

WAR DEPARTMENT TECHNICAL MANUAL

TM 11-620

RADIO SETS

SCR-608-A AND SCR-628-A

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War Department Technical Manual

TM 11-620

Radio Sets SCR-608-A and SCR-628-A

War Department

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By order of the Secretary of War:

G. C. MARSHALL,
Chief of Staff.

Official:

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*Major General,
The Adjutant General.*

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(For explanation of symbols see FM 21-6.)

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DESTRUCTION NOTICE

WHY To prevent the enemy from using or salvaging this equipment for his benefit.

WHEN When ordered by your commander, or when you are in immediate danger of capture.

- HOW**
1. Smash— Use sledges, axes, hand-axes, pick axes, hammers, crowbars, heavy tools, etc.
 2. Cut— Use axes, hand-axes, machete, etc.
 3. Burn— Use gasoline, kerosene, oil, flame-throwers, incendiary grenades, etc.
 4. Explosives— Use firearms, grenades, TNT, etc.
 5. Disposal— Bury in slit trenches, foxholes, other holes. Throw in streams. Scatter.
 6. *Use anything immediately available for destruction of this equipment.*

- WHAT**
1. Smash— Crystals, meter, plugs, tuning controls, tubes, capacitors, resistors, sockets, insulators, microphones, headsets, and relays.
 2. Cut— Cords, wiring, and cables.
 3. Bend and/or Break— Antenna sections, panels, mounting, and nameplate.
 4. Burn— Circuit label, technical manual and all papers, cords, wiring, cable, dynamotors, capacitors, resistors, and nameplate.
 5. Bury and/or Scatter— Any or all of the above pieces after breaking.

DESTROY EVERYTHING

SAFETY NOTICE

THIS EQUIPMENT USES DANGEROUSLY HIGH VOLTAGES. IT CAN KICK LIKE A MULE AND IS A DARN SIGHT MORE DANGEROUS. DON'T CHANGE VACUUM TUBES OR WORK IN THE EQUIPMENT WITH THE DYNAMOTOR RUNNING, EXCEPT AS SPECIFICALLY DIRECTED IN THIS MANUAL. BE CAREFUL, DON'T TAKE CHANCES.

SPECIAL NOTICE

Certain schematic and wiring diagrams in this manual include modifications during manufacture which are discussed in Paragraph 43. Not all these changes are included in the functional diagrams, Figs. 25 through 38. Any discrepancies between these two groups of figures are explained under appropriate heading in Paragraph 43. In case of such discrepancies, follow the circuit label on the equipment.

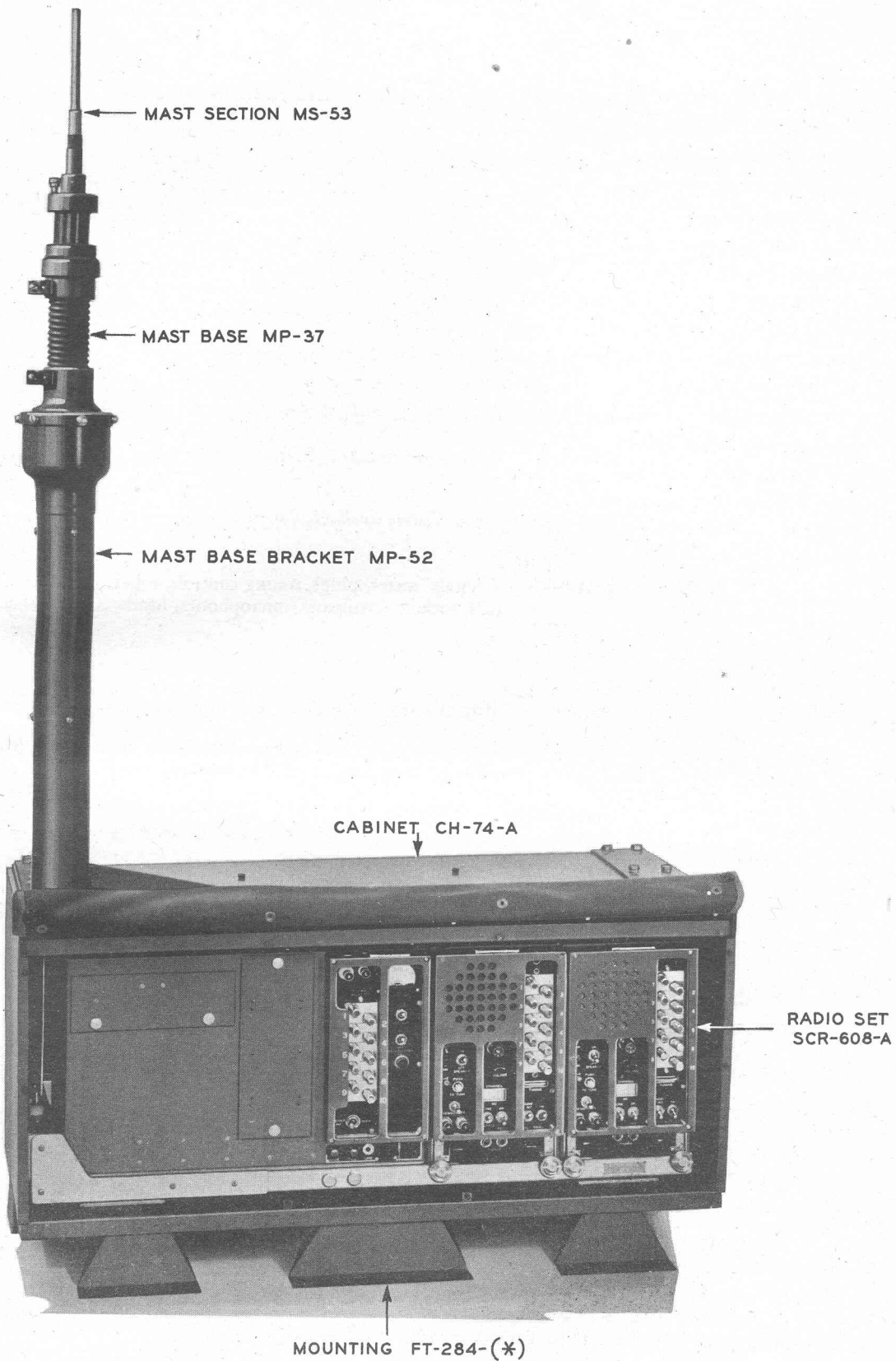


Fig. 1. Radio Set SCR-608-A: Front View of Cabinet CH-74-A with Associated Components

SECTION I. DESCRIPTION

1. **Purpose.** Radio Sets SCR-608-A and SCR-628-A provide frequency-modulated radio telephone communication for anti-aircraft and anti-tank warning and control nets, for base stations at battalion command posts for fire control and fire direction nets, and for intra-battalion communication. The radio sets may be installed and operated in combat vehicles such as command cars, half-tracks, or any other authorized vehicle.

The sets are designed to operate within a temperature range of minus 40 degrees to plus 130 degrees Fahrenheit around the set. Don't operate this equipment for long periods of time in enclosed spaces where the temperature may rise too high. Watch this.

2. **Performance Characteristics.**

a. *System.*

- (1) Frequency range.....27.0 to 38.9 megacycles
- (2) Channel spacing.....100 kilocycles
- (3) Number of channels available.....120
- (4) Channel numbers.....270 to 389 inclusive
- (5) Number of preset channels.....10
- (6) Communication range.....5 to 15 miles
- (7) Power supply.....12- or 24-volt vehicular battery (see Note)

Note: Radio Sets SCR-608-A and SCR-628-A are equipped with dynamotors for operation from a 12-volt battery. If authorized, they may be operated from a 24-volt battery by substitution of the proper dynamotor. This is explained fully in Paragraph 10c. Be sure you don't operate your set from a battery of the wrong voltage. You'll burn out tubes, dynamotor, and capacitors.

b. *Radio Receiver BC-683-A.*

- (1) Sensitivity 1 microvolt
- (2) Intermediate frequency.....2.65 megacycles
- (3) Band width80 kilocycles
- (4) Power output, speaker.....2 watts
- (5) Power output, headset.....0.2 watt
- (6) Call signalLamp
- (7) Noise suppression“Squelch”
- (8) Battery drain, 12-volt supply.....4 amperes
- (9) Battery drain, 24-volt supply.....2 amperes (see Note under Paragraph 2a.)

NOTE: Throughout this manual an asterisk within parentheses (*) indicates the applicable issue letter of interchangeable components of the equipment.

c. *Radio Transmitter BC-684-A.*

- (1) Nominal power output.....20 watts
- (2) Nominal frequency deviation± 40 kilocycles
- (3) Crystal frequency range.....375.000 to 540.277 kilocycles
- (4) Frequency multiplication72
- (5) Battery drain, 12-volt supply.....20 amperes
- (6) Battery drain, 24-volt supply12 amperes (see Note under Paragraph 2a.)

3. **General Features.**

a. *Arrangement and Weight of Major Components.* The general construction and arrangement of Radio Sets SCR-608-A and SCR-628-A are shown in Figs. 1 and 2. Over-all component and assembly dimensions are shown in Fig. 3. The radio sets consist of these combinations of major units:

(1) *Radio Set SCR-608-A.*

- 2 Radio Receivers BC-683-A with 12-volt Dynamotor DM-34-(*).....70 lbs.
- 1 Radio Transmitter BC-684-A with 12-volt Dynamotor DM-35-(*).....67 lbs.
- 1 Mounting FT-237-(*) with Cord CO-278-A for connection to power supply44 lbs.
- Total weight.....181 lbs.

(2) *Radio Set SCR-628-A.*

- 1 Radio Receiver BC-683-A with 12-volt Dynamotor DM-34-(*).....35 lbs.
- 1 Radio Transmitter BC-684-A with 12-volt Dynamotor DM-35-(*).....67 lbs.
- 1 Mounting FT-237-(*) with Cord CO-278-A for connection to power supply44 lbs.
- Total weight.....146 lbs.

b. *Components of Radio Sets SCR-608-A and SCR-628-A.* For a list of components, refer to Table I.

c. *Vacuum Tube Complement.* Radio Receiver BC-683-A and Radio Transmitter BC-684-A include, and are issued with, a complete

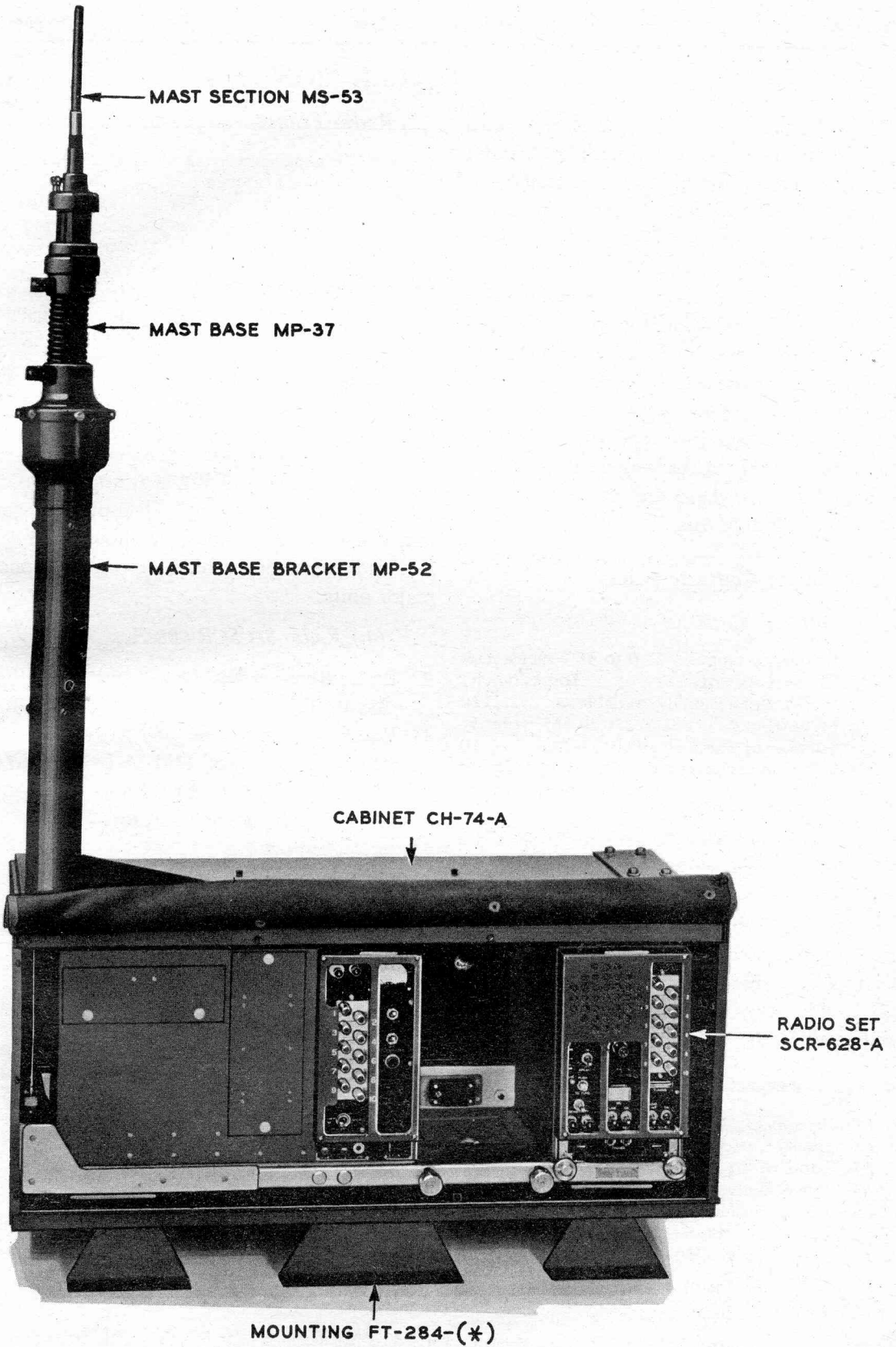


Fig. 2. Radio Set SCR-628-A: Front View of Cabinet CH-74-A with Associated Components

