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TECHNICAL MANUAL

INTERPHONE EQUIPMENTS

RC-48 AND RC-60

April 13, 1942

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TECHNICAL MANUAL |
No. 11-710

WAR DEPARTMENT,
WASHINGTON, April 13, 1942.

INTERPHONE EQUIPMENTS RC-48 AND RC-60

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SECTION I
GENERAL

	Paragraph
Purpose	1
Power	2
List of components showing weights	3
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1. Purpose.—Interphone equipments RC-48 and RC-60 are four-station, intravehicular communication systems for use in light tank M2A4 and light tank M1A1, respectively. In addition to providing voice communication between all members of the vehicular crew, the interphone equipment enables the radio operator and tank commander to retain partial control of the vehicular radio apparatus for intervehicular and base-station voice communication.

TM 11-710

2. Power.—a. Input.—The primary source of power required to operate the interphone equipment is the 12-volt, 168 ampere-hours, 6-hour rate, vehicular storage battery (not an interphone component). Normal storage battery consumption of the interphone equipment is 3.2 to 3.75 amperes.

b. Output.—The interphone amplifier has a nominal output rating of 2 watts.

3. List of components showing weights.

Quantity	Article	Unit weight (pounds)
4	Brush, HV, for dynamotor DM-25-(); spare.....	
4	Brush, LV, for dynamotor DM-25-(); spare.....	
1	Control box BC-369.....	1.3
2	Control box BC-422.....	2.0
2	Cord CD-307-A (48" long) ¹	
2	Cord CD-307-A (65" long) ¹	
3	Cord CD-318 ²	
1	Cord CD-416 ²	
1	Cord CD-420 (for interphone equipment RC-48 only).....	
4	Fuse FU-21-A; spare.....	
4	Headset HS-18 ¹	1.6
1	Interphone amplifier BC-367.....	18.5
1 set or	Interconnecting conduit, wire and clamps (RC-48).....	11.5
1 set	Interconnecting conduit, wire and clamps (RC-60).....	11.5
1	Jack box BC-370.....	2.3
6	Lamp LM-33; spare.....	
4	Microphone T-30-A ²	0.3
6	Tube VT-107 (RCA 6V6 or equal); 2 in use, 4 spare.....	0.1

¹ Headsets P-19 may be substituted for headsets HS-18. When this is done, cords CD-307-A are not used.
² Microphones T-17 may be substituted for microphones T-30-A. When this is done, cords CD-318 and CD-416 are not used.

4. Mechanical features.—The major components, which are all housed in sheet metal boxes $\frac{5}{16}$ inch thick, are mounted directly on the body of the vehicle. All of the control equipment except interphone amplifier BC-367 is permanently mounted and wired to the terminal strips in each box. The interphone amplifier BC-367 has rubber shock-mountings and is a "plug-in" type for convenience in servicing. All units are interconnected by wires which are drawn through flexible metallic conduit and soldered to the terminal strips.

