

TM 11-625

WAR DEPARTMENT

TECHNICAL MANUAL

RADIO SET SCR - 543 - A
RADIO SET SCR - 543 - B
RADIO SET SCR - 543 - C

12 JANUARY 1944

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RADIO SET SCR-543-(*)

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RADIO SET SCR-543-(*)
POWER UNIT PE-108-(*)

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DESTRUCTION OF ABANDONED MATERIAL IN THE COMBAT ZONE

In case it should become necessary to prevent the capture of this equipment, and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY, BURN ALL PAPERS AND BOOKS.

BY:--

1. Explosives, when provided.
2. Hammers, axes, sledges, or whatever heavy objects are readily available.
3. Burning with gasoline, oil paper, or wood.
4. Grenades and shots from available arms.

PROCEDURE:--

1. Destroy all identifying marks, nameplates and circuit labels.
2. Demolish all panels, castings, switch and instrument boards.
3. Destroy all controls, switches, relays, connecting means and meters.
4. Rip out all wiring in electrical equipment. Smash gas and oil lines and water cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part whether rotating, moving or fixed.
6. Break up all operating instruments such as keys, headsets, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.

DISPOSAL:--

1. Where possible, and time permits bury all debris or dispose of it in streams or other bodies of water.

WARNING

This equipment uses **HIGH VOLTAGES** which will give **SEVERE SHOCK** or cause **DEATH** if touched. The high r-f **VOLTAGES** can cause **PAINFUL BURNS**.

Don't touch the antenna or antenna connections while operating. The r-f voltage at the antenna is the only exposed voltage.

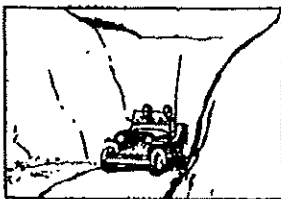
When you have the top cover of the transmitter open, other r-f voltage points are exposed. Always close the cover before turning on power to the transmitter.

When transmitter or power supply unit is removed from carrying chests for servicing, both r-f and d-c voltages are exposed. Don't try to make any service adjustments unless you know all about the equipment.

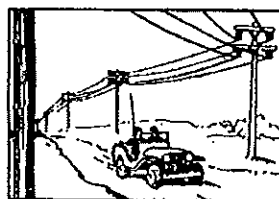
REMEMBER THESE POINTS:

1. The operation of your transmitter and receiver is simple. Practice it a few times and it will become second nature.
2. Speak up into your microphone in a clear voice, close to it. Don't talk "across" your mike or away from it.
3. Keep your antenna vertical. It sends and receives better that way.
4. If you can do it, shut off your vehicle's motor when trying to get weak signals. You'll hear further.
5. Try not to let the rain beat on your radio. Keep it dry.
6. Keep your transmissions short. The enemy can plot your location with a direction finder.

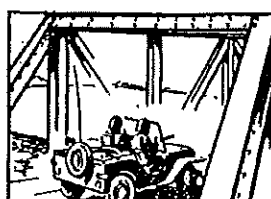
THESE PLACES ARE BAD FOR RADIO !



VALLEY



HIGH TENSION LINES

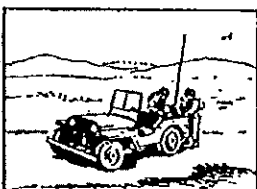


STEEL BRIDGE



UNDERPASS

THESE PLACES ARE GOOD FOR RADIO !



LEVEL GROUND



SLIGHT RISE



HILL

11C-56

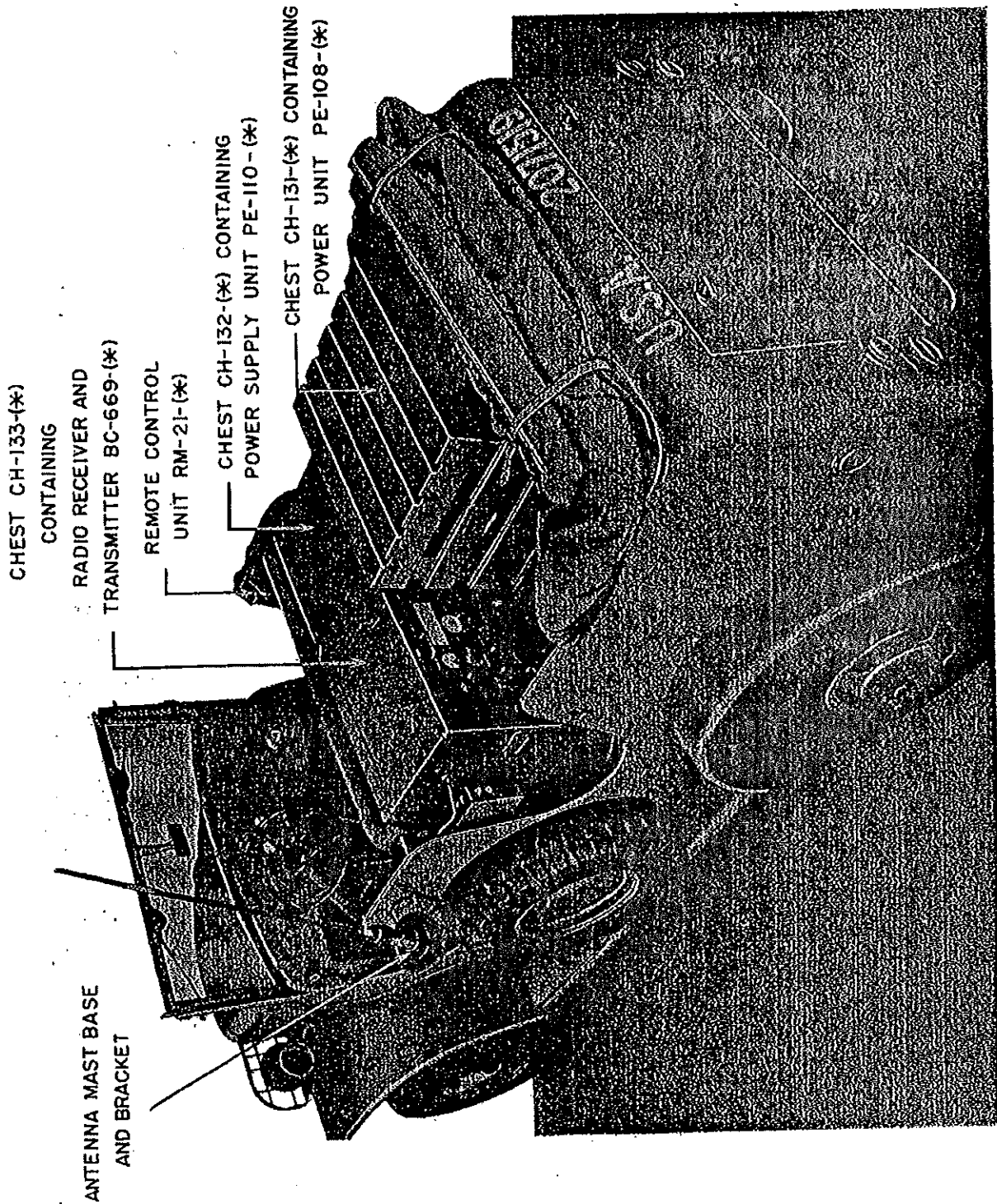


Fig. 1 - Radio Set SCR-543.(*) Installed in 3/4 Ton Command and Reconnaissance Car.

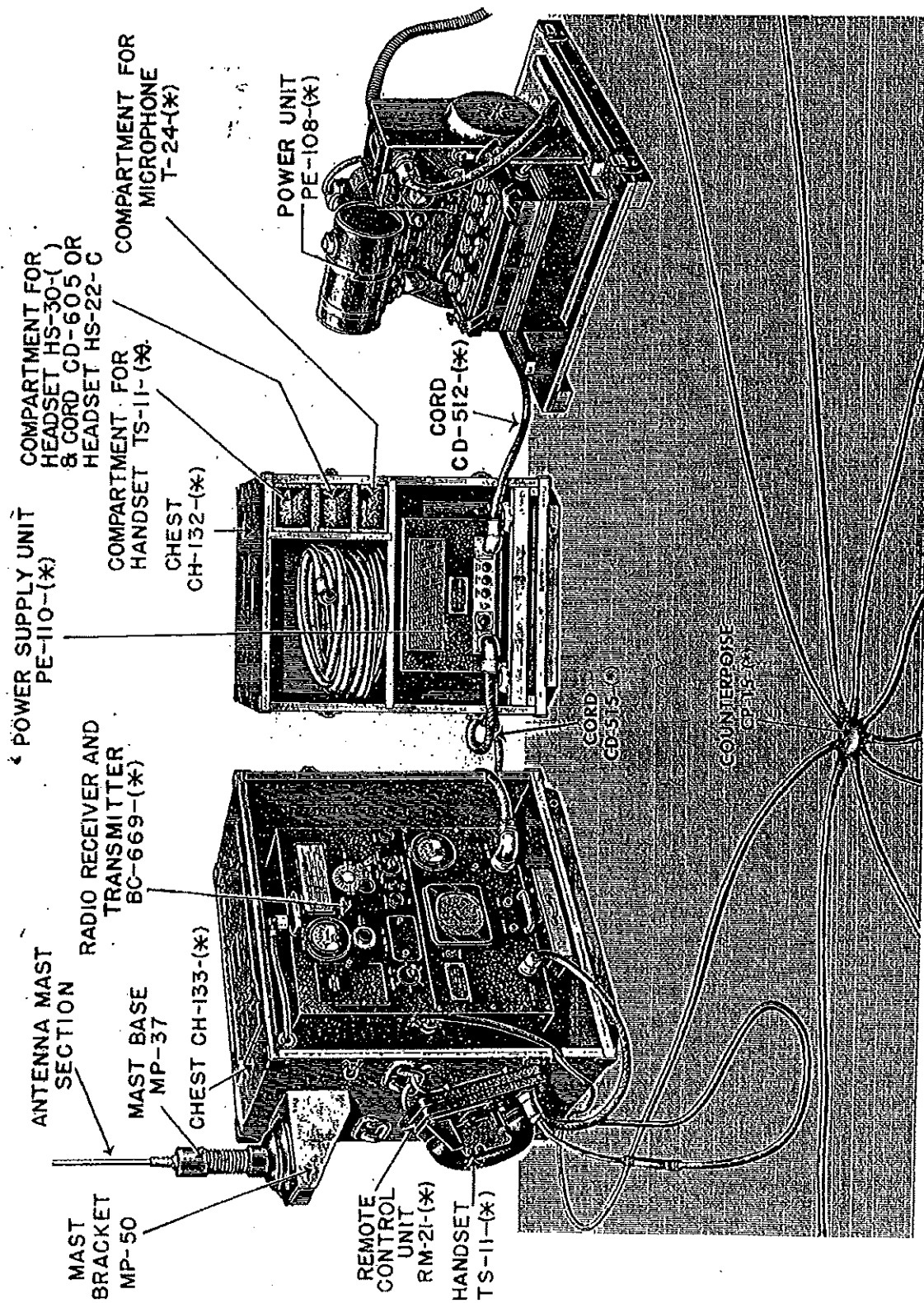


Fig. 2 - Radio Set SCR-543(*), Operating Components.

RADIO SET SCR-543-(*)

SECTION I — DESCRIPTION

1. USE.—Radio Set SCR-543-(*) can be used as a field station or as a vehicular radio set to give radio-telephone communication for Anti-aircraft Artillery Regiments and Brigades. This radio set has its own gasoline-engine driven source of power. The various components may be readily set up and the radio station put in operation in the field in five minutes. It can be used in a ½ ton pick-up truck or in a ¾ ton Command and Reconnaissance Car and other vehicles.

Differences in Nomenclature of Component Parts of Radio Set SCR-543-C, SCR-543-B and SCR-543-A:—

	SCR-543-C	SCR-543-B	SCR-543-A
Chest	CH-73-C	CH-73-B	CH-73-A
Chest	CH-131-B	CH-131-A	†
	*CH-131-C	*CH-131-C	
Chest	CH-132-B	CH-132-A	†
Chest	CH-133-B	CH-133-A	†
Cord	CD-511-C	CD-511-B	CD-511-A
Cord	CD-512-C	CD-512-B	CD-512-A
Cord	CD-513-C	CD-513-B	CD-513-A
Cord	CD-514-C	CD-514-B	CD-514-A
Cord	CD-515-C	CD-515-B	CD-515-A
Counterpoise	CP-15-C	CP-15-B	CP-15-A
Cover	BG-67-A	BG-67-A	BG-67
Handset	TS-11-M	TS-11-J	TS-11-F
Headset	HS-30-(*)	HS-30-(*)	HS-22-C
Microphone	T-24-(*)	T-24-(*)	T-24-F
Power Unit	PE-108-C	PE-108-B	PE-108-A
	*PE-108-D	*PE-108-D	
Power Supply Unit.....	PE-110-C	PE-110-B	PE-110-A
Radio Receiver and Transmitter.....	BC-669-C	BC-669-B	BC-669-A
Remote Control Unit.....	RM-21-C	RM-21-B	RM-21-A

†No nomenclature assigned.

*Replaces component listed directly above on orders No. 32780-PHILA-43 and 32781-PHILA-43.

NOTE:—Hereafter throughout this book suffix letters in the above list are replaced by the symbol (*) indicating that these components are interchangeable.

2. COMPONENTS, WEIGHTS AND DIMENSIONS.—(See figures 2 and 6) Radio Set SCR-543-(*) is composed of four chests with contents. These are:

Component	Depth	Height	Width	Wgt. Lbs.
Chest CH-73-(*) containing Remote Control Unit RM-21-(*) accessories, tools and spare parts	26-1/4"	20"	46-1/2"	249
Chest CH-131-(*) containing Power Unit PE-108-(*)	24"	23-3/4"	28"	265
Chest CH-132-(*) containing Power Supply Unit PE-110-(*)	15-1/4"	26-3/4"	22-1/2"	168
Chest CH-133-(*) containing Radio Receiver and Transmitter BC-669-(*)	20-3/8"	29-3/4"	28-1/2"	182

This Technical Manual supersedes TM 11-625, dated Feb. 25, 1943.

3. **TOTAL WEIGHTS.**—Radio Set SCR-543-(*), packed for shipment, weighs 1175 lbs. When unpacked weighs 864 lbs.
4. **SOURCE OF POWER AND POWER REQUIREMENTS.**—
 - a. **Input.**—The primary source of power required to operate Radio Receiver and Transmitter BC-669-(*), and its rectifier power supply, Power Supply Unit PE-110-(*), is 115 volts, 60 cycles, single phase alternating current. This power is usually supplied by gasoline-engine driven Power Unit PE-108-(*). The a-c power drain is 220 watts while receiving, 550 watts while transmitting. During stand-by periods the receiver will operate from 12 volts direct current supplied by the storage battery in Power Unit PE-108-(*). The d-c power drain is 5.5 amperes.
 - b. **Output.**—The transmitter has a nominal output rating of 45 watts.
5. **DISTANCE RANGE.**—In general, two Radio Sets SCR-543-(*) may be used for communication when separated by distances up to 20 or 30 miles if operating as fixed stations; and up to 15 or more miles when operating in vehicles in motion. The actual distances will vary with differences in weather, height or location of stations and the operating frequency used.
6. **FREQUENCY COVERAGE.**—Radio Set SCR-543-(*) operates in the frequency range from 1680 to 4450 kc.
7. **WAYS OF TRANSMISSION AND RECEPTION.**—
 - a. The transmitter sends voice-modulated signals, (in the usual way).
 - b. The receiver is of the superheterodyne type and it detects both voice-modulated signals and tone-modulated c-w telegraph signals.
8. **CHANNELS.**—Six crystal controlled frequencies within the operating range may be preset and instantly selected for both reception and transmission. Hand control of receiver tuning is also provided.
9. **DESCRIPTION OF COMPONENTS.**—
 - a. **Radio Receiver and Transmitter BC-669-(*), in Chest CH-133-(*).** (See Figure 3).—
 - (1) This unit consists of Chest CH-133-(*) containing the following:
 - (a) Receiver and Transmitter BC-669-(*)
 - (b) One set of tubes installed
 - (c) Two sets of crystals in Crystal Holders FT-171-B
 - (d) One 2 ft. length Wire W-128 for antenna connection
 - (2) **Size of chest.**—28½" wide x 20⅝" deep x 29¾" high.
 - (3) **Total weight.**—182 lbs.
 - (4) The receiver and transmitter are in a sheet steel cabinet which is shock-mounted in the chest. The front of the chest is removable so you can get at the equipment; the front may be put back on while

operating, with cords connected, as a protection from rain. A door in the top of the chest is for making preliminary adjustments to the transmitter. For the same purpose, there is a door in the top of the steel cabinet containing the receiver and transmitter. A sliding tray in the bottom of the chest is for storage of spare crystals. Means for mounting the antenna mast bracket is on the side of the chest.

- (5) The following further details of construction may help you, should you ever need to remove the steel cabinet from the chest. The back section of the steel cabinet is permanently fastened to the shock-mounts, which are secured to the chest. The cabinet itself is quickly removable from the back section after turning Chest CH-133-(*) over on its back (if you don't do this, it may result in damage to the banana plug on the back section which is shock-mounted to the back of Chest CH-133-(*)). Unfasten the six rear snap latches (or draw bolt clamps). Two handles on the front panel permit lifting out for servicing; Radio Receiver and Transmitter BC-669-(*) consists of two chassis decks assembled into a sheet steel cabinet, separable into two sections, each section housing one of the chassis. The two sections are securely fastened together by means of four snap latches. All metal parts are adequately protected by plating or paint.
 - (a) The upper section contains all radio frequency circuits of the transmitter and all receiver components except the output transformer and loud-speaker. Components of the top deck are shown in figure 13. On the front panel of the upper section are located a meter for indicating transmitter antenna current, a chart on which is listed transmitter channel frequencies to which the transmitter is pretuned and the following transmitter controls; a dial for resonating the antenna circuit, and a six position switch for selecting the desired operating channel. A door is provided to gain access to the antenna loading coil, and behind a removable plate, located below the antenna tuning dial, are mounted six variable capacitors for the purpose of tuning the radio frequency power amplifier plate circuit for each of the six operating channels. The following receiver controls also appear on the front panel: a dial for tuning the receiver, a control for varying the r-f gain (NOISE CONTROL), a four position switch for selecting the desired crystal or manual controlled

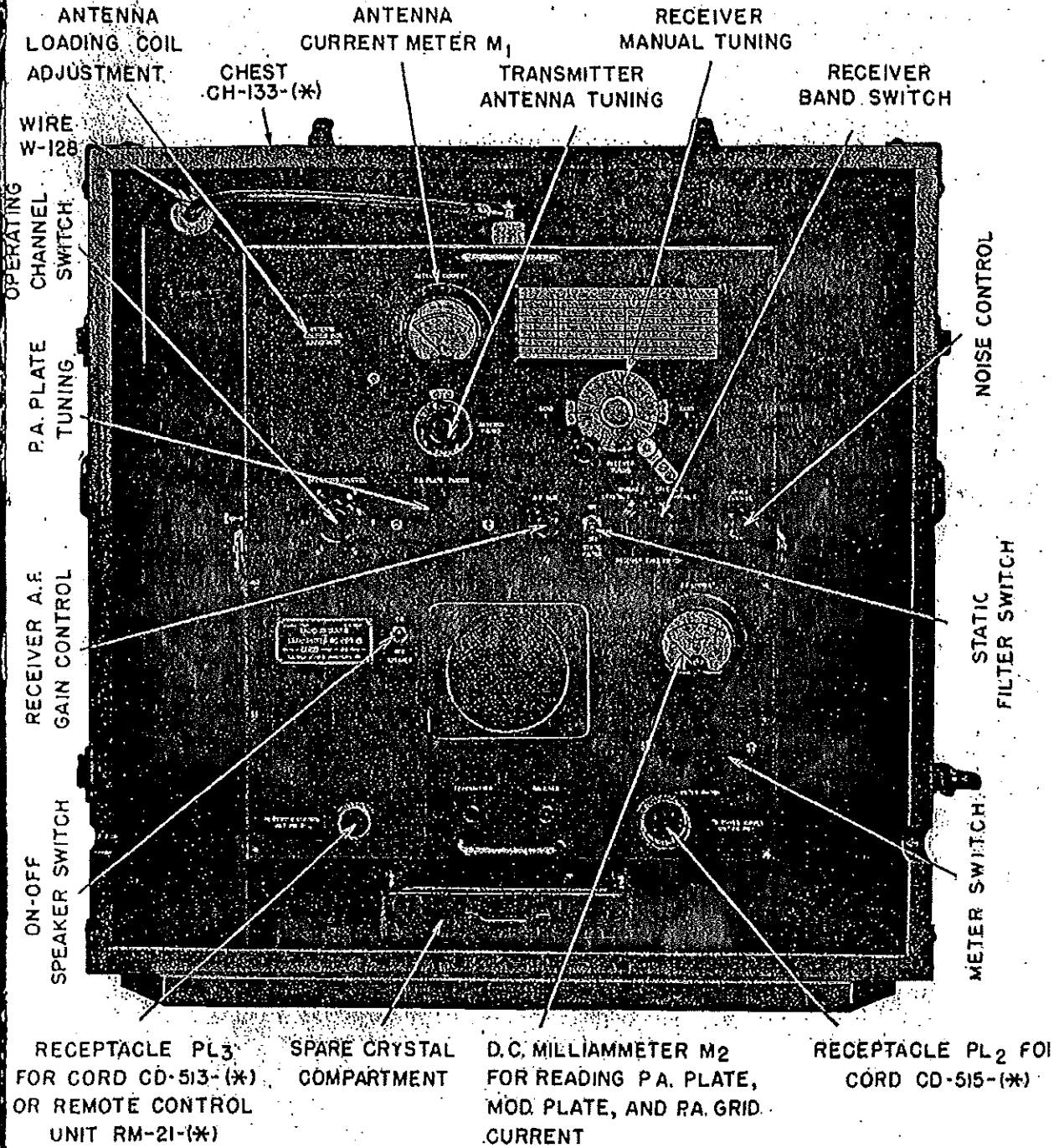


Fig. 3 - Radio and Transmitter BC-669(*) in Chest CH-133-(*).

frequency band, a toggle switch for turning the **STATIC FILTER** on and off and a control for varying the audio gain. The antenna connection is made by means of a feed-through binding post located on top of the cabinet, and a binding post is also located on the left hand side of the cabinet for making the ground connection. The components on the front panel are shown in figure 3.

(b) The lower section contains the transmitter audio and modulator circuits, receiver output transformer and loudspeaker, as well as d-c metering and power entry circuits. On the front panel of this section are mounted the loudspeaker, the loudspeaker on-off switch and nameplate. Two pilot lights are provided on the panel, one for indicating receiver filament power and the other for indicating transmitter filament power. Receptacles are provided for making connection to Remote Control Unit RM-21(*) and Power Supply Unit PE-110(*). A meter is located on

the front panel for indicating modulator plate current, radio frequency power amplifier plate current or grid current which may be selected with a three position switch recessed behind the panel below the meter. A removable plate is provided to cover the recess. A handle is provided on the upper and lower panels for lifting the unit. (See figures 2 and 3.)

(c) The upper section is reached through the open back or through the top by lifting the lid which is held closed by means of a spring latch. The lower section may be reached through the rear or by lifting off the top section after removing the twelve-prong plug, located in the rear, from its receptacle and unfastening the four snap latches. The steel cabinet can then be separated into two sections, the upper, containing all radio frequency circuits of the receiver and transmitter, and the lower section containing audio and modulator circuits, loudspeaker, d-c metering, and power entry circuits.

(6) The set of operating tubes in Radio Receiver and Transmitter BC-669-A, BC-669-B, BC-669-C are:

(a) Receiver

	BC-669-A	BC-669-B BC-669-C	BC-669-B* BC-669-C*
1 each Tube	VT-90	VT-90-A	JAN-() 6H6GT VT-90-A
1 each Tube	VT-94	VT-94-D	JAN-() 6J5GT VT-94-D
3 each Tube	VT-117	VT-117-A	JAN-() 6SK7GT VT-117-A
1 each Tube	VT-150	VT-150-A	JAN-() 6SA7GT VT-150-A
1 each Tube	VT-152	VT-152	JAN-() 6K6GT VT-152
(b) Transmitter			
2 each Tube	VT-100	VT-100-A	JAN-() 807 VT-100-A
1 each Tube	VT-115	VT-115-A	JAN-() 6L6GA
4 each Tube	VT-115-A	VT-115-A	JAN-() 6L6GA
1 each Tube	VT-135	VT-135	JAN-() 12J5GT VT-135

(7) Crystals and Crystal Holders FT-171-B.— Two sets of 12 each (one set in use, one set spare), consisting of 6 transmitting and 6 receiving crystals are furnished. The frequencies supplied with the equipment are as follows:

Channel	Transmitter Crystal Frequency	Receiver Crystal Frequency
1	1745 kc.	2131 kc.
2	2082 kc.	2467 kc.
3	2280 kc.	2665 kc.
4	2840 kc.	2725 kc.
5	3422.5 kc.	3807.5 kc.
6	4255 kc.	3870 kc.

The receiver crystal frequencies differ from the corresponding transmitter crystal frequencies by 385 kc., (the re-

ceiver i-f frequency), but reception is on the same frequency as the transmitter frequency. On channels 1, 2, 3, 4 and 5 the receiver oscillator crystal frequency is higher by 385 kc. than the corresponding transmitter crystal frequency, and on channel 6 the receiver oscillator crystal frequency is lower by 385 kc.

b. Power Supply Unit PE-110(*) in Chest CH-132(*) (See Figure 4).—

(1) This power supply unit includes circuits for converting 115 volts a-c power to suitable filament and plate power for the receiver and transmitter. Also included are circuits for converting 12 volt d-c power to filament and plate power for the receiver only, (for stand-by recep-

*On order No. 32780-PHILA-43 and 32781-PHILA-43 only.