Table I. List of Components and Other Items Required

<i>Quantity</i>	<i>Article</i>
	Adapter Kit MC-471; includes:
*	1 Adapter plate; 15 in. x 35 in. x 1 $\frac{3}{8}$ in.
	1 Reinforced plate; 16 in. x 1 $\frac{1}{2}$ in. x $\frac{3}{16}$ in.
	Necessary hardware
1	Antenna A-83-(*) (Phantom)
2	Battery Bracket BA-27 [for Remote Control Unit RM-29-(*)]; 1 in Use, 1 Running Spare
1	Box BX-40 [for 30 crystal Holders FT-241-(*)]; includes 30 Holders FT-241-(*)
*	Bracket (extension for Mounting FT-285)
*	Bracket (Cabinet CH-74-A)
*	Cabinet CH-74-A
1	Case CS-76-(*) [for Remote Control Unit RM-29-(*)]
1	Chest CH-96 [for Microphone T-17, Headset HS-30-(*), Box BX-40, spare tubes, technical manuals, etc.]
2	Clamp MC-423 (for Mast Section MS-51); 1 in Use, 1 Running Spare
2	Clamp MC-424 (for Mast Section MS-52); 1 in Use, 1 Running Spare
2	Cord CD-307-A [65-in. long, for Headset HS-30-(*)]; 1 in Use, 1 Running Spare
*	Connector and Bondnut; Appleton Electric Co. No. 61004 and BL-50 respectively
*	Connector and Bondnut; Appleton Electric Co. No. 61007 and BL-50 respectively
2	Cord CD-604 [for Headset HS-30-(*)]; 1 in Use, 1 Running Spare
1	Cord CD-689 (for Mast Base MP-48-A)
*	Cable WC-562
*	Cord CD-318-A (for Microphone T-45)
*	Cordage CO-212
*	Cordage CO-218 [for connecting slip ring to Interphone Control Box BC-606-(*) in turret.]
1	Cover BG-96 (for radio set)
1	Cover BG-108 (for Mast Base MP-48-A)
2	Dynamotor DM-34-(*) [for Radio Receiver BC-683-(*)]; 12 volts; includes the following Running Spare in BAG attached to dynamotor: 4-BRUSH (L.V.) INCLUDES SPRINGS 4-BRUSH (H.V.) INCLUDES SPRINGS
1	Dynamotor DM-35-(*) [for Radio Transmitter BC-684-(*)]; 12 volts; includes the following Running Spare in BAG attached to dynamotor: 4-BRUSH (L.V.) INCLUDES SPRING 4-BRUSH (H.V.) INCLUDES SPRING
1	Frame FM-43 [for Cabinet CH-74-A or Mounting FT-237-(*)]
1	Hardware Kit: Miscellaneous items
2	Headset HS-30-(*); 1 in Use, 1 Running Spare (When Headset HS-30-(*) is not available, Headset HS-18 or HS-23 may be issued.)
*	Insulator IN-101
*	Insulator IN-104
*	Insulator IN-121 (1 $\frac{1}{8}$ -in. long, for insulating antenna wire through metal partition.)
*	Interphone Control Box BC-606-(*); includes attached hardware as follows: screws, washers, clamps, clips, and hooks.

Table I. List of Components and Other Items Required—*Continued*

<i>Quantity</i>	<i>Article</i>
1	Mast Base MP-48-A
*	Mast Base Bracket MP-52 (Cabinet CH-74-A)
*	Mast Base Bracket MP-54
*	Mast Section MS-51
2	Mast Section MS-52; 1 in Use, 1 Running Spare
2	Mast Section MS-53; 1 in Use, 1 Running Spare
*	Microphone T-17 (hand-type)
*	Microphone T-45 (lip-type) (When Microphone T-17 or T-45 is not available, Microphone T-30 may be issued.)
3	Microphone Cover M-367; 2 in Use, 1 Running Spare
1	Mounting FT-237-(*); includes: 1 Cord CO-278 (for power) 1 set dust covers for receptacles All necessary mounting bolts, nuts, and lock washers.
*	Mounting FT-284 (for Cabinet CH-74-A)
*	Mounting FT-285 (for Cabinet CH-74-A); includes: mounting bolts, nuts, screws, straps, and bracket.
*	Mounting FT-326
2	Radio Receiver BC-683-(*); includes: 10 Fuse FU-24; 1 in Use, 9 Running Spare 3 Lamp LM-63; 1 in Use, 2 Running Spare 2 Tube JAN-6H6 (VT-90); 1 in Use, 1 Running Spare 2 Tube JAN-6J5 (VT-94); 1 in Use, 1 Running Spare 2 Tube JAN-6V6GT/G (VT-107-A); 1 in Use, 1 Running Spare 4 Tube JAN-6AC7/1852 (VT-112); 3 in Use, 1 Running Spare 3 Tube JAN-12SG7 (VT-209); 2 in Use, 1 Running Spare 3 Tube JAN-6SL7GT (VT-229); 2 in Use, 1 Running Spare
1	Radio Transmitter BC-684-(*); includes: 120 Crystal Holder FT-241-(*), with Crystal (10 in Sockets, 80 in Drawer Compartment, 30 in Box BX-40) 10 Fuse FU-64; 1 in Use, 9 Running Spare 3 Lamp LM-38; 1 in Use, 2 Running Spare 11 Tube JAN-1619 (VT-164); 7 in Use, 4 Running Spare 2 Tube JAN-1624 (VT-165); 1 in Use, 1 Running Spare
1	Remote Control Unit RM-29-(*)
1	Roll BG-56-A (for antenna mast sections)
2	Technical Manual TM 11-620 for Radio Sets SCR-608-(*), and SCR-628-(*)
6 ft.	Wire W-128

The asterisk within parentheses (*) indicates that items so indicated are interchangeable with those marked with a different suffix letter.

An asterisk in the column headed *Quantity* indicates that the item is issued in quantities authorized, depending upon the type of installation to be made.

set of vacuum tubes in place. The tube complement of each component follows:

(1) *Radio Receiver BC-683-A.*

Circuit Designation	Function	Signal Corps Designation	Commercial Designation
V1	R-f amplifier	VT-112	6AC7
V2	Modulator	VT-112	6AC7
V3	R-f oscillator	VT-94	6J5
V4	I-f amplifier	VT-209	12SG7
V5	I-f amplifier	VT-209	12SG7
V6	Limiter	VT-112	6AC7
V7	Detector (discriminator)	VT-90	6H6
V8	Second a-f amplifier	VT-107-A	6V6-GT
V9	AVC and squelch	VT-229	6SL7-GT
V10	First a-f amplifier and i-f oscillator	VT-229	6SL7-GT

(2) *Radio Transmitter BC-684-A.*

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

d. Crystal Holders and Frequency Range.

The receiver and transmitter operate between 27.0 and 38.9 megacycles; this range is divided into 120 channels of 100 kilocycles each. (See Table II.) Channels 270 to 279, inclusive, have the same frequencies as channels 70 to 79, inclusive, of the Armored Force [Radio Sets SCR-508-(*), SCR-528-(*), and SCR-538-(*)]. These channels may therefore be used for liaison purposes.

A drawer in the transmitter provides storage for 80 Crystal Holders FT-241-A, one for each of 80 channel frequencies out of the 120 channels available. Each crystal holder contains a low-frequency quartz crystal (see Table II), and is marked with the channel number and output frequency.

e. General Spare Equipment.

(1) *Receiver.* Ten 15-ampere Fuses FU-24 (one in use, one in the spare holder, and eight in the attached bag) and three neon CALL SIGNAL lamps (one in use and two in the attached bag) are furnished with each receiver.

(2) *Transmitter.* Ten 1/2-ampere Littelfuse Type 4AG fuses (one installed, one in the spare holder, and eight in the attached bag) and three pilot lamps (one installed and two in the attached bag) are furnished with each transmitter.

(3) *Mounting.* The mounting includes and is issued with one Cord CO-278-A and ten 75-ampere Western Electric 66B fuses (one in use, one in the spare holder, and eight in the attached bag). Also included are one set of receptacle dust covers and all necessary mounting bolts, nuts, and lock washers, together with two copies of Preliminary Instructions for Radio Sets SCR-608-A and SCR-628-A.

f. Code Designation of Component Parts.

Remember the method of numbering the component parts used in the various units of these radio sets. This will help you determine whether the part belongs in the receiver, transmitter, etc. Parts in the schematic and wiring diagrams, and usually on the equipment units also, are designated by a number preceded by one or more letters. For example, C25, C115, L701, etc. Numbers for these units are shown in the column headed "Reference Number" in the Table of Replaceable Parts, Paragraph 45. Reference numbers from:

- 1 to 99 are used for parts in Radio Receiver BC-683-A.
- 101 to 199 are used for parts in Radio Transmitter BC-684-A.
- 401 to 499 are used for parts in Mounting FT-237-(*).
- 501 to 599 are used for parts in Dynamotor DM-35-(*). (transmitter, 12 volts).
- 601 to 699 are used for parts in Dynamotor DM-37-(*). (transmitter, 24 volts).
- 701 to 799 are used for parts in Dynamotor DM-34-(*). (receiver, 12 volts).
- 801 to 899 are used for parts in Dynamotor DM-36-(*). (receiver, 24 volts).

Table II. Channel and Crystal Frequencies

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

4. Associated Items.

a. Antenna System.

(1) Mast Base MP-48 or MP-37 is used and *must be mounted in such a way that the antenna will normally be in a vertical position.* Mast Base MP-48 is equipped with a coaxial connector cable running up through the center. An antenna terminal is provided at the top of the mast base. Another terminal is provided on the lower end of the coaxial connector cable for connecting to the set by means of Wire W-128. A coaxial cable fitting is also furnished with MP-48 for the purpose of joining the lower end of the coaxial connector cable of MP-48 to a coaxial line from the set.

(2) Three mast sections (MS-51, MS-52, MS-53) must be used, except that only two mast sections (MS-52, MS-53) are to be used with Mast Base Bracket MP-52. (Mast Base Bracket MP-52 is used in half-track installations and is mounted on the top of Cabinet CH-74-A at the left front corner.) Mast joints should be tightened securely by use of gas pliers or other suitable tools, and should be taped to prevent loss of mast sections. Put on two servings of friction tape as tightly as possible. The first serving should be applied counterclockwise, starting on the lower half of the joint and taping upwards from the left to the right. If available, Clamps MC-423 and MC-424 should be used instead of tape.

(3) Wire W-128 should be used between the mast base and the set when the length of the run is less than 40 inches. Do not use more W-128 than is necessary. This wire can be connected to either the top or the bottom terminal of MP-48, or may be fed up through the center of MP-48 after removal of the center coaxial connector cable. In the latter case the maximum permissible length of W-128 is 52 inches. *The center coaxial cable must always be removed when connection is made to the top terminal; otherwise the range of the set will be reduced greatly.* When passing W-128 through the side of the vehicle, chests, etc., always insert an insulating bushing, such as IN-101 or IN-111, in the

hole to protect the wire. Wire should be run and supported in such a way that it is protected from damage and will not be subject to chafing due to vibration.

(4) Coaxial cable, Cordage CO-282, should be used between the mast base and the set when the length of run is over 40 inches. The length of CO-282 must *always* be 7 feet (plus or minus 1 foot). If 7 feet is more than is needed, tape up the excess in a coil. The sheath of CO-282 *must* be grounded at *both* ends. When MP-37 is used, a short ground lead at the mast base is required to ground the sheath. When MP-48 is used, the coaxial cable fitting that joins CO-282 to the center coaxial cable connector of MP-48 provides for sheath grounding at the mast base. When passing CO-282 through the side of the vehicle, chests, etc., always insert an insulating bushing, such as IN-101 or IN-111, in the hole. Cable should be run and supported in such a way that it is protected from damage and will not be subject to chafing due to vibration.

(5) In installations using Mast Base Bracket MP-52 mounted on top of Cabinet CH-74-A, the lead from the mast base to the binding post on Mounting FT-237-(*) will be W-128 run inside of MP-52. Coaxial cable must not be used and will be removed from MP-48, if already installed.

(6) The antenna may be tied down when the vehicle is in motion in order to clear overhead power lines and obstructions. When the vehicle is stationary, the antenna may be tied down for reasons of concealment. Remember, however, that *range and signal strength are reduced* when the antenna is tied down. For maximum range and signal strength release the antenna. The antenna may be tied down by the use of Rope RP-5, an insulator such as IN-86 or IN-87, and a short piece of flat metal. Drill holes in each end of the metal piece, slip it over the threaded part of a mast section ferrule, and assemble the joint. Tie down to a convenient point on the vehicle with the insulator placed close to the antenna mast.

