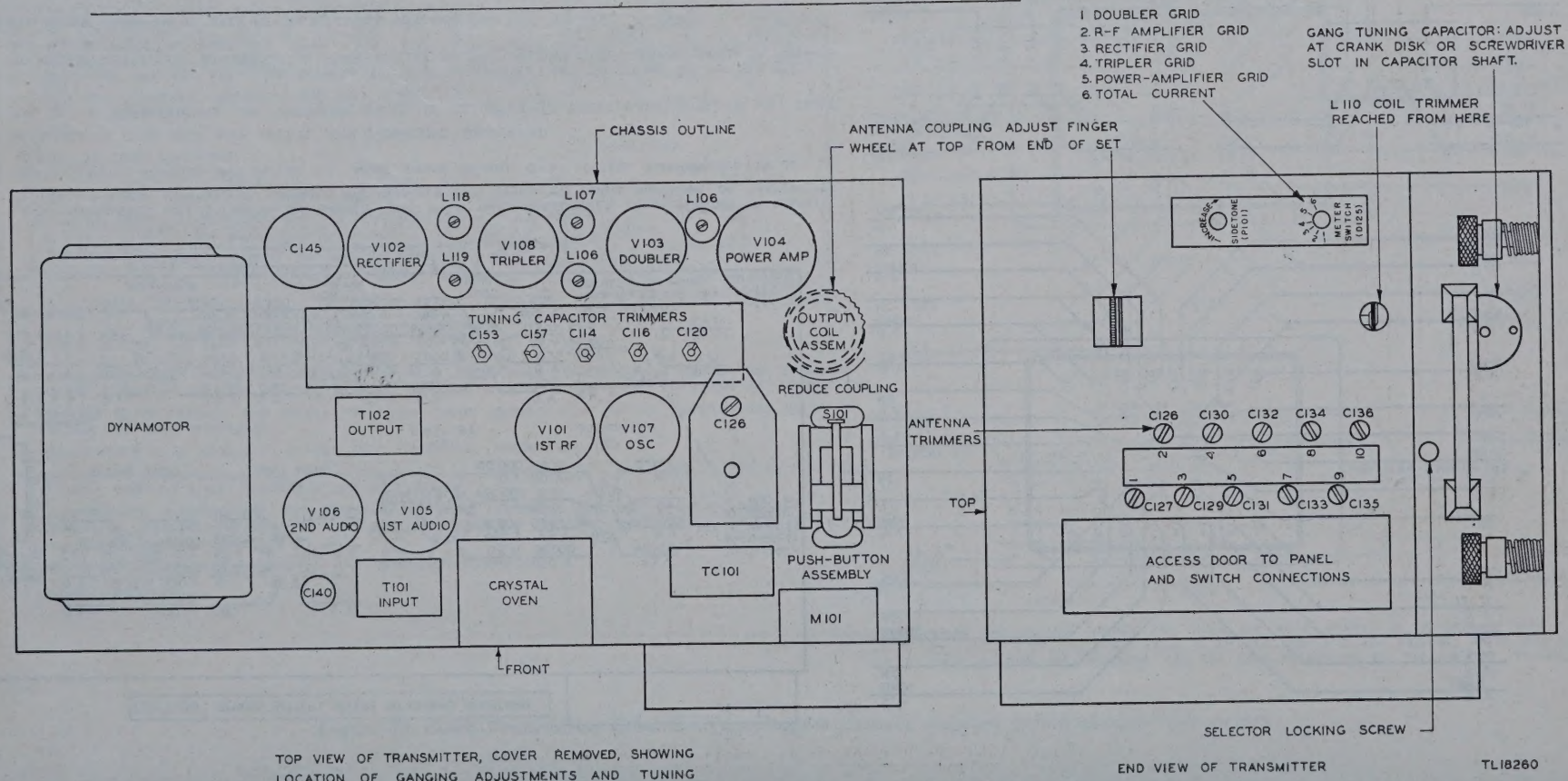


Figure 41. Radio Transmitter BC-684-A, location of alignment and tuning controls.

TABLE VI. METER SWITCH READINGS*

SWITCH POSITION	1	2	3	4	5	6
CIRCUIT	DOUBLER GRID	FIRST R-F GRID	RECTIFIER GRID	TRIPLER GRID	POWER AMPLIFIER GRID	TOTAL PLATE AND SCREEN
METER READING (27.0 MC)	30	30	20	20	30	30
METER READING (38.9 MC)	20	25	25	25	30	30

*TRANSMITTER RECEIVER TUNE-OPERATE SWITCH AT RECEIVER TUNE.