CORDS

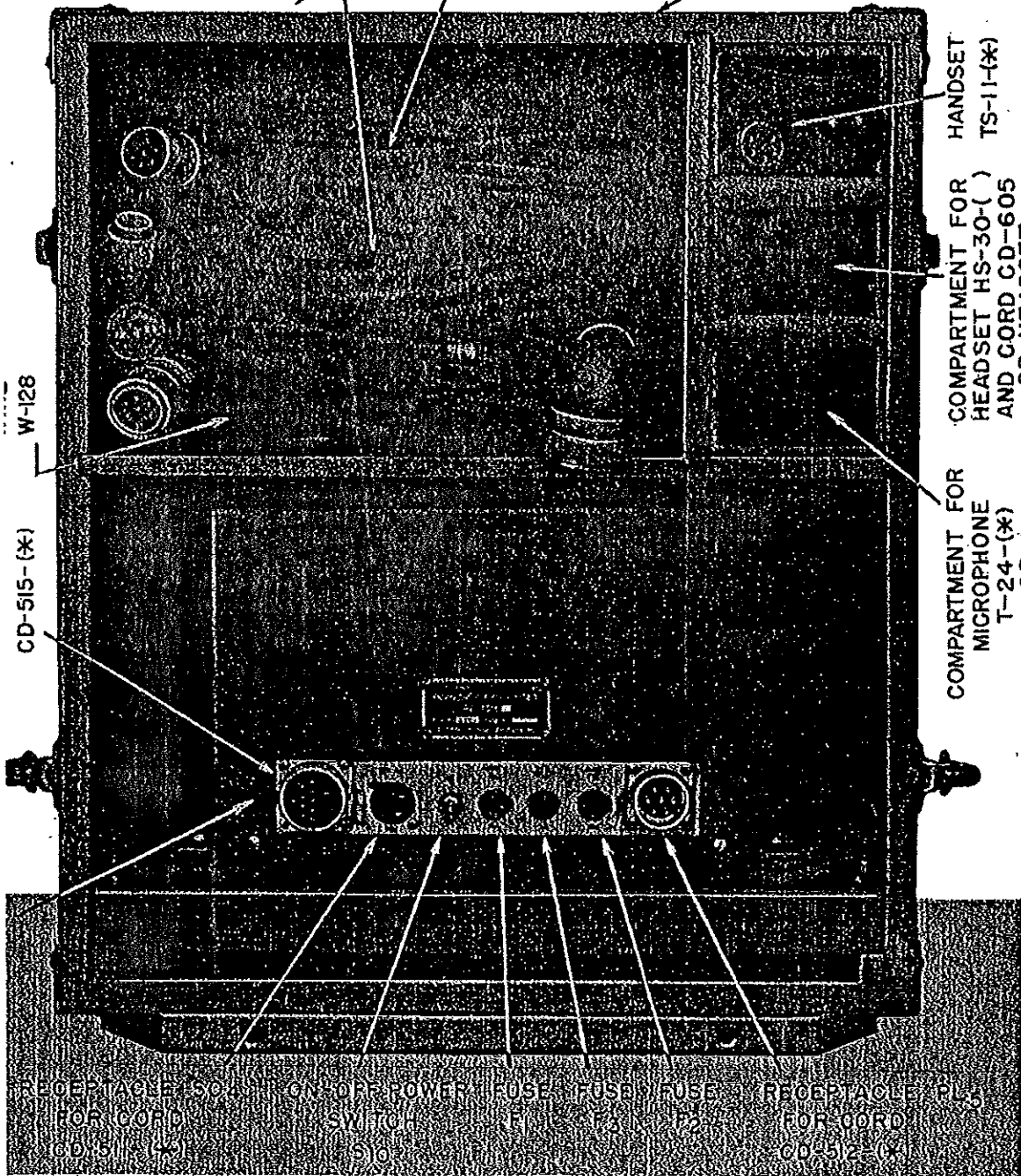
- CD-511-(*)
- CD-512-(*)
- CD-513-(*)
- CD-514-(*)
- CD-515-(*)

COUNTERPOISE

CP-15-(*)

CHEST

CH-132-(*)



HANDSET
TS-11-(*)

COMPARTMENT FOR
HANDSET HS-30-()
AND CORD CD-605
OR HEADSET
HS-22-C

COMPARTMENT FOR
MICROPHONE
T-24-(*)
OR
OTHER OPERATING

W-128

CD-515-(*)

RECEPTACLE FOR CORD CD-514 (*) SWITCH FUSE FUSE FUSE RECEPTACLE FOR CORD CD-512 (*)

Fig. 4 - Power Supply Unit PE-110-(*) in Chest CH-132-(*)

tion). The power supply unit connects to the receiver and transmitter, and to the primary source of power, by suitable cords and plugs carried in Chest CH-132-(*). This chest is divided into compartments which contain the following:

- (a) The shock-mounted metal cased power supply unit
 - (b) One set tubes (installed)
 - (c) One set cordage
 - (d) One 15 ft. length Wire W-128
 - (e) One Handset TS-11-(*)
 - (f) One Headset HS-22-C. (Supplied with SCR-543-A)
 - (g) One Headset HS-30-(*). (Supplied with SCR-543-B, C)
 - (h) One Cord CD-605. (Supplied with SCR-543-B, C)
 - (i) One Cord CD-307-A and one Cord CD-604. (Supplied with SCR-543-B, C, in some cases as a substitute for Cord CD-605)
 - (j) One spare compartment for Microphone T-24-(*), when supplied
 - (k) One Counterpoise CP-15-(*)
- (2) *Size of chest.*—22½" wide x 15¼" deep x 26¾" high.
- (3) *Total weight.*—168 lbs.
- (4) Power Supply Unit PE-110-(*), is on a plated sheet steel chassis having a sheet steel cover and is shock-mounted on a shelf within Chest CH-132-(*). You can get at the main power switch, fuses, cords and plugs from the front. The shelf slides readily out of the carrying chest for servicing. The front of the chest is removable for getting at the interior, but may be replaced when operating with cords connected, for protection against rain.
- (a) The dust cover is designed so as to expose the chassis front apron which mounts the following parts: receptacles for connection to Radio Receiver and Transmitter BC-669-(*), Remote Control Unit RM-21-(*), and a commercially available source of a-c power; on-off switch and fuse posts.
 - (b) The nameplate is mounted on the front of the dust cover. The base is constructed with extensions beyond the cabinet at each side to allow shock mounting of the unit.

(5) The set of operating tubes consists of the following:

	PE-110-A	PE-110-B	PE-110-B*
		PE-110-C	PE-110-C*
1 each Tube	VT-80	VT-80	JAN-()80
			VT-80
4 each Tube	VT-145	VT-145	JAN-()5Z3
			VT-145

*On order No. 32780-PHILA-43 and 32781-PHILA-43.

(6) The set of cordage consists of the following:

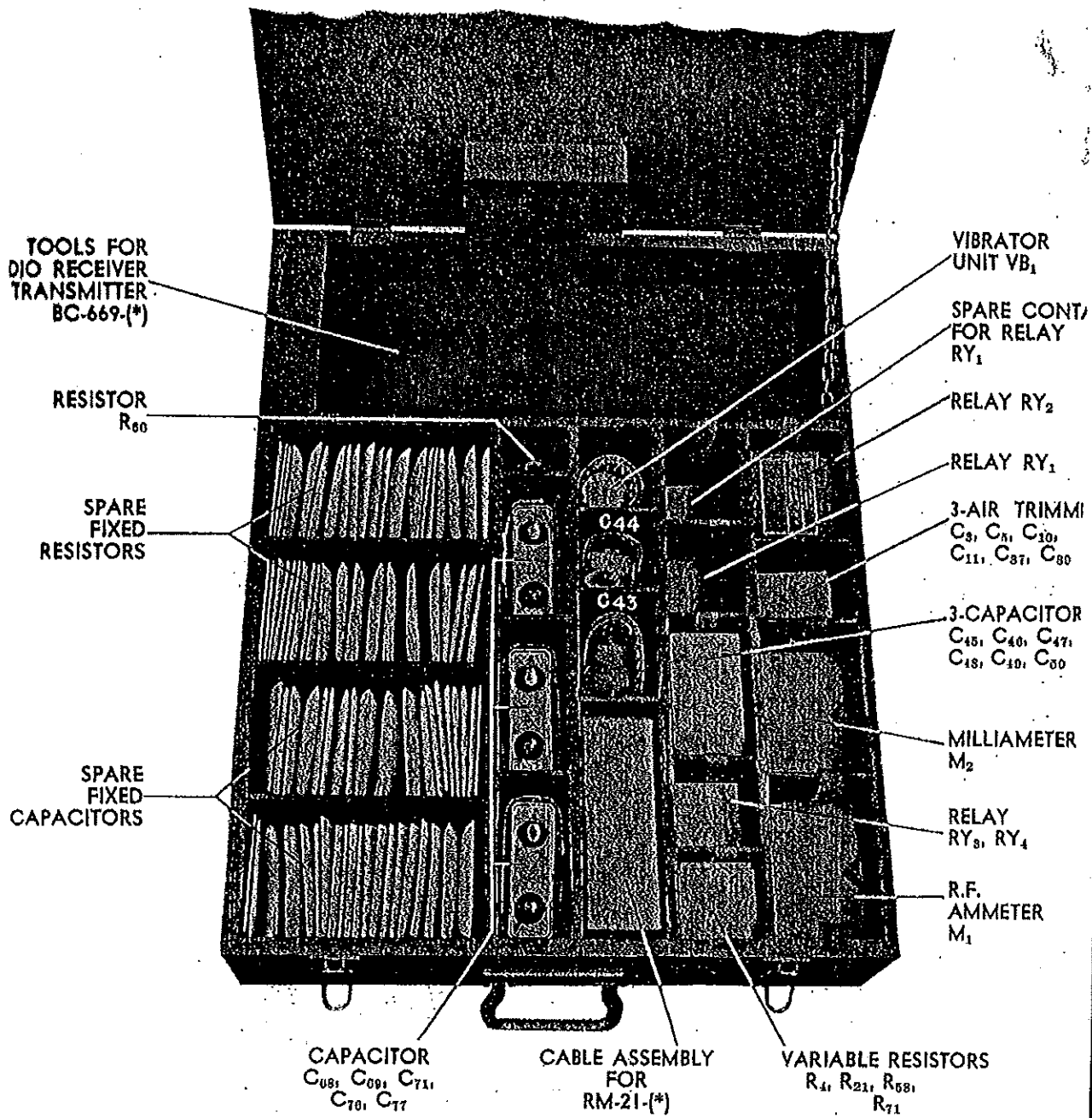
- Cord CD-513-(*), length 15 ft., used as extension cord between RM-21-(*), and BC-669-(*)
 - Cord CD-515-(*), length 4 ft., for connecting BC-669-(*), to PE-110-(*)
 - Cord CD-512-(*), length 6 ft., for connecting PE-110-(*), to PE-108-(*)
 - Cord CD-514-(*), length 20 ft., for extension of CD-512-(*), between PE-110-(*), and PE-108-(*)
 - Cord CD-511-(*), length 25 ft., for connecting PE-110-(*), to a commercial power source when you can get to it.
- (7) The fifteen foot length of Wire W-128 is used in vehicular installations to connect the antenna mast base to the antenna terminal on the receiver and transmitter.
 - (8) Handset TS-11-(*), is used with Remote Control Unit RM-21-(*), for listening to the receiver and for voice-modulating the transmitter.
 - (9) Headset HS-22-C (in Radio Set SCR-543-A) is used with Microphone T-24-(*), in place of Handset TS-11-(*), when so desired.
 - (10) Headset HS-30-(*), (in Radio Set SCR-543-B, C) connected to Cord CD-605 or to Cord CD-307-A with Cord CD-604 is used with Microphone T-24-(*), in place of Handset TS-11-(*), when so desired.
 - (11) Microphone T-24-(*), is used with Headset HS-30-(*), connected to Cord CD-605 or Headset HS-22-C in place of Handset TS-11-(*), when so desired.
 - (12) Counterpoise CP-15-(*), replaces the use of a direct ground connection. It consists of 8 radial wires connected to a central point with a connecting lead for attaching to the radio set ground.

c. Chest CH-73-(*).—(See Figures 6 and 7).—

- (1) This chest is for storage of all component units or accessories not stored in Chests CH-131-(*), CH-132-(*), or CH-133-(*), together with service tools and spare parts. Chest CH-73-(*), is made of heavy plywood and has a hinged lid to get at the interior. A removable wooden tray as well as several compartments provide for storage of individual items, keeping them separated so that removal of one item will not cause the others to be loosened. Contained in this chest are:

Chest CH-73-A

- (a) One Remote Control Unit RM-21-(*), in carrying case.
- (b) One Microphone T-24-(*).
- (c) One Handset TS-11-(*), (spare).
- (d) One Headset HS-22-C (spare).
- (e) One set cordage (spare).
- (f) One set spare tubes.
- (g) Three Insulators IN-101.
- (h) One trouble-lamp with 50 watt bulb.
- (i) Two Mast Brackets MP-50, each with Mast Base MP-37.



NOTE: The following not supplied in tray from Chest CH-73-B, C:
 3-air trimmers C₃, C₅, C₁₀, C₁₁, C₃₇, C₃₀.
 One capacitor C₄₄.
 3-capacitors C₄₅, C₄₀, C₄₇, C₄₈, C₄₀, C₅₀.

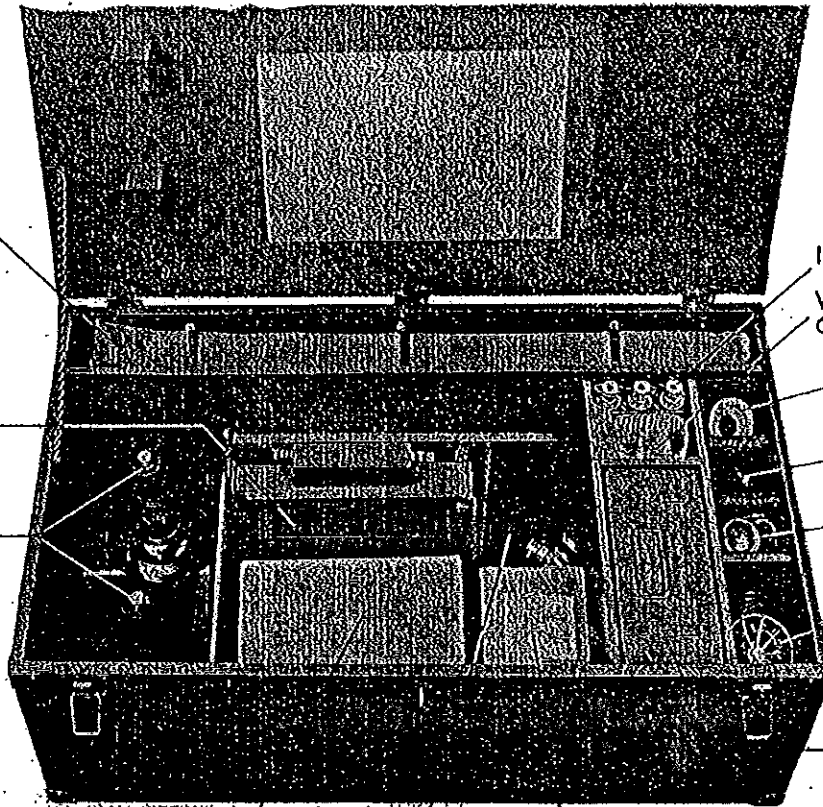
Fig. 5 - Tray from Chest CH-73-(*)

TM 11-625

ROLL BG-56-A
WITH ANTENNA
MAST SECTIONS
MS-49, MS-50,
MS-51, MS-52,
MS-53

TOOLS AND
SPARE PARTS
PE-108-(*)

MAST BASE
MP-37 WITH
MAST BRACKET
MP-50
COVER BG-67-(*)



INSULATOR IN-10
VARIABLE CAPAC
C_{1.1}, C_{1.2}, C_{1.3}

HEADSET
HS-22-C

HANDSET
TS-11-(*)

MICROPH
T-24-(*)

TROUBLE
LAMP

REMOTE
CONTROL
UNIT RM
IN CARR
CASE

MAST BASE MP-37
TECHNICAL MANUAL TM 11-625

SPARE
CORDS

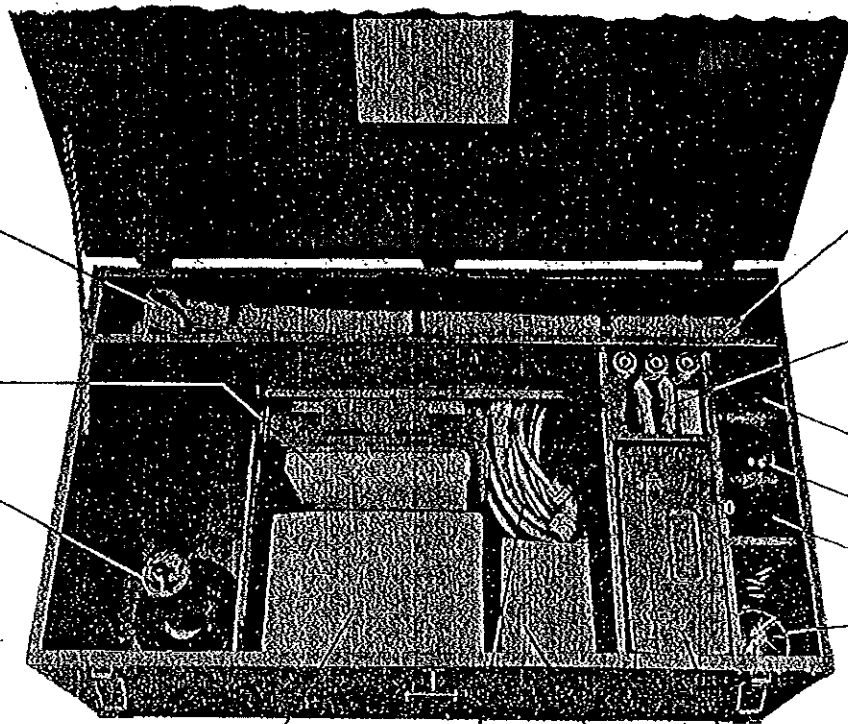
SPARE KIT
OF TUBES

Fig. 6 - Chest CH-73-A, With Tray Removed.

ROLL BG-56-A
WITH ANTENNA
MAST SECTIONS
MS-49, MS-50,
MS-51, MS-52,
MS-53, MS-54

TOOLS AND
SPARE PARTS
PE-108-(*)

MAST BASE
MP-37 WITH
MAST BRACKET
MP-50
COVER BG-67-(*)



INSULATOR
IN-101

COVER BG
GUY-11
GUY-12

COMPART
HEADSET H
CORD CD-

HANDSET T

SPARE
COMPART

TROUBLE L

REMOTE
CONTROL
UNIT RM-21
IN CARRYI
CASE

MAST BASE MP-37
TECHNICAL MANUAL TM 11-625

SPARE
CORDS

SPARE KIT
OF TUBES

Fig. 7 - Chest CH-73-B, With Tray Removed.

Quantity	Description
24 ea.	Crystal Holder FT-171-B with crystal (2 sets of 12 each; 1 set consists of 6 transmitting crystals and 6 receiving crystals)
2 ea.	Handset TS-11-(*) (1 in use, 1 spare)
2 ea.	Headset HS-22-C (1 in use, 1 spare)
4 ea.	Insulator IN-101 (1 in use, 3 spare)
1 ea.	Lamp, trouble, with bulb
3 ea.	Mast Base MP-37 (2 in use, 1 spare)
2 ea.	Mast Bracket MP-50
3 ea.	Mast Sections MS-49, MS-50, MS-51, MS-52, MS-53, (1 each in use, 2 spare)
2 ea.	Microphone T-24-(*) (1 in use, 1 spare)
1 ea.	Power Unit PE-108-(*)
1 ea.	Power Supply Unit PE-110-(*)
1 ea.	Radio Receiver and Transmitter BC-669-(*)
1 ea.	Remote Control Unit RM-21-(*)
1 ea.	Roll BG-56-A
1 set	Tools and Spare Parts for BC-669-(*), PE-110-(*) and RM-21-(*)
1 set	Tools and Spare Parts for PE-108-(*)
2 sets	Vacuum Tubes
2 lengths	Wire W-128, one 15 ft. length, one 2 ft. length.

Radio Set SCR-548-B, C

Quantity	Description
1 ea.	Chest CH-73-(*)
1 ea.	Chest CH-131-(*)
1 ea.	Chest CH-132-(*)
1 ea.	Chest CH-133-(*)
2 ea.	Cord CD-511-(*) (1 in use, 1 spare)
2 ea.	Cord CD-512-(*) (1 in use, 1 spare)
2 ea.	Cord CD-513-(*) (1 in use, 1 spare)
2 ea.	Cord CD-514-(*) (1 in use, 1 spare)
2 ea.	Cord CD-515-(*) (1 in use, 1 spare)
2 ea.	Cord CD-605 (1 in use, 1 spare)
2 ea.	Cord CD-307-A with Cord CD-604 (1 in use, 1 spare) substitute for CD-605
1 ea.	Counterpoise CP-15-(*)
2 ea.	Cover BG-67-(*)
24 ea.	Crystal Holder FT-171-B with crystal (2 sets of 12 each; 1 set consists of 6 transmitting crystals and 6 receiving crystals)
1 ea.	Guy GY-11
1 ea.	Guy GY-12
2 ea.	Handset TS-11-(*) (1 in use, 1 spare)

2 ea.	Headset HS-30-(*) (1 in use, 1 spare)
4 ea.	Insulator IN-101 (1 in use, 3 spare)
1 ea.	Lamp, trouble, with bulb
2 ea.	Mast Base MP-37 (1 in use, 1 spare)
1 ea.	Mast Bracket MP-50
2 ea.	Mast Sections MS-49, MS-50, MS-51, MS-52, MS-53, MS-54 (1 each in use, 1 spare)
1 ea.	Power Unit PE-108-(*)
1 ea.	Power Supply Unit PE-110-(*)
1 ea.	Radio Receiver and Transmitter BC-669-(*)
1 ea.	Remote Control Unit RM-21-(*)
1 ea.	Roll BG-56-A
2 ea.	Technical Manual TM 11-625 for Radio Set SCR-548-(*)
1 set	Tools and Spare Parts for BC-669-(*), PE-110-(*) and RM-21-(*)
1 set	Tools and Spare Parts for PE-108-(*)
2 sets	Vacuum Tubes
2 lengths	Wire W-128, one 15 ft. length, one 2 ft. length

**CONTROL PANEL FOR
OPERATING POWER UNIT
PE-108-(*)**

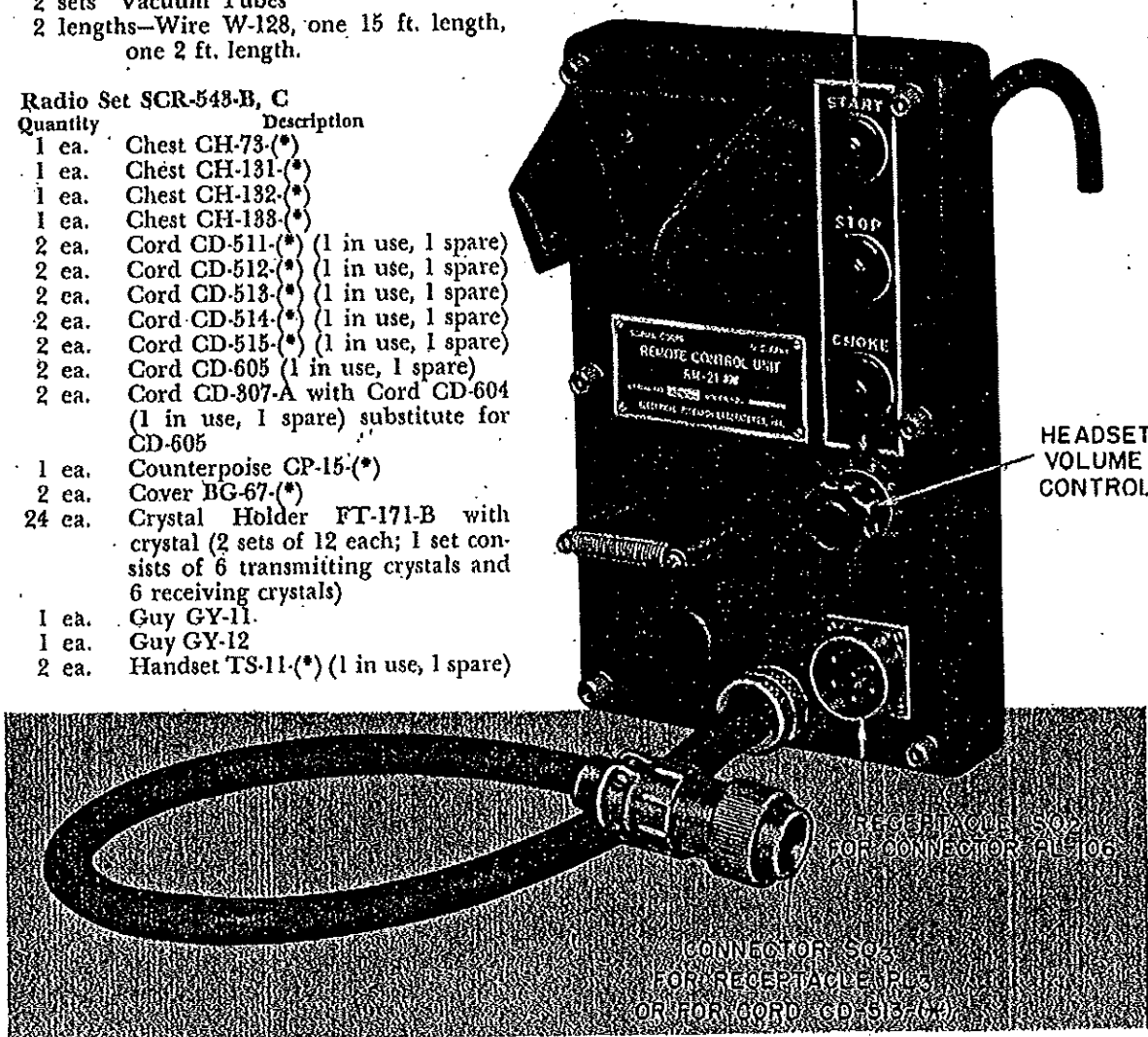
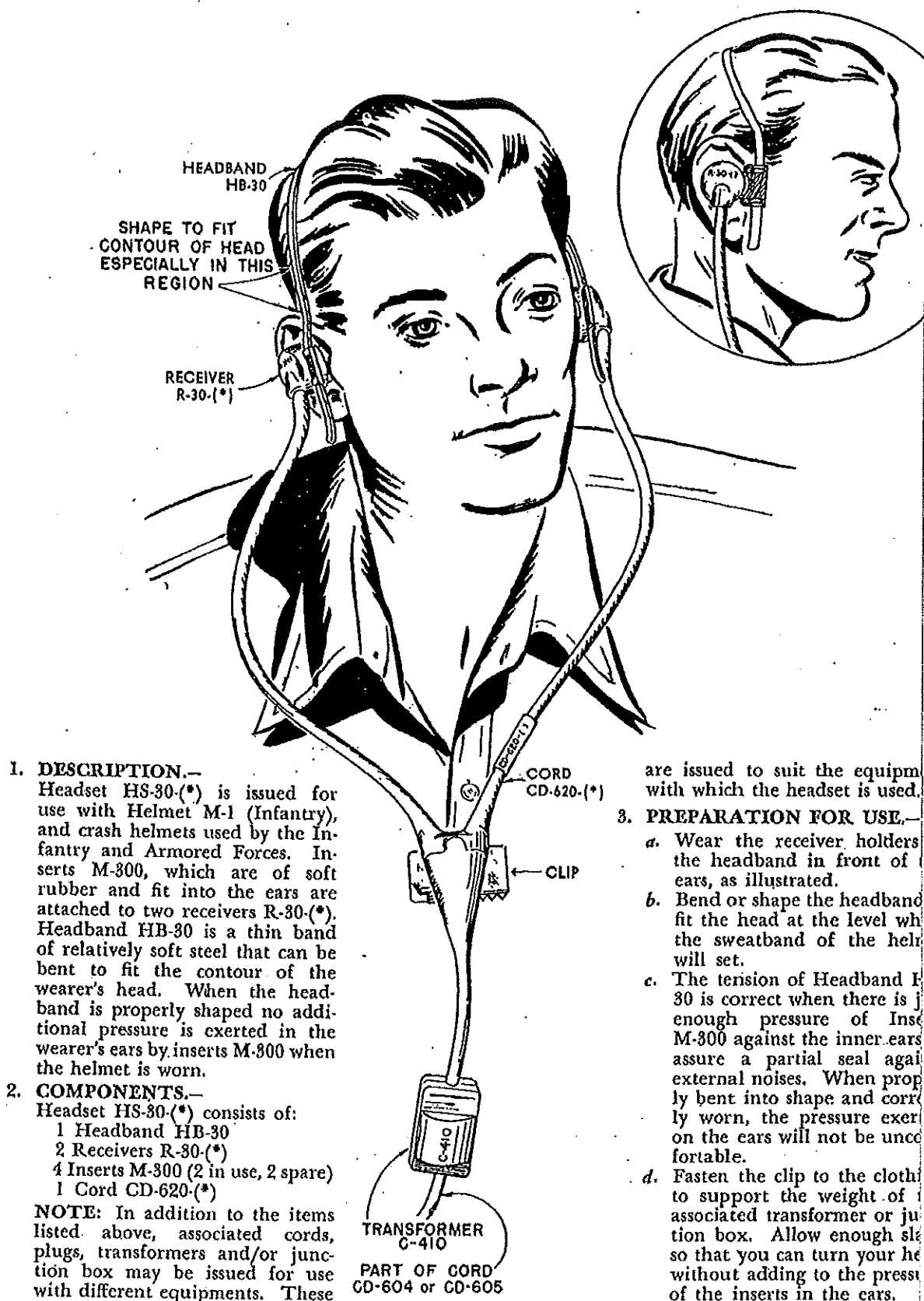


Fig. 8 -- Remote Control Unit RM-21-(*)

10. INSTRUCTIONS FOR HEADSET HS-30-(*).



1. **DESCRIPTION.**—
Headset HS-30-(*). is issued for use with Helmet M-1 (Infantry), and crash helmets used by the Infantry and Armored Forces. Inserts M-300, which are of soft rubber and fit into the ears are attached to two receivers R-30-(*). Headband HB-30 is a thin band of relatively soft steel that can be bent to fit the contour of the wearer's head. When the headband is properly shaped no additional pressure is exerted in the wearer's ears by inserts M-300 when the helmet is worn.