Note: The radiating system, which includes the antenna and ground circuit, must be of such

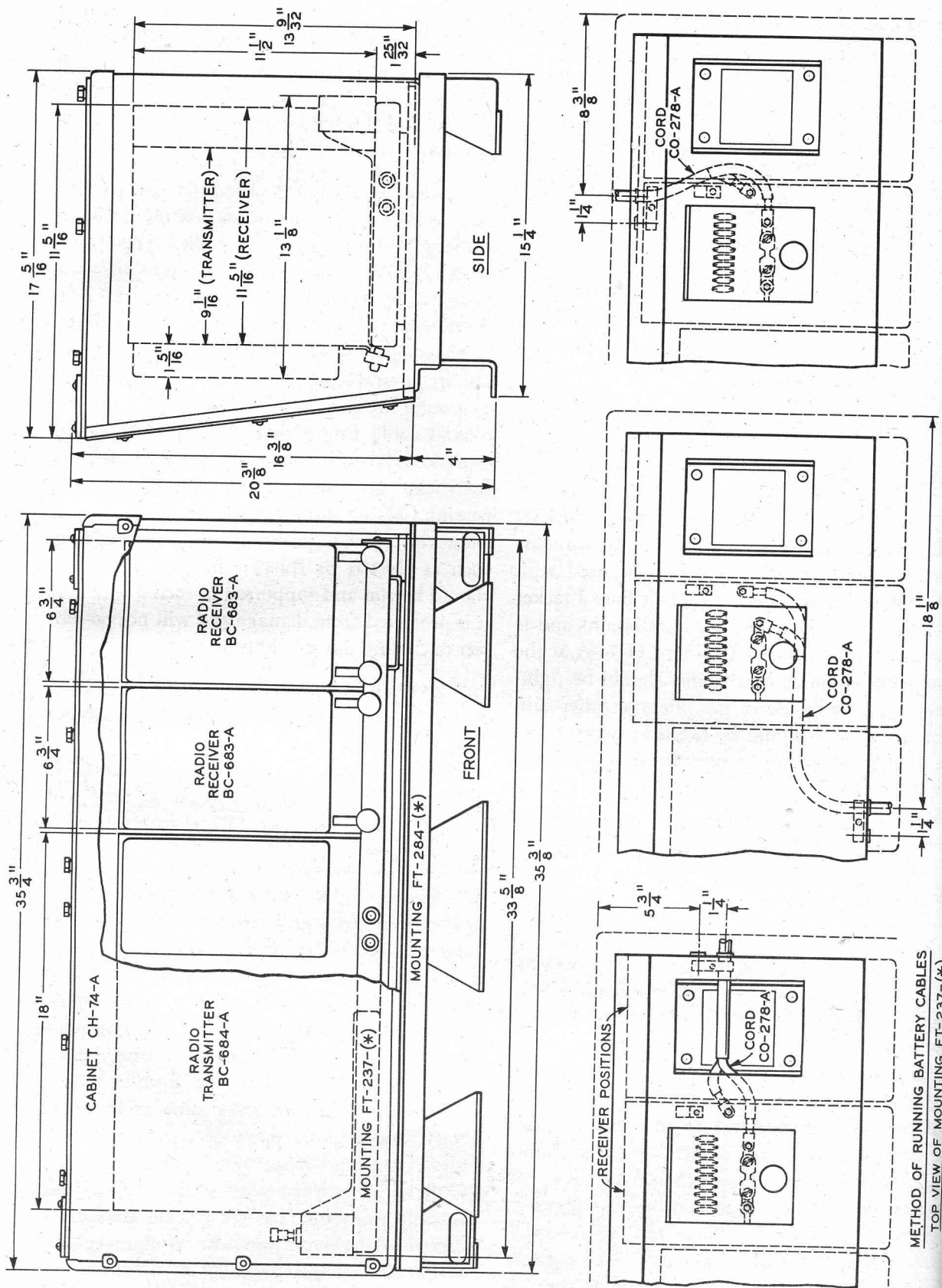


Fig. 3. Radio Set SCR-608-A: Over-all and Unit Dimensions

dimensions that the circuits of the transmitter and the receiver can be resonated at the authorized frequencies. Make the ground connection for the antenna system through the contact between the mounting and the frame of the vehicle. Where there is no direct connection to the frame, or where the connection is unsuitable, connect it to the frame through short lengths of braided copper strap 1/2-inch wide. Make certain that there is good electrical contact at both ends of the straps and allow sufficient slack to permit free movement of the unit in the shock mounting. If your ground lead is too short, vibration will soon break it.

b. Microphones and Headsets. One Headset HS-30-(*), HS-18, or HS-23 and one Microphone T-17, T-30, or T-33 are required for each person using the equipment. Microphone T-17 is the carbon hand type, Microphone T-30 is the carbon throat type, and Microphone T-33 is the magnetic hand type. Separate jacks are provided for use with either the carbon or the magnetic type of microphone.

c. Battery Power Supply. Your radio sets operate from either a 12- or 24-volt battery power source (depending upon the transmitter and receiver dynamotors furnished; see Paragraph 10). The battery used is the one already installed in your vehicle. *You must have sufficient battery capacity and charging rate to maintain essentially full charge in the battery under all operating conditions.* The battery current required to operate all units of the radio sets is given in Table III. Keep it in mind. Don't let your battery become discharged. If it does your communications will fail and your vehicle stall.

Table III. Battery Currents

Radio Set	Battery Drain (Amperes)	
	12-Volt Battery (11-15 volts)	24-Volt Battery (22-30 volts)
SCR-608-A	28	16
SCR-628-A	24	14

5. Frequency Modulation.

a. Radio Sets SCR-608-A and SCR-628-A operate on the principle of frequency modulation.

This system of communication, which is comparatively new, has one important advantage over the older amplitude modulation systems: Within the limit of its useful range, trouble from static is greatly reduced. Of course, static is not completely eliminated, but *within* the normal 5- to 15-mile range it is much less troublesome. If static becomes strong when talking to another station, it is generally a sign that you are near the limit of your working range. (See Paragraph 20d for good and bad places for radio communication.) Some of the technical features of frequency modulation (FM) are explained in Section III of this manual. The basic idea is outlined briefly in the following paragraphs.

b. Communication is effected by modulation of the carrier frequency. That is to say, *the carrier frequency is made to vary with the loudness and pitch of the voice signal. Loud speech causes greater variation of the carrier frequency, soft speech causes less variation. High-pitched sounds cause the carrier frequency to vary more rapidly than do low-pitched sounds. The amplitude and power of the transmitted wave remain substantially constant during modulation.*

These characteristics are quite different from those of amplitude modulation such as used by Radio Sets SCR-245-(*) and SCR-299-(*) in which the *amplitude and modulating frequency* of the transmitted wave vary with the speech *loudness and pitch*, while the carrier frequency remains constant. Static noise is more closely related to *amplitude modulation* than it is to *frequency modulation*; therefore interference with signals is reduced through the use of frequency-modulation receiver circuits which suppress amplitude variations. This "*discrimination*" against received static noise gives you improved communication within your set's range. But at the *end* of your range and *beyond it*, frequency modulation cannot control static. Therefore, when static gets bad, you're either at the end of your range, or your receiver isn't getting much of a signal from the station you are trying to hear.

The methods employed for modulation and demodulation are explained in Paragraphs 23 and 24 of this technical manual.

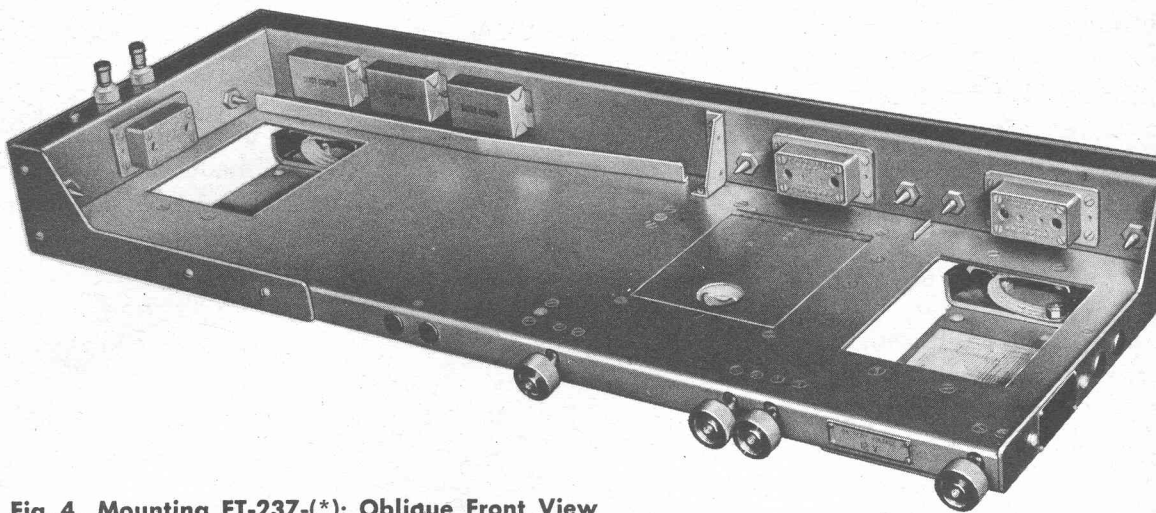


Fig. 4. Mounting FT-237-(*): Oblique Front View

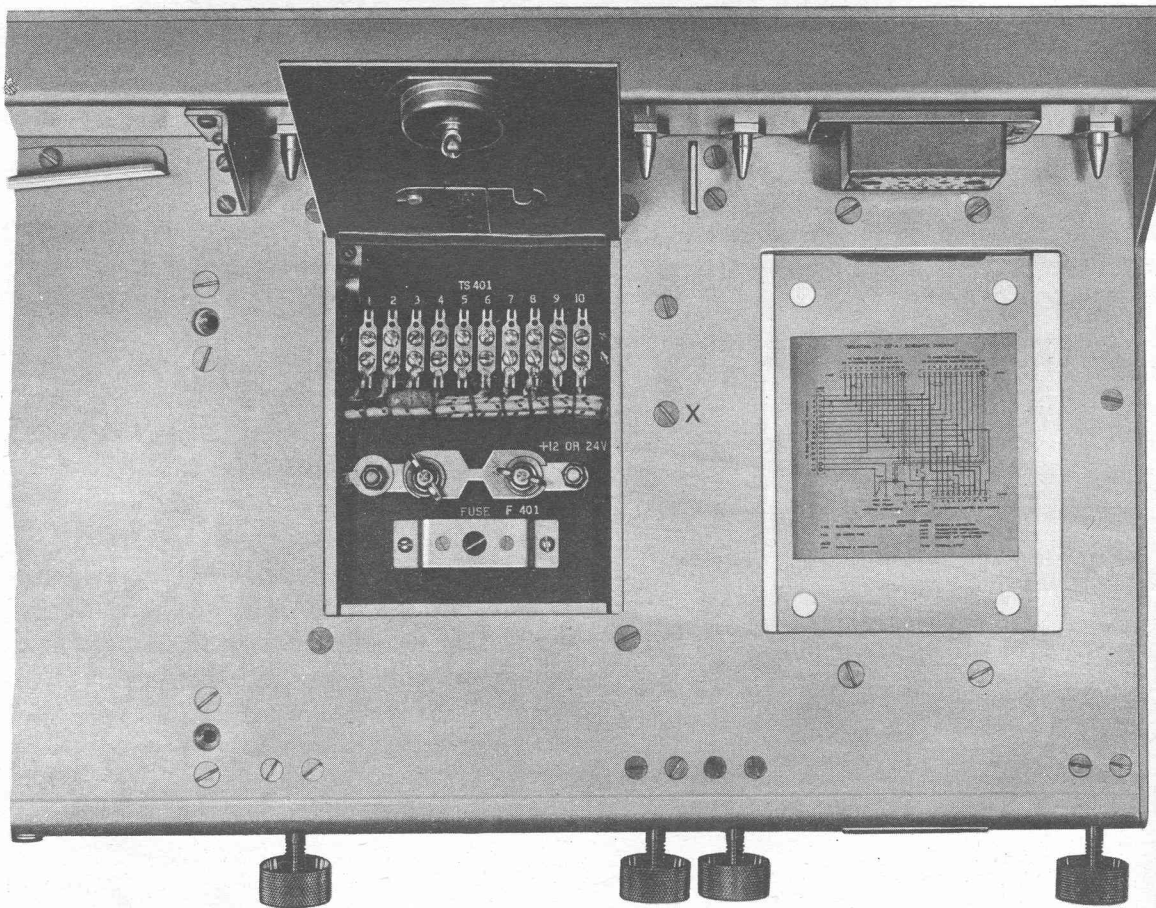


Fig. 5. Mounting FT-237-(*): Details

6. Mounting FT-237-(*).

a. General. This mounting (Fig. 4), will hold either:

(1) Radio Set SCR-608-A. One Radio Transmitter BC-684-A and two Radio Receivers BC-683-A.

(2) Radio Set SCR-628-A. One Radio Transmitter BC-684-A and one Radio Receiver BC-683-A.

The transmitter must be installed in its allotted place at the left end of the mounting, but the receiver may be installed in either of the two right-hand positions. Each unit is secured to the mounting by thumbscrew clamps and may be quickly removed without tools.

Dust covers are provided for protection of the unused receptacles. Screw the dust covers to the rear of the mounting when removed from the receptacles. (See Fig. 4.)

A reversible nameplate bearing the words BATTERY VOLTAGE 12 V on one side, and BATTERY VOLTAGE 24 V on the other side, is screwed to the front of the mounting near the right-hand end. (This plate will normally show BATTERY VOLTAGE 12 V for Radio Sets SCR-608-A and SCR-628-A. Don't reverse the nameplate unless 24-volt operation is authorized.)

b. Fastening of Mounting. Secure the mounting to the vehicle frame or other support by bolts passed through two heavy bedplates on the mounting. There are four bolt holes in each bedplate.