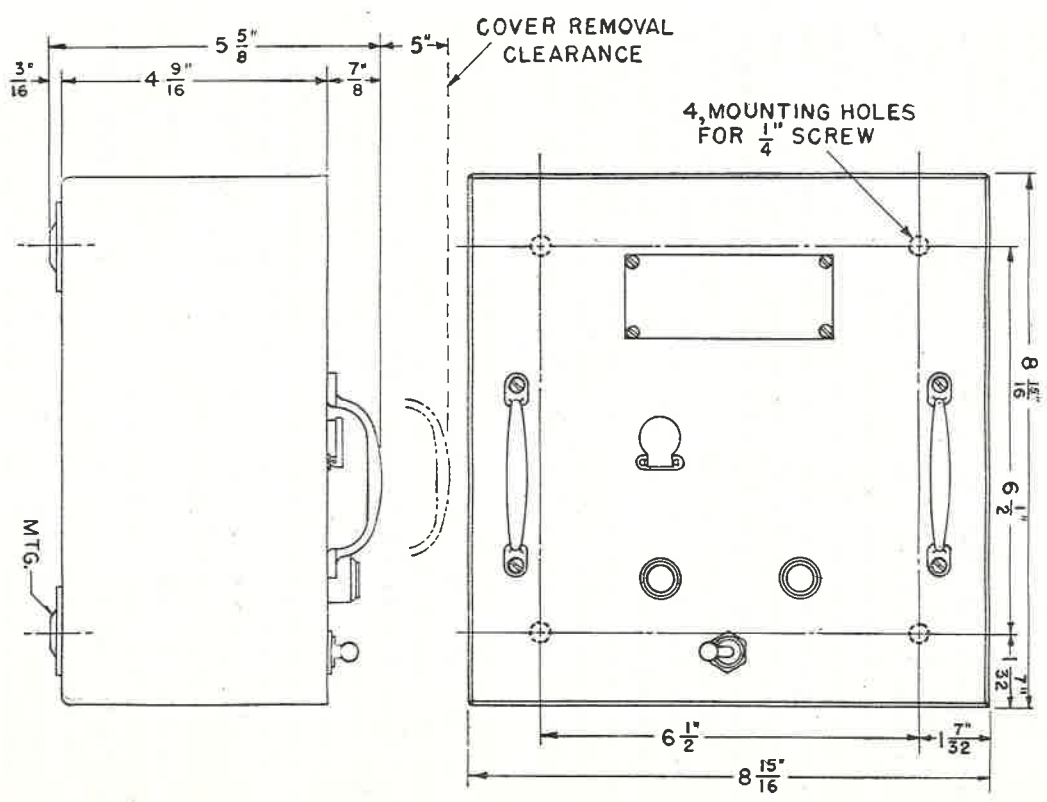
a. Interphone amplifier BC-367 (fig. 1).—This unit consists of a panel and tube chassis assembly fitting into a sheet steel box. The entire unit can be removed from the box as electrical connections are

made by the use of plugs and jacks. Two guide angles on the sides of the box and chassis assure proper alinement of the plugs when entering the jacks. In the box, which is approximately $8\frac{3}{4}$ inches long by $8\frac{3}{4}$ inches wide by $4\frac{1}{2}$ inches deep, is mounted a 14-point terminal block on which the external interconnecting wires of the system terminate. The back of the box contains four rubber shock-mountings by means of which the amplifier is mounted on the vehicle. The panel and chassis assembly consists of a tube shelf riveted to a sheet steel front panel approximately $8\frac{3}{4}$ inches long by $8\frac{3}{4}$ inches wide. The front panel provides the mounting for the dynamotor and its associated filter, an OFF-ON switch, two fuse posts, and an opening for adjustment of a volume control with a screw driver. On the tube shelf are mounted two beam amplifier tubes VT-107, one input transformer, one output transformer, one oscillator transformer, and two capacitors. The volume control is mounted on a bracket supported from the tube shelf and consists of a 500,000-ohm potentiometer equipped with a special knob which may be adjusted through the panel with a screw driver. A spring provides friction on the knob to prevent turning under vibration. Mounted on brackets and supported from the tube shelf is a terminal board located in the back of the box.

b. Control box BC-422 (fig. 2).—Two control boxes BC-422 are used in this installation, one for the tank commander and one for the radio operator. Control box BC-422 consists of a sheet steel box approximately 4 inches long by 4 inches wide by 2 inches deep, with a cover. In it are mounted: one 10,000-ohm, wire-wound potentiometer for volume control; one INTERPHONE-RADIO transfer switch consisting of two double-pole, double-throw toggle switches operated together by a common switch handle; two jacks, one for a headset and one for a microphone; and one 16-point terminal block which connects the unit to the rest of the system.

c. Control box BC-369 (driver) (fig. 3).—This control box consists of a sheet steel box approximately 4 inches long by 2 inches wide by 2 inches deep, with a cover. In it are mounted one push-button signal switch; one microphone switch consisting of one double-pole, single-throw toggle switch; one red pilot light; and one 6-point terminal block which connects the unit to the rest of the system.

d. Jack box BC-370 (driver and bow gunner) (fig. 4).—This unit consists of a sheet steel box approximately 4 inches long by 4 inches wide by 2 inches deep, with a cover. In it are mounted four jacks, two for headsets and two for microphones; two 10,000-ohm wire-wound potentiometers for volume control, one for the driver and one for the bow gunner; one green pilot indicating lamp; one red pilot



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FIGURE 1.—Interphone amplifier BC-367 or BC-667.