2. **COMPONENTS.**—
Headset HS-30-(*). consists of:
1 Headband HB-30
2 Receivers R-30-(*).
4 Inserts M-300 (2 in use, 2 spare)
1 Cord CD-620-(*).

NOTE: In addition to the items listed above, associated cords, plugs, transformers and/or junction box may be issued for use with different equipments. These

are issued to suit the equipment with which the headset is used.

3. **PREPARATION FOR USE.**—
a. Wear the receiver holders the headband in front of ears, as illustrated.
b. Bend or shape the headband fit the head at the level where the sweatband of the helmet will set.
c. The tension of Headband HB-30 is correct when there is just enough pressure of Inserts M-300 against the inner ears assure a partial seal against external noises. When properly bent into shape and correctly worn, the pressure exerted on the ears will not be uncomfortable.
d. Fasten the clip to the clothing to support the weight of the associated transformer or junction box. Allow enough slack so that you can turn your head without adding to the pressure of the inserts in the ears.

Fig. 9 -- Instructions for Headset HS-30-(*).

SECTION II — INSTALLATION AND OPERATION

11. UNPACKING.—

- a. Uncrate Chest CH-133-(*) containing Radio Receiver and Transmitter BC-669-(*) carefully and inspect for any possible damage during shipment. Do the same with Chest CH-132-(*) containing Power Supply Unit PE-110-(*), and Chest CH-131-(*) containing Power Unit PE-108-(*) and Chest CH-73-(*), and the box containing the bottles of electrolyte for the storage battery (see Sections VI to X).

CAUTION

Handle the bottles containing electrolyte very carefully. They contain sulphuric acid.

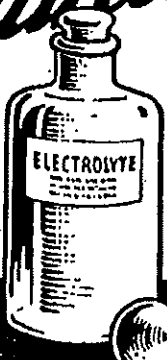


- b. *Other Considerations.*—Radio Receiver and Transmitter BC-669-(*) has been equipped with crystals and pretuned to the frequency channels outlined in paragraph 9 a (7). No further adjustment is necessary unless operation on other channels is required. Procedure for pretuning channels is outlined under "Maintenance," par. 21.

12. INSTALLATION.—

- a. Radio Set SCR-543-(*) may be used as a field radio station on the ground or as a vehicular radio station in any suitable vehicle. In paragraphs 13, 14 and 15, directions are given for the following installations:
- (1) As a field station
 - (2) In a 1/2 ton Pick Up Truck
 - (3) In a 3/4 ton Command and Reconnaissance car.
- b. The simplest installation is the field station. For this reason, this type of installation is best for instructing new personnel until familiar with this set. In reading these instructions for the first time it is recommended that after covering par. 13, the reader skip paragraphs 14 and 15, continuing immediately with paragraphs 16 (Precautions before Operating) and 17 (Operation).

13. INSTALLATION AS A FIELD STATION.

- a. Set up Radio Receiver and Transmitter BC-669-(*), Power Supply Unit PE-110-(*) and Power Unit PE-108-(*) in operating position. Figure 2 shows a recommended arrangement.
- b. Unlatch and remove all covers.
- c. If it is not desired to carry Chest CH-73-(*) to this position, open lid and remove the following:
- (1) Remote Control Unit RM-21-(*) in carrying case.
 - (2) Mast Base MP-37 mounted on Mast Bracket MP-50.
 - (3) Roll BG-56-A containing Mast Section MS-49, MS-50, MS-51, MS-52, MS-53 and MS-54. (MS-54 included in Chest CH-73-B, CH-73-C only.)
 - (4) Guys GY-11 and GY-12 (if MS-54 is to be used. Guys GY-11 and GY-12 included in Chest CH-73-B, CH-73-C only).
- d. Remove Remote Control Unit RM-21-(*) from carrying case and hang it on the carrying handle on left side of Chest CH-133-(*). Insert plug on cord of the remote control unit into receptacle PL₃ in front of the transmitter and screw the plug locking ring on by hand as far as it will turn.
- e. (1) Remove from the upper compartment of Chest CH-132-(*) the following:—
 Cord CD-515-(*)
 Cord CD-512-(*)
- (2) Insert the right-angle cord connector on one end of Cord CD-515-(*) into receptacle PL₂ on the front panel of Radio Receiver and Transmitter BC-669-(*) and tighten the locking-ring. In the same way connect the other end with receptacle PL₆ on the front panel of Power Supply Unit PE-110-(*).
- (3) Insert right-angle cord connector on one

 <p>Caution</p> <p>Do not spill this electrolyte as it will burn the body and damage clothing or equipment</p>	 <p>The bottles containing electrolyte should be handled very carefully as they contain sulphuric acid . .</p>	 <p>Remedy</p> <p>for accidental spillage Immediately flush well with clean water and wipe dry</p>
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end of Cord CD-512-(*) into receptacle PL₅ on the front panel of Power Supply Unit PE-110-(*) and the other end into receptacle PL₇ on Power Unit PE-108-(*) located on the side of the control box. Tighten the locking-rings.

- f. (1) Select the Mast Base MP-37 which is mounted on Mast Bracket MP-50 having captive wing nuts (wing nuts supplied with SCR-543-C are not of the captive type). Attach this bracket to left side of Chest CH-133-(*), as follows:
- (a) Insert bracket bolt heads thru key-holes in chest
 - (b) Drop bolts into keyhole slots
 - (c) Tighten wing nuts.
- (2) Remove Cover BG-67-(*).
- (3) Remove Mast Sections MS-49, 50, 51, 52 and 53 from Roll BG-56-A and screw them tightly together. Fit ends having the same colors to each other. Then screw Mast Section MS-53 tightly to the mast base.
- (4) If you want a taller antenna to get greater range, use Mast Section MS-54 and Guys GY-11 and GY-12 (supplied with SCR-543-B, C only) besides the above antenna.
- (5) Insert the clamping ring of Guy GY-11 between Mast Sections MS-52 and MS-53 and secure the ends of the clamp by the hook provided on Guy GY-12. Insert Mast Section MS-54 between Mast Section MS-53 and Mast Base MP-37. Secure the other ends of Guys GY-11 and GY-12 to some anchor point near the ground.
- g. (1) Remove Counterpoise CP-15-(*) from Chest CH-132-(*) and attach the longest wire to the ground post on the left side of the metal cabinet of Radio Receiver and Transmitter BC-669-(*).
- (2) Run the free end of the antenna lead (Wire W-128) thru Insulator IN-101, then thru the hole in the mast bracket and connect to the binding post at the bottom of Mast Base MP-37.
- h. (1) Select from the right-hand compartments of Chest CH-132-(*) in SCR-543-A, Handset TS-11-(*) or the combination of Microphone T-24-(*) and Headset HS-22-C.
- (2) Select from the right-hand compartments of Chest CH-132-(*) in SCR-543-B, C, Handset TS-11-(*) or the combination of Microphone T-24-(*) and Headset HS-30-(*) with Cord CD-605. (Use Cord CD-307-A with Cord CD-604 when supplied as a substitute for Cord CD-605.)
- (3) Plug either handset or microphone into receptacle SO₂ on Remote Control Unit RM-21-(*).
- (a) If Microphone T-24-(*) is used in SCR-543-A, plug Headset HS-22-C into the jack on the microphone cord.
 - (b) If Microphone T-24-(*) is used in SCR-543-B, C, plug Cord CD-605 (or

Cord CD-307-A with Cord CD-604) connected to Headset HS-30-(*) into the jack on the microphone cord.

- i. If you want to operate Power Unit PE-108-(*) at a greater distance from the operating position, remove Cord CD-514-(*) from Chest CH-132-(*) and insert it in series with Cord CD-512-(*) and Power Unit PE-108-(*). This reduces the noise from the power unit and can be further helped by extending the exhaust pipe as far away from the operating position as possible.
- j. (1) If you want to operate Remote Control Unit RM-21-(*) at a distance from the transmitter, remove Cord CD-513-(*) from Chest CH-132-(*) and insert it between the cord attached to Remote Control Unit RM-21-(*) and receptacle PL₈ on Radio Receiver and Transmitter BC-669-(*).
- (2) In the event that Radio Frequency potentials (indicated by sparks, shocks or burns) should appear on Remote Control Unit RM-21-(*) when Cord CD-513-(*) is used, ground the remote control unit as follows:—
- (a) Attach one end of a wire to one of the captive thumb screws on the front panel of Remote Control Unit RM-21-(*).
 - (b) Attach the other end of the wire to the nearest external ground. *Keep this ground wire as short as possible.*
- k. In case of rain, replace and latch the covers on Chests CH-132-(*) and CH-133-(*) and bring the cords out thru the openings.

14. INSTALLATION IN ½ TON PICK-UP TRUCK (See Figure 11).—

- a. Let down the rear platform of the truck.
- b. Let down the right seat-bench inside the truck. Let the left seat-bench remain up.
- c. Place Chest CH-133-(*) containing Radio Receiver and Transmitter BC-669-(*) on the floor inside the truck as far front as possible with the open face toward the rear.
- d. Place Chest CH-132-(*) containing Power Supply Unit PE-110-(*) alongside Chest CH-133-(*) on the left seat-bench with the open face toward the right side and as far up front as possible.
- e. Locate Chest CH-131-(*) containing Power Unit PE-108-(*) about two feet in back of Chest CH-133-(*) on the floor of the truck, and remove chest.
- f. (1) Drill four holes in the seat-back rails directly behind Chest CH-132-(*). Use Mast Bracket MP-50 as template. In SCR-543-A use Mast Bracket MP-50 having removable wing nuts. This mast bracket is not supplied with SCR-543-B, C and will have to be obtained from the supply depot.
- (2) Mount the mast base and bracket to this point. Assemble the antenna mast sections as described in par. 13. f. (1).
- g. (1) Remove Wire W-128 from Chest CH-

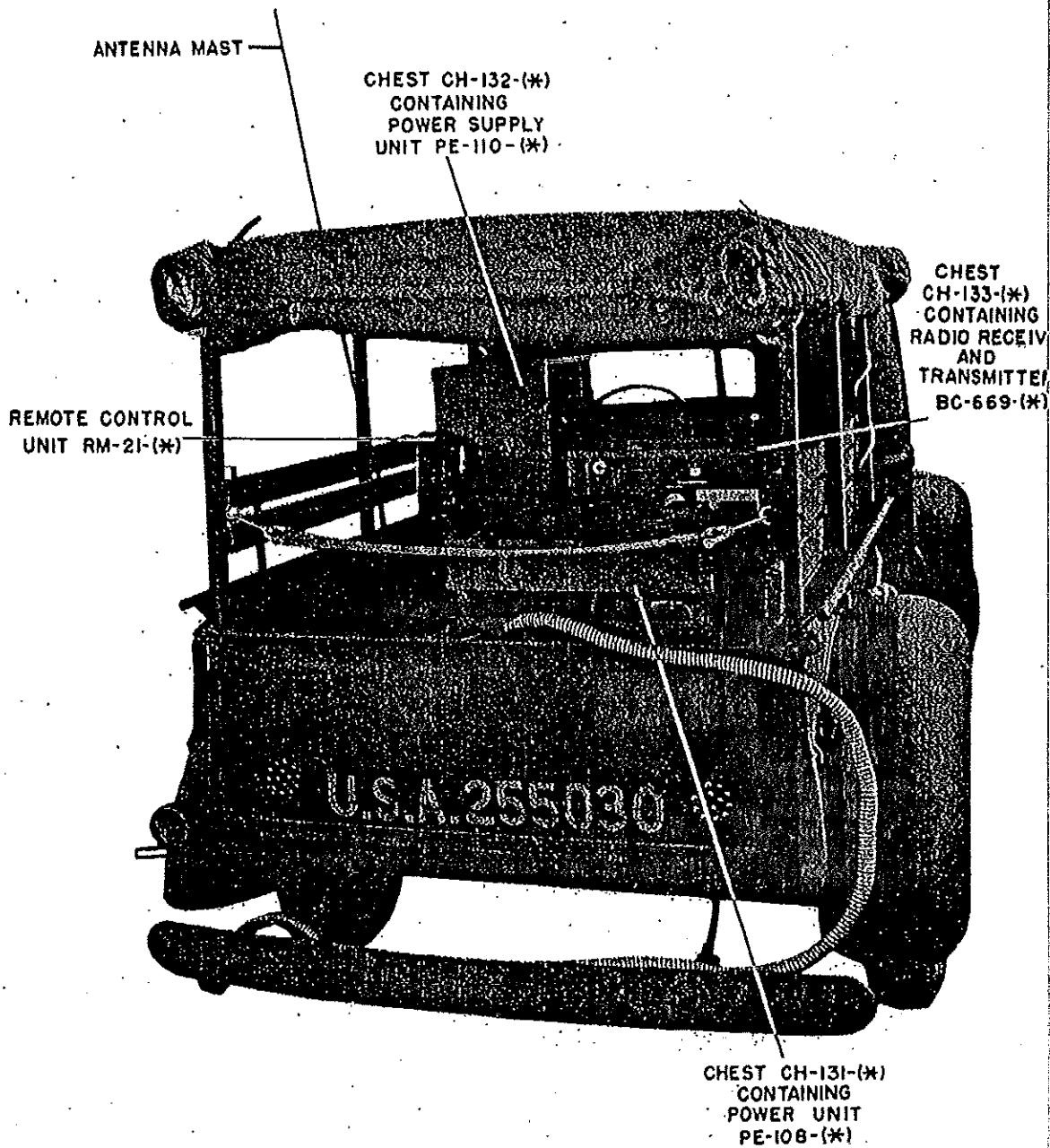


Fig. 11 - Radio Set SCR-543-(*) Installed in 1/2 Ton Pick-up Truck.

132-(*) and attach the terminal end to the antenna post on top of Radio Receiver and Transmitter BC-669-(*)).

- (2) Feed this wire thru the insulated eye-bolt attached to the top of the chest and thru Insulator IN-101. Cut off all excess length. Connect to the terminal at the bottom of Mast Base MP-37. *Do not let this wire rest on metal parts of the vehicle.*
- (3) Connect a wire from the ground post of Radio Receiver and Transmitter BC-669-(*) to the metal body of the truck at any convenient point. For this purpose, use the wire furnished in the tools and spare parts box located in the tray of Chest CH-73-(*)).
- h.* (1) Remove Remote Control Unit RM-21-(*) from carrying case and hang it on any support near the operator.
(2) Connect plug on cord of RM-21-(*) with receptacle PL₃ on front of BC-669-(*)).
- i.* Install Cords CD-515-(*) and CD-512-(*) as described in par. 13. *e.* (2) and (3).
- j.* Tie Chest CH-132-(*) into place by rope or straps fastened around the seat-back, or other suitable means provided.
- k.* Install exhaust pipe extension as outlined in in par. 15. *a.* (2) thru (6).
(1) Put up truck rear platform and fasten in place.

15. INSTALLATION IN 3/4 TON COMMAND AND RECONNAISSANCE CAR. (See Figure 1).—

- a.* (1) Place Chest CH-131-(*) containing Power Unit PE-108-(*) on top of rear seat as far to the right as possible and remove Chest CH-131-(*). If installation is to be anything but very temporary, a simple wood platform of 2 x 4 lumber should be built over the seat with two legs extending to the floor. The power unit may be placed on this.
(2) Remove the roll of asbestos tape and iron wire from the Tools and Spare Parts Box for PE-108-(*) in Chest CH-73-(*).
(3) Wrap the asbestos tape around the exhaust pipe extension, securing it with the iron wire.
(4) Remove the exhaust pipe extension and feed it thru the slots in Chest CH-131-(*) and replace exhaust pipe extension.
(5) Replace Chest CH-131-(*)
(6) Tie the exhaust pipe extension to the exterior of the vehicle with iron wire furnished.
(7) Tie Chest CH-131-(*) containing Power Unit PE-108-(*) down to the seat with straps or rope to prevent it from jumping while the car is in motion.
- b.* Place Chest CH-132-(*) containing Power Supply Unit PE-110-(*) on the floor between front and rear seats of the command car as far to the right as you can.

- c.* Place Chest CH-133-(*) containing Radio Receiver and Transmitter BC-669-(*) on the floor at the left of Chest CH-132-(*)
- d.* Connect the cords as described in Paragraph 13. *e.* Cord CD-512-(*) should be fed thru a slot in Chest CH-131-(*)
- e.* Take the following units out of Chest CH-73-(*)
(1) Remote Control Unit RM-21-(*) in case.
(2) Roll BG-56-A with antenna mast sections.
- f.* (1) Locate the necessary holes on the left side of the command car in the space provided for the antenna mast base bracket.
(2) Attach the bracket supplied with the vehicle to this point.
(3) Assemble and attach antenna as described in Paragraph 13. *f.* (3).
- g.* (1) Remove Wire W-128 from Chest CH-132-(*) and attach the terminal end to the antenna post on top of Radio Receiver and Transmitter BC-669-(*)
(2) Feed this wire thru the insulated eye-bolt attached to the top of the chest and thru Insulator IN-101. Cut off all excess length. Connect to the terminal at the bottom of Mast Base MP-37. *Do not let this wire rest on metal parts of the vehicle.*
(3) Using the remaining length of Wire W-128, connect the ground post located on the left side of Radio Receiver and Transmitter BC-669-(*) to any point on the metal frame of the car.
- h.* There is room for an operator at the left of Chest CH-131-(*) to operate the equipment.

16. PRECAUTIONS BEFORE OPERATING.—

- a.* In Radio Receiver and Transmitter BC-669-(*)
(1) Unlatch and lift open the top cover door of Chest CH-133-(*)
(2) Unlatch and lift open the top cover door of the metal cabinet within the chest.
(3) Make sure that all tubes and crystal holders are firmly seated in their sockets, and that the plate lead clips are in place on tubes V₃ and V₀.
(4) Close top cover doors.
(5) See that all cord connections are tight.
- b.* If the set is mounted in a vehicle, make sure that all components are sufficiently well fastened, so that they will not jar out of place or be damaged.

17. OPERATION.—Components of Radio Set SCR-543-(*) having been installed (as outlined in any one of paragraphs 13, 14 or 15) operation is accomplished as follows:

- a.* To Receive (Battery operation)
(1) To Start Receiver
(*a.*) Set the ON-OFF (main power) switch, on the front of Power Supply Unit PE-110-(*), to ON. The RECEIVER

pilot lamp on the front of the BC-669-(*) will light, and after about 15 seconds, during which the tube filaments heat up, the receiver will be ready for use.

(2) *To Tune Receiver (Manual Control).*

(a) Turn NOISE CONTROL to maximum (extreme right).

(b) Release RECEIVER TUNING dial lock.

(c) If signal to be received is in frequency range 1680 to 2750 kc.

Set RECEIVER BAND SWITCH to MANUAL 1.

Set RECEIVER TUNING dial to desired frequency, reading at indicator marked BAND 1.

(d) If signal to be received is in frequency range 2750 kc. to 4450 kc.

Set RECEIVER BAND SWITCH to MANUAL 2.

Set RECEIVER TUNING dial to desired frequency, reading at indicator marked BAND 2.

(e) Set ON-OFF SPEAKER switch to ON.

(f) Advance A.F. GAIN control to the right until the signal is heard in loudspeaker. (If no signal is present, rush noise or static will be heard, indicating receiver is in operation).

(g) Extremely noisy conditions may be relieved by adjusting the NOISE CONTROL (R.F. GAIN in SCR-543-A) as follows:

Set the RECEIVER TUNING dial to a position at which no signal is heard in the loudspeaker.

Turn the NOISE CONTROL to a point at which the background noise is not too loud.

(h) Re-adjust RECEIVER TUNING dial until signal is heard clearest and with least background noise. This adjustment will be fairly sharp.

(i) Lock RECEIVER TUNING dial.

(3) *To Tune Receiver (Crystal Control).*

Note: Signal to be received must be one for which the proper frequency crystal has been installed. (This should be noted on chart on front panel.)

(a) Turn NOISE CONTROL to maximum (extreme right).

(b) Set OPERATING CHANNEL switch to number corresponding to frequency selected.

(c) Release RECEIVER TUNING dial lock.

(d) If signal to be received is in frequency range 1680 to 2750 kc.

Set RECEIVER BAND SWITCH to CRYSTAL 1.

Set RECEIVER TUNING dial to desired frequency, reading at indicator marked BAND 1.

(e) If signal to be received is in fre-

quency range 2750 to 4450 kc.

Set RECEIVER BAND SWITCH to CRYSTAL 2.

Set RECEIVER TUNING dial to desired frequency, reading at indicator marked BAND 2.

(f) Advance A.F. GAIN control to the right until signal is heard in loudspeaker.

(g) If the background noise is too great when signal is heard, set RECEIVER BAND SWITCH to MANUAL and repeat paragraph 17. a. (2) (g).

NOTE: With crystal control, RECEIVER TUNING dial setting will be much less critical than in the case of manual control; however, it should be adjusted for the loudest signal and least background noise or interference.

(h) Lock the RECEIVER TUNING dial.

(i) To change frequency, set OPERATING CHANNEL switch to a different channel and repeat steps (c) thru (h).

(4) *Miscellaneous Controls*

(a) Handset or Headset Reception:—The above describes reception on the loudspeaker. It will be found that the signal will also be heard in the handset earpiece or headset (whichever is connected to Remote Control Unit RM-21-(*)). The signal volume in the handset or headset is controlled by the gain control located under the arrow below the CHOKE button on the remote control unit.

(b) The loudspeaker may be turned off by setting the ON-OFF SPEAKER switch to OFF. It is normally used for convenience in tuning the receiver. The loudspeaker should be turned off when the operator is transmitting from a position directly in front of the transmitter, to avoid audio feedback.

Note: The ON-OFF STATIC FILTER switch, when turned ON, operates a peak voltage limiter and a 1000 cycle tuned circuit which effectively reduces static and electrical disturbances outside of the 1000 cycle frequency band. It is very useful in receiving 1000 cycle code signals but is of little value for voice frequencies because these frequencies, not being near 1000 cycles, will be attenuated almost equally with static and electrical disturbances. When this switch is OFF the static filter has no effect on the received signal.