Each bedplate supports the mounting through two sets of rubber shock absorbers. In addition, two rubber snubbers on each bedplate prevent excessive movement of the equipment on the mounting. Electrical bonding straps are connected across each rubber shock absorber to provide a good ground connection to the bedplates.

c. Terminals. There are two terminals at the left end of the mounting. Connect the antenna system to the terminal designated TR for radio transmission and reception (Radio Sets SCR-608-A and SCR-628-A) or to the terminal designated REC for reception only. A ground terminal

is provided by a screw on the mounting. Later mountings have a ground binding post located near the antenna terminals for grounding the sheath of coaxial cable (Cordage CO-282).

A door in the base plate of the mounting permits access to the battery fuse (F401), and a terminal strip (TS401). (See Fig. 5.) One of the spare battery fuses is held in a clip on the under side of the door. The positive battery connection is made at the right-hand end of fuse F401. The negative battery connection is made at a screw on the under side of the mounting base plate, which is marked x in Fig. 5. Three methods of running the battery cable, through the right end, front, or rear of Mounting FT-237-(*), are illustrated in Fig. 3.

d. Interconnections Between Units. All connections between the transmitter and receiver units and the mounting are made through multi-contact plugs and receptacles which are automatically engaged when the units are inserted into their proper positions on the mounting. The wiring between receptacles is enclosed in a trough along the rear and left end of the mounting.

7. Radio Receiver BC-683-A.

a. Description of Functions. Radio Receiver BC-683-A is of the superheterodyne type and is intended for reception of frequency-modulated signals within the range of 27.0 to 38.9 megacycles. The receiver can deliver an output of approximately 2 watts to its self-contained loudspeaker or about 200 milliwatts to its headset circuits.

A front view of the receiver is shown in Fig. 6 and an oblique rear view is shown in Fig. 7.

The receiver is turned to ON or to OFF by the switch marked REC.

The front panel contains ten push buttons by means of which any one of ten preadjusted channels may be selected immediately, much the same as any home "touch-tuning" radio. When a push button is fully depressed, it catches and is held in until another push button is *partially* depressed, at which time the first push button releases and the selector mechanism is disengaged. When the selector is disengaged (all push but-

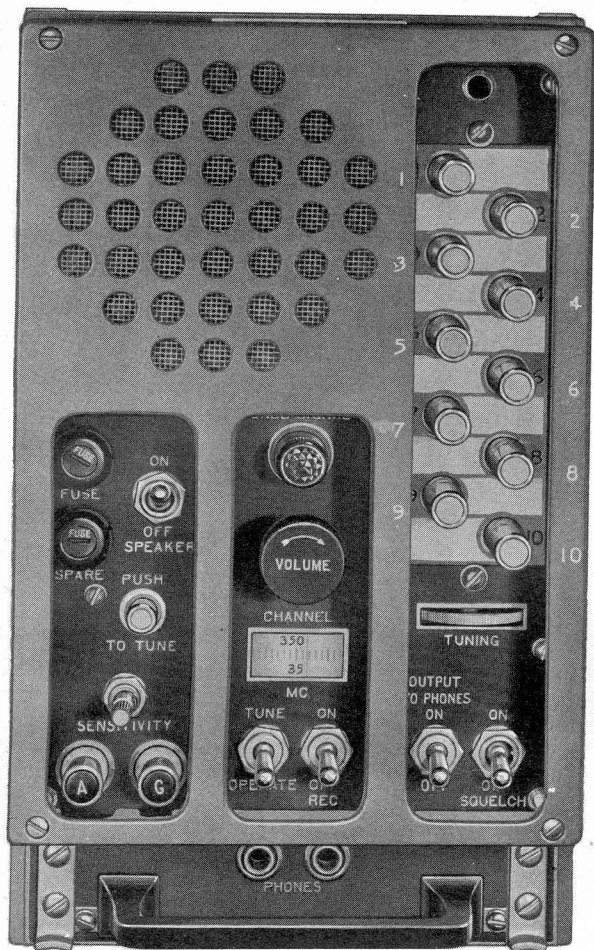


Fig. 6. Radio Receiver BC-683-A: Front View

tons released), the receiver may be tuned by pushing the PUSH TO TUNE push button while rotating the TUNING control.

Two jacks, marked PHONES, are provided for headset operation. The output of the receiver may be connected to the headset circuit by throwing the OUTPUT TO PHONES switch to ON. When the OUTPUT TO PHONES switch is at OFF, the headset circuit is disconnected from the radio receiver. The loudspeaker, however, will still be connected to the receiver output. To use the loudspeaker, place the SPEAKER switch at ON. Regulate the headset and loudspeaker volume by adjusting the VOLUME control.

A noise suppression or "squelch" circuit is switched on or off by the SQUELCH switch. When the SQUELCH switch is at ON, the sensitivity of the receiver is adjusted by the SENSITIVITY con-

trol. When the SQUELCH switch is at OFF, the receiver sensitivity is restored to maximum and cannot be adjusted.

The CALL SIGNAL lamp indicates that a signal is being received provided the SQUELCH switch is at ON and the SENSITIVITY control has been adjusted to prevent operation of the squelch circuit by received noise.

The TUNE-OPERATE switch starts a preset intermediate-frequency oscillator when at TUNE to assist in the adjustment of the channel selector mechanism or to aid in tuning to weak signals. The intermediate-frequency oscillator is also used when aligning or servicing the receiver.

Active and spare fuses are contained in the two fuse receptacles designated FUSE and SPARE.

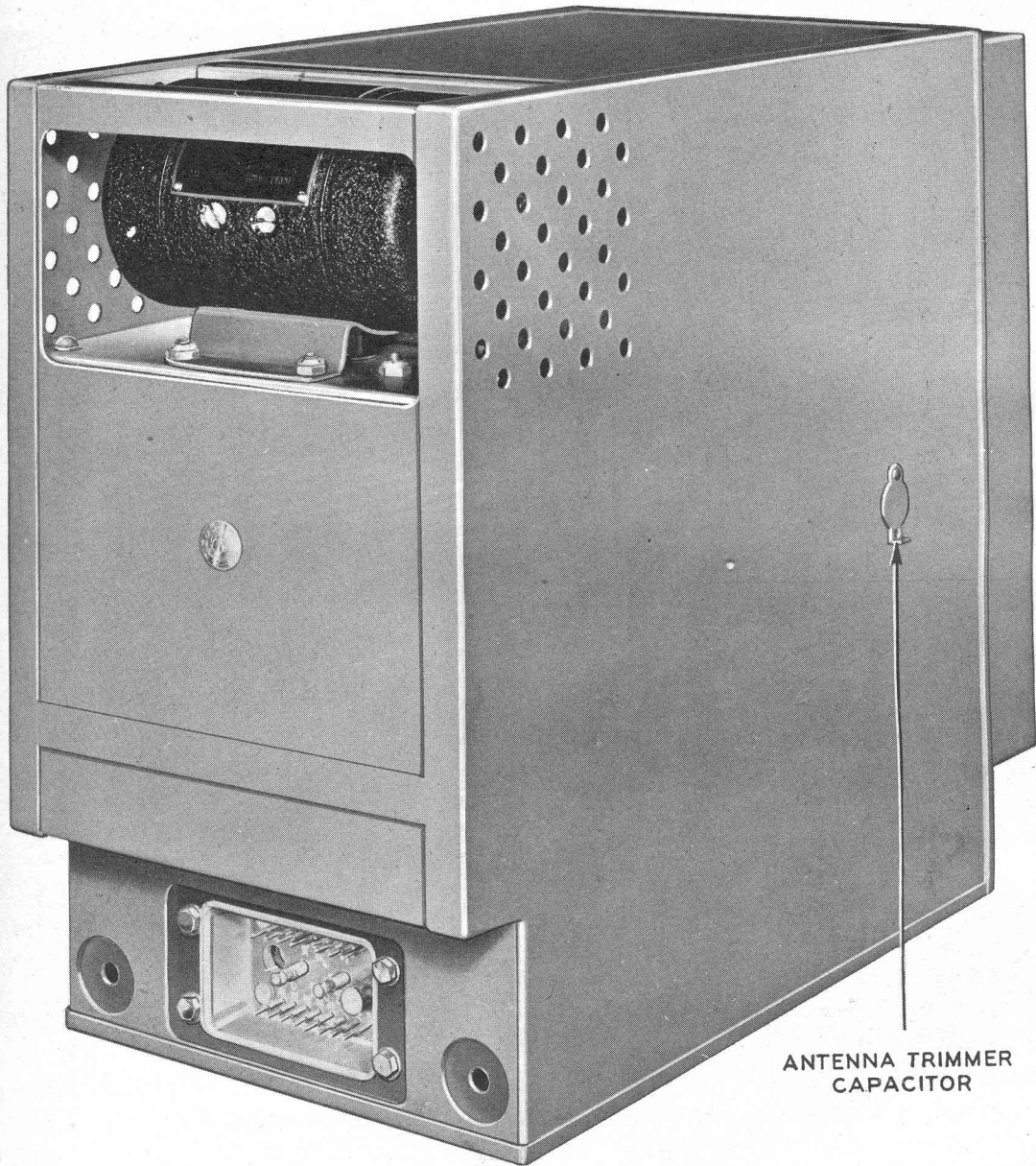
Antenna and ground binding posts, designated A and G, are provided for testing purposes and special services. These connections are not used when the receiver is installed for operation.

To remove the receiver dust cover turn the fastener on the rear of the cover (see Fig. 7) one-fourth turn to the left and slide the cover off the rear of the receiver. Figure 8 is a view of the left-hand side of the receiver, and Fig. 9 shows the right-hand side of the receiver after removal of the dust cover. Figures 10 and 11 show the receiver push button assembly, viewed from the right side and the front respectively.

b. Power Supply. Radio Receiver BC-683-A is issued with Dynamotor DM-34(*) for operation from a 12-volt vehicle battery. If authorized, the receiver may be operated from a 24-volt vehicle battery by merely substituting Dynamotor DM-36(*) in place of Dynamotor DM-34(*). This is the only change necessary since a multi-contact jack on the base of each dynamotor is wired to make the necessary circuit changes.

8. Radio Transmitter BC-684-A.

a. Description of Functions. The transmitter operates in the frequency band from 27.0 to 38.9 megacycles and delivers a nominal power output of 20 watts to its antenna system. The carrier is frequency-modulated. A maximum frequency deviation of plus or minus 80 kilocycles (total frequency swing, 160 kilocycles) can be ob-