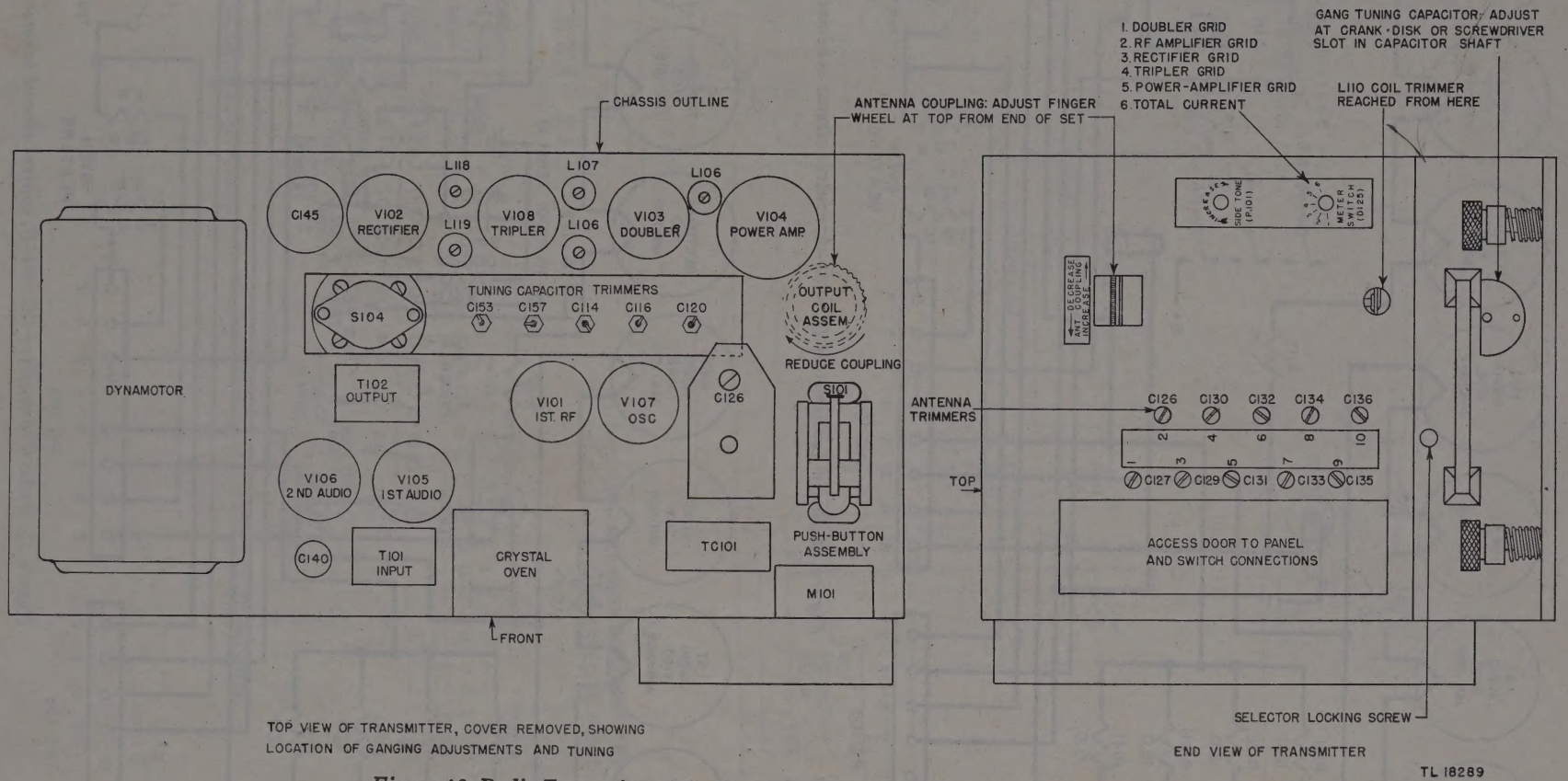


Figure 42. Radio Transmitter BC-684-B, location of alignment and tuning controls.

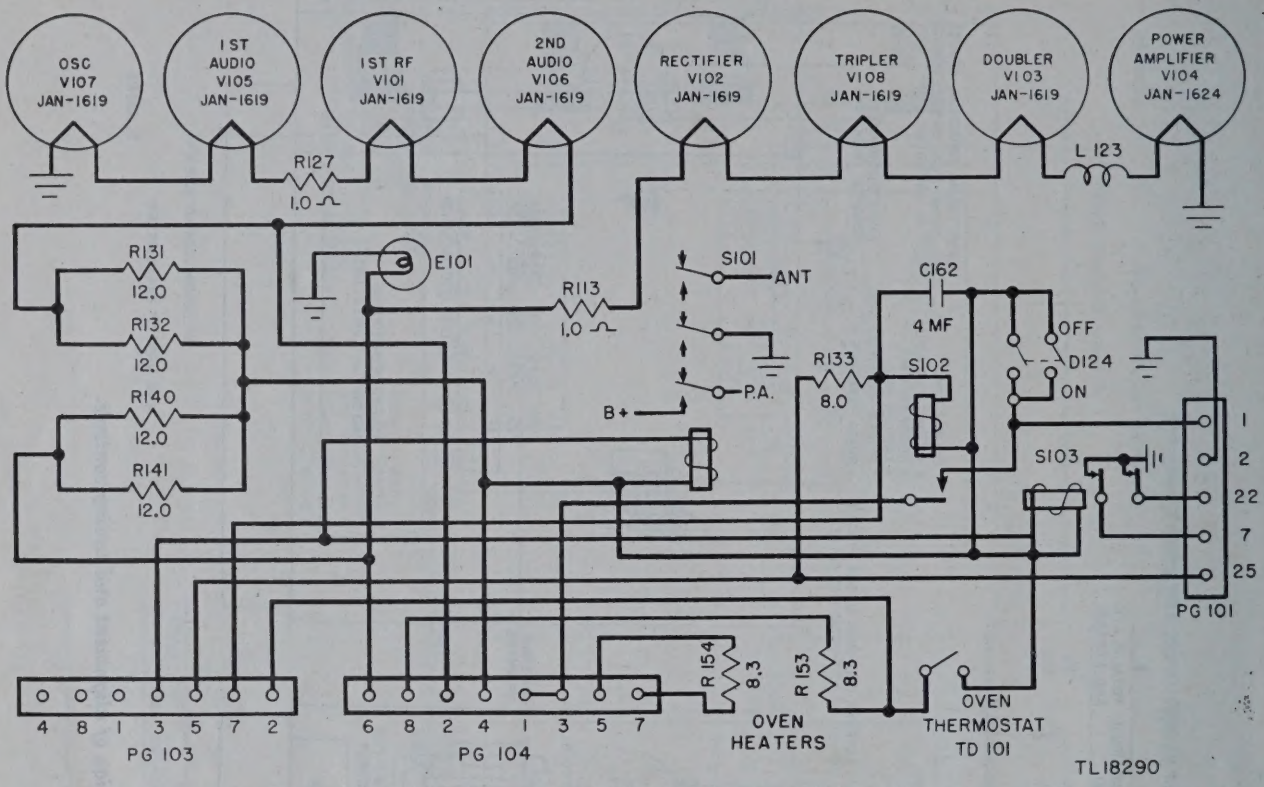


Figure 43. Radio Transmitter BC–684–A, control circuit schematic.