(5) *To Stop Receiver*

(a) Set the ON-OFF (main power) switch, located on the front of Power Supply Unit PE-110-(*), to OFF.

b. *To Receive (a-c operation from Power Unit PE-108-(*)).*

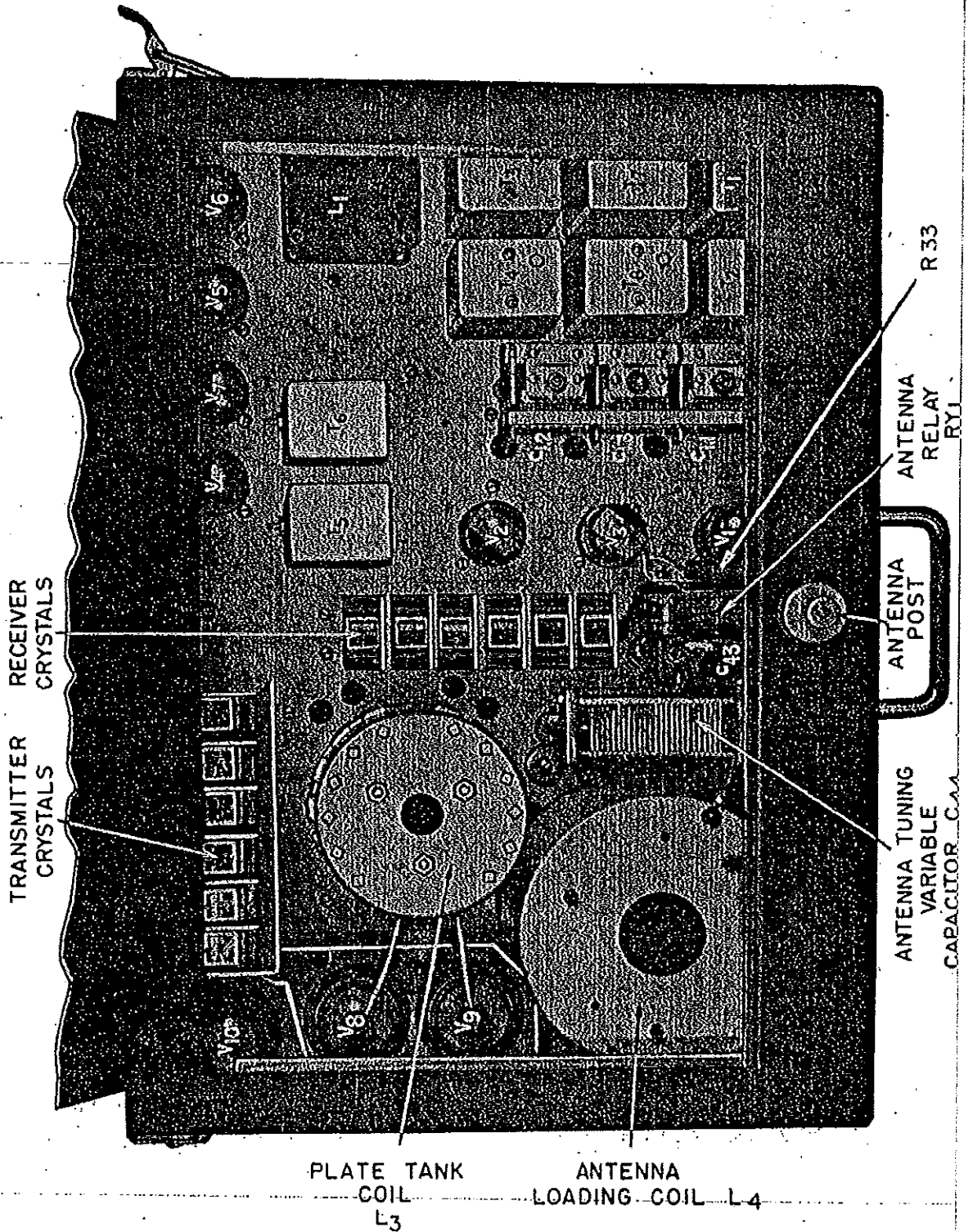


Fig. 13 - Radio Receiver and Transmitter BC-669-(*), Top View of Chassis.

- (1) Place receiver in operation as in par. 17. a. (1). (Battery Operation).
- (2) To start Power Unit PE-108-(*).
 - (a) Press the START button on Remote Control Unit RM-21-(*), and hold closed until Power Unit PE-108-(*), starts. The power unit should come up to an even speed and run smoothly, and both TRANSMITTER and RECEIVER pilot lamps on the modulator should light, indicating that both are ready for operation.
 - (b) Release START button.

NOTE: If the power unit is cold, it may be necessary to press CHOKE button on the remote control unit while pressing START button, until engine starts.

- (3) To Tune Receiver
Follow same procedure as in paragraph 17. a. (2) or (3). Operation will be identical.
 - (4) To Stop Power Unit
 - (a) Press STOP button on Remote Control Unit RM-21-(*), until Power Unit PE-108-(*), has come to a complete stop. If ON-OFF switch on Power Supply Unit PE-110-(*), has been left ON, the receiver will continue to operate. (The battery is automatically switched on and off as Power Unit PE-108-(*), is stopped or started).
- c. To Transmit
- (1) Start Power Unit PE-108-(*), as described in par. 17. b. and put receiver in operation.
 - (2) Make sure that OPERATING CHANNEL switch is set for desired crystal frequency.
 - (2) Press the press-to-talk switch on Handset TS-11-(*), (or Microphone T-24-(*), if used). An indication on the DC CURRENT meter will be noticed, as well as some indication on the ANTENNA CURRENT meter.

DON'T mumble QUIETLY
AWAY FROM YOUR MIKE--



- (4) Rotate ANTENNA TUNING dial until ANTENNA CURRENT meter reads at its maximum. The DC CURRENT meter should now read between 150 and 210 ma.
- (5) Modulate the transmitter by speaking distinctly and in a normal tone of voice

into the microphone or the mouthpiece of the handset.

- (6) When finished speaking, release the press-to-talk switch on handset or microphone; this puts the transmitter off the air and switches the receiver on again.
- d. To Change Transmitter Frequency. This is accomplished by setting the OPERATING CHANNEL switch to a different position and repeating the steps outlined in par. 17. c. (3) and (4). Caution: Do not change the position of the OPERATING CHANNEL switch while pressing the press-to-talk switch on either the handset or microphone.
- e. Receiving and Transmitting Channels. Changing the position of the OPERATING CHANNEL switch changes the frequency of both transmitter and receiver. Unless specifically directed not to do so, the operator should tune both the receiver and the transmitter immediately after switching to a new operating channel.
- f. Operation from a-c source of power other than Power Unit PE-108-(*).
- (1) Radio Set SCR-543-(*), may be operated without Power Unit PE-108-(*), if a source of 115 volts, 60 cycle, single phase a-c power is available (within 25 feet), which can supply 600 watts. For this operation the components are connected in the usual way except as follows:
 - (a) CAUTION: Make no connection to PL₅ on Power Supply Unit PE-110-(*). THIS IS DANGEROUS.
 - (b) Use Cord CD-511-(*), (from Chest CH-73-(*)) to make the connection. Proceed as follows:
 - Plug one end of Cord CD-511-(*), into receptacle 3O₄, (marked 115 v. a-c) on the power unit.
 - Plug the other end of this cord into a receptacle providing the a-c power.
 - (2) Operation of receiver and transmitter is similar to that already described for a-c operation; with the following exception:
 - (a) The ON-OFF switch on the power supply unit controls the power. Turning it OFF stops both receiver and transmitter.
 - (b) No battery operation of receiver for stand-by monitoring is provided when operating from an a-c source other than PE-108-(*).
 - (c) References to stopping and starting the power unit should be disregarded as this unit is not connected, in this case.
- g. Power Unit PE-108-(*). When this unit is disconnected from the other components of Radio Set SCR-543-(*), it may be operated for test or other purposes. Once in operation it may be stopped by pressing the stop switch located on the magneto housing directly below the exhaust pipe outlet.

SECTION III — FUNCTIONING OF PARTS

18. RADIO RECEIVER AND TRANSMITTER
BC-669-(*)

a. Receiver — (Refer to figures 17 and 18)
Electrically, the receiver consists of radio frequency amplifier tube V_1 , mixer tube V_2 , heterodyne oscillator tube V_3 , intermediate frequency amplifier tube V_4 , second detector, automatic noise limiter and A.V.C. tube V_7 , audio frequency voltage amplifier tube V_5 and audio frequency power amplifier tube V_6 together with their associated circuits.

(1) Radio frequency amplifier tube V_1 is a Tube VT-117 (commercial type 6SK7), the function of which is to amplify signal voltages at radio frequencies and, together with the sharply tuned circuits of r-f transformers T_1 or T_2 , greatly attenuate signals of undesired frequency. (BC-669-B, and BC-669-C use Tube VT-117-A, commercial type 6SK7 GT/G, as V_1 .)

(a) Connection of the antenna to r-f transformer T_1 is made through a set of normally closed contacts in relay RY_1 . The antenna is switched from T_1 primary to T_2 primary by switch section $S_{1.1}$.

(b) Signal voltages picked up by the antenna appear across the primary of transformer T_1 and are in turn induced into the secondary. The secondary together with capacitor section $C_{1.1}$ forms a tuned parallel resonant circuit which determines the frequency of the signal fed to the control grid of tube V_1 . Switch section $S_{1.2}$ switches $C_{1.1}$ and the control grid of tube V_1 from T_1 secondary to T_2 secondary.

(c) The gain of tube V_1 is controlled by varying its cathode bias by means of variable resistor R_4 , whose movable tap is connected to the cathode through cathode bias resistor R_3 . One end of R_4 is returned to ground through a set of normally closed contacts in relay RY_1 . Capacitor C_6 is connected from the movable tap of R_4 to ground to by-pass any noise produced by R_4 . (See Fig. 17.) The cathode is by-passed by capacitor C_7 .

(d) In BC-669-B r-f choke L_{16} is connected between resistor R_4 and resistor R_3 to provide, in conjunction with capacitor C_6 (connected from the movable tap of R_4 to ground), additional filtering of noise produced by R_4 . (See Fig. 16 a.)

(e) In BC-669-C (also BC-669-B on Order No. 32780-PHILA-43) C_6 is connected between r-f choke L_{16} and resistor R_3 , for the same purpose. (See figure 16 b.)

(f) An A.V.C. voltage is applied to the control grid of tube V_1 through resistor R_2 and the r-f transformer secondary and filtered by capacitor

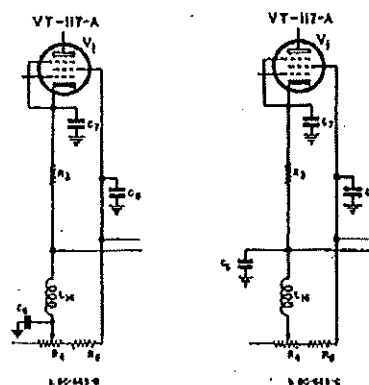


Fig. 16

C_4 to assist in maintaining the received signal voltage at a constant level, thus preventing overloading of this tube by very strong signals.

(g) The plate of tube V_1 receives its voltage through the primary of r-f transformer T_3 directly from the receive plate voltage supply.

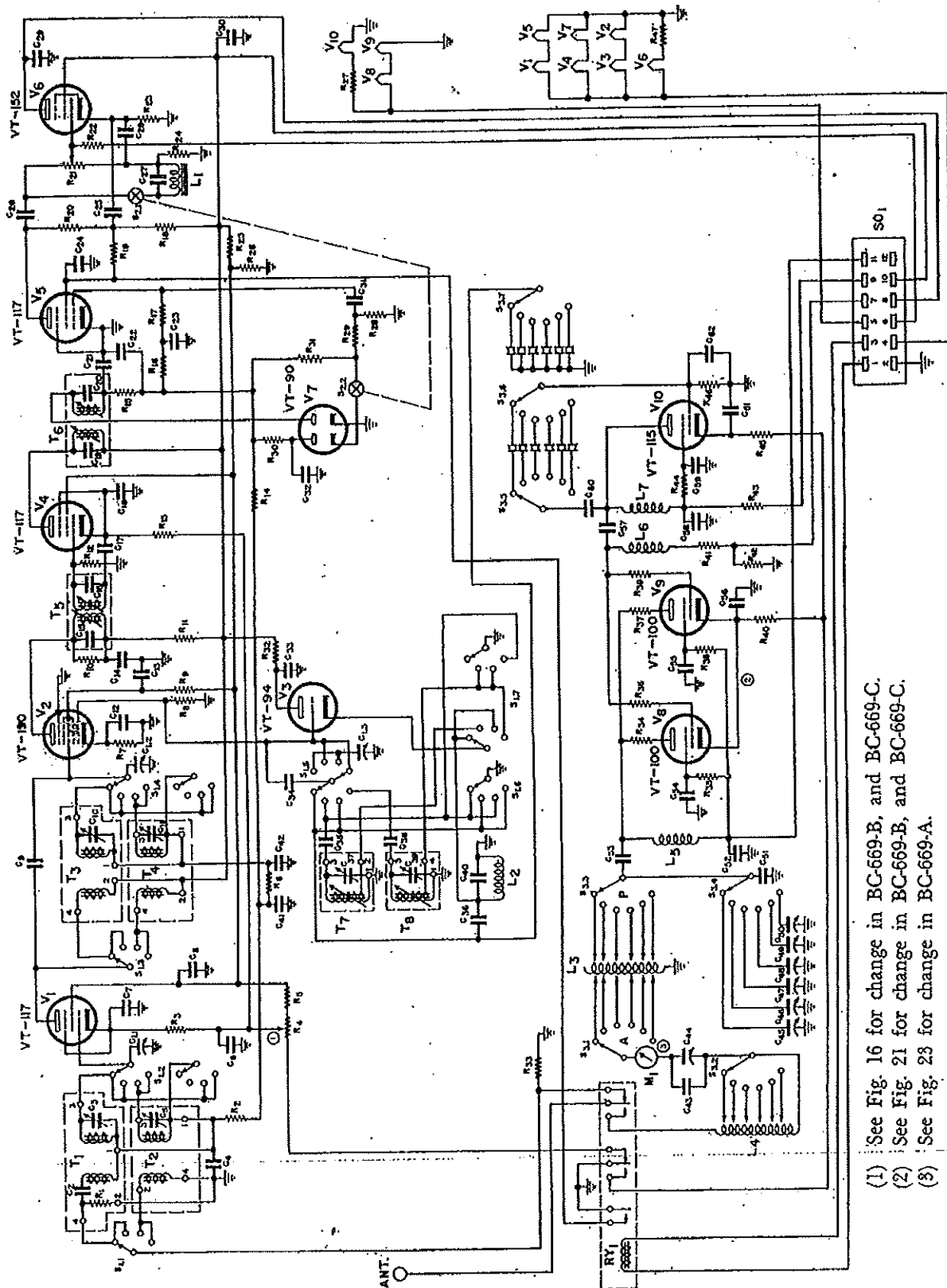
(h) The screen grid of tube V_1 receives its voltage directly from the receive screen voltage supply and is by-passed by capacitor C_8 .

(i) A positive voltage is placed across the fixed portion of variable resistor R through resistor R_5 from the screen supply. A portion of this voltage, the magnitude of which depends on the setting of R_4 , then appears on the cathode in addition to the positive voltage supplied by resistor R_3 with a corresponding negative voltage appearing on the control grid. This then allows greater attenuation of signal voltages at a given setting than if the voltage drop across R and R_4 only is utilized to bias the grid.

(2) Mixer tube V_2 is a Tube VT-150 (commercial type 6SA7). The function of the tube is to heterodyne the amplified r-f signal voltage supplied by tube V_1 with the high frequency r-f voltage provided by oscillator tube V_3 . (BC-669-B, and BC-669-C use tube VT-150-A, commercial type 6SA7 GT/G, as V_2 .)

(a) Grid #3 of tube V_2 receives the signal voltage amplified by tube V_1 through the inductive coupling provided by r-f transformer T_3 and the capacitive coupling of capacitor C_9 . T_3 and T_4 primary switching is accomplished by switch section $S_{1.3}$ and secondary switching by switch section $S_{1.4}$. The tuned circuit formed by T_3 secondary and capacitor section C_9 determines the frequency of the signal received by grid #3.

(b) Tube V_2 receives its plate voltage through resistor R_{11} , primary of i



- (1) See Fig. 16 for change in BC-669-B, and BC-669-C.
- (2) See Fig. 21 for change in BC-669-B, and BC-669-C.
- (3) See Fig. 23 for change in BC-669-A.

Fig. 17 - Radio Receiver and Transmitter BC-669-A Schematic Diagram of Transmitter and Receiver.

- transformer T_5 and resistor R_{10} , and the voltage is filtered of r-f by capacitor C_{14} .
- (c) The screen grid of tube V_2 receives its voltage through resistor R_6 and is by-passed by capacitor C_{13} .
 - (d) The cathode of tube V_2 is biased by the voltage drop across resistor R_7 and by-passed by capacitor C_{12} .
 - (e) An A.V.C. voltage is applied through resistor R_6 and T_3 secondary to grid #3 of tube V_2 , filtered by capacitor C_{41} and by-passed by capacitor C_{42} , for the same purpose as that outlined in paragraph 18 a (1) (f).
- (8) Heterodyne oscillator tube V_3 is a Tube VT-94 (commercial type 6J5) which has the function of generating oscillations at a frequency which differs from the signal frequency by the value of the intermediate frequency used (385 KC.). The oscillator employs a Hartley circuit for manual operation and an additional circuit for crystal operation. Band switching and manual to crystal switching is accomplished by means of switch sections $S_{1.5}$, $S_{1.6}$ and $S_{1.7}$. BC-669-B, C use Tube VT-94-D (commercial type 6J5-GT/G) as V_3 .
- (a) In *manual operation* the frequency of oscillation is determined by the tuned circuit formed by transformer T_7 and capacitor section $C_{1.8}$. The control grid of tube V_3 is connected to one end of T_7 through switch section $S_{1.5}$ and padding capacitor C_{35} and to one end of T_8 through padding capacitor C_{38} . The other end of each coil is grounded, and a tap on each coil connects to the cathode of tube V_3 through switch section $S_{1.7}$ to provide feed-back. Grid-leak resistor R_3 provides a negative bias on the grid of the oscillator tube V_3 .
 - (b) In *crystal operation* the oscillator frequency is determined by the frequency of the crystal selected by means of switch section $S_{3.7}$. Capacitors C_{38} and C_{40} are connected in series across the crystal, and the cathode of tube V_3 is connected between them through switch section $S_{1.7}$, with coil L_2 in parallel with capacitor C_{40} to provide sufficient feed-back for the purpose of sustaining strong oscillations. Grid-leak resistor R_3 is connected to the control grid of tube V_3 at all times. Capacitor C_{34} provides coupling between the control grid of tube V_3 , the oscillator transformer and capacitor $C_{1.8}$ when switch S_1 is in either of the two manual positions.
 - (c) Switch section $S_{1.6}$ grounds T_7 when in either crystal position and the crystals when in either manual position. A portion of switch section $S_{1.7}$ grounds T_8 cathode tap when in MANUAL 1 and CRYSTAL 2 positions and T_7 when in MANUAL 1 position.
- (d) The control grid of oscillator tube V_3 is coupled directly to the injection grid (#1) the mixer tube V_2 where the oscillator frequency is heterodyned with the incoming signal frequency to produce an intermediate frequency of 385 kc.
 - (e) The plate of tube V_3 receives its voltage through resistor R_{22} and is by-passed by capacitor C_{33} .
- (4) Intermediate frequency amplifier tube V_4 is a Tube VT-117 (commercial type 6SK7), the function of which is to amplify an intermediate frequency of 385 kc. supplied by mixer tube V_2 . BC-669-B, and BC-669-C use Tube VT-117 (commercial type 6SK7-GT/G) as V_4 .
- (a) The output of tube V_2 is inductively coupled to the control grid of tube V_4 through i-f transformer T_6 . The frequency which reaches the grid is determined by the primary and secondary parallel resonant circuits of transformer T_6 . The secondary is returned to cathode through capacitor C_{17} .
 - (b) The cathode of tube V_4 is biased by resistor R_{13} which is returned to the ground side of resistor R_3 so that the gain of tube V_4 may be controlled along with that of tube V_1 , using variable resistor R_4 . Capacitor C_{11} by-passes the cathode.
 - (c) Tube V_4 obtains its screen grid voltage directly from the receiver screen supply which is bled by resistor R_{21} and dropped by resistor R_{25} .
 - (d) The plate voltage of tube V_4 is supplied directly through the primary of i-f transformer T_6 from the receiver plate supply.
- (5) The second detector, NOISE LIMITER and A.V.C. tube V_7 is a Tube VT-90 (commercial type 6H6). One diode of tube V_7 functions as the signal detector and is also utilized as a source of automatic volume control voltage. The second diode section is employed as a peak limiter which automatically limits high noise voltage peaks.
- (a) The modulated 385 kc. i-f signal amplified by tube V_4 , appears across the primary of diode i-f transformer T_6 . Through the inductive coupling provided by transformer T_6 , the signal appears across the secondary and the detector diode section of tube V_7 . Only the audio modulation then appears across i-f filter capacitor C_{21} as a result of the detector action and is filtered by resistor R_{15} and capacitor C_{22} , fed through a voltage dividing network, consisting of resistors R_{81} , R_{28} , and R_{29} , and coupled

by capacitor C_{21} to the control grid of tube V_6 .

- (b) The d-c voltage supplied by the detector is fed through filter resistor R_{14} to supply an A.V.C. voltage to the control grids of tubes V_1 and V_2 and through filter resistor R_{16} and grid-leak resistor R_{17} as A.V.C. voltage to the control grid of tube V_6 . Any portion of audio component remaining is removed by capacitor C_{23} .
 - (c) When switch $S_{2,2}$ is closed, the peak limiter diode section of tube V_7 is placed in operation. The cathode of this diode section is biased to a potential less negative than the plate by resistor R_{20} . When an audio peak of an amplitude not exceeding the absolute value of the difference between plate and cathode potentials appears across resistor R_{21} , no plate current flows. But, when an audio voltage peak which exceeds this value appears across resistor R_{21} , the cathode becomes negative with respect to plate, causing a flow of plate current. The negative peaks of the audio component are then by-passed to ground through capacitor C_{22} , limiting the amplitude of audio voltages reaching the control grid of tube V_6 to a value controlled by the bias voltage on the diode plate.
- (6) Audio frequency voltage amplifier tube V_6 is a Tube VT-117 (commercial type 6SK7), the function of which is to amplify audio voltage supplied by the detector diode of tube V_7 and furnish an audio output voltage, having an amplitude great enough to drive tube V_6 . BC-669-B, and BC-669-C use Tube VT-117-A (commercial type 6SK7-GT/G) as V_6 .
- (a) The cathode of tube V_6 is connected to ground, and the control grid receives its bias, filtered by resistor R_{11} and capacitor C_{23} , from the A.V.C. voltage supply through grid leak resistor R_{17} .
 - (b) The screen grid of tube V_6 receives its voltage, filtered by resistor R_{18} and capacitor C_{26} , through dropping resistor R_{10} and is by-passed by capacitor C_{24} . The screen is returned to ground through a set of contacts in relay RY_1 , closed when in transmit position, to assist in rendering the receiver inoperative.
 - (c) The plate receives its voltage, filtered by resistor R_{18} and capacitor C_{25} , through load resistor R_{20} .
- (7) Audio frequency power amplifier tube V_8 is a Tube VT-152 (commercial type 6K6-GT/C). The function of this tube is to amplify the output of tube V_6 and provide sufficient power to drive loudspeaker LS_1 .
- (a) The output of tube V_6 is resistance-

capacity coupled to the control grid of tube V_6 by capacitor C_{20} , variable resistor R_{21} and resistor R_{24} . The audio gain is controlled by varying the input to the control grid with variable resistor R_{21} .

- (b) The cathode of tube V_6 is biased by resistor R_{23} . Capacitor C_{28} is connected from the grid return to the cathode to filter out any variations in cathode voltage and, in conjunction with resistor R_{23} , to eliminate the necessity for a high value cathode by-pass capacitor across R_{23} .
- (c) Screen voltage for tube V_6 is supplied directly from the receiver plate supply which is by-passed by capacitor C_{30} .
- (d) The plate receives its voltage through the primary of output transformer T_9 , located on the modulator chassis. This connection is made through contact 8 of socket SO_1 and plug PL_1 (see figure 17). The plate is by-passed by capacitor C_{20} .
- (e) The audio output power of tube V_6 is transferred to the voice coil of loudspeaker LS_1 by means of transformer T_9 , the secondary of which has an impedance of 6 ohms to match the voice coil impedance. The secondary is also connected to the headset through contact F on plug PL_3 which connects to Remote Control Unit RM-21-(*).
- (f) In BC-669-B, and BC-669-C transformer T_9 has a 100 ohm secondary which is connected to Headset HS-30-(*). A 6 ohm tap is provided on T_9 secondary and is connected to switch S_4 . (See Fig. 19).

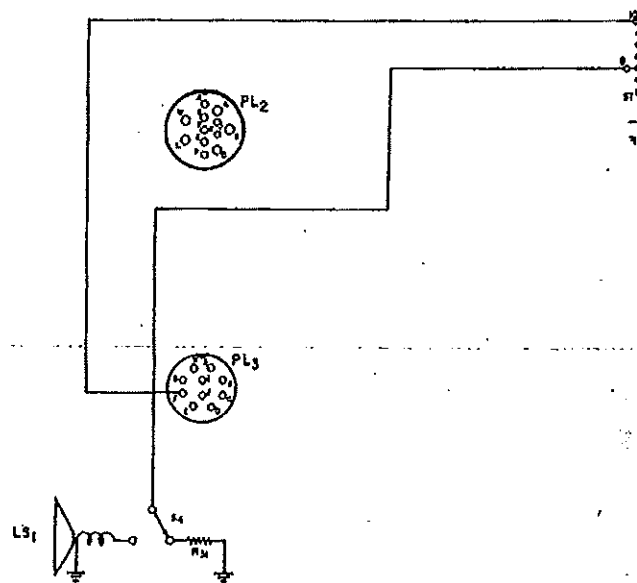


Fig. 19

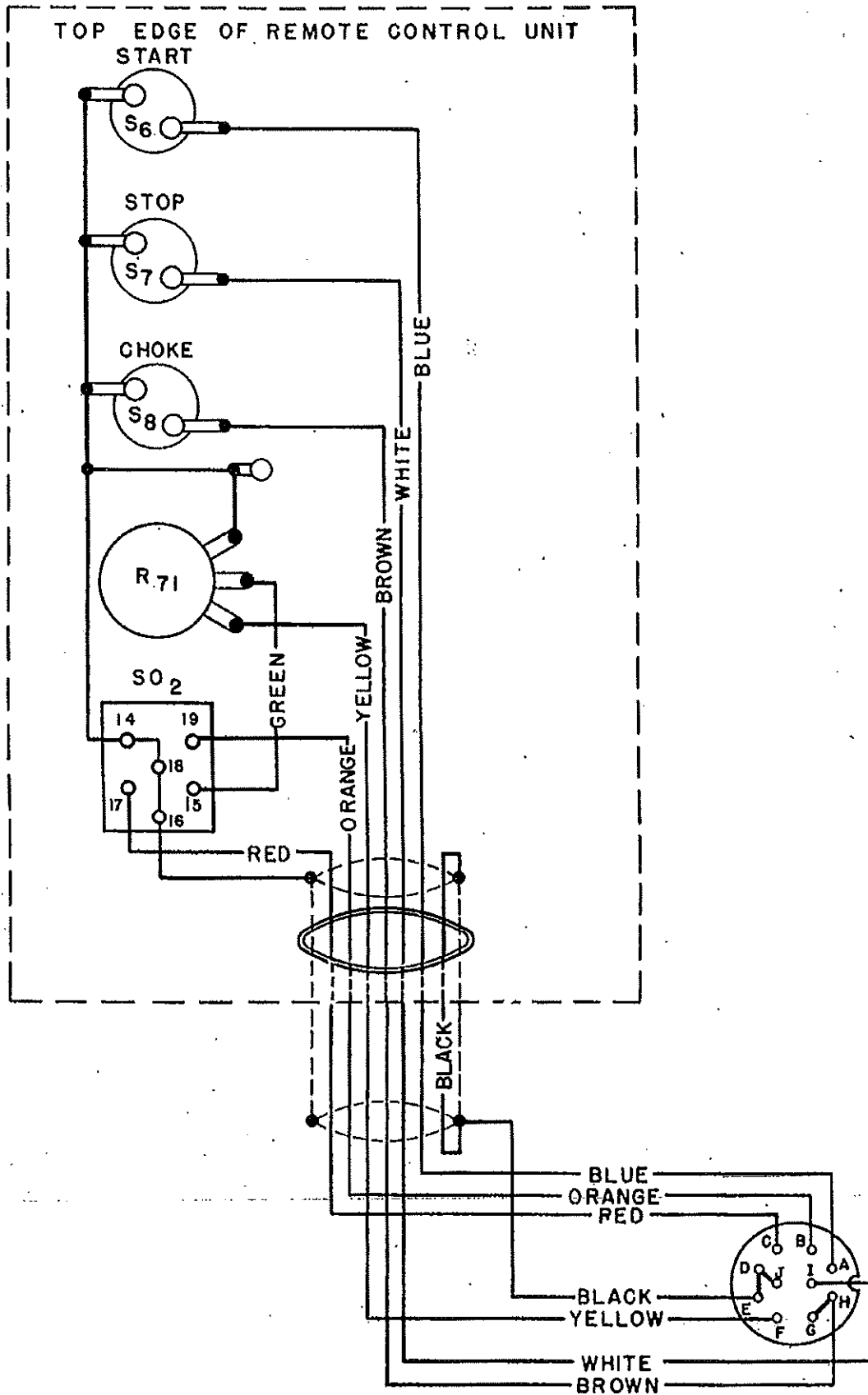


Fig. 20 - Remote Control Unit RM-21-(*), Practical Wiring Diagram.