ANTENNA TRIMMER
CAPACITOR

Fig. 7. Radio Receiver BC-683-A: Oblique Rear View

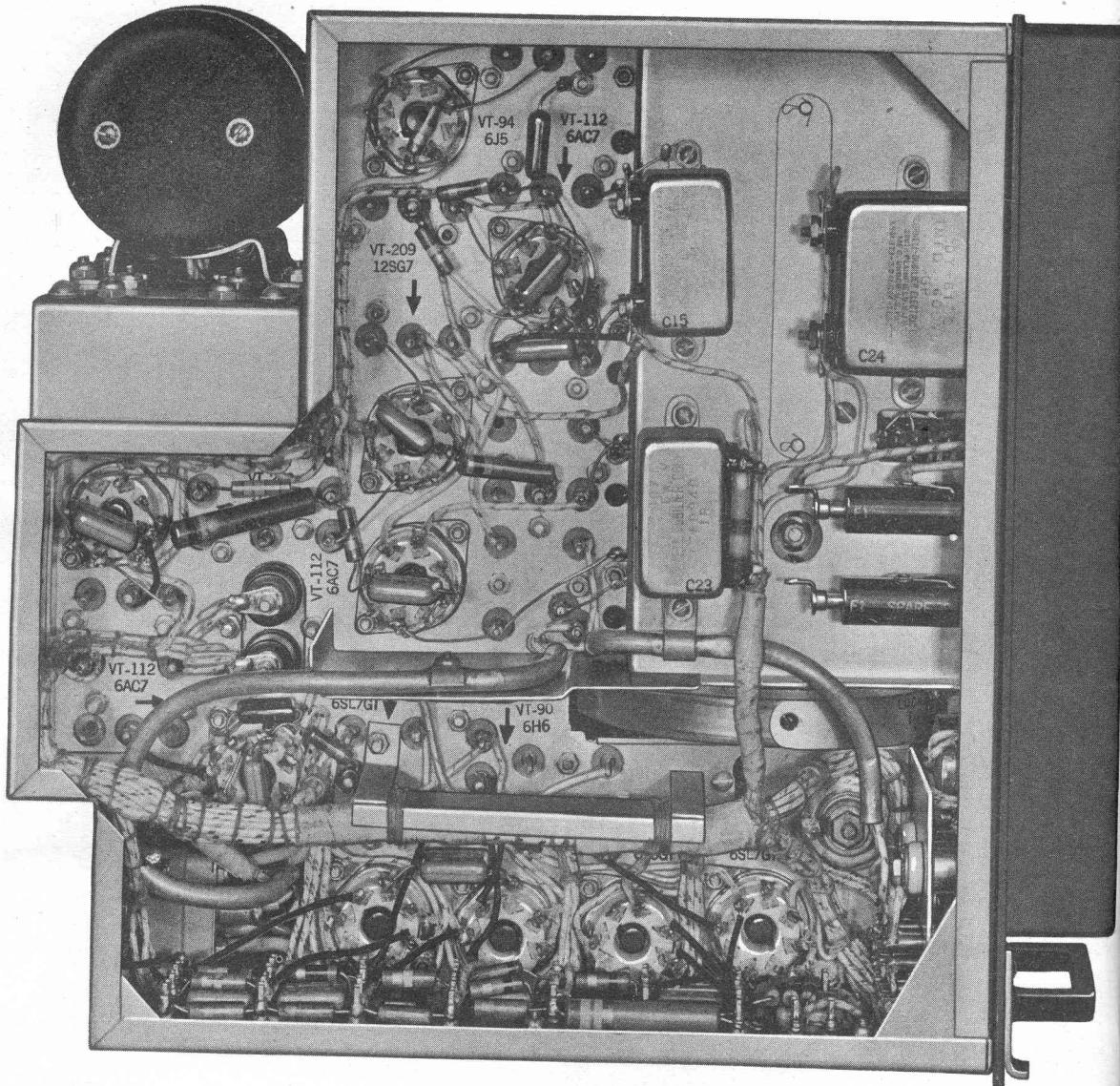


Fig. 8. Radio Receiver BC-683-A: Left-hand Interior View

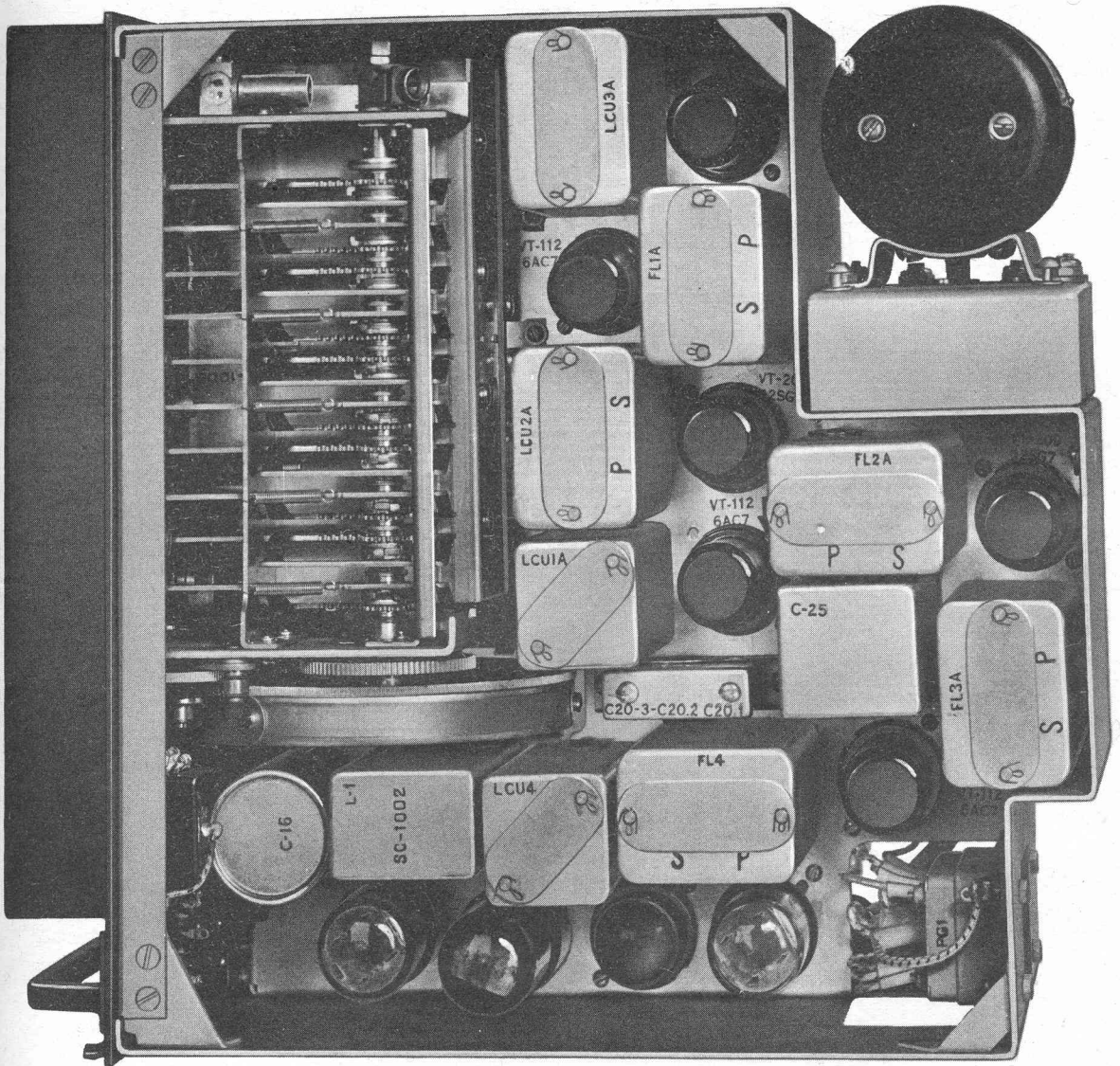
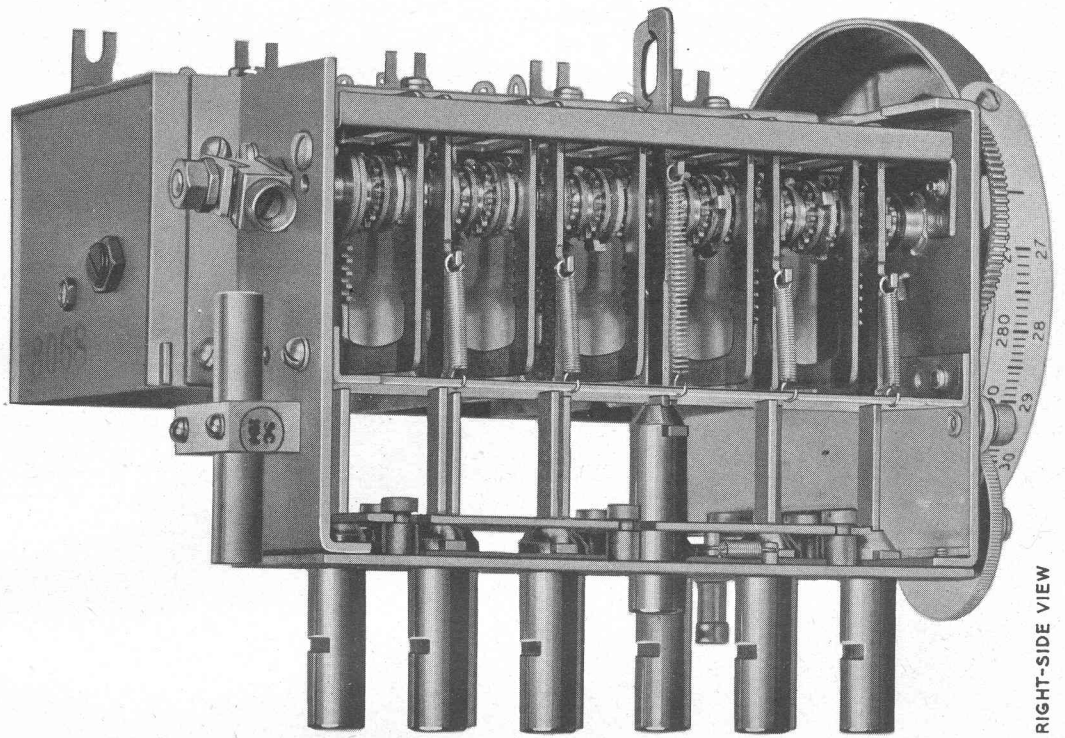
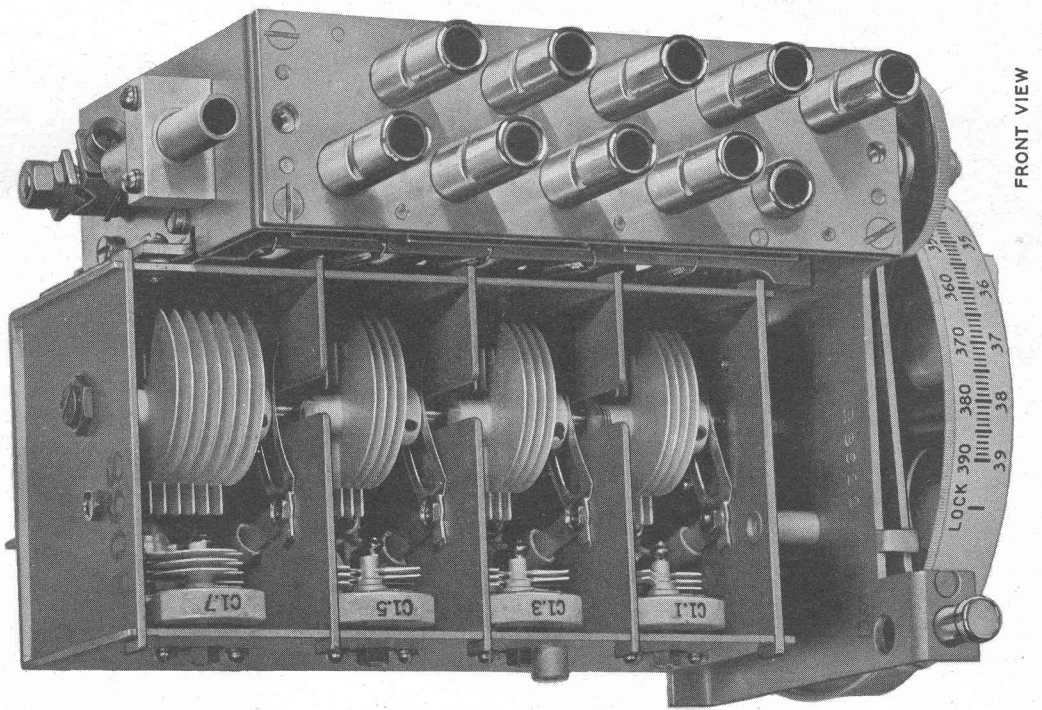


Fig. 9. Radio Receiver BC-683-A: Right-hand Interior View



RIGHT-SIDE VIEW

Fig. 10. Radio Receiver BC-683-A: Push-button Assembly, Right-side View



FRONT VIEW

Fig. 11. Radio Receiver BC-683-A: Push-button Assembly, Front View



Fig. 12. Radio Transmitter BC-684-A: Front View with Crystal Compartment Open

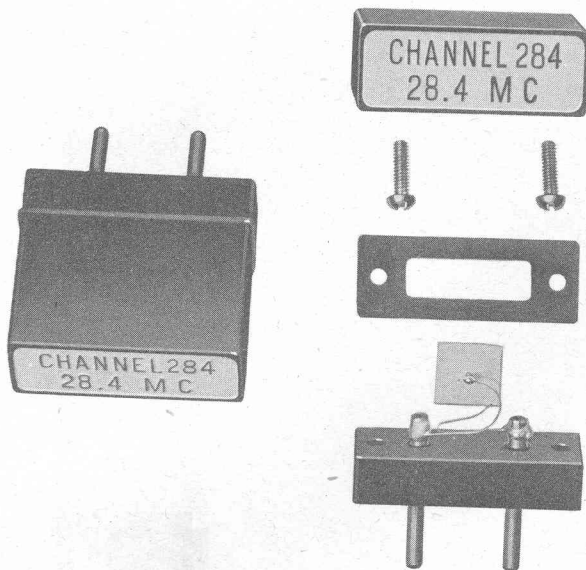


Fig. 13. Radio Transmitter BC-684-A: Assembly and Exploded View of Crystals

tained; ordinarily, however, the frequency deviation is much less than this. Under most operating conditions the deviation, even on voice peaks, is less than plus or minus 40 kilocycles (total swing, 80 kilocycles).

A front oblique view of the transmitter is shown in Fig. 1 (large unit at the left). Figure 12 is a closer front view and Fig. 13 shows assembly and exploded views of typical crystals. A view of the right-hand end of the transmitter showing the various controls and access openings is given in Fig. 14.

The front panel contains ten push buttons by means of which any of ten preadjusted transmitting channels may be immediately selected. This operates exactly like the push-button type of broadcast radio for the home. Like the receivers, you merely push one of several buttons on the front of the set to select the channel you want. Antenna and ground binding posts, designated A and G, are provided for test purposes, and they are not normally used when the transmitter is installed for operation. The RECEIVER TUNE-OPERATE switch makes it possible to use the transmitter as a source of known signal frequency for adjustment and testing of associated radio receivers. The transmitter filaments and relay circuits are energized by the ON-OFF switch and

transmission is started by operating the control switch on the operator's microphone. The pilot lamp lights when the TRANSMITTER switch is at ON. Plug microphones of the carbon type, such as Microphone T-17 and Microphone T-30, into the CARB MIC jack. Connect Microphone T-33, which is of the magnetic type, at the MAGNETIC MIC jack.

Active and spare fuses are contained in the two fuse receptacles designated FUSE and SPARE.

The panel meter may be connected in various circuits by means of the TUNE-ANT CUR switch on the panel and the six-position METER SWITCH (Fig. 14) to observe transmitter output and circuit operating conditions. The meter is not calibrated in milliamperes or other standard unit of measure as it is used only as an indicator of relative current flow.

The SIDETONE control shown in Fig. 14 adjusts the volume of transmitted speech heard in the operator's headset. The ten screwdriver-operated controls are for antenna tuning adjustments.