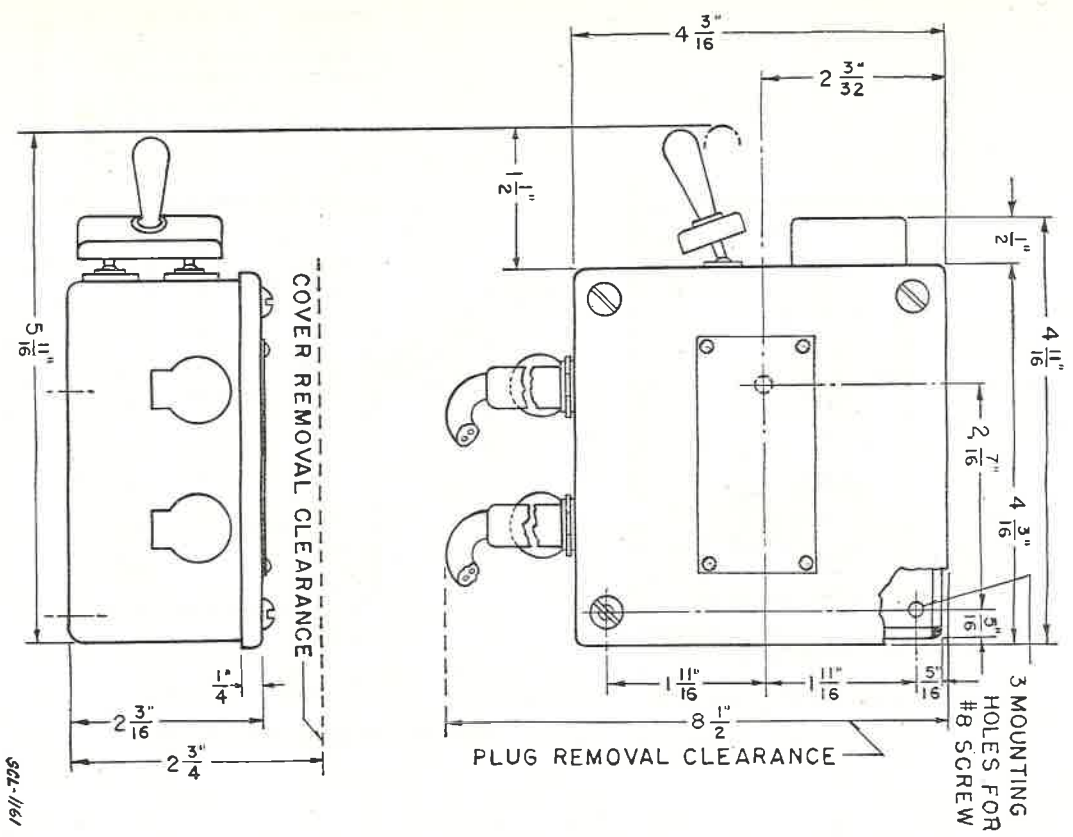
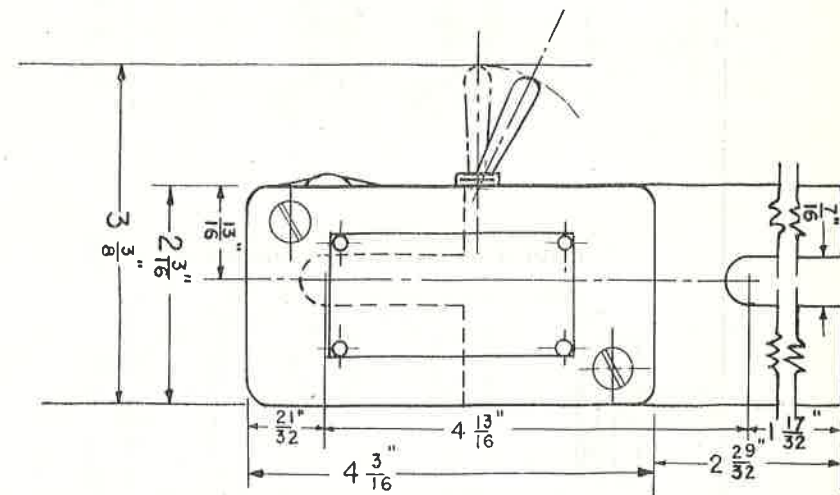
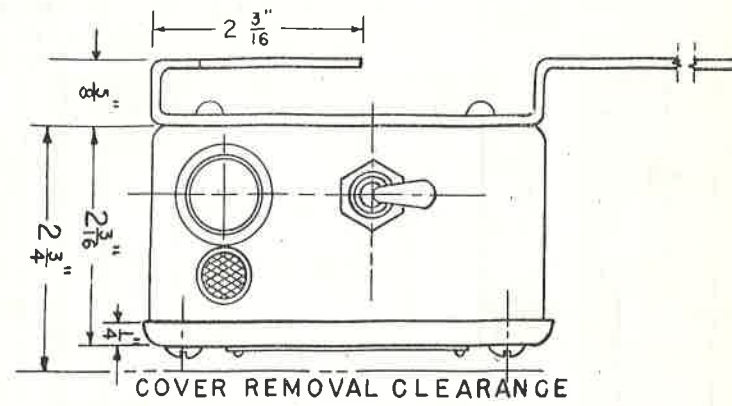