- (g) Audio choke L_1 and capacitor C_{27} form a parallel resonant circuit, resonant at 1000 cycles. When switch $S_{2,1}$ is closed, this circuit is connected across resistor R_{21} , offering a low impedance between grid and ground to audio frequency currents outside of the 1000 cycle frequency band.
- (h) Switch S_1 is provided for switching speaker LS_1 on and off. With the switch at ON, the voice coil is connected to the secondary of transformer T_0 , at OFF resistor R_{51} is connected in its place to maintain the proper load on the output transformer.

b. Transmitter — (Refer to figures 14 and 15) Electrically, the transmitter consists of oscillator tube V_{10} , r-f power amplifier tubes V_8 and V_9 , modulator driver tube V_{11} and modulator tubes V_{12} , V_{13} , V_{14} and V_{15} together with their associated circuits.

(1) Oscillator tube V_{10} is a Tube VT-115 (commercial type 6L6) which has the function of generating oscillations at a radio frequency for providing power to the final stage, and maintaining these oscillations accurately at the desired frequency. (See figure 17.) BC-669-B, and BC-669-C use Tube VT-115-A (commercial type 6L6G) as V_{10} .

- (a) The frequency of oscillation is determined by the frequency of the crystal that is connected between control grid and plate of tube V_{10} . Crystal switching is accomplished by means of switch sections $S_{3,5}$ and $S_{3,6}$. Capacitor C_{60} is connected in series with the crystal to keep d-c voltage off the crystal. Capacitor C_{62} is connected across grid-leak resistor R_{40} to provide excitation.
- (b) Cathode bias is provided by the voltage drop appearing across resistor R_{45} which is connected to ground through a set of contacts in relay RY_1 ; closed when in transmit position, and opened when in receive position to render the transmitter oscillator inoperative. The cathode is by-passed by capacitor C_{51} .
- (c) The plate of tube V_{10} receives its voltage from the transmitter plate supply through contact 9 of plug PL_1 and socket SO_1 , dropping resistor R_{43} and r-f-choke L_7 which prevents r-f from entering the transmitter plate supply system. The plate supply is by-passed by capacitor C_{53} .
- (d) The screen grid receives its voltage through resistor R_{44} and is by-passed by capacitor C_{59} .

(2) R-F power amplifier tubes V_8 and V_9 are each a Tube VT-100 (commercial type 807). BC-669-B, and BC-669-C use Tube

VT-100-A (commercial type 807) as V_8 and V_9 . They operate in parallel as class "C" power amplifier.

(a) The oscillations produced by tube V_{10} is coupled to the control grids of tubes V_8 and V_9 through capacitor C_{57} which also prevents d-c from entering the amplifier grid circuit. Resistors R_{36} and R_{39} are provided in the grid circuit to suppress parasitic oscillations. The grids are returned to ground through r-f choke L_6 and resistors R_{41} and R_{42} .

(b) The cathodes of tubes V_8 and V_9 are connected together and biased by resistor R_{40} which is connected to resistor R_{45} and grounded at the same time as R_{45} through RY_1 . The cathodes are by-passed by capacitor C_{50} .

(c) In BC-669-B, and BC-669-C an additional capacitor C_{58} is connected from V_8 cathode to ground as a bypass. Cathode bias resistor R_{40} is disconnected from R_{45} and grounded directly. (See Fig. 21.)

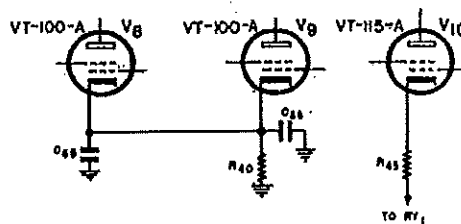


Fig. 21

(d) The plates of tubes V_8 and V_9 receive their voltage through r-f choke L_5 which prevents r-f from entering the transmitter plate supply. The plate supply is by-passed by capacitor C_{62} . Resistors R_{34} and R_{37} are connected in series with the plates to suppress parasitic oscillations.

(e) The screens of tubes V_8 and V_9 receive their voltage through resistors R_{35} and R_{38} and are by-passed by capacitors C_{54} and C_{55} respectively.

(f) The plate tank circuit consists of coil L_3 in parallel with fixed capacitor C_{51} and variable capacitors C_{48} , C_{47} , C_{49} , C_{46} and C_{50} , selected with switch section $S_{3,4}$. The plate tank inductance is varied by means of a set of sliding contacts which are selected with switch section S_3 . Capacitor C_{53} is inserted to keep d-c from tank coil L_3 .

(g) Antenna coupling is varied by another set of sliding contacts on tank coil L_3 , selected by means of switch section $S_{3,1}$. L_3 is connected to the antenna through antenna ammeter M_1 and a series resonant circuit consisting of fixed capacitor C_{48} , antenna

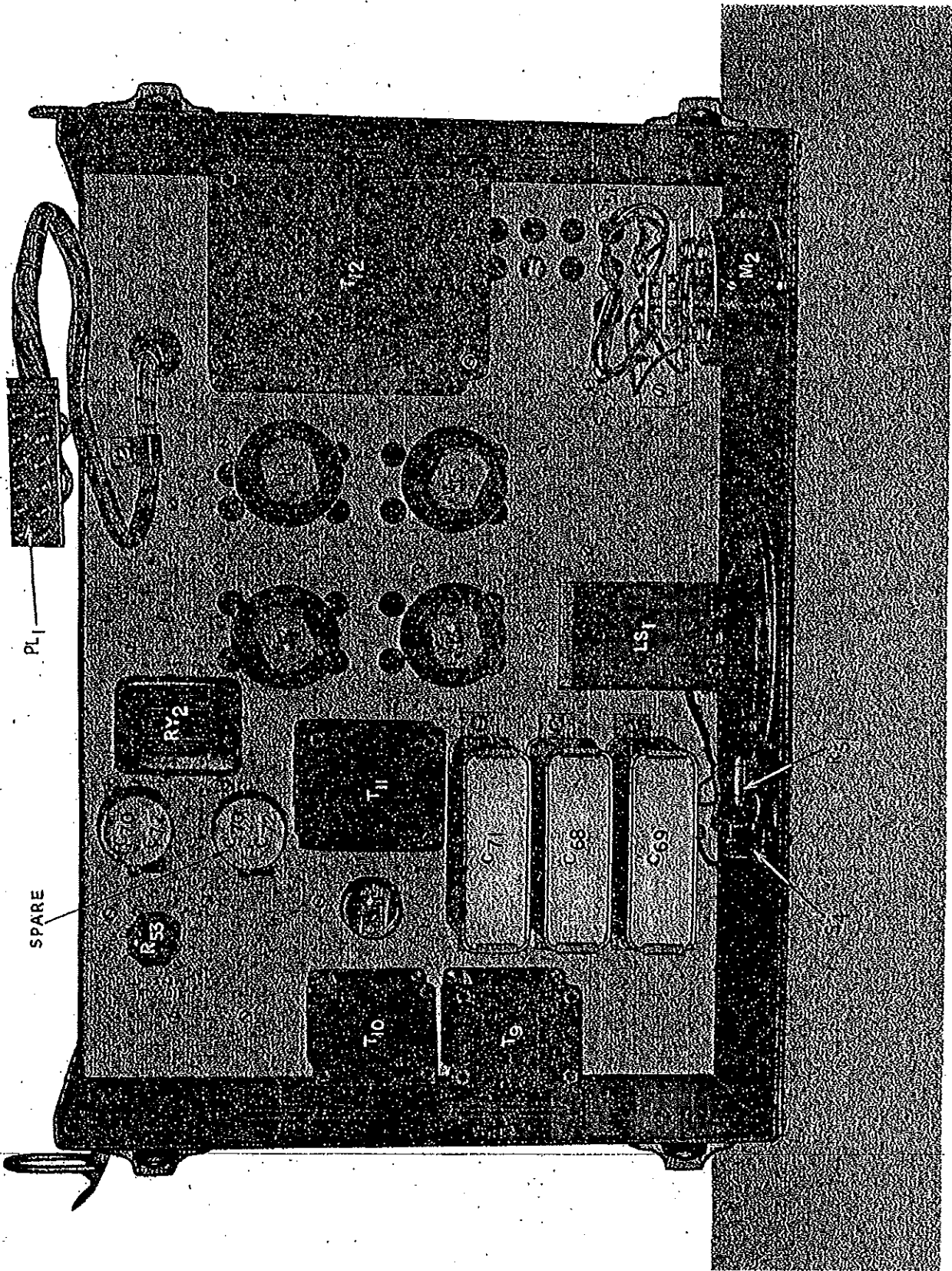


Fig. 22 - Radio Receiver and Transmitter BC-669-(*), Top View of Modulator Section.

tuning variable capacitor C_{44} and antenna loading coil L_4 . The loading inductance is varied by means of a set of sliding contacts on coil L_4 which are selected with switch section $S_{3,2}$. The transmitter antenna circuit is opened in receive position by a set of contacts in relay RY_1 . (In SCR-543-A, some early units had antenna ammeter M_1 connected on the antenna side of antenna loading coil L_4 . See Fig. 23.)

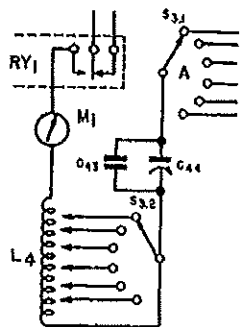


Fig. 23

(3) Modulator driver tube V_{11} is a Tube VT-135 (commercial type 12J5-GT). The function of this tube is to amplify low-level microphone voltage and provide a sufficiently large voltage swing to drive the modulator power stage. (See figure 18.)

(a) Audio speech currents enter through contact C in plug PL_3 and flow through transformer T_{10} primary which is shunted by resistor R_{52} .

(b) An induced audio voltage appears across the secondary of transformer T_{10} . This voltage is then divided by resistors R_{55} and R_{56} and a portion of it appears on the grid of tube V_{11} .

(c) The voltage drop across resistor R_{55} provides bias for the cathode of tube V_{11} . Capacitor C_{64} , in conjunction with resistor R_{57} , eliminates the necessity of a by-pass capacitor across R_{55} .

(d) The plate voltage is delivered through the primary of transformer T_{11} and resistor R_{88} . Filtering is provided by capacitor C_{71} .

(4) Modulator tubes V_{12} , V_{13} , V_{14} and V_{16} are each a Tube VT-115-A (commercial type 6L6-G) which operate in push-pull parallel as a Class AB_1 audio frequency power amplifier.

(a) The amplified audio voltage appearing across the primary of driver transformer T_{11} is transferred to the secondary which has a grounded center tap. On alternate cycles the audio appears across one half of the secondary. One side of the secondary connects to the control grids of

tubes V_{12} and V_{14} and the other side to the control grids of tubes V_{13} and V_{15} . The grids are provided with by-pass capacitors C_{65} and C_{66} .

(b) Resistor R_{60} provides bias voltage for the modulator tube cathodes and also for the microphone through filter resistor R_{70} and the primary of transformer T_{10} . The cathodes are by-passed by capacitor C_{70} and the microphone voltage is filtered by capacitor C_{72} .

(c) Plate voltage for the modulator tubes is furnished through resistor R_{60} and R_{63} (R_{63} is a meter shunt through the center-tapped primary of modulation transformer T_{12} , and parasitic suppressor resistors R_{65} , R_{60} , R_{61} and R_{62}). This voltage is filtered by capacitor C_{68} .

(d) Screen voltage is received through resistor R_{65} , filtered by capacitor C_6 and bled to cathode by resistor R_6 .

(e) The secondary of modulation transformer T_{12} is inserted in series with the high voltage plate power supply of power amplifier tubes V_8 and V_9 through contact 11 of plug PL_1 and socket SO_1 so that audio frequency fluctuations present in the secondary will result in proportional fluctuations in the plate voltage of the power amplifier stage and cause the output power of the transmitter to vary correspondingly, creating modulated radio frequency carrier.

(f) To provide a means of monitoring the audio modulation, a side-tone circuit is included. To accomplish this a portion of the modulator output is taken from the primary of transformer T_{12} and fed through resistor R_{54} , side-tone volume control resistor R_{53} , blocking capacitor C_{67} , a set of contacts in relay RY_2 , contact #6 of plug PL_1 and socket SO_1 and finally through resistor R_{22} to the grid of receiver power output tube V_6 . The audio modulation may then be heard in loudspeaker LS_1 when the latter is in the circuit and the transmitter is modulated; also in Headset HS-22-C, or Headset HS-30(*) or ear piece of Handset TS-11(*) when volume control R_{11} is turned up.

(5) Meters provided are antenna current meter M_1 and milliammeter M_2 . (See figures 16 and 18.)

(a) Meter M_1 has the function of indicating when the antenna loading circuit is tuned to resonance by proper setting of capacitor C_{44} and the sliding contacts of loading coil L_4 . This is indicated by a maximum r-f current reading of meter M_1 .

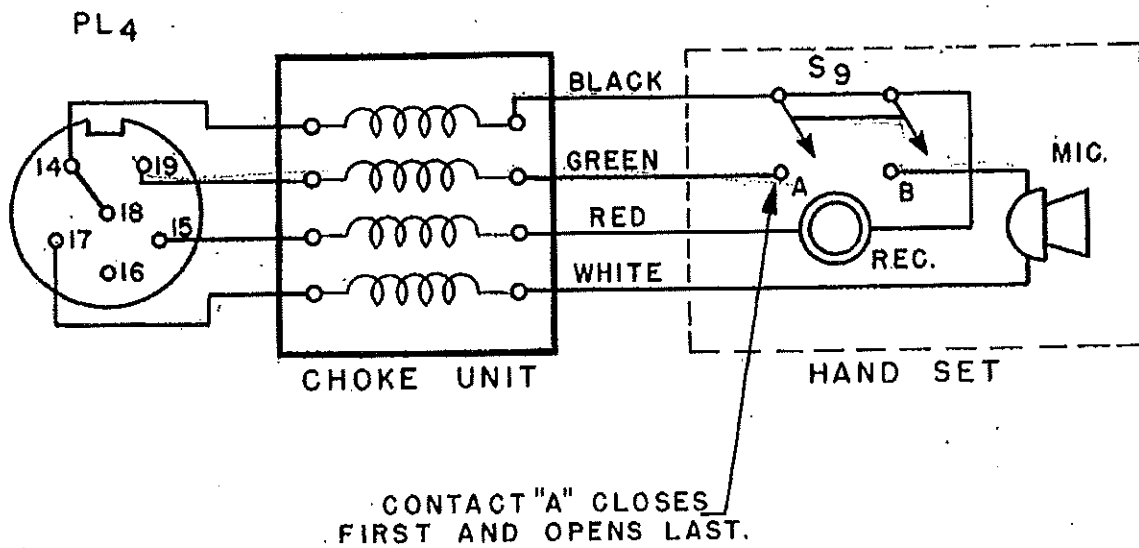
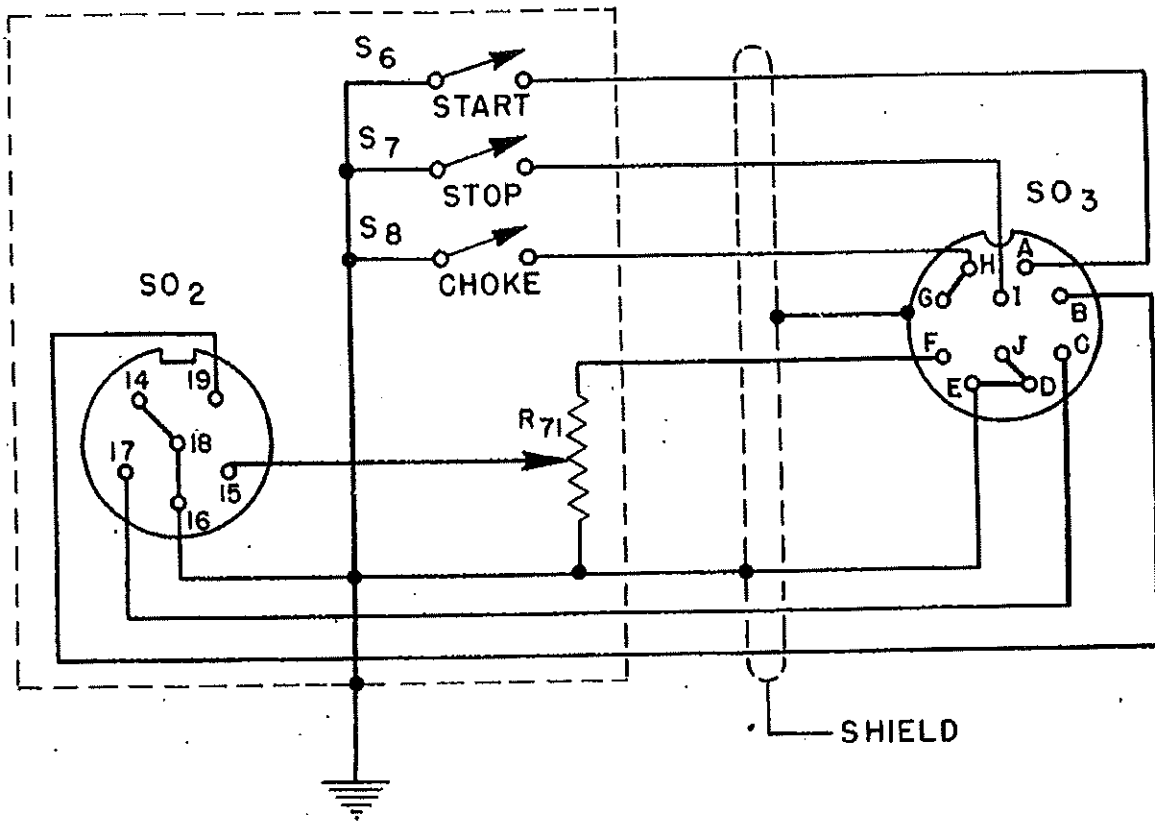


Fig. 24 - Remote Control Unit RM-21(*), Schematic Diagram.

(b) Meter M_2 functions as a milliammeter in three circuits which are selected by switch $S_{5.1}$ and $S_{5.2}$.

- (1) In position 1 meter M_2 is connected in series with the high voltage plate supply circuit of modulator tubes V_{12} , V_{13} , V_{14} and V_{15} , with resistor R_{03} as a shunt, for indicating modulator plate current.
- (2) In position 2 this meter is connected in series with the secondary of modulation transformer T_{12} in the high voltage plate supply circuit of power amplifier tubes V_8 and V_9 , with resistor R_{64} as a shunt, for indicating power amplifier plate current.
- (3) In position 3 meter M_2 is connected in the control grid circuit of tubes V_8 and V_9 through contact 7 of plug PL_1 and socket SO_1 for indicating power amplifier grid current.

19. REMOTE CONTROL UNIT RM-21-(*)

a. *Electrical Circuits*—(See figure 19.) Remote Control Unit RM-21-(*) contains circuits for the control of Power Unit PE-108-(*), switching from transmit to receive, voice modulating the transmitter, and operation of handset or microphone from a remote position.

(1) Variable resistor R_{71} is connected across the secondary of receiver output transformer T_9 through contacts F and E of connector SO_3 which connects to plug PL_3 on BC-669-(*). The movable tap on resistor R_{71} is connected to the handset receiver or headset through contact 15 of socket SO_2 and plug PL_4 , allowing the receiver audio output voltage appearing across the handset receiver or headset to be varied. The other side of the handset receiver or headset is connected to ground through contact 14 of plug PL_4 and socket SO_2 . (See figure 24.)

(2) Switch S_6 has one side connected to ground and the other side to starting relay RY_5 in Power Unit PE-108-(*) through contact A of connector SO_3 in RM-21-(*) and plug PL_3 in BC-669-(*), contact D of plug PL_2 in BC-669-(*) and plug PL_6 in PE-110-(*), and contact E of plug PL_5 in PE-110-(*) and plug PL_7 in PE-108-(*). When the switch is closed, the battery circuit to the coil of relay RY_5 is closed, and this in turn closes the battery circuit to the series cranking field of motor MT_1 . (See figures 10, 15 and 51.)

(3) Switch S_7 also has one side connected to ground. The other side is connected to magneto breaker points S_{11} in Power Unit PE-108-(*) through contact I of connector SO_3 in RM-21-(*) and PL_3 in BC-669-(*), contact H of plug PL_2 in BC-669-(*) and plug PL_6 in PE-110-(*)

and contact G of plug PL_5 in PE-110-(*) and plug PL_7 in PE-108-(*). When switch S_7 is closed the engine ignition voltage is shorted to ground stopping the engine.

(4) Switch S_8 is connected from ground to choke solenoid L_{10} in Power Unit PE-108-(*) through contacts G and H of connector SO_3 and plug PL_3 , contact C of plugs PL_2 and PL_5 and contact B of plugs PL_5 and PL_7 . On closing switch S_8 , the battery circuit is closed through solenoid L_{10} , drawing in its iron core which is attached to the engine choke lever, choking the engine.

(5) The microphone is connected to the primary of transformer T_{10} in BC-669-(*) modulator through contact 17 of plug PL_4 and socket SO_2 and contact C of connector SO_3 and plug PL_3 , causing audio frequency voltages to appear across the primary when the microphone is agitated. The microphone circuit is closed when the other side is grounded by one pole of switch S_9 through contact 14 of plug PL_4 and socket SO_2 .

(6) The other pole of switch S_9 completes the circuit of the coil of relay RY_2 to ground when closed, providing the latter with a voltage from the receiver plate supply which is dropped to the rated voltage of relay RY_2 by resistor R_{50} . This connection is made through contact 19 of plug PL_4 and socket SO_2 and contact B of connector SO_3 and plug PL_3 . The other side of switch S_9 is grounded through contact 14 of plug PL_4 and socket SO_2 . (In BC-669-B, and BC-669-C on orders No. 32780-PHILA-43 and 32781-PHILA-43 resistor R_{50} is reduced in value. Resistor R_{76} is added, one end

being connected between R_{50} and the coil of relay RY_2 , the other end being grounded. This resistor acts as a bleeder to lower the voltage on Handset switch S_9 . (See fig. 25.)

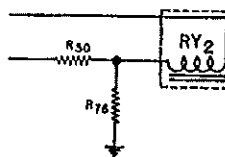


Fig. 25

20. POWER SUPPLY UNIT PE-110-(*)

a. *Electrical Design*—(Refer to figure 12.)

Power Supply Unit PE-110-(*) includes circuits for converting 115 volts a-c power to suitable filament power for the receiver and transmitter, plate power for the receiver and separate plate power for the transmitter. A circuit is also provided to furnish filament power to the receiver from a 12 volt storage battery and also convert it to suitable plate power for the receiver. (See figures 12, 26 and 27.)

(1) 115 volts A-C is supplied from Power Unit PE-108-(*) through contacts A and F of receptacle PL_3 or from a lighting power source through socket

- (1) C₉₁ not included in PE-110-A.
- (2) Ref. No. C₆₇ is C₆₂ in PE-110-A.
- (3) Ref. No. C₆₈ is C₉₁ in PE-110-A.