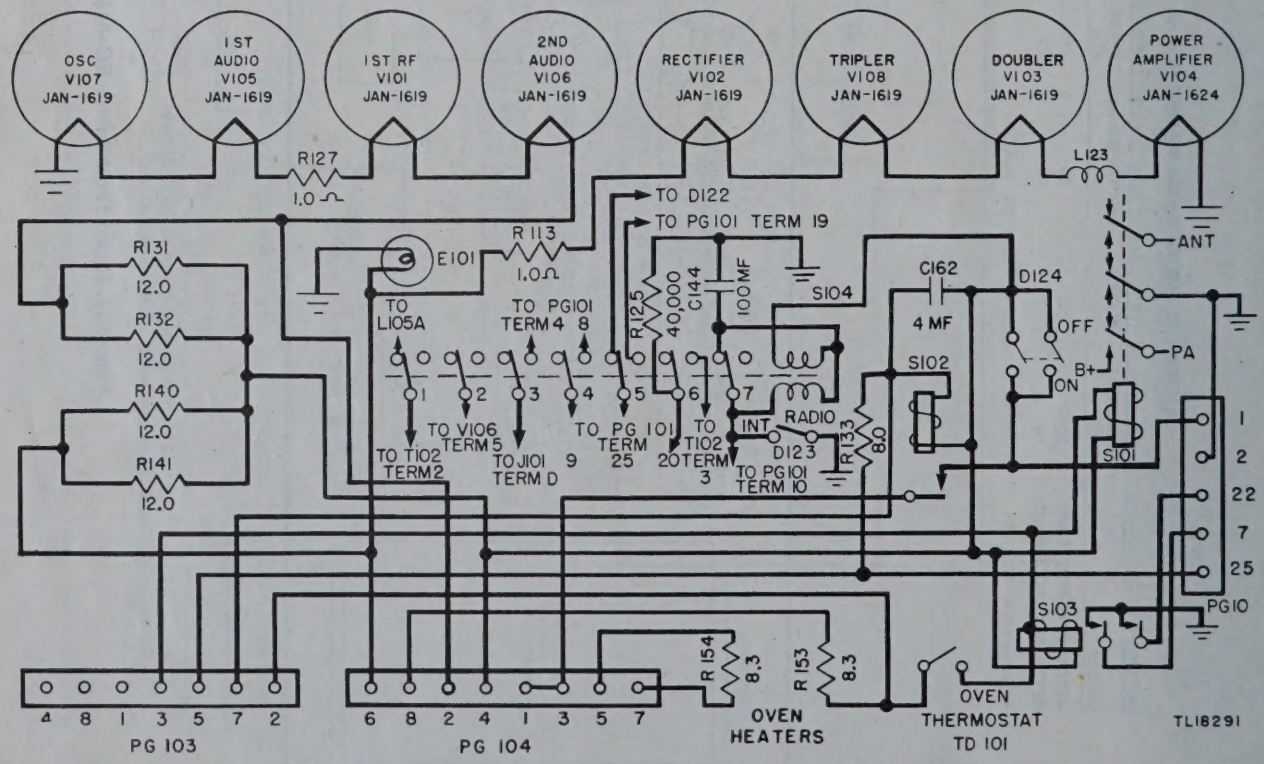


Figure 44. Radio Transmitter BC–684–B, control circuit schematic.

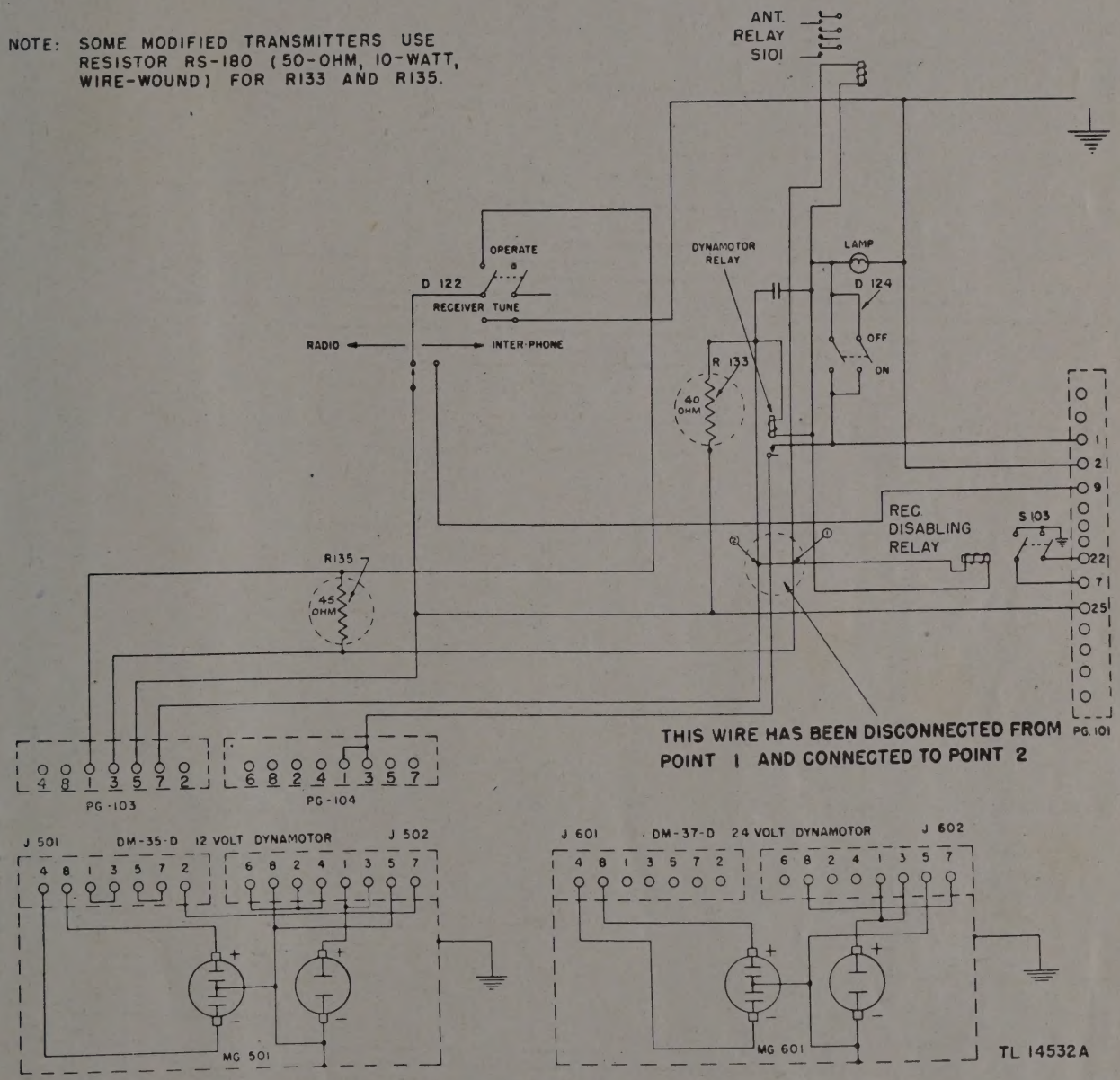


Figure 45. Circuit differences between Radio Transmitters BC–684–B and –BM.