Remove the top or bottom cover plates for access to the interior of the transmitter. Figure 15 is a view of the interior with the top cover plate removed. Figures 16 and 17 show the transmitter push-button assembly viewed from the left and from the right side respectively. A view of the interior with the bottom cover plate removed is shown in Fig. 18.

b. Power Supply. Radio Transmitter BC-684-A is furnished with a dynamotor, Dynamotor DM-35-(*), suitable for operation from a 12-volt vehicle battery. If authorized, the transmitter may be operated from a 24-volt vehicle battery by merely substituting Dynamotor DM-37-(*), in place of Dynamotor DM-35-(*). This is the only change necessary, since a multicontact jack on the base of each dynamotor is wired to make the necessary circuit changes. *The design of Dynamotors DM-35-(*), and DM-37-(*), is based on an average duty cycle of 5 minutes on and 15 minutes off at high temperatures. Don't operate the transmitter dynamotors continuously over long periods. You might burn out your dynamotor.*

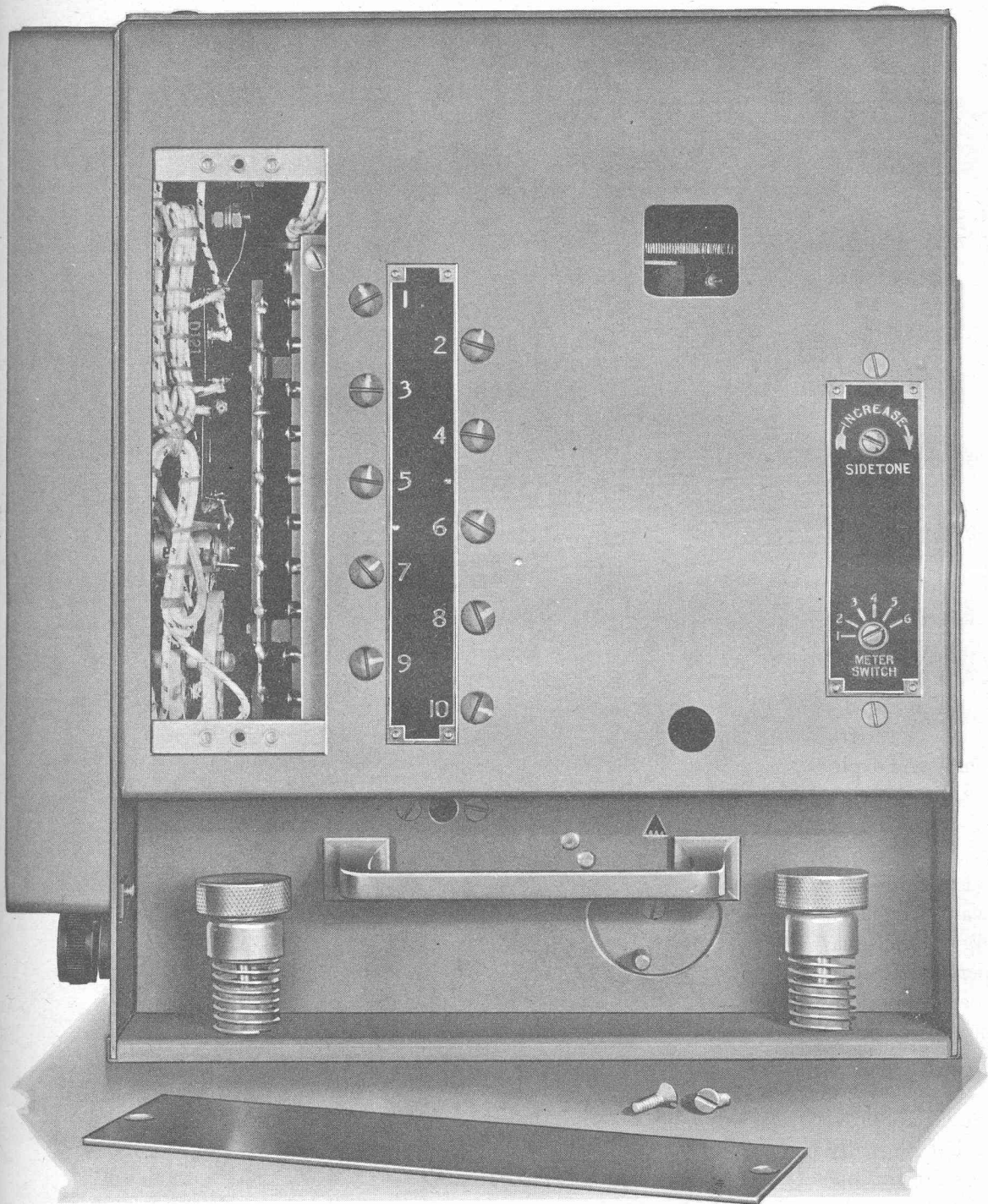


Fig. 14. Radio Transmitter BC-684-A: Right-hand End View with Cover Plate Removed

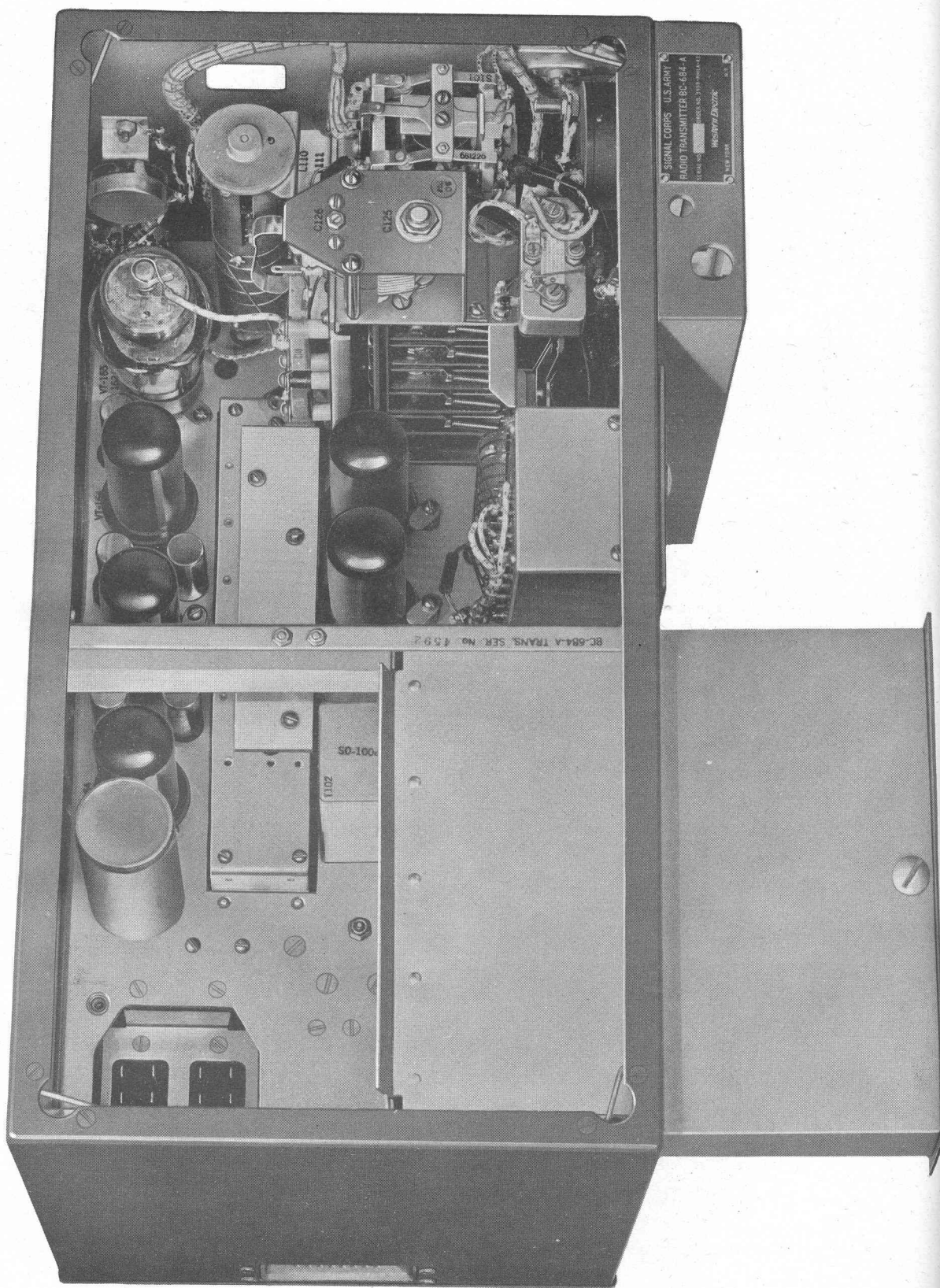
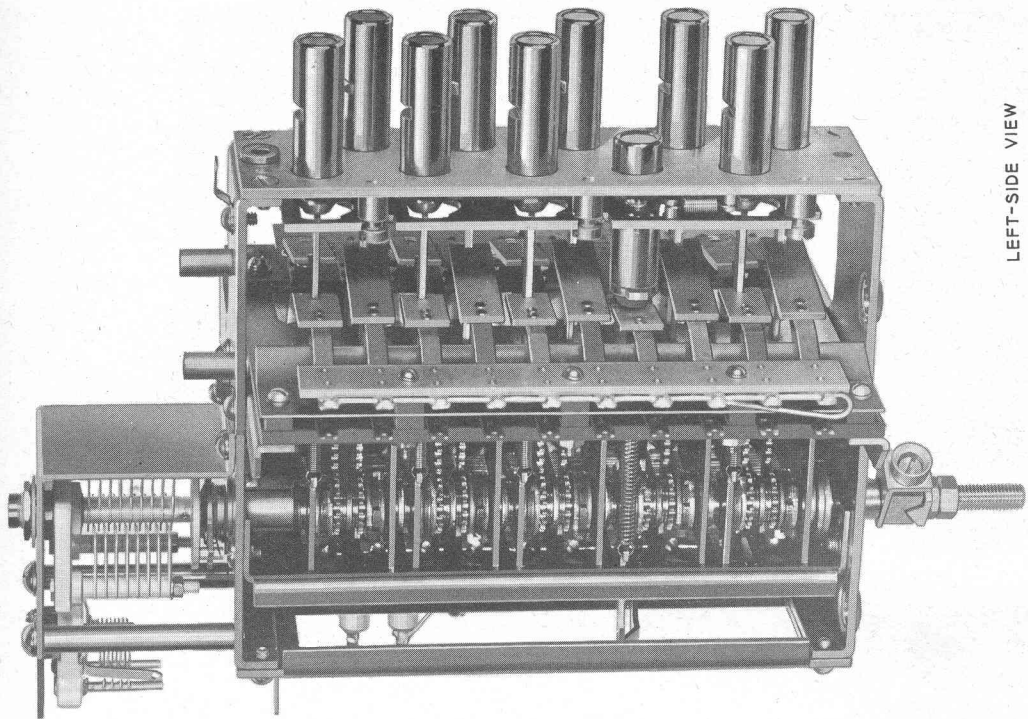
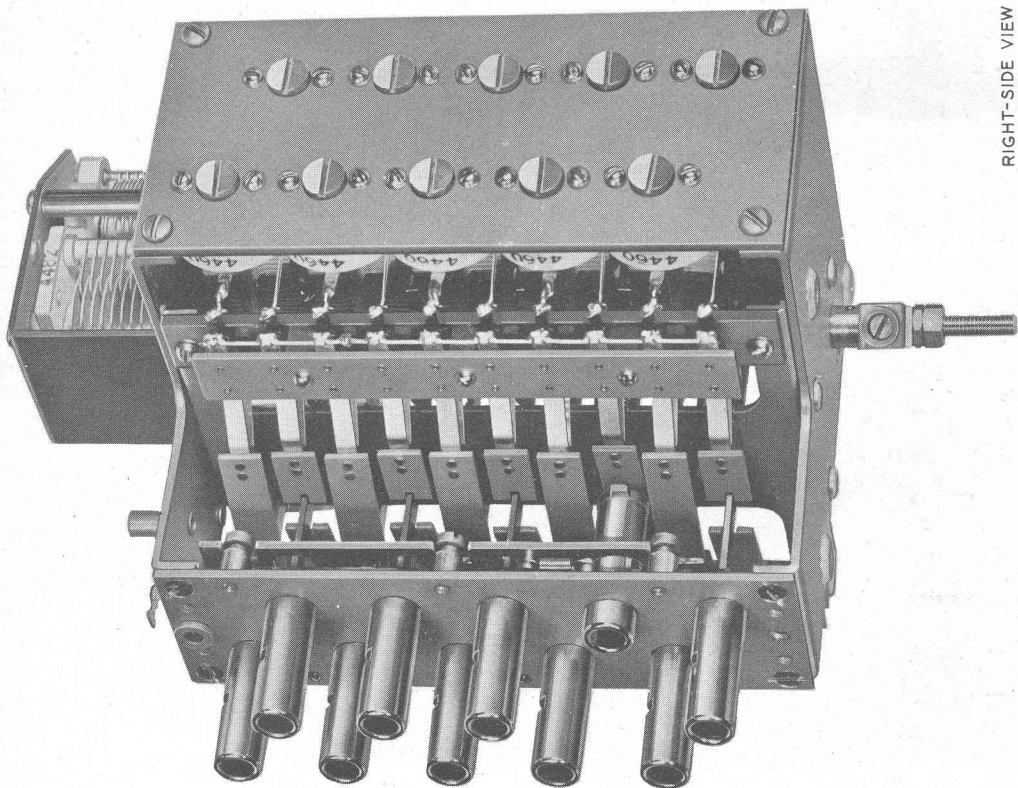