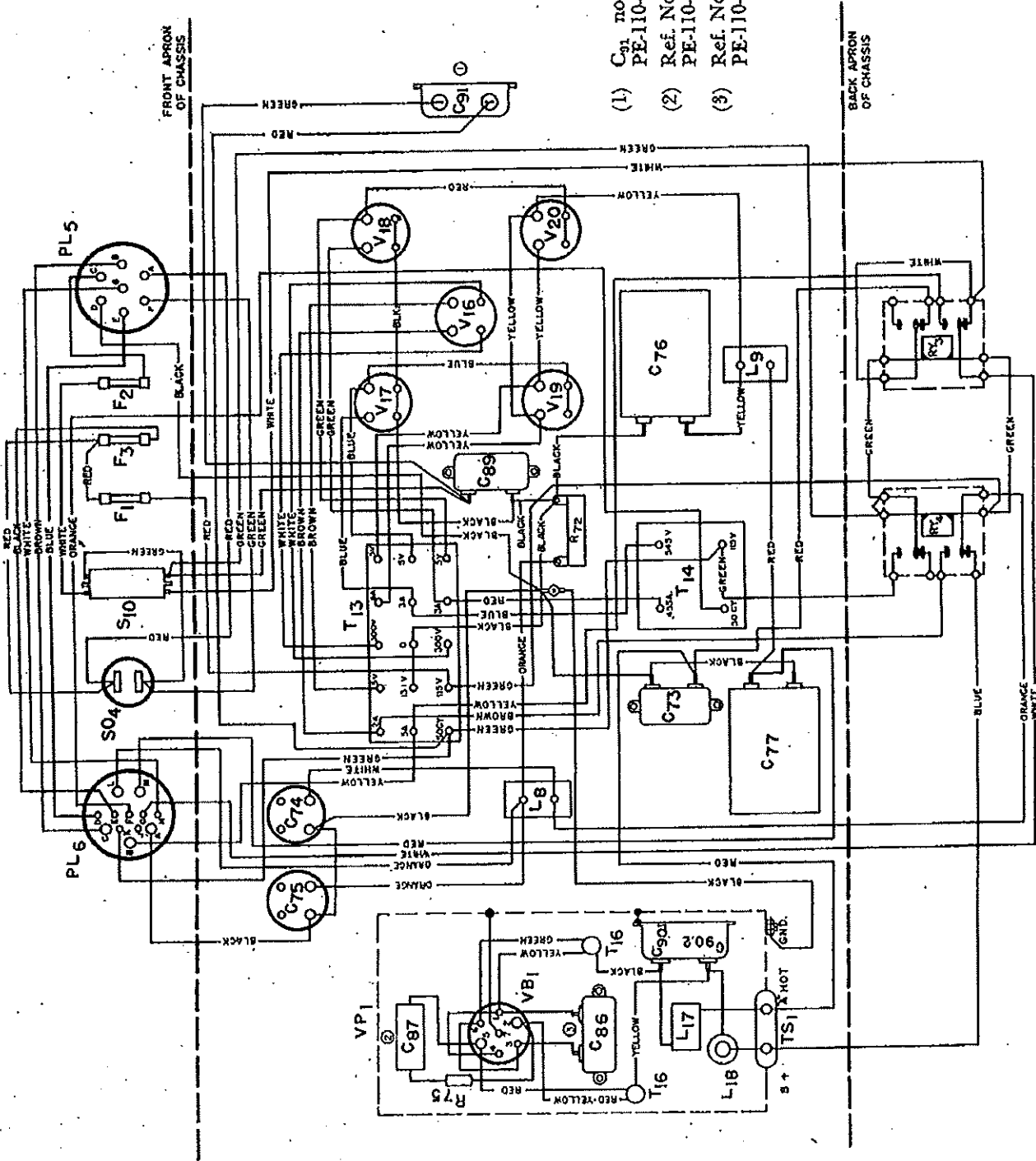


Fig. 26 - Power Supply Unit PE-110-B, Practical Wiring Diagram.

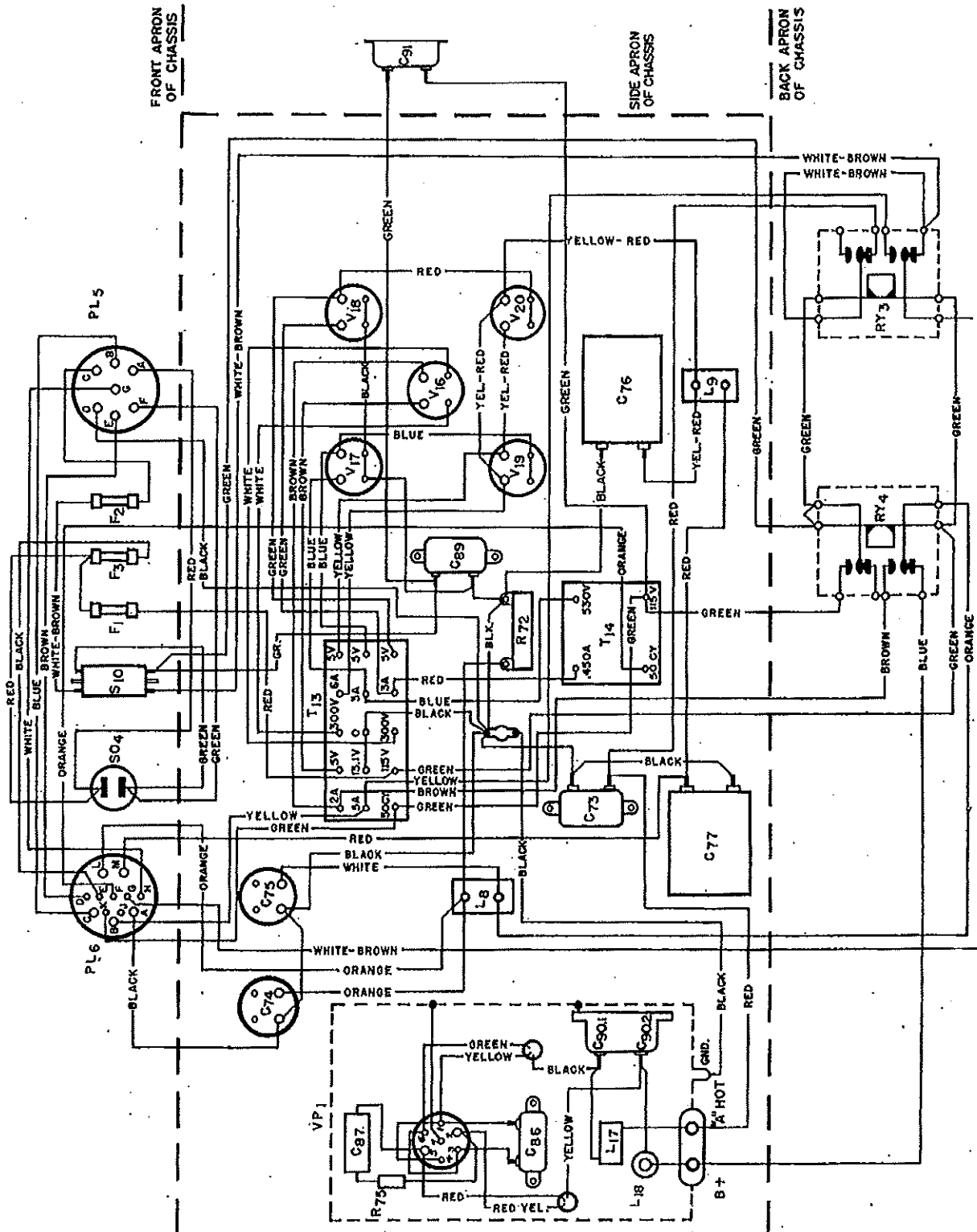


Fig. 27 - Power Supply Unit PE-110-B, PE-110-C, Practical Wiring Diagram.*

SO₄, connected across contacts A and F. One side of the a-c line connects to one side of the primary of transformers T₁₃ and T₁₄ from contact F through main power switch section S₁₀₋₁ and a set of normally open contacts in relay RY₄. In PE-110-B, and PE-110-C capacitor C₉₁ has been added as an arc suppressor for this set of contacts. (See fig. 28.)

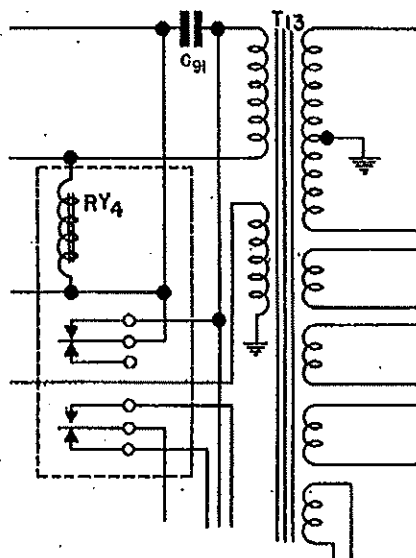


Fig. 28

The other side of the a-c line connects to the remaining side of T₁₃ primary through fuse F₁ and to the remaining side of T₁₄ primary through fuse F₂, contact E of plugs PL₃ and PL₂, a set of normally open contacts in relay RY₂, and contact F of plugs PL₂ and PL₃. This set of contacts in relay RY₂ is by-passed by capacitor C₉₃ to suppress arcing.

- (2) The coil of relay RY₁ receives its voltage from the a-c line by connection across the primary of transformer T₁₄. One side is connected through contact K of plugs PL₃ and PL₂, and contact 1 of plug PL₁ and socket SO₁. The remaining side is connected through contact F of plugs PL₃ and PL₂, and contact 3 of plug PL₁ and socket SO₁.
- (3) A 12 volt winding in transformer T₁₃ supplies filament voltage for both receiver and transmitter.

(a) The tubes of the modulator section receive their voltage through contact B of plugs PL₃ and PL₂. Tube V₁₁ is connected to receive the full 12 volts as it has a 12 volt filament. Tubes V₁₂, V₁₃, V₁₄ and V₁₅ are supplied with 6 volts a-c by series-parallel connection. In BC-669-C on all orders and BC-669-B on order No. 32780-PHILA-43 only, the above tubes are connected in a different

series parallel combination to accomplish the same purpose of the previous models. (See fig. 29.) Pilot lamp LM₁ is supplied with 6 volts a-c by voltage dropping resistor R₄₈. This lamp has the function of indicating the presence of filament power on the transmitter tubes.

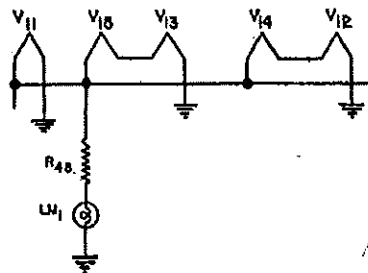


Fig. 29

- (b) Transmitter r-f tubes V₈ and V₉ receive their filament voltage by connection to the modulator tube filaments through contact 5 of plug PL₁ and socket SO₁. They are supplied with 6 volts a-c by series-parallel connection. Dropping resistor R₂₇ supplies 6 volts to the filament of tube V₁₀.
- (c) Receiver tube filament voltage is supplied through a set of normally open contacts in relay RY₃, contact G of plugs PL₃ and PL₂, and contact 4 of plug PL₁ and socket SO₁. 6 volts is obtained by series-parallel connection. The voltage is dropped to 6 volts for tube V₆ by resistor R₄₇. Pilot lamp LM₂ is supplied with 6 volts a-c from the receiver filament supply through dropping resistor R₄₉. Lamp LM₂ serves to indicate the presence of filament power on the receiver tubes.

- (4) Tube V₁₀ is a tube VT-80 (commercial type 80) which rectifies the high voltage supplied by transformer T₁₃ to furnish plate power for the receiver tubes.
- (a) A winding of transformer T₁₃ supplies 5 volts to the filament of tube V₁₅.
- (b) The rectified power is connected to a set of normally open contacts in relay RY₄ and filtered by capacitors C₇₄ and C₇₅ and by filter choke L_B. C₇₄ and C₇₅ are transposed in SCR-543-C (SCR-543-B on order No. 32780-PHILA-43 also) See Fig. 30. Resistor R₇₂ acts as a bleeder resistor to assist in maintaining a constant voltage and to drain off any voltage remaining when the plate power is removed.

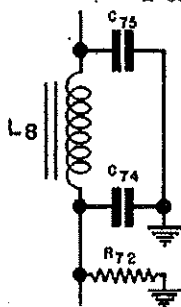


Fig. 30

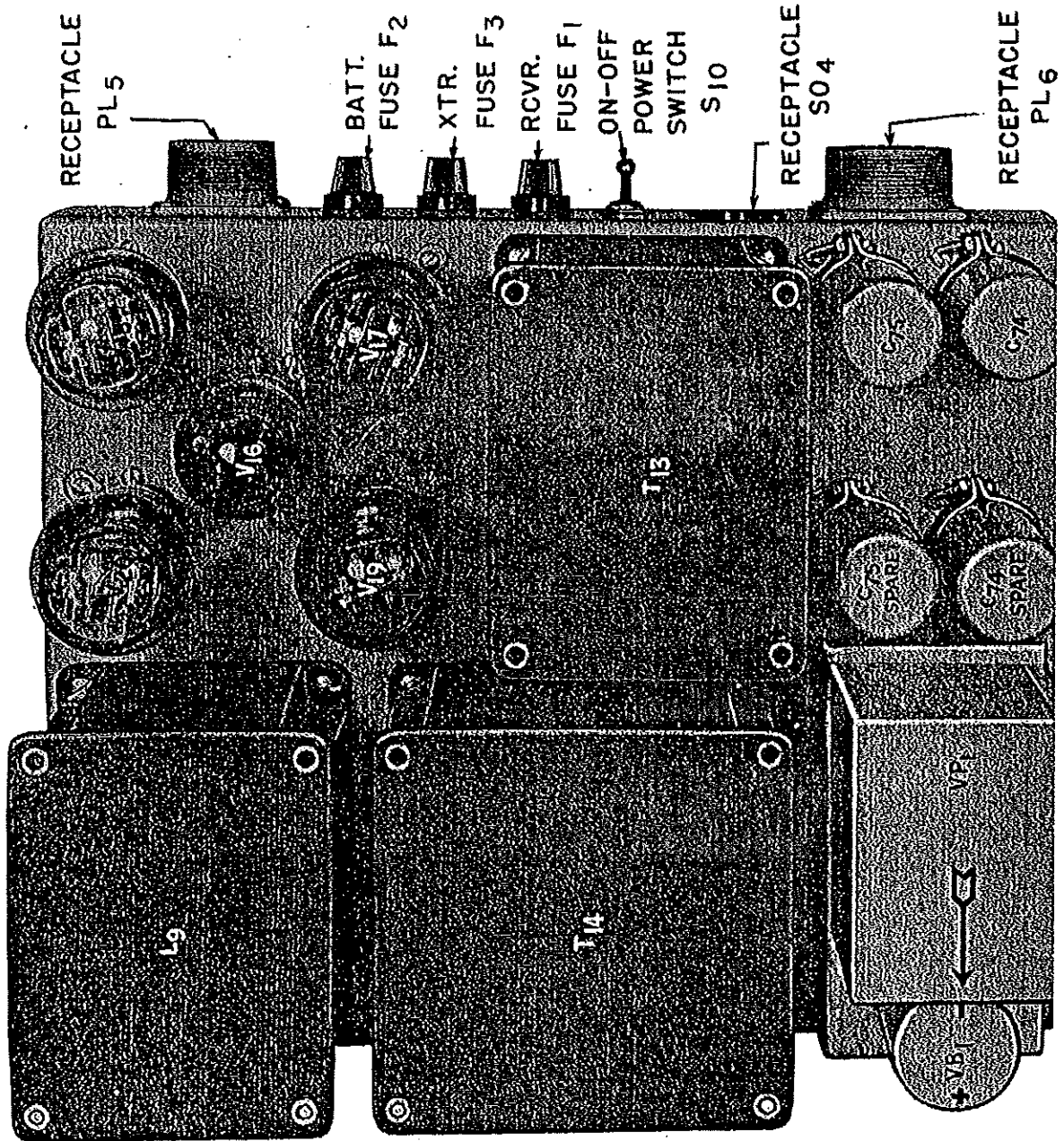


Fig. 31 - Power Supply Unit PE-110-(*), Top View of Chassis.

SECTION IV — MAINTENANCE

21. MAINTENANCE OF RADIO COMPONENTS.—

a. Routine Maintenance

The radio set components should be periodically cleaned and checked for tightness of connections, etc. Any dust that accumulates on the interior should be blown out. Tubes and crystals should be firmly seated in their sockets.

b. Normal meter readings.

D. C. CURRENT

Meter switch set at MOD. PLATE — 200 — 230 ma.

Meter switch set at P.A. PLATE — 150 — 210 ma.

Meter switch set at P.A. GRID — 4 — 6.5 ma.

ANTENNA CURRENT

1800 k.c. 1—1.5 amps.

4000 k.c. 1—1.5 amps.

c. Radio Receiver and Transmitter BC-669.(*)—

(1) To replace tubes in the r-f chassis.

(a) Open the top lid of Chest CH-133.(*)

(b) Raise the lid of the metal cabinet giving access to all tubes in the r-f compartment.

(c) Loosen screw to release tension on tube clamps (used on BC-669-B, and BC-669-C only) if tube V_{10} or V_{13} is removed.

(d) Insert new tube and tighten clamp.

(e) Lift bracket of tube hold-down bracket (used on BC-669-B, and BC-669-C only) on tubes V_8 and V_9 high enough to clear the tube caps, turn bracket 90 degrees and remove tube.

(f) Insert new tube and replace bracket.

(2) To replace crystals (transmitter or receiver).

(a) Open the top lid of Chest CH-133.(*)

(b) Raise the lid giving access to the r-f compartment.

(c) Loosen knurled screws on crystal hold-down bracket. Slide bracket to the side and remove desired crystal or crystals.

(d) Insert new crystal, or crystals, and replace bracket.

(3) Replacement of Parts.—To replace parts, the radio receiver and transmitter must be removed from Chest CH-133.(*) and separated from the modulator chassis as follows:

(a) Lay the chest on its back.

(b) Unsnap the six snap fasteners (or draw-bolt clamps) holding the receiver and transmitter to the bottom pan. (Refer to Par. 9 a. (5).)

(c) Lift up and out by the two front panel handles.

CAUTION: Pull evenly on both handles or damage may result to the banana plug located on the mounting pan.

(d) Unsnap the four snap fasteners holding the r-f section to the modulator.

(e) Reach inside and detach plug

(f) Lift off the r-f section.

(g) Don't remove metal case (all work done with case on).

(4) Replacement of antenna loading coil

(a) Unsolder six leads on coil studs the two leads at the lugs mounted the coil form.

(b) Remove the three screws holding coil form to the chassis.

(c) Loosen tank coil L_3 by unscrewing the three nuts holding L_3 and (don't remove nuts completely that L_3 can be shifted to one side)

(d) Hold tank coil L_3 to one side, antenna loading coil L_4 out, replace with new coil. Put tank coil L_3 into position and tighten down fully to base.

(5) Replacement of tank coil L_4 .

(a) Unsolder 12 leads from studs of tank coil L_4 .

(b) Remove 3 nuts holding coil form chassis.

(c) Lift out coil and insert new coil

(d) Remount new coil to chassis solder leads.

(6) Replacement of relay RY_1 .

(a) Remove all accessible leads soldered to the lugs on the relay and unscrew the two screws holding the relay to the partition.

(b) Lift the relay away from the partition and unsolder the remaining leads.

(c) Solder leads removed at Par. 21 c. (b) above to the relay before mounting. Then screw down to the partition and solder wires.

(7) Replacement of i-f coils.

(a) First remove coil shield by taking off the nuts holding the coil shield to the base.

(b) Remove slug mounting nuts, all turning slugs all the way in, on side of the shield holding the coil the can. Lift off shield.

(c) Unsolder leads from coil lugs, insert the coil itself and NOT at the tube sockets or tie lugs. Replace with new coil after removing its shield

CAUTION: Don't try to jerk or pull wires when removing them from soldered lugs. A heated lug breaks very easily. To remove a wire from a lug, first find the hot end and untwist it gradually from its lug while applying heat.

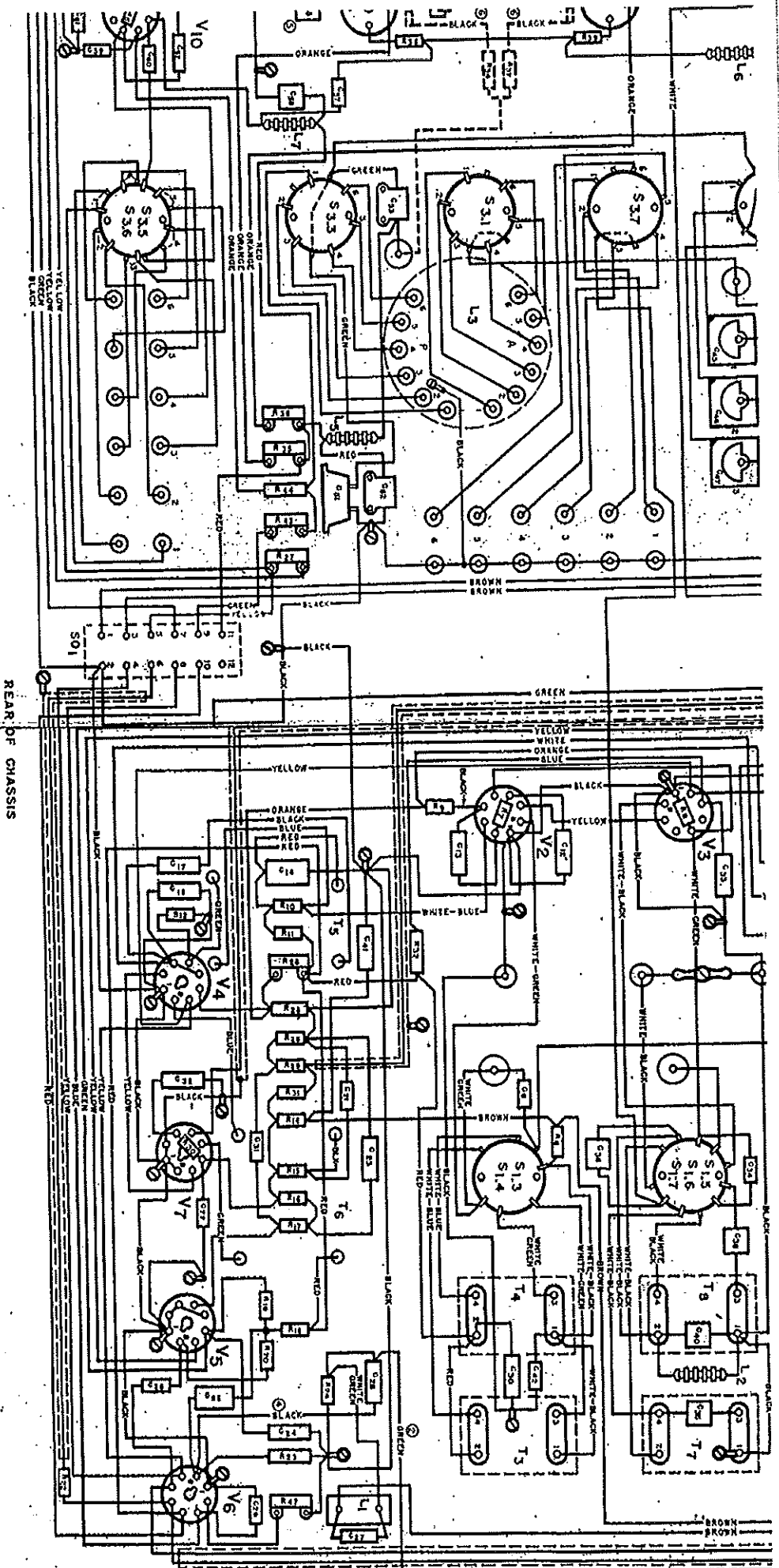
(d) Replace can, tighten coil to shield with slug nuts and mount back to chassis.

(8) Replacement of r-f coils.

(a) Disconnect leads from coil lugs and remove coil assembly from chassis.

- (b) Mount new coil on chassis, replace wires and resolder.
- CAUTION:** Do not overheat lugs as solder will drop down lug eyelet into coil and short out coil winding.
- (9) Replacement of ANTENNA CURRENT meter.
- (a) Take off the two nuts holding the two wires to the back of the meter. Remove the three screws holding the meter to the metal cabinet and take out meter.
- (b) Mount and screw down the new meter. Tighten the two leads to the terminals on the back of the meter.
- (10) Replacement of RECEIVER BAND-SWITCH.
- (a) Take out the three shield partitions by removing the three screws holding down each partition.
- (b) Remove all wires (to aid you in connecting these wires to the new switch mark the leads with tags, or use the practical wiring diagram, or another chassis as a sample). Take off the following: knob; the nut holding down the rear bracket to the chassis; the nut holding the switch to the front panel and lift out defective switch.
- (c) Mount new switch to base, replace and solder wires. Put shield partitions back on.
- (11) Replacement of ceramic wafers on CHANNEL SWITCH.—It is easier to replace wafers than to remove the whole switch; in doing this, proceed as follows:
- (a) Unsolder all leads from the defective wafer.
- (b) Remove the four nuts located at the front end of the switch. The two rods at each side of the switch can now be pulled out.
- (c) Take off the inner "C" washer on the switch shaft, loosen the coupling and remove the shaft. Remove the defective wafer and replace new wafer in exactly the same position as the one taken out.
- (d) Line up all switch centers. Gently ease the switch shaft thru the switch centers (these switch centers are easily damaged so be careful).
- (e) Replace the "C" washer on the switch shaft. Insert the two rods and secure them into place with nuts.
- (f) Align the CHANNEL SWITCH with the high voltage switch and tighten the coupling set screws.
- (g) Connect and solder leads back on the wafer.
- (h) Dress all leads to prevent shorts. Inspect wiring when finished.
- (12) Replacement of P. A. PLATE TUNING capacitors C₄₆ to C₅₀.
- (a) Capacitors for either channel 4, 5 or 6 are removed by first unscrewing the two nuts on capacitor 1, 2 or 3 whichever capacitor is above the one you have to remove.
- (b) Do not remove any wires from the capacitor on the top row, just lay the capacitor and its respective wires to the back of the chassis.
- (c) Disconnect the leads from the defective capacitor by removing the nuts holding the rotor and stator leads down. Remove the wires and lift capacitor from its mounting.
- (d) Insert new capacitor. Mount to chassis and bolt down leads.
- (e) Replace top capacitor not disconnected and redress all leads.
- (13) Replacement of ANTENNA TUNING capacitor.
- (a) Loosen P. A. PLATE TUNING capacitors for channels 2 and 5. Move them back about 1/4". (One screw holding down the ANTENNA TUNING capacitor is directly under these two capacitors.)
- (b) Remove the two screws (one is reached by moving the P. A. PLATE TUNING capacitor back, the other is located behind this capacitor) holding the capacitor to the chassis.
- (c) Unsolder the lead at the rear of the capacitor. Take off the nut holding the lead down at the stator section and remove the lead.
- (d) Remove the capacitor and reassemble the ceramic stand-offs to the new one.
- (e) Mount the unit to the chassis (be sure to put the cork washers back on the stand-offs, otherwise they will crack when tightened down) and screw down firmly.
- (f) Tighten the nuts down on P. A. PLATE TUNING capacitors. Check leads for shorts.
- (g) Wire and solder lead to the rotor lug. Place wire on stator terminal screw and tighten down with nut.
- (14) Replacement of tubes in modulator.
- (a) The tubes in the modulator compartment may be reached through the rear of the cabinet when the radio receiver and transmitter is out of Chest CH-133-(*) and also from the top of the cabinet when the r-f chassis is removed.
- (b) Loosen screw to release tension on tube clamps (used on BC-669-B, C only) if tube V₁₂, V₁₃, V₁₄ or V₁₅ is removed.
- (c) Insert new tube and tighten clamp.
- (15) Replacement of relay RY₂.
- (a) Unsolder leads. Remove the two screws holding down relay and take out relay.





whitened in BC-669-A.
 white-green in BC-669-A.
 t included in BC-669-A.
 white in BC-669-A.
 t included in BC-669-A.