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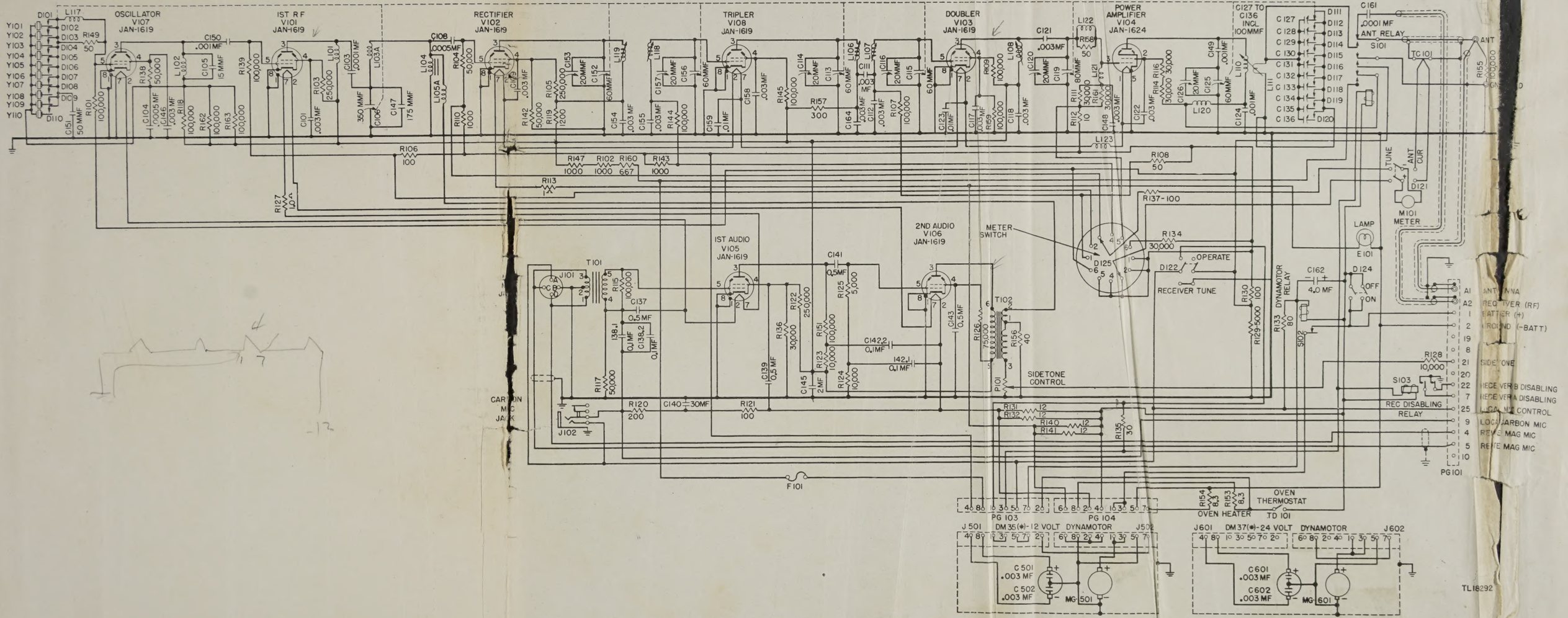
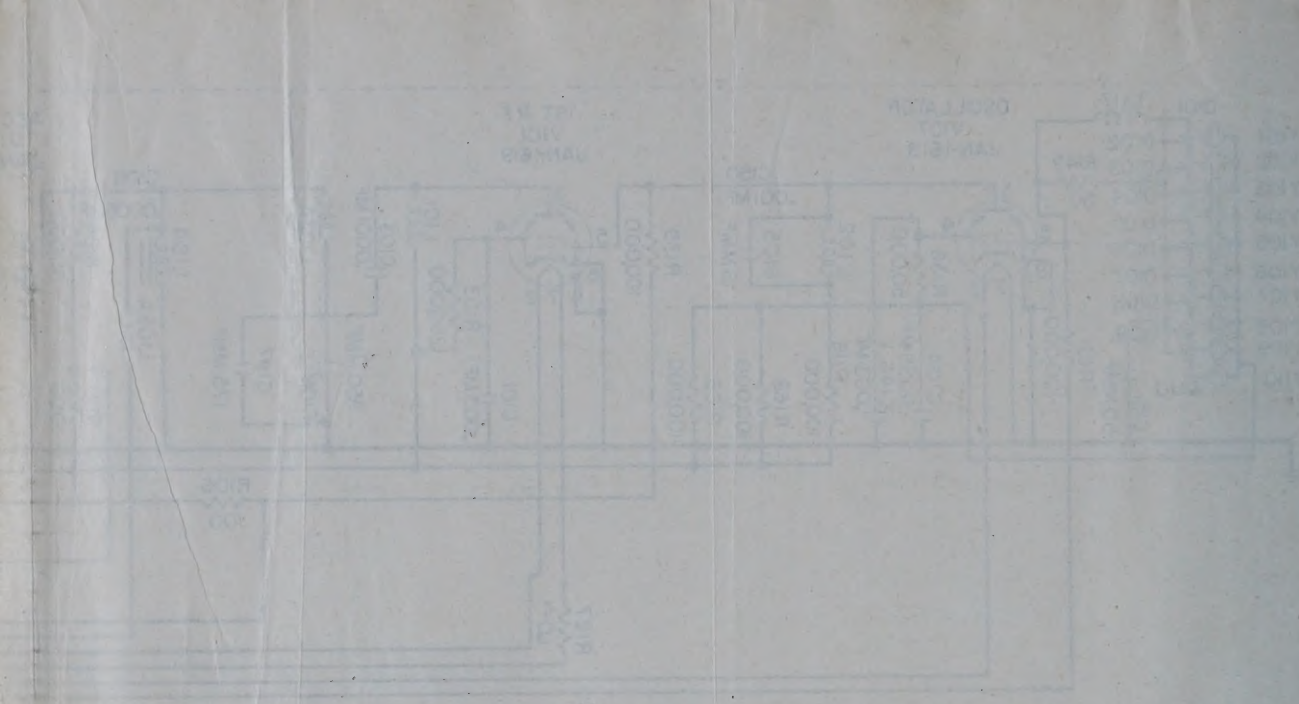
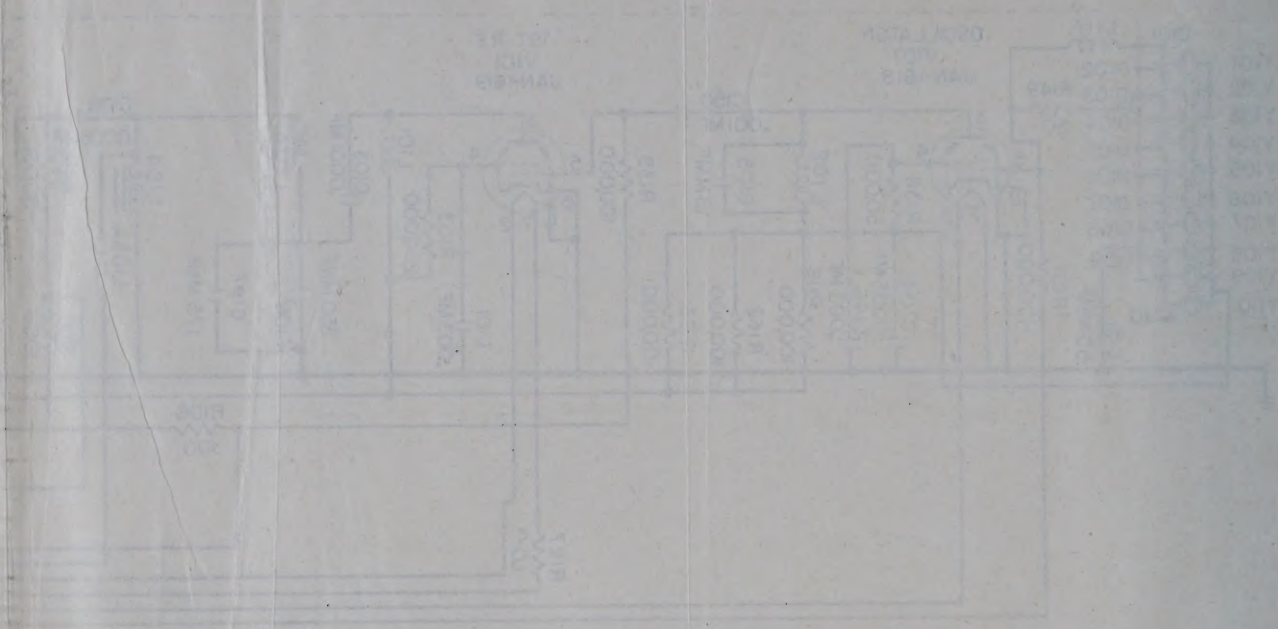


Figure 46. Radio Transmitter BC-684-A, over-all schematic.