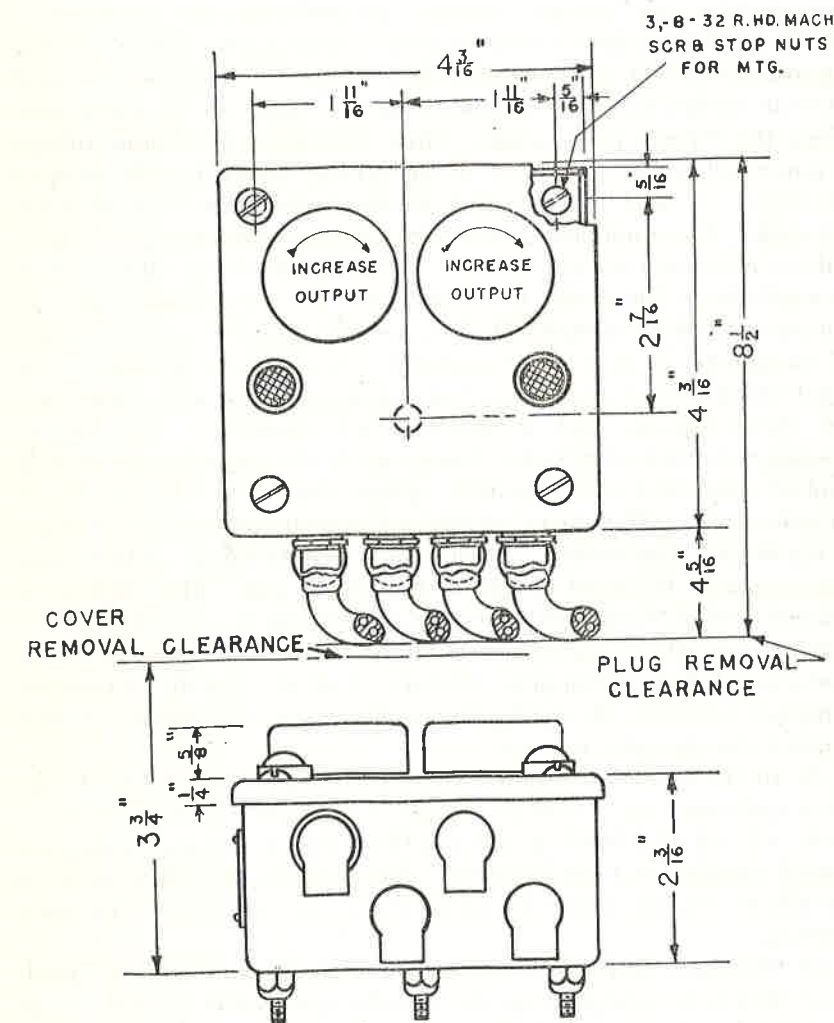
FIGURE 2.—Control box RC-422.