Fig. 15. Radio Transmitter BC-684-A: Interior View with Top Cover and Dynamotor Removed



LEFT-SIDE VIEW

Fig. 16. Radio Transmitter BC-684-A: Push-button Assembly, Left-side View



RIGHT-SIDE VIEW

Fig. 17. Radio Transmitter BC-684-A: Push-button Assembly, Right-side View

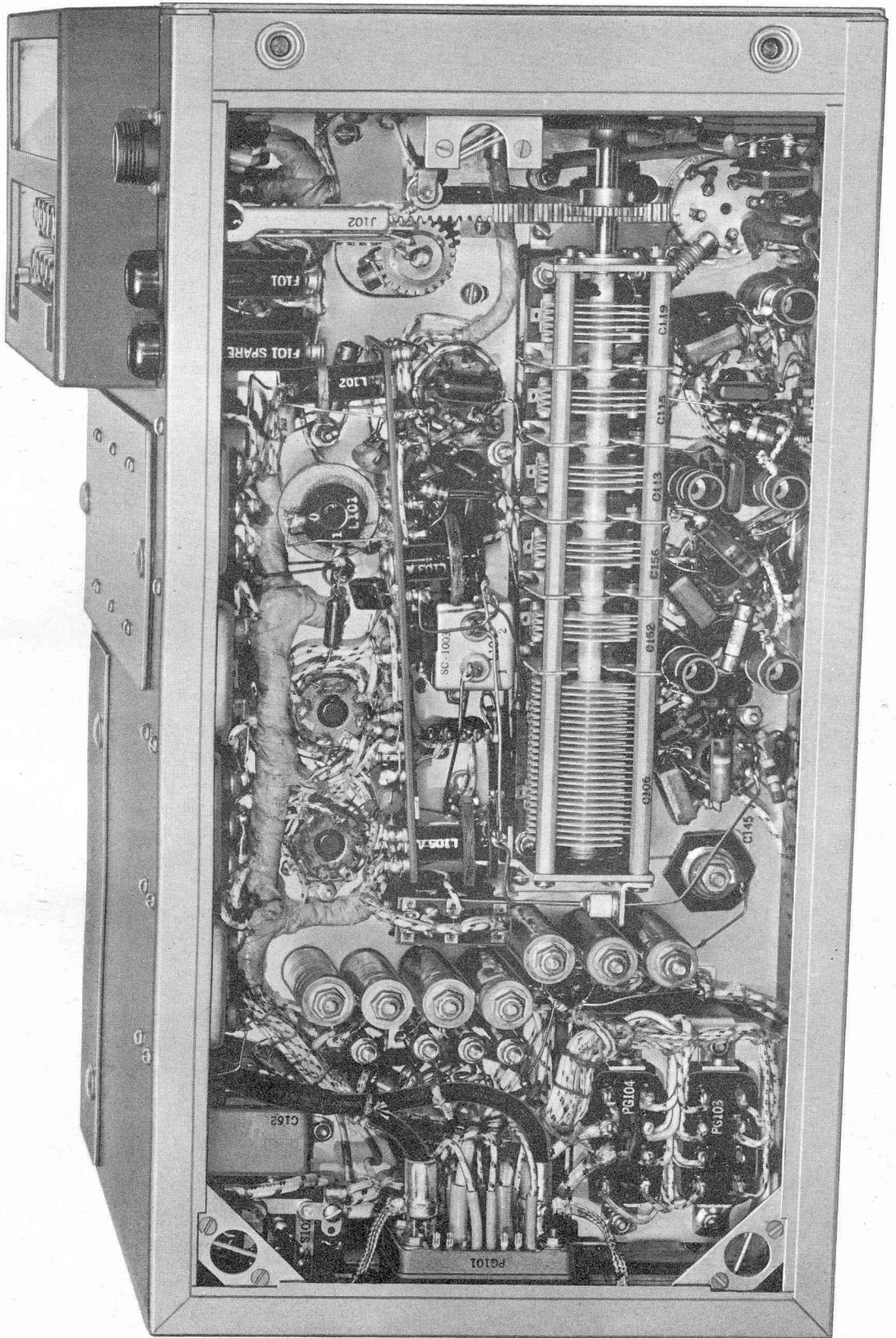


Fig. 18. Radio Transmitter BC-684-A: Interior View with Bottom Cover Removed



Fig. 19. Remote Control Unit RM-29-D: Front View

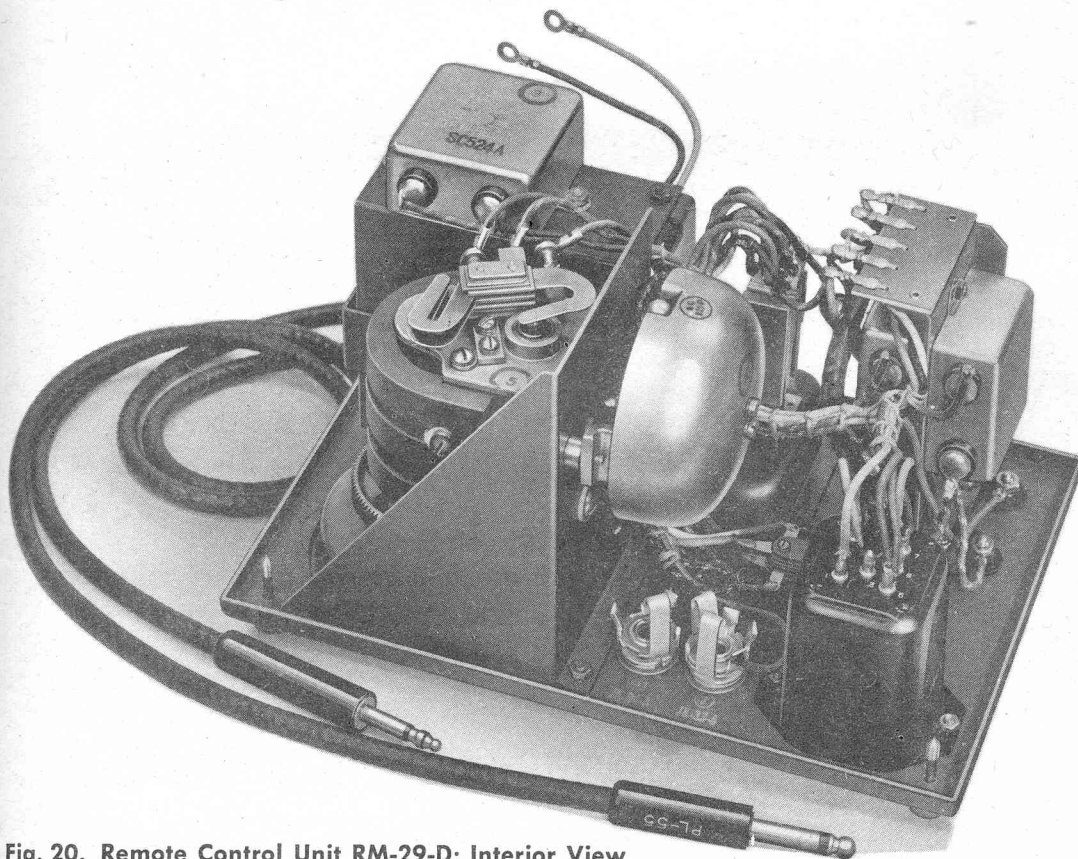


Fig. 20. Remote Control Unit RM-29-D: Interior View

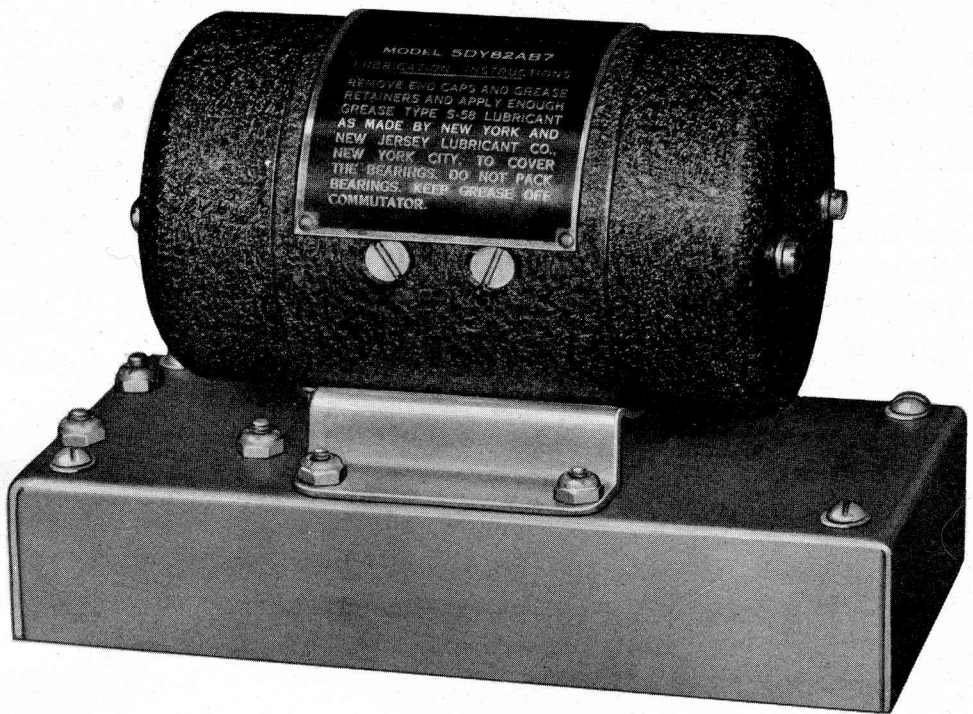


Fig. 21a. Dynamotor DM-34-(*) or Dynamotor DM-36-(*)

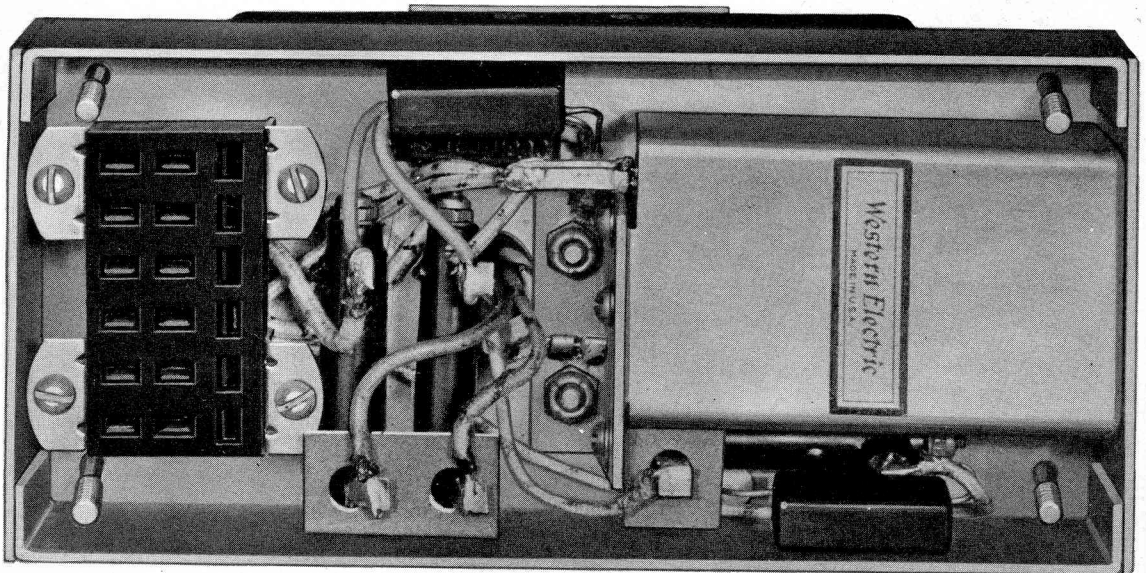


Fig. 21b. Dynamotor DM-34-(*) or Dynamotor DM-36-(*): Sub-base View

9. Remote Control Unit RM-29-D.

Note: The information regarding Remote Control Unit RM-29-D in this and subsequent paragraphs is given to assist radio operators in setting up Radio Sets SCR-608-A and SCR-628-A for remote control operation. Do not regard this information as complete, but refer to Technical Manual TM 11-308, covering the remote control unit, for detailed information and instructions.

a. Description of Functions. Remote Control Unit RM-29-D provides for remote control of the radio equipment and operates in conjunction with Telephone EE-8-(*) over a two-wire telephone line. A front view of the remote control unit is shown in Fig. 19, and an internal view with the housing removed is shown in Fig. 20.

Two plug-terminated cords are provided to connect the remote control unit to the radio transmitter and radio receiver. The two-wire telephone line from the remotely located field Telephone EE-8-(*) terminates at binding posts L1 and L2 on the remote control unit. Microphone T-17 and a headset, when plugged into the remote control unit, are used for transmission and reception of signals via the radio set, for monitoring signals between the telephone and the radio set, and for direct communication with Telephone EE-8-(*) .

The three modes of operation are selected by the switch marked RADIO-THROUGH-TELEPHONE on the front of the remote control unit. Operation is as follows:

(1) *Switch at RADIO.* The radio set is controlled entirely by the operator stationed at the remote control unit, with the switch at RADIO. The operator can transmit and receive signals via the radio set.

(2) *Switch at THROUGH.* The radio set is still under control of the operator at the remote control unit with the switch at THROUGH. However, this operator can no longer transmit via the radio set, but can only monitor all signals passing over the line, both from the radio receiver to any Telephone EE-8-(*) connected to the telephone line from the remote control unit, and from any telephone to the radio transmitter.