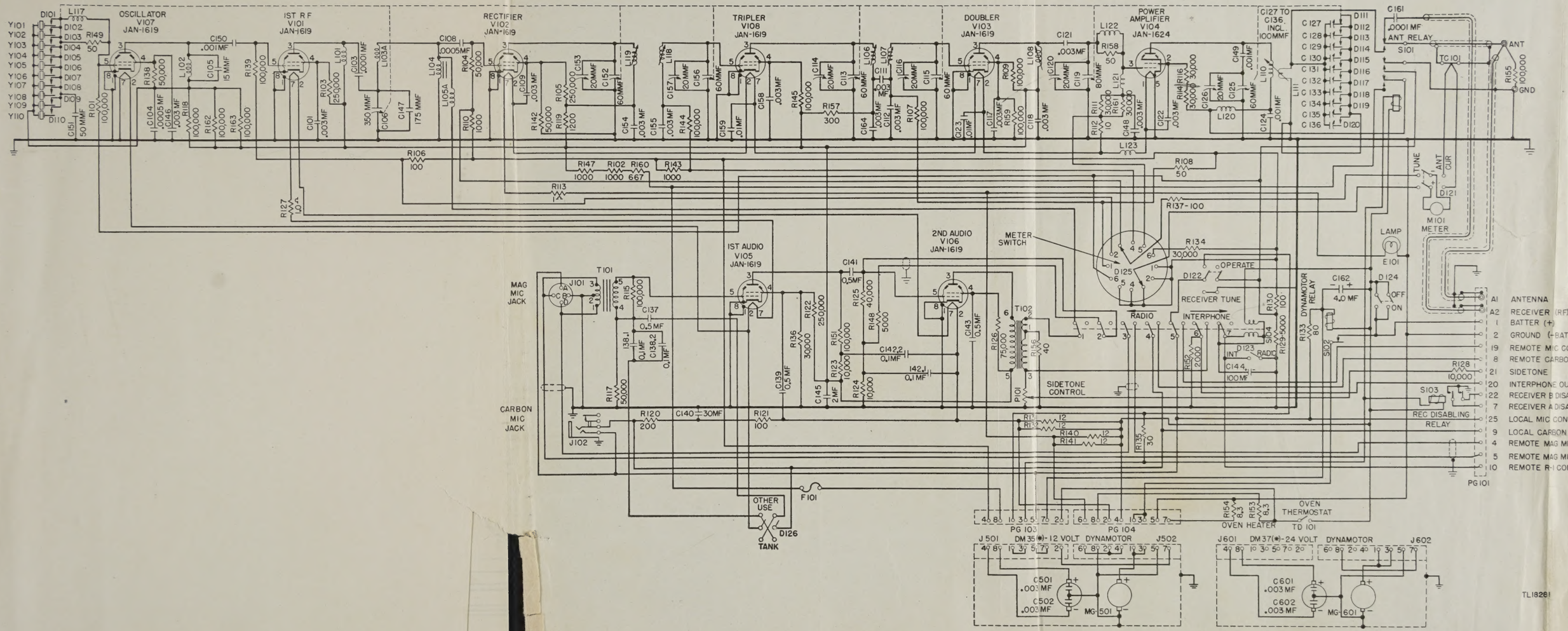
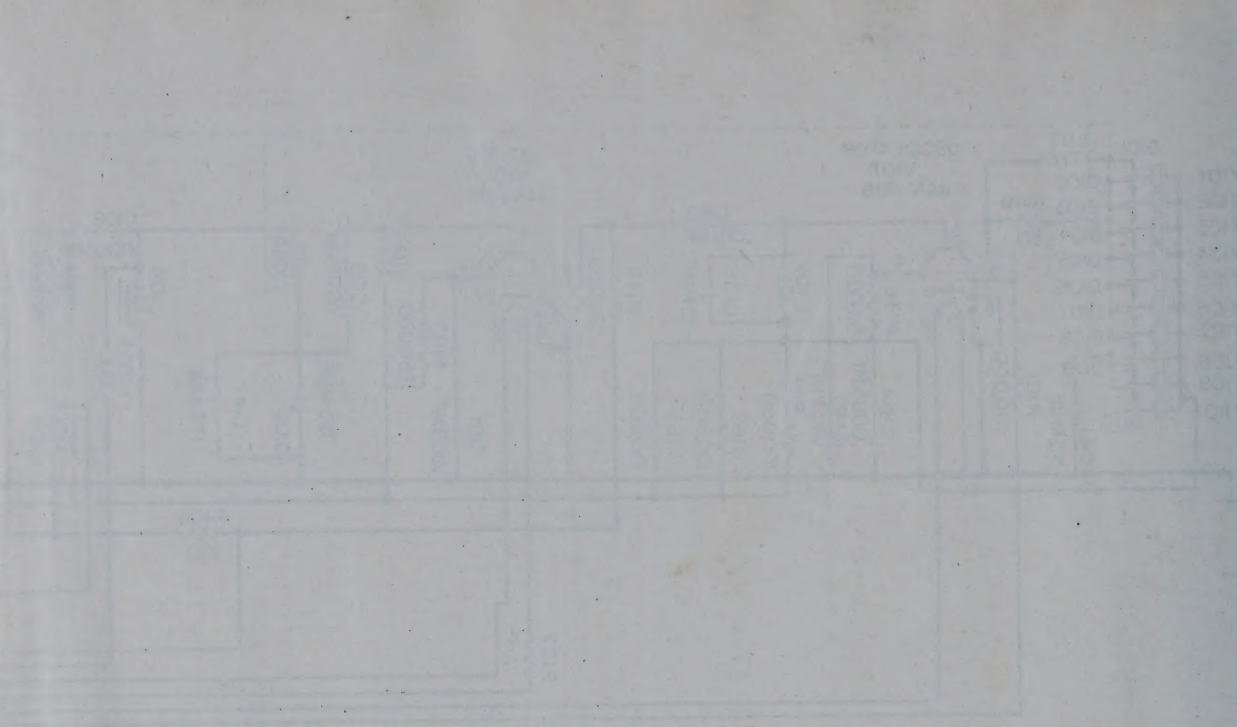
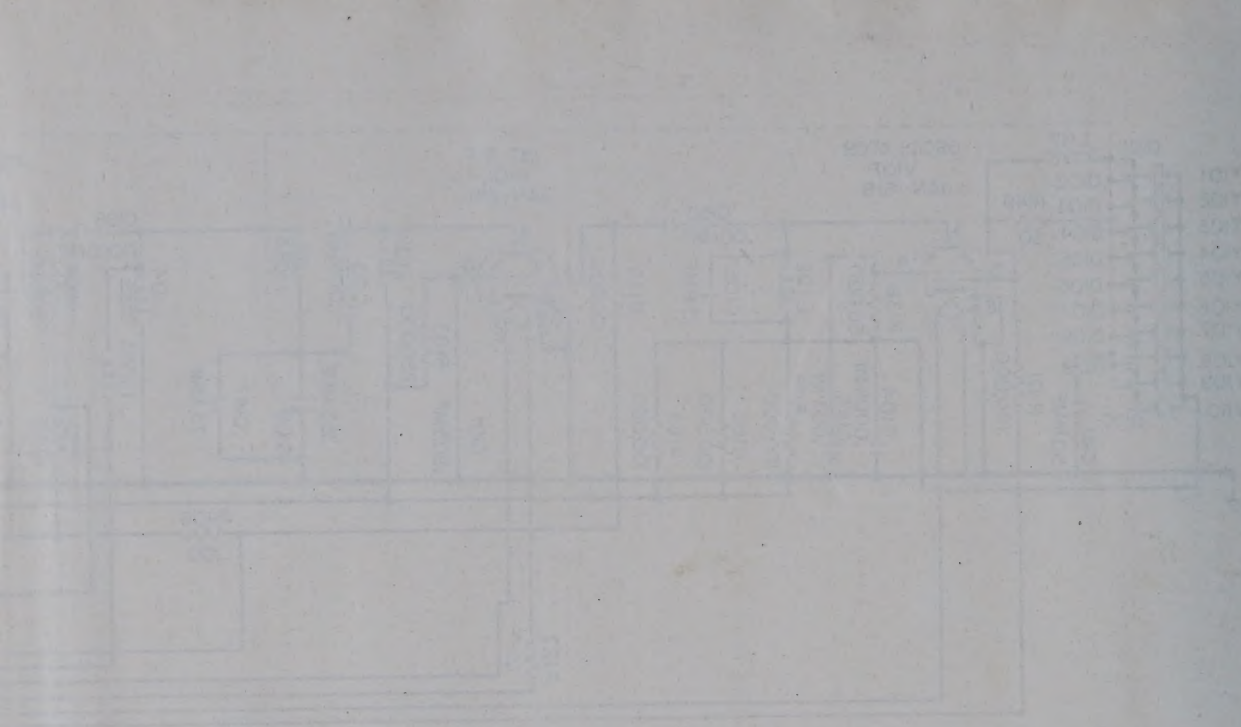