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FIGURE 3.—Control box BC-369.



SCL-1158

FIGURE 4.—Jack box BC-370.

indicating lamp; and one 16-point terminal block which connects the unit to the rest of the system.

5. Electrical features.—a. Interphone amplifier BC-367.—(1) This unit contains two separate circuits, an oscillator, and an amplifier (fig. 5). The oscillator circuit is used to generate an audio signal of approximately 600 cycles to provide a means for the driver to signal when he wishes to speak to anyone on the radio side of the system. When the driver's push-button switch is pressed, this audio voltage is impressed across the input of the second audio if radio receiver BC-312-() is used, or across the output of other type radio receivers are used. The amplifier is of the transformer-coupled type and provides a maximum output of over 2 watts. The rising fidelity characteristic from 100 cycles to 2,500 cycles (attenuation at lower frequencies) tends to compensate for the poor high-frequency response of microphone T-30-A and to prevent excessive noise pick-up. The input transformer consists of a two-winding primary with each winding center-tapped, and a single-wound secondary. The audio-frequency voltage, after being stepped up by the input transformer, is applied through a potentiometer volume control to the grid of the amplifier tube. The output of this tube appears across the secondary of the output transformer. Various output impedances of this transformer can be obtained by use of the proper tap. The amplifier is shipped with an output impedance of 2,500 ohms in use. The direct-current microphone current is obtained from the car-battery source through a 100-ohm dropping resistor. A 50- μ f, 25-volt, electrolytic capacitor bypasses the audio component of the microphone current through the dropping resistor.

(2) In the oscillator circuit, the grid is coupled inductively to the plate and tuned by a 0.05 μ f capacitor across the grid and ground. Tube VT-107 is a beam power amplifier with screen and plate connected together to form a triode. The oscillator transformer has a secondary winding which is connected to the output of the radio receiver.

(3) The plate and screen voltage for both the amplifier and oscillator circuits are obtained by the use of a dynamotor (12-volts input to 250-volts output) mounted on the front panel of the interphone amplifier chassis. The negative 12-volt terminal of this dynamotor is kept above ground potential and used as the dynamotor control lead; depressing any microphone switch connects it to ground, thus starting the dynamotor. A filter unit, consisting of a 10-henry choke coil with a 2 μ f paper capacitor across the load side, is mounted on the front panel of the interphone amplifier chassis and provides filtered direct