Fig. 33 - Radio Receiver and Transmitter BC-669-P.R.F. Section and Receiver, Practical Wiring Diagram.

- (6) Coded green in BC-669-A.
- (7) In BC-669-A, R₄₀ connected to ground through same set of contacts in RY₁ as R₄₁.
- (8) M₁ connected between L₁ and RY₁ in some BC-669-A units.

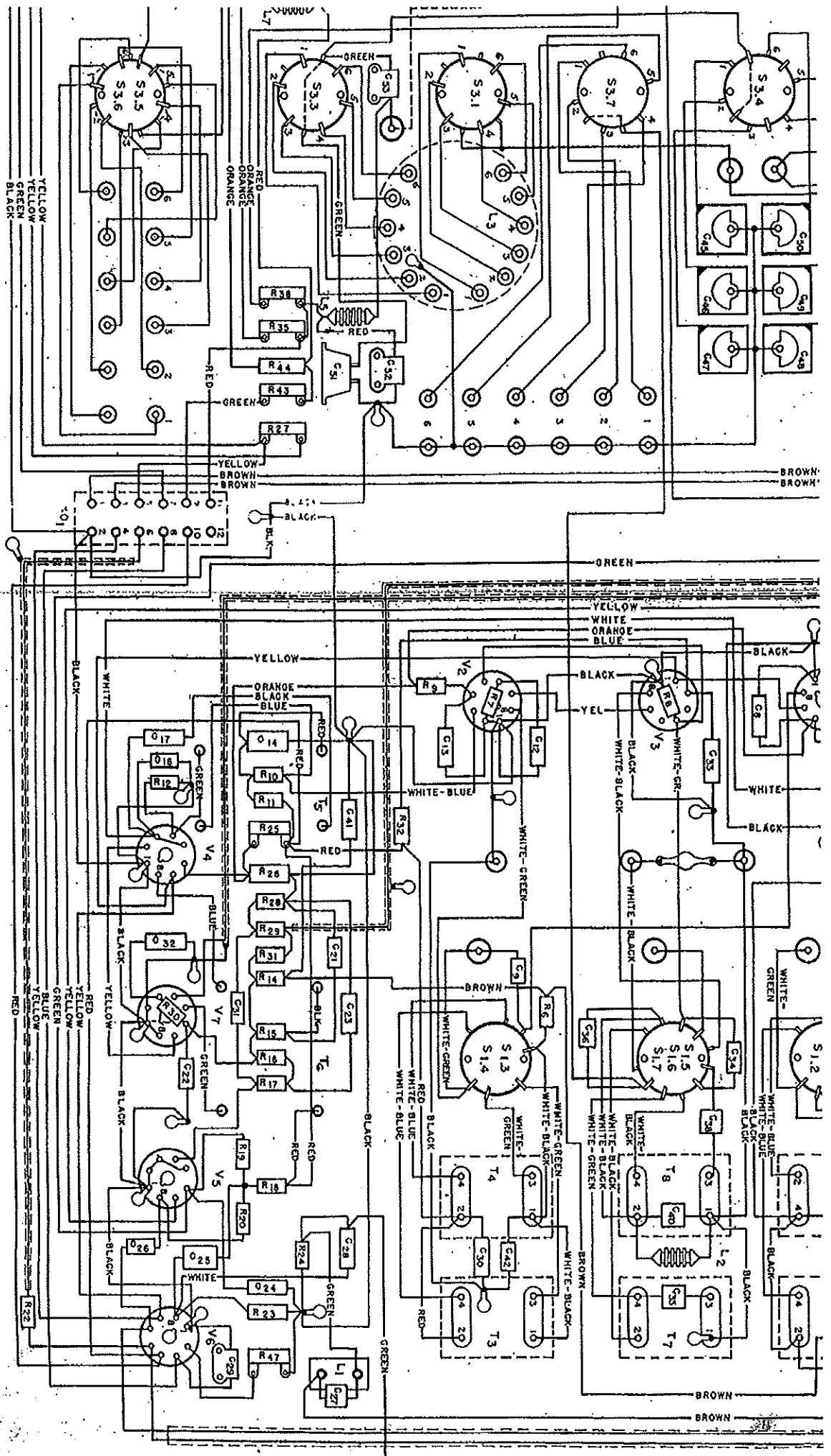
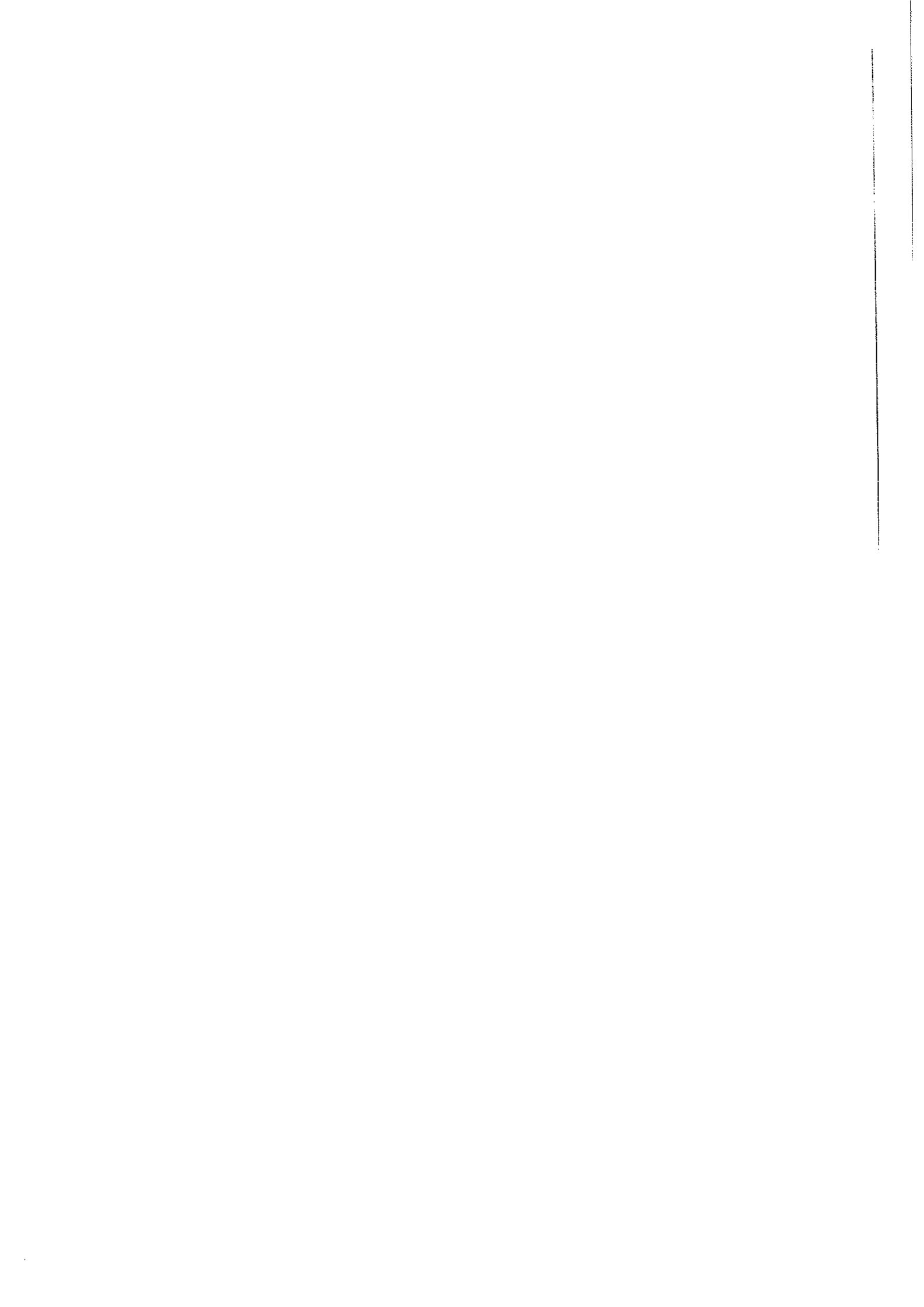


Fig. 34 - Radio Receiver and Transmitter W. 669-B, C. R. F. Section and Receiver, Practical Wiring Diagram.



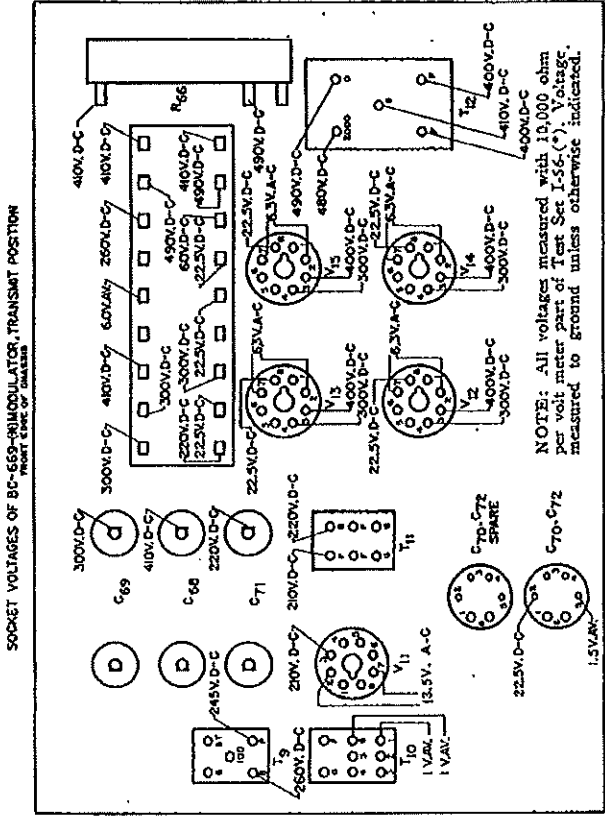
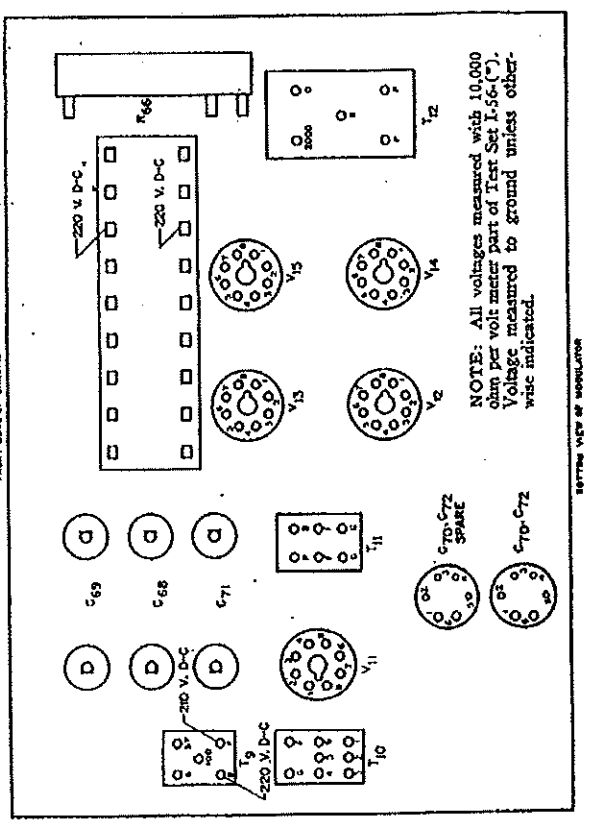
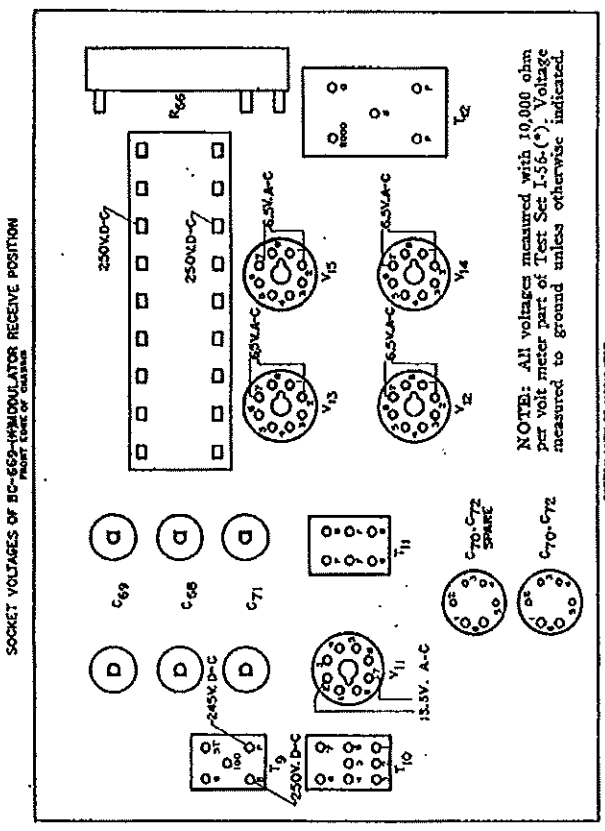


Fig. 35 - Transmitter Modulator Section Tube Socket Layout Diagrams Showing Voltages.

- (b) Mount new relay. Connect leads and solder (do not let solder run into terminals as shorts will occur).
 - (16) Replacement of speaker LS₁.
 - (a) Unsolder leads from switch S₄. Remove the four nuts holding speaker to front of cabinet.
 - (b) Mount new speaker. Connect and solder leads to switch S₄.
 - (17) Replacement of capacitors C₇₀, C₇₂.
 - (a) Loosen screw to release tension on electrolytic clamps. Remove defective electrolytic and replace with spare mounted next to it.
 - (b) Tighten clamp.
 - (18) Replacement of capacitor C₆₈, C₆₉ or C₇₁.
 - (a) Remove hold-down brackets on side of capacitor. Disconnect leads and lift out.
 - (b) Obtain spare from Chest CH-73, mount with hold-down brackets.
 - (c) Connect and solder leads.
 - (19) Replacement of meter M₂.
 - (a) Disconnect meter by removing two nuts from terminals on the back of it and lift off the two leads.
 - (b) Remove meter from panel by unscrewing the three screws.
 - (c) Mount new meter on panel and connect the two leads.
- CAUTION:** Replaced leads must be put on the terminals with correct polarity or the meter will be damaged.
- (20) Replacement of receptacles PL₂ or PL₃.

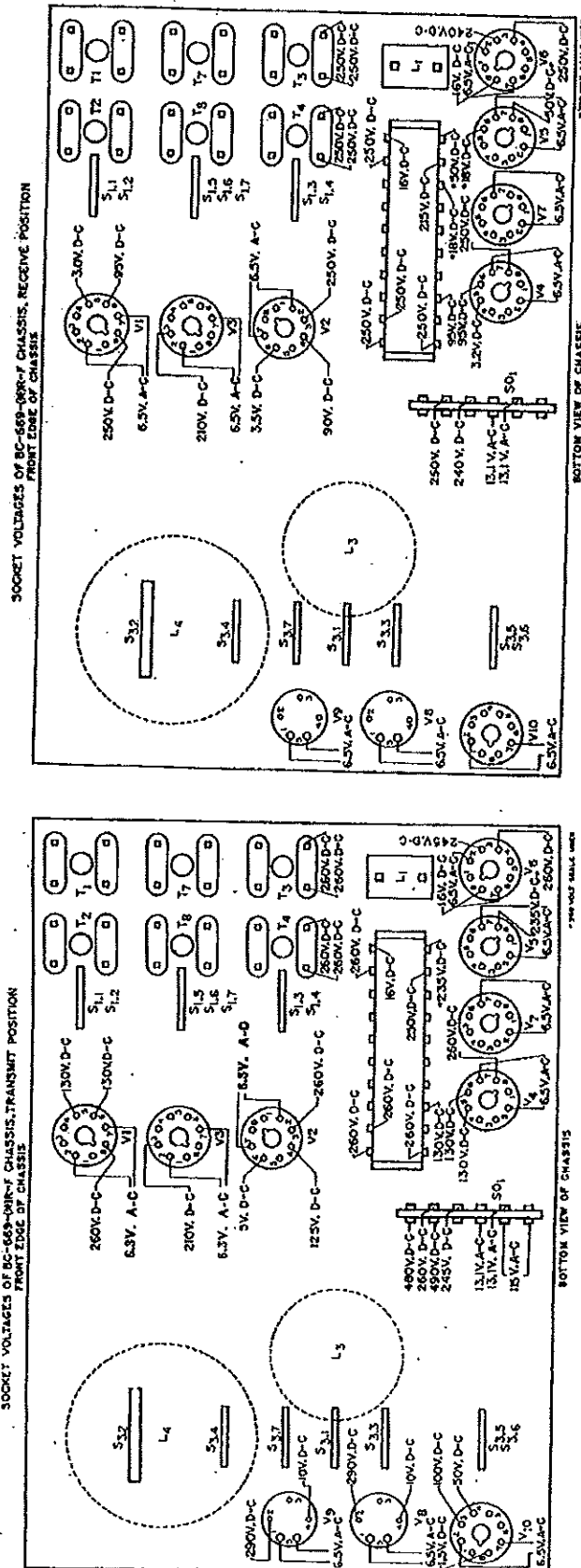
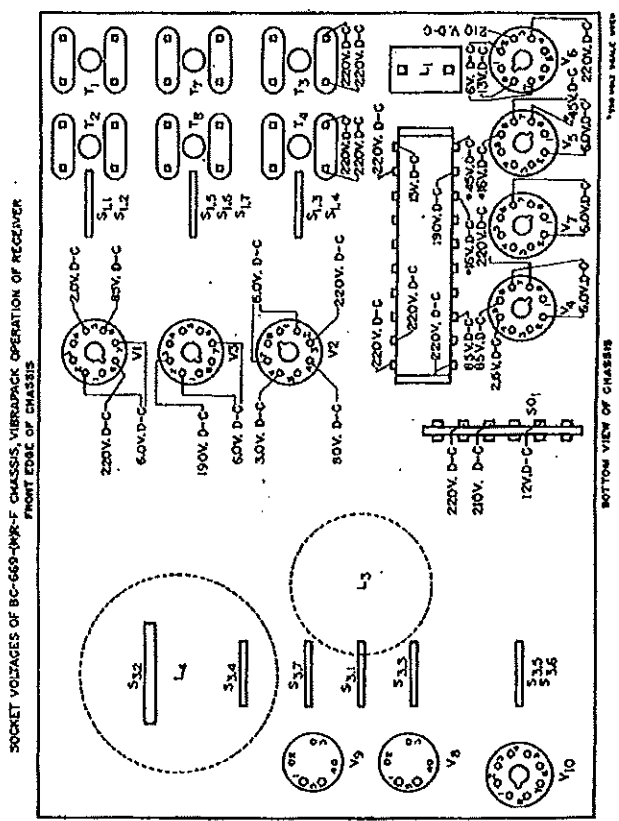


Fig. 36 — Transmitter R-F Section and Receiver Tube Socket Layout Diagrams Showing Voltages.

NOTE: All voltages measured with 10,000 ohm per volt meter part of Test Set I-56-(*). Voltage measured to ground unless otherwise indicated.



- (a) Remove the four mounting screws.
- (b) Lay receptacle to one side with leads connected.
- (c) Mount new receptacle into position, using the four mounting screws.
- (d) Transfer wires from defective receptacle to the one newly mounted.
- (21) Replacement of pilot lamps.
 - (a) Unscrew the glass jewel from the front of the panel.
 - (b) Using the fingers, press in, turn and remove the pilot lamp. (Its socket is of the bayonet catch type.)
 - (c) Insert new pilot lamp and replace glass jewel.
- d. Power Supply Unit PE-110-(*).
 - (1) To replace fuses.
 - (a) Unscrew the black knurled bakelite knobs on the front of the power unit.

- (b) Remove old fuse.
- (c) Insert new fuse into the holder mounted on the chassis front.
- (d) Screw the knob back into place.
- (2) To replace tubes, it is necessary to remove Power Supply Unit PE-110-(*) from Chest CH-132-(*) and remove the top metal cover. The unit slides out of the chest after lifting the latches on either side. It remains attached to a wooden base by the shock-mounts, and the metal cover may be lifted off after removing the screws around its sides. A screwdriver for doing this may be found in the tool box located in Chest CH-73-(*). If tube clamps are used loosen screw to release tension of clamp and remove tube. Insert new tube and retighten clamp.

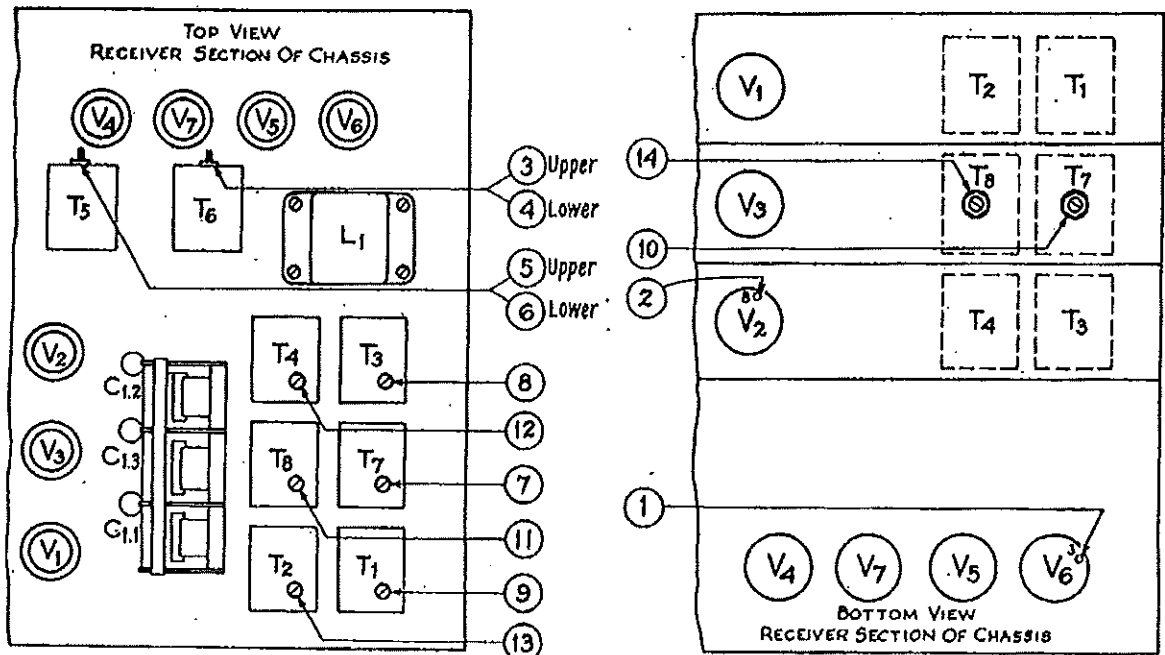
22. **PRETUNING CHANNELS.**—All pretuning adjustments for operation on frequencies outlined in par. 8. g. have been made at the manufacturer's plant before shipment. However, if new channels are to be used, or if adjustments have been altered during servicing, follow instructions outlined below:

- a. **Receiver.**—No adjustments need be made on the receiver to pretune it other than to plug the desired crystals (in Crystal Holders FT-171-B) into the proper crystal sockets. Figure 12 shows the location of the receiver crystal sockets. The sockets are numbered to correspond to the position of the OPERATING CHANNEL switch. The receiver crystal frequency must differ from the desired receiving frequency by 385 kc. For example, if it is desired to receive on a frequency of 2280 kc. in Channel 3, a crystal having a frequency of 2665 kc. (or 1895 kc.) is plugged into receiver crystal socket No. 3.
- b. To pretune receiver, proceed as follows:
 - (1) Unlatch and lift open cover door in top of Chest CH-133-(*).
 - (2) Unlatch and lift open top cover door in the metal cabinet within the chest.
 - (3) Plug crystal of proper frequency into the receiver crystal socket whose number corresponds with the number of the channel selected for operation.
- c. **Receiver alignment.** (See fig. 37.)
 - (1) Check all frequencies set on signal generator with frequency meter.
 - (2) Modulate signal generator.
 - (3) Turn A. F. GAIN control full on.
 - (4) Turn SPEAKER switch ON.
 - (5) Turn STATIC FILTER switch OFF.
 - (6) Turn NOISE CONTROL full on.
 - (7) Connect "low" side of signal generator to chassis.
 - (8) Connect output meter through series capacitor to V_0 plate (1) and chassis.
 - (9) I-F alignment.
 - (a) Set signal generator to 385 kc.
 - (b) Connect "high" side of signal generator to grid of V_2 (2). Use 0.001 uf capacitor in series.

- (c) Adjust sec. (3) and pri. (4) of T_6 for maximum output.
 - (d) Adjust sec. (5) and pri. (6) of T_5 for maximum output.
 - (e) Repeat (c) and (d). I-F is now aligned.
- (10) **R-F alignment, 1700-2700 kc. band.**
- (a) Set RECEIVER BAND SWITCH on MANUAL 1 and the tuning dial to 2700 kc.
 - (b) Set signal generator to 2700 kc., and connect "high" side to antenna post with 150 uuf capacitor in series.
 - (c) Adjust C_{37} in T_7 (7), C_{10} in T_3 (8), and C_3 in T_1 (9), for maximum output.
 - (d) Set signal generator to 1800 kc. and RECEIVER TUNING dial to 1800 kc.
 - (e) Check receiver calibration and sensitivity. If there is appreciable loss of sensitivity or miscalibration, follow par. c. (10) (f) and (g).
 - (f) Adjust slug T_7 (10) for maximum output.
 - (g) Repeat par. c. (10) (a) to (c) and (d) to (f) if necessary. The 1700-2700 kc. band is now aligned.
- (11) **R-F alignment, 2700-4400 kc. band.**
- (a) Set RECEIVER BAND SWITCH on MANUAL 2, the tuning dial to 4400 kc. and signal generator to 4400 kc.
 - (b) Adjust C_{39} in T_8 (11), C_{11} in T_4 (12) and C_3 in T_2 (13) for maximum output.
 - (c) Set RECEIVER TUNING dial to 2900 kc. and the signal generator to 2900 kc.
 - (d) Check receiver calibration and sensitivity. If there is appreciable loss of sensitivity or miscalibration, follow par. c. (11) (e) and (f).
 - (e) Adjust slug in T_8 (14) for maximum output.
 - (f) Repeat par. c. (11) (a) to (c) and (d) to (e) if necessary. The receiver is now aligned.
- d. **Transmitter.**—Figure 38 shows the location of the transmitter crystal sockets and tuning components. Crystals (in Crystal Holders FT-171-B) having the same frequencies as the desired transmitter operating frequencies should be used. The crystal sockets are numbered to correspond to the positions of the OPERATING CHANNEL Switch. Design of the equipment does not require that the crystals be arranged in any particular order, although they are usually arranged in order of frequency for convenience in referring to the tuning chart on the front panel. The following adjustments have already been made on this transmitter at the time of manufacture. They need not be disturbed unless it is necessary to change the operating frequencies.