Figure 47. Radio Transmitter BC-684-B, over-all schematic.





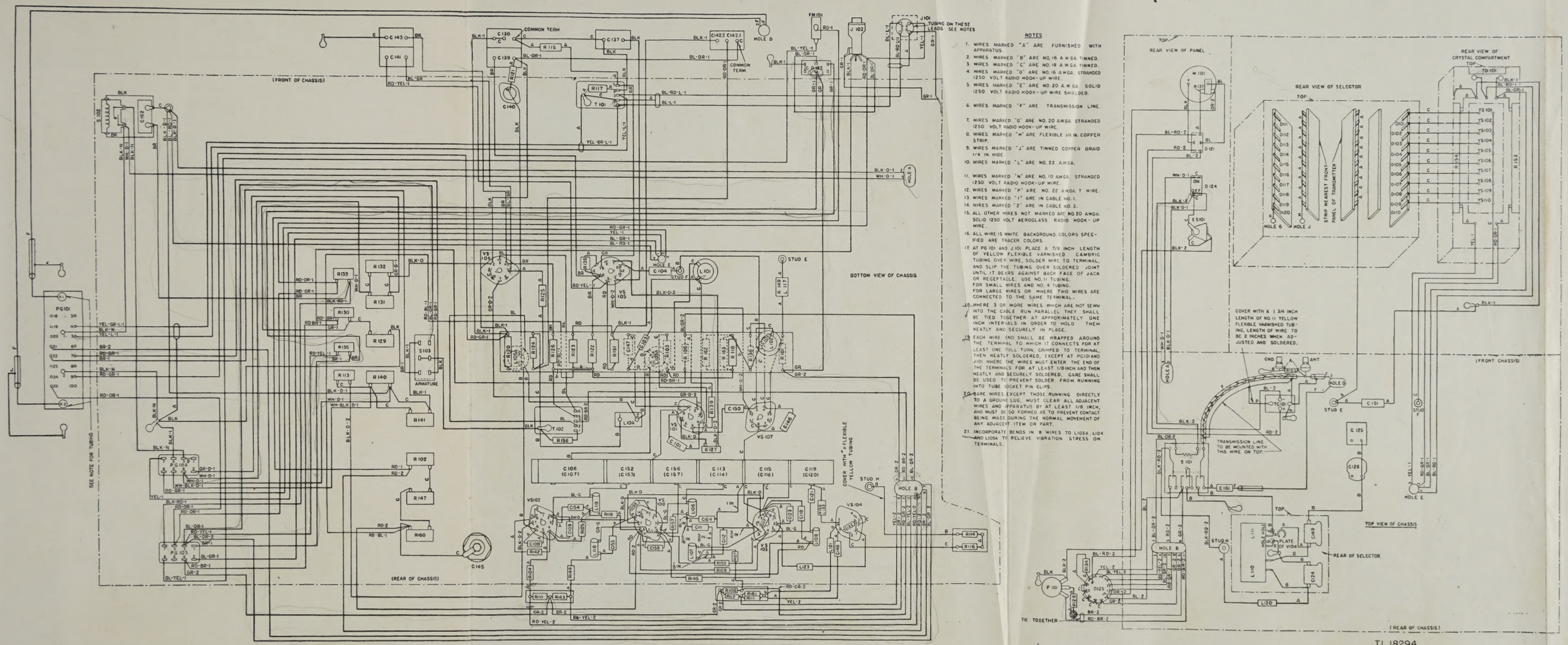
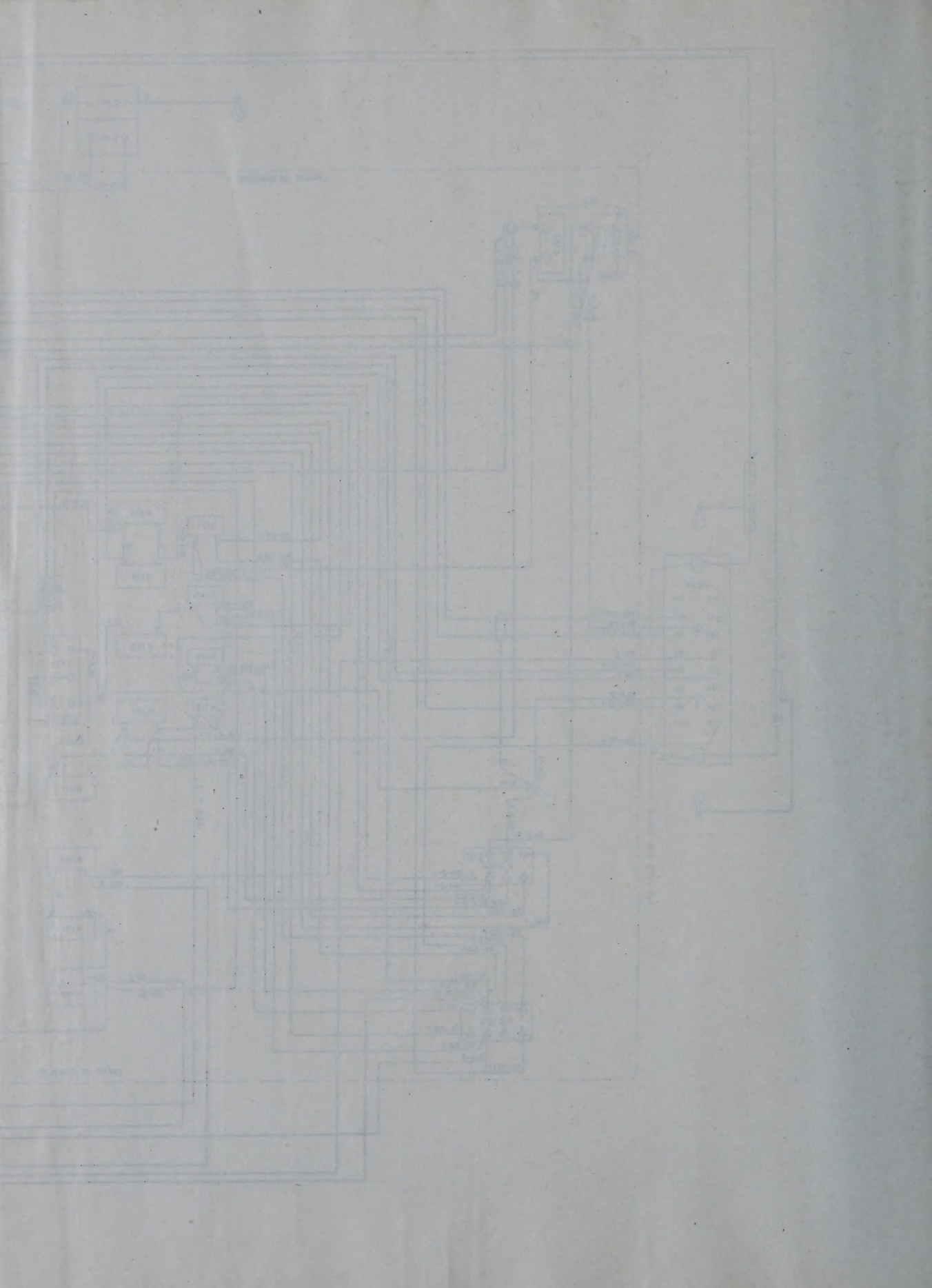