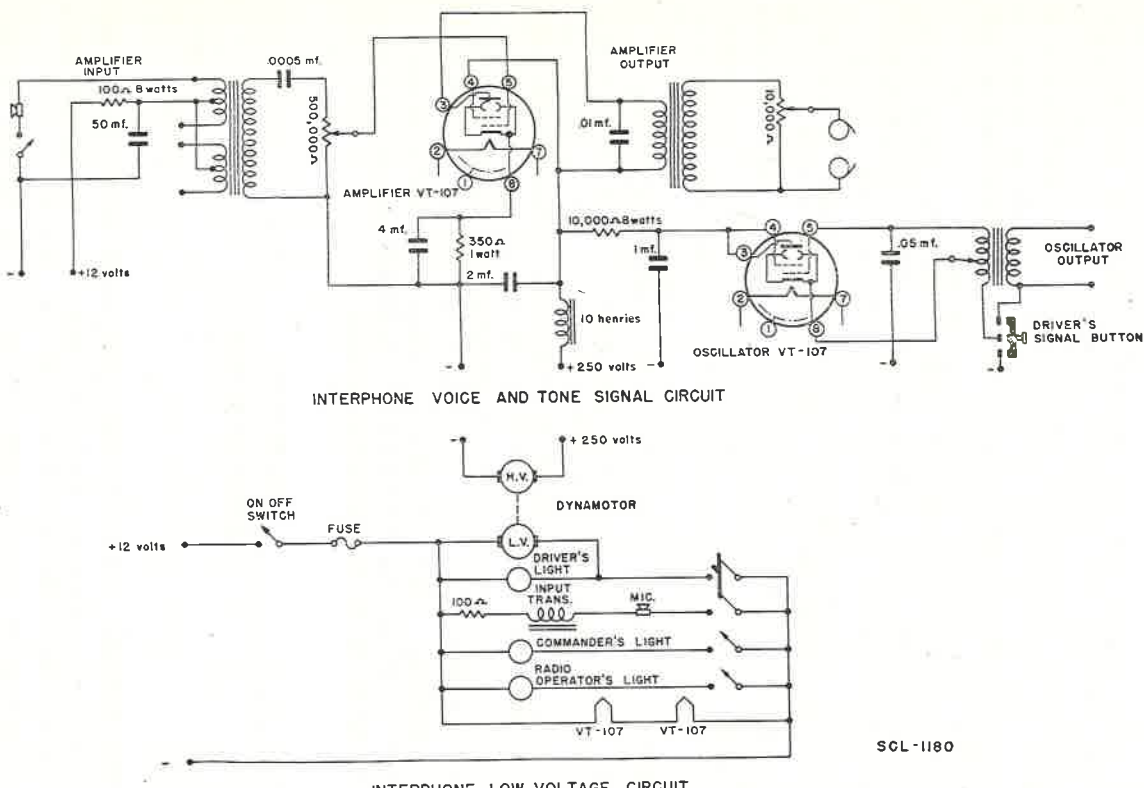


FIGURE 5.—Interphone amplifier BC-367, schematic circuit.

current for the tube plates and screens. The filaments of tubes VT-107 are connected in series across the battery supply.

b. *Control box BC-422.*—Two control boxes BC-422 are used in this installation, one for the tank commander and one for the radio operator. Control box BC-422 is wired so that the headset and microphone for either the tank commander or radio operator can be switched to either the radio system or the interphone system by means of a 4-pole, double-throw switch. A potentiometer controls the output from the radio or interphone amplifier.

c. *Control box BC-369 (driver).*—The driver operates a 2-pole, single-throw toggle switch which connects the driver's microphone to the interphone system. A red indicating lamp lights when the microphone switch is turned ON or when any other member of the crew depresses his microphone button. This lamp when lighted serves as a warning to the driver to prevent him from leaving the microphone switch ON for long periods of time. The push-button signal switch is wired so that pushing the button starts the dynamotor in the interphone amplifier and grounds the cathode circuit of the oscillator tube, causing an audio signal to be set up in the radio output circuit.

d. *Jack box BC-370 (driver and bow gunner).*—This box provides means for insertion of headsets and microphones for the driver and bow gunner. The VOLUME potentiometers are connected directly across the output of the interphone amplifier. The green indicating lamp lights whenever the tank commander operates his INTERPHONE-RADIO switch on control box BC-422 to the INTERPHONE position. The red indicating lamp lights whenever the radio operator operates his INTERPHONE-RADIO switch on control box BC-422 to the INTERPHONE position.

SECTION II
EMPLOYMENT

Installation.....	Paragraph 6
Operation.....	7

6. *Installation.*—a. *Drilling data.*—Light tank M1A1 comes with all the necessary mounting holes, but light tank M2A4 does not. Figure 6 gives the drilling details for light tank M2A4.

b. *Clamps, screws, etc.*—All clamps, screws, nuts, and lock washers needed to install the various components in this vehicle are shown in figure 7. Care will be taken to use the exact screw specified, and all screws, clamps, etc., left over will be placed in a cloth bag and secured to a bracket. It is important to have the holes in the vehicle and the