RECEIVER ALIGNMENT

All frequencies set on signal generator are to be checked with frequency meter.
 Signal generator is modulated.
 A.F. Gain control full on.
 Speaker on.
 Static Filter off.
 R.F. Gain or Noise Control full on.
 Connect "low" side signal generator to chassis.
 Connect output meter through series capacitor to V_6 plate (1) and chassis.



I-F Alignment

1. Set signal generator to 385 kc.
2. Connect "high" side signal generator to grid V_2 (2). Use 0.001 μ f capacitor in series.
3. Adjust sec (3) and pri (4) of T_6 for maximum output.
4. Adjust sec (5) and Pri (6) of T_5 for maximum output.
5. Repeat 3 and 4.

I-F is now aligned.

1700-2700 kc. R-F Alignment

6. Set Receiver Band Switch on Manual 1. Tuning dial at 2700 kc.
7. Set signal generator to 2700 kc. and connect high side to antenna post with 150 μ f capacitor in series.
8. Adjust C_{37} in T_7 (7), C_{10} in T_3 (8), and C_3 in T_1 (9), for maximum output.
9. Set signal generator to 1800 kc. and receiver tuning dial to 1800 kc.
10. Check receiver calibration and sensitivity. If there is appreciable loss of sensitivity because of miscalibration follow steps 11 and 12.

11. Adjust slug T_7 (10) for maximum output.
12. Repeat steps 6 to 8 and then steps 9 to 11 if necessary.

The 1700-2700 kc. band is now aligned.

2700-4400 kc. R-F Alignment

13. Set Receiver Band Switch on Manual 2, the tuning dial to 4400 kc. and signal generator to 4400 kc.
14. Adjust C_{30} in T_8 (11), C_{11} in T_4 (12), and C_6 in T_2 (13), for maximum output.
15. Set receiver tuning dial to 2900 kc. and the signal generator to 2900 kc.
16. Check receiver calibration and sensitivity. If there is appreciable loss of sensitivity or miscalibration, follow steps 17 and 18.
17. Adjust slug in T_8 (14), for maximum output.
18. Repeat steps 13 to 15 and 16 to 17 if necessary.

The receiver is now aligned.

Fig. 37 - Receiver Alignment Chart.

e. To pretune transmitter, proceed as follows:
(See Figure 38).

- (1) With Radio Set SCR-543(*) connected for operation and supplied with a-c power, turn the ON-OFF switch of Power Supply Unit PE-110(*) to ON.

WARNING: This equipment uses **HIGH VOLTAGES** which will give **SEVERE SHOCK** or **CAUSE DEATH** if touched. High r-f **VOLTAGES** can cause **PAINFUL BURNS**. Do not touch the antenna or antenna connections while operating. The r-f voltage at the antenna is the only exposed voltage. When you have the top cover of the transmitter open, other r-f voltage points are exposed. Always close your cover before turning on power to the transmitter. With transmitter or power supply unit removed from carrying chests for servicing, both r-f and d-c voltages are exposed. Don't try to make any service adjustments unless you know all about this equipment.

- (2) On the transmitter, plug crystal of desired frequency into the transmitter crystal socket whose number corresponds with the channel number selected for operation.
- (3) Turn the OPERATING CHANNEL switch to selected channel number.
- (4) Remove the cover plate under the inscription P.A. PLATE TUNING. This permits access to the plate tuning capacitor shafts.
- (5) Move the sliding contactor (whose number corresponds to the channel number) on the A side of the plate tank coil L₃ down to the bottom of the coil.
- (6) Move the sliding contactor on the P side under numbered position corresponding to the channel number, to approximately the center of the coil.
- (7) Remove the cover plate over the inscription METER SWITCH and set the switch to position marked P. A. PLATE.
- (8) Turn the transmitter on by pressing the press-to-talk switch on hand-set or microphone, (DC CURRENT meter will now indicate some value).
- (9) Use the 1/2 inch socket wrench provided in the tool box to unlock the shaft of the plate tuning capacitors by loosening the locking nut. Using a screwdriver, turn the slotted shaft of the plate tuning capacitor, whose number corresponds to the channel number, until the plate current is a minimum. Note: When the slot is horizontal the capacity is at mid-value. Do not turn it past the vertical position.
- (10) Turn the transmitter off and move the same "P" sliding contactor on the plate tank coil L₃ a few turns toward the top.
- (11) Repeat (8), (9) and (10) and continue these readjustments until the plate cur-

rent dips to a minimum and rises again while the plate tuning capacitor is being turned in one direction, but thru not more than 180°, during which the slot must not turn past vertical.

- (12) Then set the shaft to the position producing a minimum plate current. (This will be about 40 to 60 ma.) If no minimum is obtained repeat the above procedure, moving the sliding contactor downward, however, instead of upward!
- (13) Repeat the above procedure with any remaining channels, whose frequency it is desired to change.
- (14) Adjust the antenna circuit in the following manner:

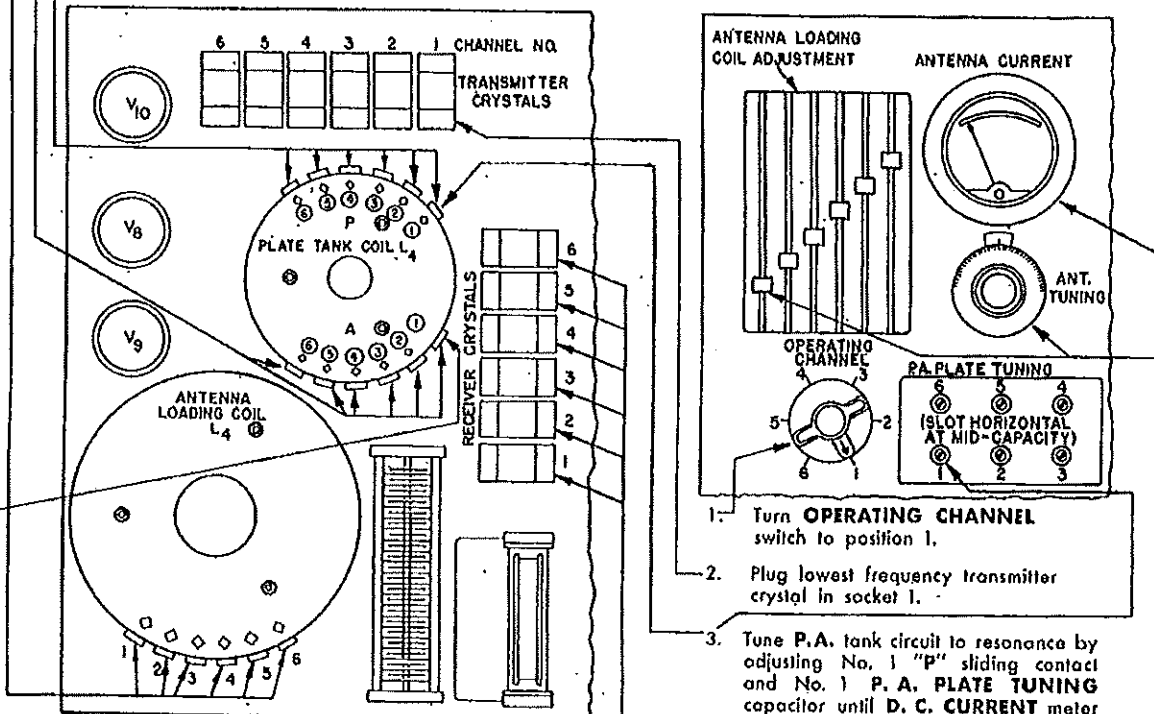
- (a) Set the OPERATING CHANNEL switch to the channel number selected for tuning.
- (b) Move the corresponding numbered sliding contactor on the A side of the plate tank coil L₃ up approximately five turns.
- (c) Open the door marked ANTENNA LOADING ADJUSTMENT.

Note: The antenna must be connected to the antenna post of the transmitter from here on.

- (d) Move the sliding contactor (whose number corresponds to the channel number), on antenna loading coil L₄ approximately half-way up the coil.
- (e) Turn the transmitter on by pressing the press-to-talk switch of the hand-set or microphone.
- (f) Turn ANTENNA TUNING knob until the ANTENNA CURRENT meter reads maximum, then release press-to-talk switch. If the reading goes thru a maximum and then dips while the ANTENNA TUNING dial is turned from 0 to 100 on its scale, the antenna tuning is correct when set for the maximum ANTENNA CURRENT meter reading.
- (g) If no maximum is reached, move the same antenna loading coil sliding contactor up or down, repeating (e) and (f) until the ANTENNA CURRENT meter goes thru a maximum, then set the dial for this maximum. If maximum ANTENNA CURRENT is reached as the ANTENNA TUNING dial is rotated past 0, move the sliding contactor up one turn at a time. If the maximum is reached as the dial is rotated past 100, move the sliding contactor down one turn at a time.
Caution: Do not be misled by a false maximum caused by passing 0 or 100 on the ANTENNA TUNING dial.
- (h) Press the press-to-talk switch for one or two seconds and note the D.C.

TRANSMITTER PRESETTING

Remove plate under P. A. PLATE TUNING; leave antenna disconnected.
 Remove plate over METER SWITCH and set to P. A. PLATE.
 Open ANTENNA LOADING COIL ADJUSTMENT door.
 Set all ANTENNA LOADING COIL sliding contacts to mid-position.
 Set all "A" sliding contacts to bottom position.
 Set all "P" sliding contacts to mid-position.



4. Repeat 1 to 3 above for channels 2 through 6, turn OPERATING CHANNEL switch to corresponding positions in turn.
5. Reset OPERATING CHANNEL switch to position 1.
6. Set No. 1 "A" sliding contact 6 turns up from bottom.
7. Connect antenna and tune circuit to resonance, by adjusting ANTENNA TUNING knob and No. 1 sliding contact on antenna A. loading coil until maximum ANTENNA CURRENT meter reading is obtained.
8. If necessary adjust No. 1 "A" sliding contact and retune antenna circuit as in 7 above

1. Turn OPERATING CHANNEL switch to position 1.
2. Plug lowest frequency transmitter crystal in socket 1.
3. Tune P.A. tank circuit to resonance by adjusting No. 1 "P" sliding contact and No. 1 P. A. PLATE TUNING capacitor until D. C. CURRENT meter dips to a minimum (40 to 60 ma.).

CAUTION: Make sure sliding contacts do not short-circuit turns. Erratic behavior indicates improper sliding contact setting.

until D. C. CURRENT meter reads between 150 to 210 ma. ANTENNA CURRENT meter should read from 1.2 to 1.5 amperes.

9. Repeat 5 to 8 above for channels 2 through 6, turn OPERATING CHANNEL switch to corresponding positions in turn
10. Repeat 3 through 8 on all channels making slight readjustment where necessary.

RECEIVER PRESETTING

Plug receiving crystals into receiving crystal sockets. That is all that is required for operation on CRYSTAL 1 or CRYSTAL 2.

Each receiving crystal is 385 KC higher than the corresponding transmitting crystal of the same channel number, except for channel 6 which is 385 KC lower

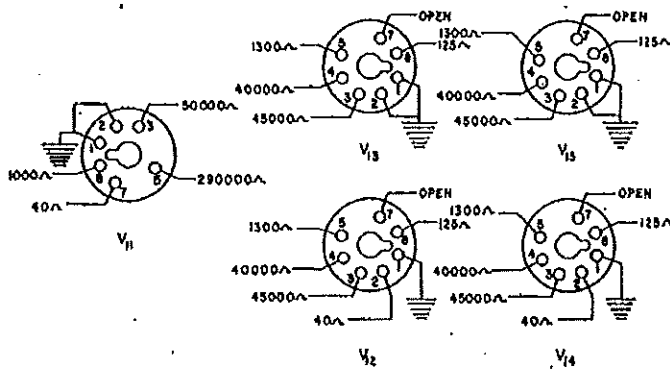
Fig. 38 - Transmitter Presetting Chart.

23. TROUBLE AND REMEDY CHART.—

Symptom	Possible Cause	Check	Remedy
<i>a. Receiving</i> (1) No B+ on Receiver (Battery operation)	(a) Dead or weak battery	Check battery voltage	Charge if weak Return to depot if dead
	(b) Blown Fuse F ₂	Check continuity with meter	Replace
	(c) Poor Relay contacts at RY ₃ and RY ₄	Check continuity with meter	Clean contacts
	(d) Transformer T ₁₃ sec. in Vibrapak open	Check continuity with meter	Return to depot
	(e) Defective Vibrator VB ₁	Check by substitution	Replace
	(f) Choke L ₁₃ in Vibrapak open	Check continuity with meter	Return to depot
	(g) Capacitor C _{90.1, 90.2} in Vibrapak shorted	Check continuity with meter	Replace
	(h) Buffer Capacitor C ₈₇ in Vibrapak shorted	Check continuity with meter	Replace
	(i) Capacitors C _{74, 75} shorted	Check continuity with meter	Replace
	(j) Filter choke L ₈ open	Check continuity with meter	Return to depot
	(k) Poor contact between plug PL ₃ of power supply unit and PL ₂ of modulator at pin L & Cord CD-515-(*)	Check continuity with meter	Repair
	(l) Poor contact between PL ₁ and SO ₁ pin #10	Check continuity with meter	Repair
	(2) No B+ on Receiver (a-c operation).	(a) Blown Fuse F ₁	Check continuity with meter
(b) Transformer T ₁₃ pri. or sec. open		Check continuity with meter	Return to depot
(c) Relay RY ₄ inoperative or has bad contacts.		Check continuity with meter	Replace
(d) Defective tube V ₁₀		Check by substitution	Replace
(e) Capacitors C ₇₄ or C ₇₅ shorted		Check continuity with meter	Replace
(f) Follow par. 23 <i>a.</i> (1), sections (j), (k) and (l) for further procedures		Same	Same
(3) Failure of Tubes to light (Battery operation). Note: Tubes in power supply unit and modulator unit do not light on battery operation.	(a) Follow par. 23. <i>a.</i> (1) (a), (b), (c), (k) and (l) for procedure	Same	Same
	(b) Defective tube filaments	Check by observing filaments and substitution	Replace

RESISTANCE MEASUREMENTS OF MODULATOR SECTION

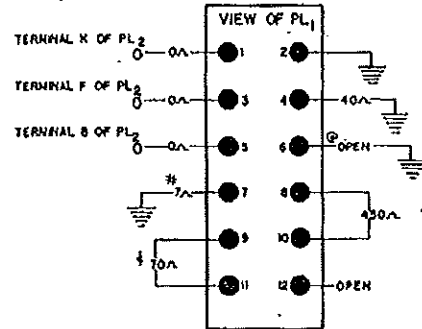
SIDETONE VOLUME CONTROL FULL ON.
 ALL TUBES REMOVED FROM SOCKETS.
 ALL CORDING DISCONNECTED.
 PL₁ DISCONNECTED FROM SO₁.
 MEASUREMENTS FROM TUBE SOCKETS TO CHASSIS.
 ALL VALUES ARE AVERAGE, ACTUAL READINGS MAY VARY.



BOTTOM VIEW OF MODULATOR TUBE SOCKETS.

Fig. 41 - Modulator Resistance Measurements.

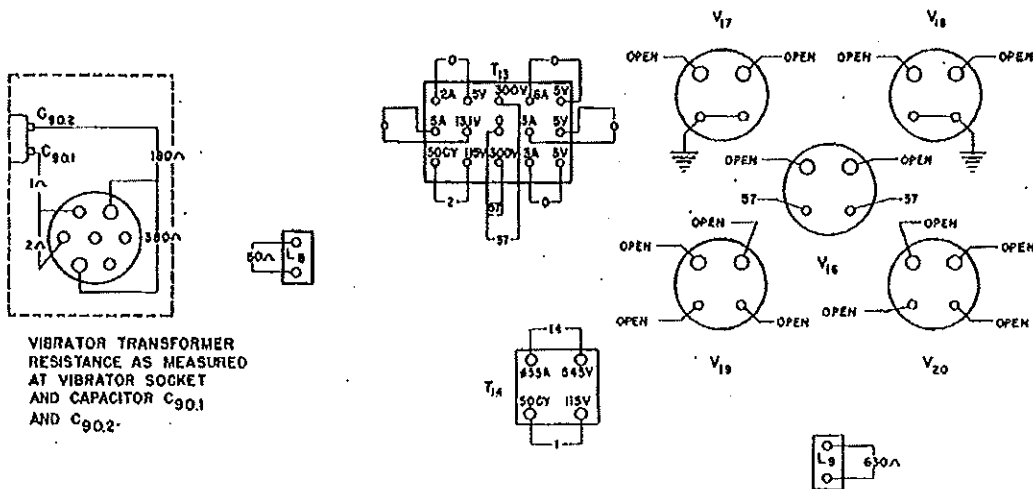
RESISTANCE MEASUREMENTS FROM PL₁ TO POINTS INDICATED.



METER SWITCH AT PA GRID
 † METER SWITCH AT PA PLATE
 ‡ RY₂ HELD CLOSED BY HAND

RESISTANCE MEASUREMENTS OF POWER SUPPLY.

ALL TUBES REMOVED FROM SOCKETS.
 ALL CORDING DISCONNECTED.
 MEASUREMENTS FROM SOCKET TERMINALS TO CHASSIS.
 ALL VALUES ARE AVERAGE.



BOTTOM VIEW REAR OF CHASSIS

NOTE: Values given in ohms on the outside of T₁₃ and T₁₄.

Fig. 42 - Power Supply Unit Resistance Measurements.

Symptom	Possible Cause	Check	Remedy
(4) Failure of Tubes to light (a-c operation)	(a) Follow Par. 23. a. (2) (a) and (b) for procedure.		
	(b) Relays RY ₃ or RY ₄ inoperative or have bad contacts	Check continuity with meter	Repair
	(c) Defective tube filaments	Check by observing filaments and substitution	Replace
	(d) No a-c being supplied by PE-108-(*)	Check PE-108-(*)	Repair
(5) Dead audio	(a) Speaker voice coil open	Check continuity with meter (speaker ON-OFF switch in OFF position)	Return to depot
	(b) Output transformer T ₀ sec. winding open	Check continuity with meter between terminals 6 and ST (lead from T ₀ to ON-OFF switch disconnected)	Return to depot
	(c) Output transformer T ₀ pri. winding open	Check continuity with meter between terminals P and B	Return to depot
	(d) Capacitor C ₂₉ shorted	Check continuity with meter	Replace
	(e) Capacitor C ₃₀ shorted	Check continuity with meter	Replace
	(f) Resistor R ₂₃ open	Check continuity with meter	Replace
	(g) Capacitor C ₂₅ shorted	Check continuity with meter	Replace
	(h) Capacitor C ₂₆ shorted	Check for positive voltage on pin #7 of tube V ₆ . Check continuity of C ₂₆	Replace
	(i) Capacitor C ₂₈ open	Check by substitution	Replace
	(j) Resistor R ₁₉ open	Check continuity with meter	Replace
	(k) Capacitor C ₂₄ shorted	Check continuity with meter	Replace
	(l) Capacitor C ₃₁ open	Check by substitution	Replace
	(m) Capacitor C ₂₂ shorted	Check continuity with meter	Replace
	(n) Capacitor C ₂₁ shorted	Check continuity with meter	Replace
	(o) Resistor R ₁₅ open	Check continuity with meter	Replace
	(p) Resistor R ₃₁ open	Check continuity with meter	Replace
(q) Defective tube V ₈	Check by substitution	Replace	
(r) Defective tube V ₆	Check by substitution	Replace	
(6) Audio blocks on signal after a period of reception	(a) Resistor R ₁₆ or R ₁₇ open	Check continuity with meter	Replace

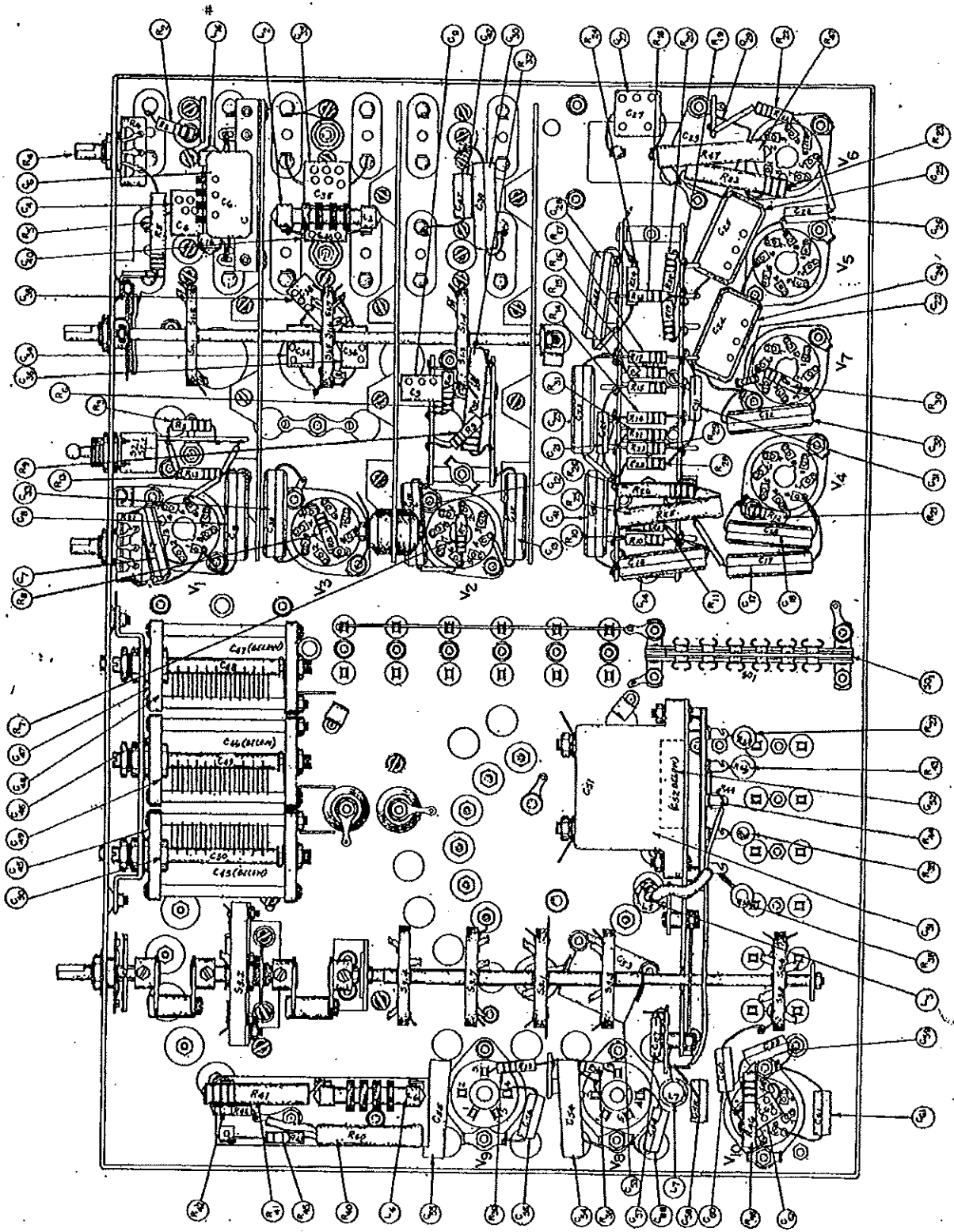


Fig. 43 - Parts Layout of R.F. Chassis.

Symptom	Possible Cause	Check	Remedy
(7) Audio gain higher than normal	(a) Resistor R ₂₈ open	Check continuity with meter	Replace
(8) Dead Noise Limiter (Audio also blocks on strong signal)	(a) Capacitor C ₂₇ open	Check by substitution	Replace
	(b) Capacitor C ₂₇ shorted	Check continuity with meter	Replace
	(c) Capacitor C ₂₈ shorted	Check continuity with meter	Replace
	(d) Choke L ₁ open	Check continuity with meter	Return to depot
	(e) Capacitor C ₂₄ open	Check by substitution	Replace
	(f) Resistor R ₃₀ open	Check continuity with meter	Replace
	(g) Capacitor C ₃₂ shorted	Check continuity with meter	Replace
(9) Signal output higher with Noise Limiter switch in ON position	(a) Capacitor C ₃₁ shorted	Check continuity with meter	Replace
(10) Poor reaction of Noise Limiter to noise	(a) Capacitor C ₃₂ open	Check by substitution	Replace
(11) Dead i-f (at grid of V ₂)	(a) Tube V ₄ defective	Check by substitution	Replace
	(b) Transformer T ₆ sec. or pri. open	Check continuity with meter	Repair or return to depot
	(c) Capacitor C ₁₇ shorted	Check continuity with meter	Replace
	(d) Resistor R ₁₈ open	Check continuity with meter	Replace
	(e) Capacitor R ₁₄ shorted	Check continuity	Replace
	(f) Tube V ₂ defective	Check by substitution	Replace
(12) Weak i-f (slug for tuning T ₆ will not peak coil) (slug for tuning T ₆ will not peak coil) (Tuning slug on sec. T ₆ will not peak coil) (Tuning slug at pri. T ₆ will not peak coil) (at grid of Tube V ₂) (at grid of Tube V ₂)	(a) Capacitor C ₁₇ open	Check by substitution	Replace
	(b) Transformer T ₅ sec. or pri. open	Check continuity with meter	Repair or return to depot
	(c) Capacitor C ₂₀ shorted	Check continuity with meter	Remove shield from coil and replace
	(d) Capacitor C ₂₀ open	Check by substitution	Remove shield from coil and replace
	(e) Capacitor C ₁₈ shorted	Check continuity with meter	Replace
	(f) Capacitor C ₁₆ open	Check by substitution	Remove coil shield and replace
	(g) Capacitor C ₁₆ open	Check by substitution	Remove coil shield and replace
	(h) Capacitor C ₁₄ open	Check by substitution	Replace
	(i) Capacitor C ₁₃ shorted	Check continuity with meter	Replace
	(j) Defective tube V ₄	Check by substitution	Replace
	(k) Capacitor C ₁₂ open	Check by substitution	Replace
	(l) Resistor R ₇ open	Check continuity with meter	Replace
(m) Defective tube V ₂	Check by substitution	Replace	