(3) *Switch at TELEPHONE.* The remote control unit functions as a telephone very similar to Telephone EE-8-(*) with the switch at TELEPHONE, and the operator can communicate with any telephone connected to the telephone line, but is disconnected from the radio equipment.

b. Power Supply. One Battery BA-27 (4½ volts) is mounted inside the remote control unit for operation of Microphone T-17. The current drain from this battery is from 50 to 95 milliamperes, depending on the position of the microphone.

10. Dynamotors DM-34-(*), DM-35-(*), DM-36-(*), DM-37-(*) .

a. Dynamotors DM-34-() and DM-36-(*) .* Each of these dynamotors provides about 200 volts for operation of the receiver. The dynamotors are of similar appearance; and two views are shown in Fig. 21a and Fig. 21b. The dynamotors are totally enclosed. Their armatures are dynamically balanced and are supported by two single-race ball bearings. Both dynamotors are shunt wound. The primary and secondary windings are wound in the same armature slots, but the two windings are brought out to separate commutators mounted on opposite ends of the armature shaft.

b. Dynamotors DM-35-() and DM-37-(*) .* Each of these dynamotors provides approximately 625 volts for operation of the transmitter. The dynamotors are of similar appearance; and two views are shown in Fig. 22a and Fig. 22b. Except for screened breathing vents in the end covers, the dynamotors are totally enclosed. The screened holes have been omitted in later dynamotors to reduce the entrance of dust or sand. This does not affect the power rating of the dynamotors. Their armatures are dynamically balanced and are supported by two single-race ball bearings. Both dynamotors are compound wound. The primary and secondary are wound in the same armature slots, but the two windings are brought out to separate commutators mounted on opposite ends of the armature shaft.

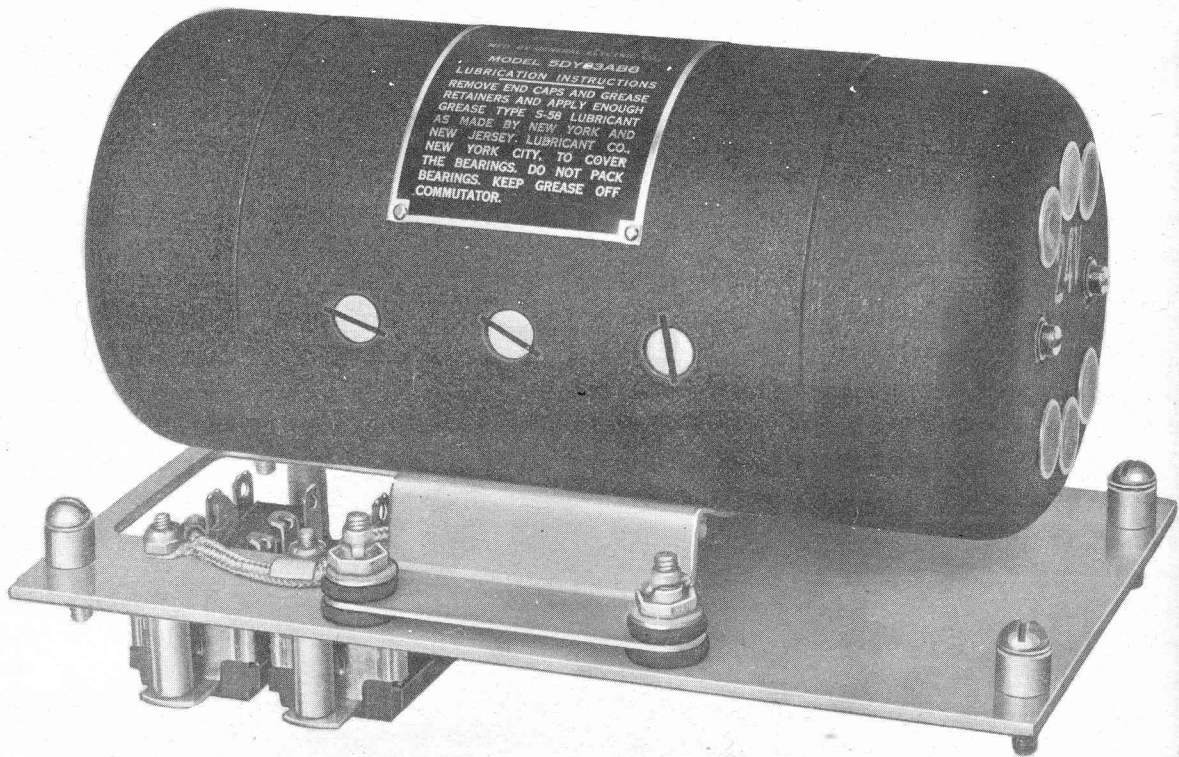


Fig. 22a. Dynamotor DM-35-(*) or Dynamotor DM-37-(*)

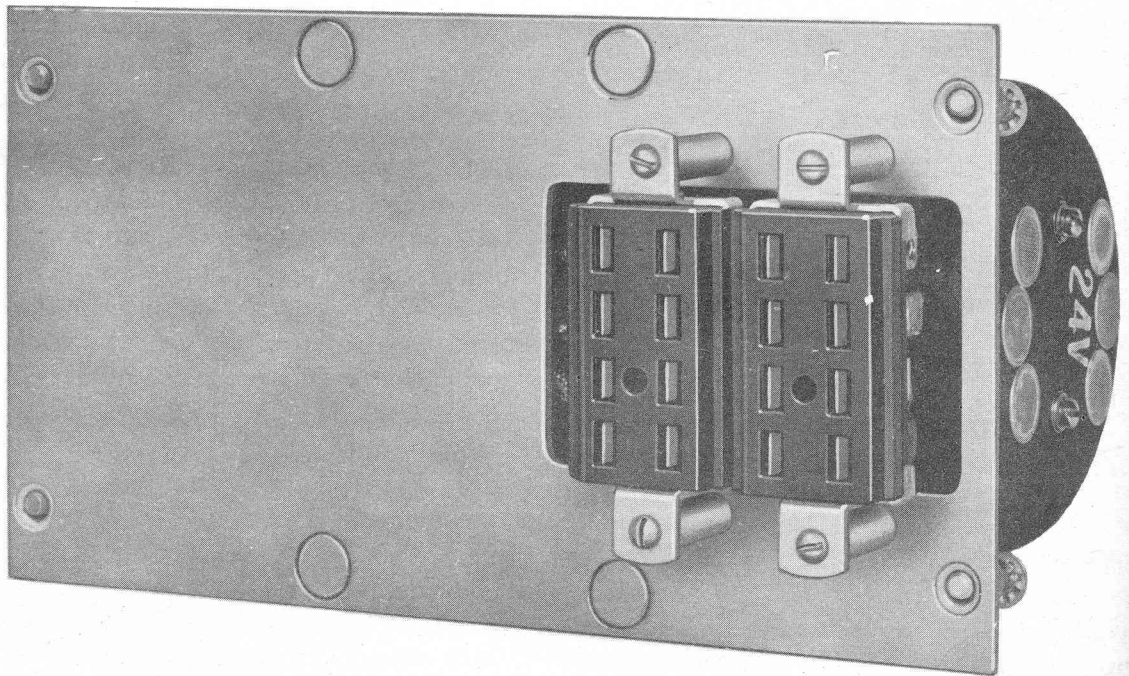


Fig. 22b. Dynamotor DM-35-(*) or Dynamotor DM-37-(*): Sub-base View

c. 12- or 24-Volt Operation. Dynamotor DM-34-(*) for the receiver and Dynamotor DM-35-(*) for the transmitter are designed for operation from a 12-volt vehicle battery supply. These dynamotors are issued with Radio Sets SCR-608-A and SCR-628-A which will normally be operated from a 12-volt battery. However, as mentioned in Paragraphs 7*b* and 8*b*, the receiver and transmitter can be operated in vehicles having a 24-volt battery supply. To do this, it is only necessary to substitute Dynamotors DM-36-(*) and DM-37-(*) for Dynamotors DM-34-(*) and DM-35-(*) in the receiver and transmitter, respectively. Dynamotors DM-36-(*) and DM-37-(*) operate from a 24-volt battery supply.

11. Cabinet CH-74-A. Cabinet CH-74-A is a protective housing for the radio equipment in installations where the equipment would otherwise be exposed to the elements (see Fig. 1). Cabinet CH-74-A is supported within the vehicle by Mounting FT-284-(*), Mounting FT-285-(*), or Frame FM-43, depending upon which vehicle is being used. Mounting FT-237-(*) is bolted in place in the cabinet. The top of the cabinet extends somewhat over the front of the radio equipment. A canvas cover assembly is provided for the front of the cabinet to completely enclose the radio equipment, if desired. The canvas cover may be rolled back over the top of the cabinet, or it may be supported by a bracket which telescopes into the top of the cabinet. Except in an emergency, do not operate the equipment during hot weather with the canvas cover completely closed. *Even in an emergency, do not operate either the transmitter or the receiver long enough for the equipment to overheat before the cover is raised.*

12. Mountings FT-284-(*) and FT-285-(*) and Frame FM-43. Mountings FT-284-(*) and FT-285-(*) and Frame FM-43 are used to support Cabinet CH-74-A in vehicles where the cabinet is used. The choice among these mountings depends upon the particular vehicle in which the radio equipment is to be installed. (See Paragraph 3*b*.) Figure 1 shows an installation using Mounting FT-284-(*).

13. Mast Bases.

a. Mast Base MP-37. This mast base provides an insulated and flexible mounting for the antenna; it is rigidly mounted on the vehicle but includes a large helical spring for flexibility. Mast Section MS-53, the largest, screws into this base.

b. Mast Base MP-48. Another way to have a flexible antenna support is to use Mast Base MP-48. Use this base with a coaxial transmission line such as Cordage CO-282. Two binding posts permit use of a single wire lead (Wire W-128).

14. Mast Base Bracket MP-52. Mast Base Bracket MP-52 serves to support an antenna and mast base about two feet above Cabinet CH-74-A. Clamp the mast base to the bracket cover plate and bring the antenna lead down through insulating guides into the cabinet for connection to the radio equipment. The bracket is fastened to the cabinet by 12 bolts. (See Fig. 1.)

15. Mast Sections. Mast Sections MS-51, MS-52, and MS-53 are used with these radio sets, except that only two mast sections (MS-52, MS-53) are to be used with Mast Base Bracket MP-52. (Mast Base Bracket MP-52 is used in half-track installations and is mounted on the top of Cabinet CH-74-A at the left front corner.) The mast sections are made of high-tensile-strength flexible steel. Mast Section MS-51 is the top (and smallest) section. The others follow in numerical order. The lower end of each mast section is fitted with a serrated (notched) shank and screw for engaging the threaded upper end of the next mast section. Ends which are joined in assembling have enamel marks of the same color. The body of each section is enameled black and bears the type number at the lower end. The lower end of each mast section has an entering guide to aid assembly. Store the mast sections in Roll BG-56-A when not in use.

16. Cords and Cordage.

a. Cord CO-278-A. Cord CO-278-A is used to connect Mounting FT-237-(*) to the terminal box (battery) of the vehicle. It consists of 8 feet

of Cordage CO-212 to which connection terminals have been soldered. The inner conductor is connected to the positive side of the battery and the outer conductor is grounded.

b. Cord CD-307-A. Cord CD-307-A in two lengths, 48 inches and 65 inches, extends the radius within which the crew of the vehicle may receive signals in their headsets. Plug PL-55 at one end of Cord CD-307-A plugs into the radio receiver. The headset plug is connected into Jack JK-26 at the other end of Cord CD-307-A.

c. Cord CD-318. Cord CD-318 is a 7-foot cord assembly for connection between the short cord supplied with Microphone T-30 and the radio equipment or a remote control box. The assembly includes Switch SW-141-E for control of the microphone current, provided with a neck strap for its support. The neck strap quickly detaches from the switch.

d. Cord CD-786. The auxiliary Cord CD-786 provides for making thirteen connections to a receiver or transmitter when not installed in the mounting. One such use is testing a receiver on a bench. The cord consists of

(1) A male plug for insertion in the socket J401, J402, or J403 of Mounting FT-237-(*).

(2) A receptacle for connection to the plug PG1 of the receiver, or PG101 of the transmitter.

(3) Six feet of cordage containing conductors to connect corresponding numbers in these two plugs.

Terminals 1 and 2 of the plug are connected to corresponding numbers in the receptacle by 10-gauge stranded wires. This constitutes the power connection and is suitable for carrying several amperes. A 22-gauge twisted, shielded pair of stranded wire is used for terminals 4 and 5. The other terminals used are numbers 7, 8, 9, 10, 19, 20, 21, 22, and 25.

e. Cordage CO-212. Cordage CO-212 is composed of two concentric conductors and is used in making Cord CO-278-A. Cordage CO-212 is supplied in bulk lengths and is used to replace damaged Cords CO-278-A or where a longer cord is needed. The cordage is installed so that the inner conductor is positive and the outer conductor is at ground potential.

f. Cordage CO-282. Cordage CO-282 is a flexible two-conductor coaxial cordage intended for transmission of high-frequency currents. It is used in all installations of Radio Sets SCR-608-A and SCR-628-A where the distance between the binding post on Mounting FT-237-(*) and the mast base is more than 40 inches. The length of Cordage CO-282 must *always* be 7 feet (plus or minus 1 foot). If 7 feet is more than is needed, tape up the excess in a coil. Be sure to ground the sheath at both ends.