Figure 48. Radio Transmitter BC–684–A, over-all wiring diagram.



FIISHED WITH :

10 16W.GA. TINNED
10 16W.GA. TINNED
10 16WGA STRANDED
WIR
10 21 W GA SOLID
P WIISHIELDED

TRANSMISSION LINE

20 16GA STRANDED
WIRE
EXIE 1/4 IN. COPPER

NNECOPPER BRAID

22 WGA

10 16A STRANDED
WIR
20 22WGA T WIRE
CAB NO. 1
CAB NO 2.
EDRE NO 20 AWGA
1D10 HOOK-UP

UNECOLORS SPEC-

7/ INCH LENGTH
NISED CAMBRIC
WIR TO TERMINAL,
SLDERED JOINT
CKFACE OF JACK
TUING
TBING
E TWO WIRES ARE
ERMINAL

HICH ARE NOT SEWN
LL THEY SHALL
ROXIMATELY ONE
TO HOLD THEM
PLICE

WRAPPED AROUND
CONNECTS FOR AT
PED TO TERMINAL,
CEPT AT P101 AND
ENTER THE END OF
T 1/8 INCH AND THEN
RED. CARE SHALL
R FROM RUNNING

UNNING DIRECTLY
AR ALL ADJACENT
LEAST 1/8 INCH,
D PREVENT CONTACT
MAL MOVEMENT OF

RES TO L103A, L104
TION STRESS ON

VER FROM V106 FOR
ITERPHONE CIRCUIT,
VE-COVERED WIRE
R152. CONNECT
STEM (AT TERMINAL
HING TRANSFORMER
0 OHM LOAD.