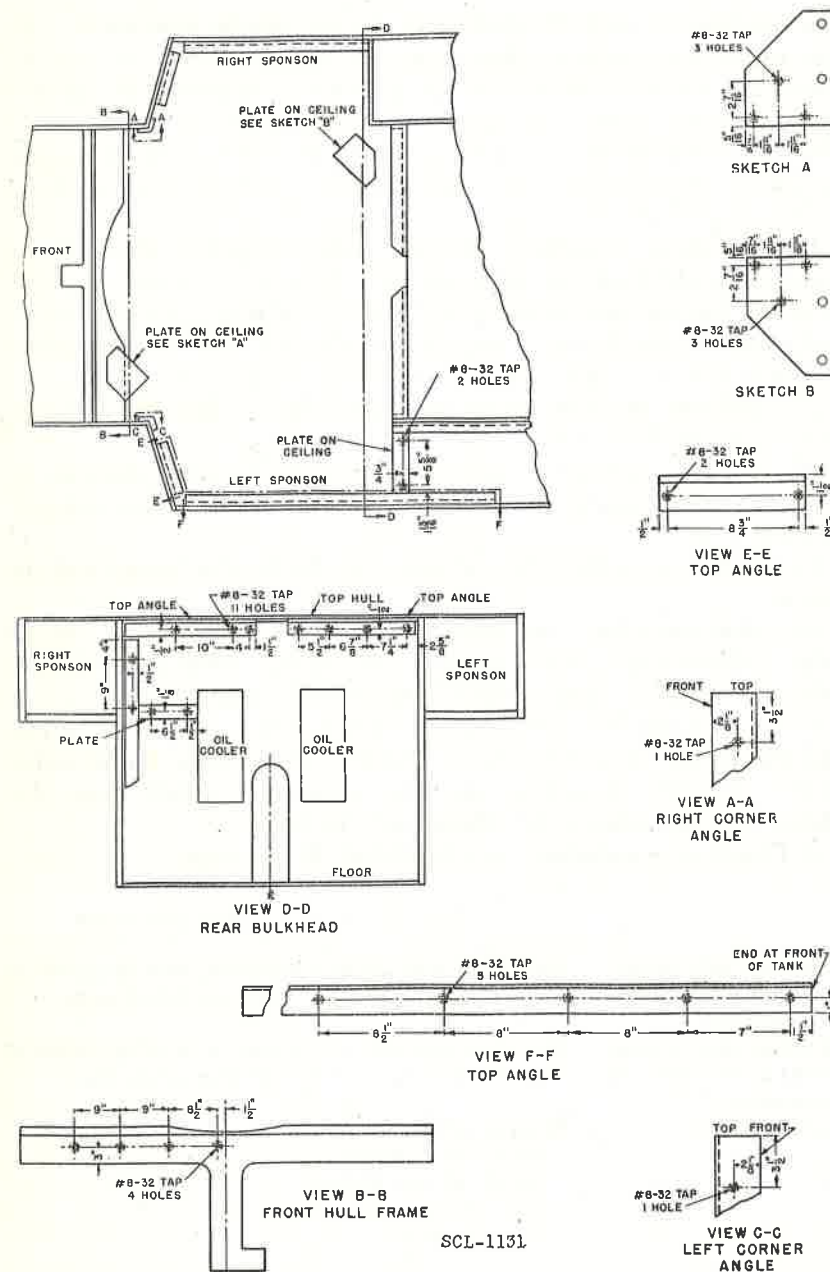


FIGURE 6.—Mounting holes and location for interphone equipment in light tank M2A4.

brackets line up with the drilling in the interphone equipment. Be sure to use lock washers where stop nuts are not called for. *Do not change hole line-up on the interphone parts unless absolutely necessary.*

c. *Initial procedure.*—(1) *Interphone equipments RC-48 and RC-60.*—This comes completely wired for installation. The requisite mounting plates and brackets are supplied as part of light tank M2A4 or M1A1, respectively.

(2) *Interphone amplifier BC-367.*—The amplifier assembly is mounted on the underside of the cover. Remove the cover assembly from the box by removing the eight screws which fasten the cover, and pulling it straight out. Install two tubes VT-107 on the amplifier assembly and one spare tube VT-107 in the amplifier box.