NT MAXIMUM LEAD
HAVE BEEN

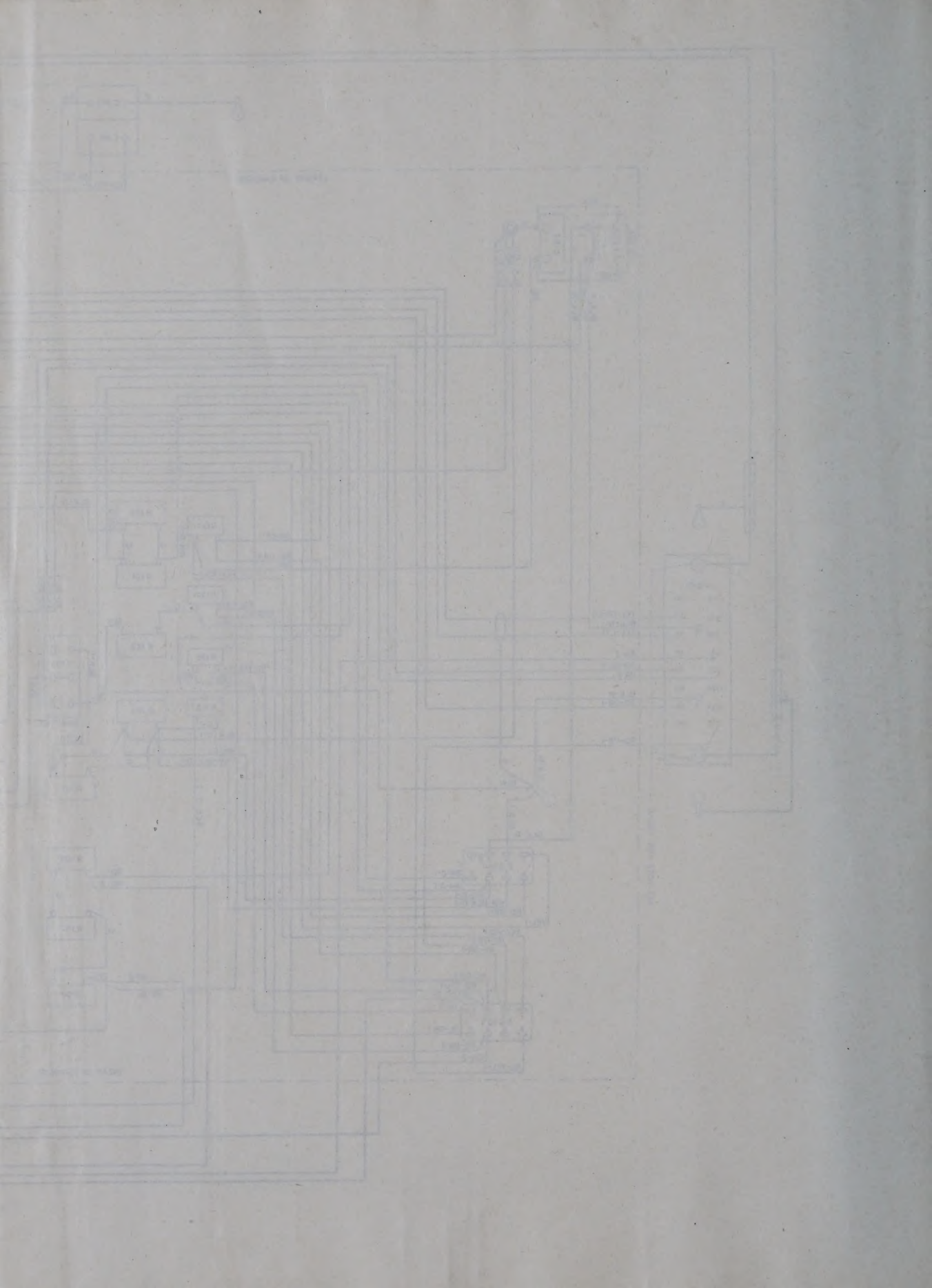
TOP
REAR VIEW OF PANEL

M 101
R137
BL
BLK
OR-2
BL-RD-2
RD-2
BL-2
D121
WH-D-1
D 124
ON
OFF
BLK-2
BLK-D-1
YEL-1
ES101
BLK-2
GR-1
D 123
INTER RADIO PHONE
BL-GR-1
YEL-1
WH-D-1
BLK-D-1
BL-GR-1
(HOLE A)
GR-1

REAR VIEW OF SELECTOR
TOP
D111
D112
D113
D114
D115
D116
D117
D118
D119
D120
HOLE G
HOLE J
STRIP NEAREST FRONT PANEL OF TRANSMITTER
D101
D102
D103
D104
D105
D106
D107
D108
D109
D110

COVER WITH A 1 3/4 INCH LENGTH OF NO 11 YELLOW FLEXIBLE VARNISHED TUBING, LENGTH OF WIRE TO BE 2 INCHES WHEN ADJUSTED AND SOLDERED.

GND
ANT.
R155
HOLE D
BL-2
TC101
STUD E
C 151
BLK-2
RD-2
BL-OR-2
TRANSMISSION LINE TO BE MOUNTED WITH THIS WIRE ON TOP
S 101
BLK-RD-2
C 161
C 125
C126
TOP
TOP VIEW OF C
BL-2
BL-OR-2
RD-2
GR-2
BLK-RD-2
STUD H
HOLE B
L111
HOLE
PLATE OF V104
C149
REAR OF SELECTOR
L110
C124
L120
BL-RD-2
YEL-2
BL-YEL-2
RD-YEL-2
BL-GR-2
RD-GR-2
BR-2
RD-BR-2
R134
D125
OR-2
GR-2
BL-2
R128
BR-2
RD-BR-2



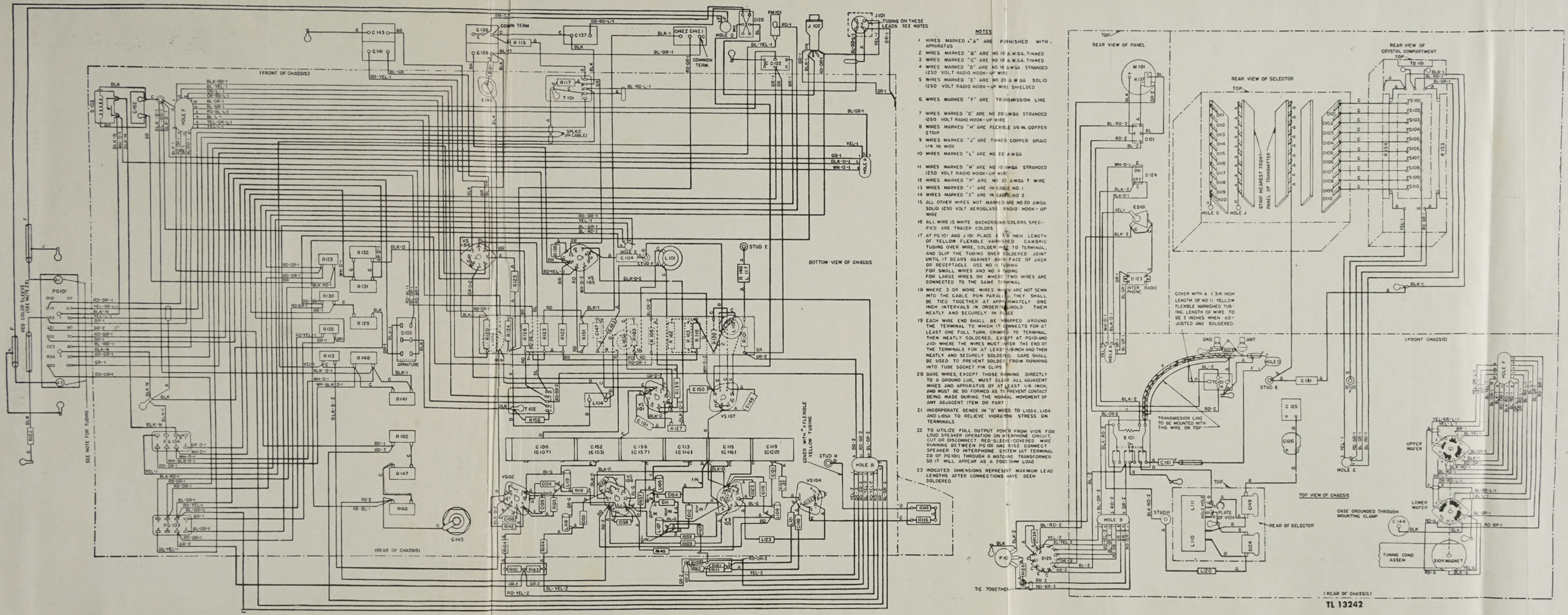


Figure 49. Radio Transmitter BC–684–B, wiring diagram.

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