(3) *Jack box BC-370 (driver and bow gunner).*—Remove the four cover screws and the cover.

(4) *Mounting bracket for jack box BC-370.*—Unscrew the two 3/8-inch nuts and remove the bracket from the front center support. (See fig. 7 or 8.)

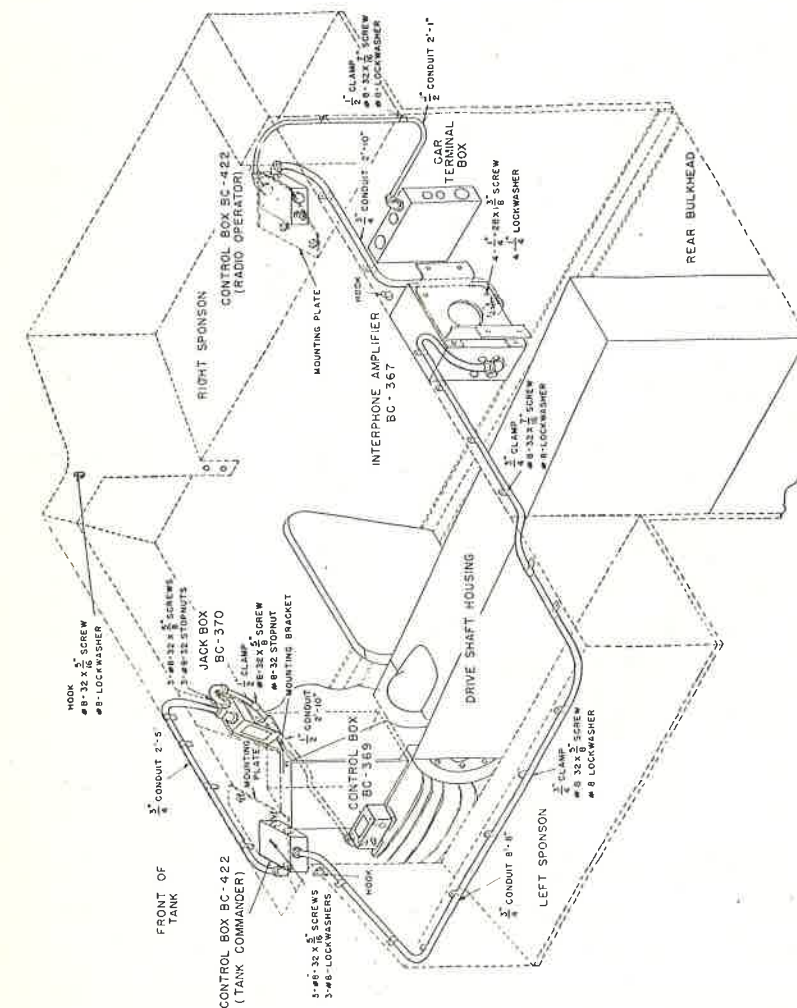
(5) *Control boxes BC-422.*—Remove the four cover screws and the cover.

(6) *Mounting plates for control boxes BC-422 (light tank M2A4 only).*—Remove the two 3/8-inch nuts and plate. Drill and tap three holes per figure 6. Jacks should face center of tank.

(7) *Control box BC-369 (driver).*—Remove the two cover screws and the cover. Unsolder the six conduit wires from the terminal block. Unscrew coupling nut and separate conduit from 45° elbow. Do not remove 45° elbow from the box.

d. *Details of installation.*—(1) *Light tank M1A1 only.*

Part	Place	Method and material
Mounting plate for control box BC-422 (tank commander).	On ceiling near front of left sponson.	Secure in place by means of the two 3/8-inch nuts.
Mounting plate for control box BC-422 (radio generator).	On ceiling near rear of right sponson.	Secure in place by means of the two 3/8-inch nuts.
Cord CD-420	Between radio receiver output jack and terminals 13 and 10 in car terminal box. (See par. 6e(3).)	



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FIGURE 7.—Installation of interphone equipment RC-48 in light tank M2A4.

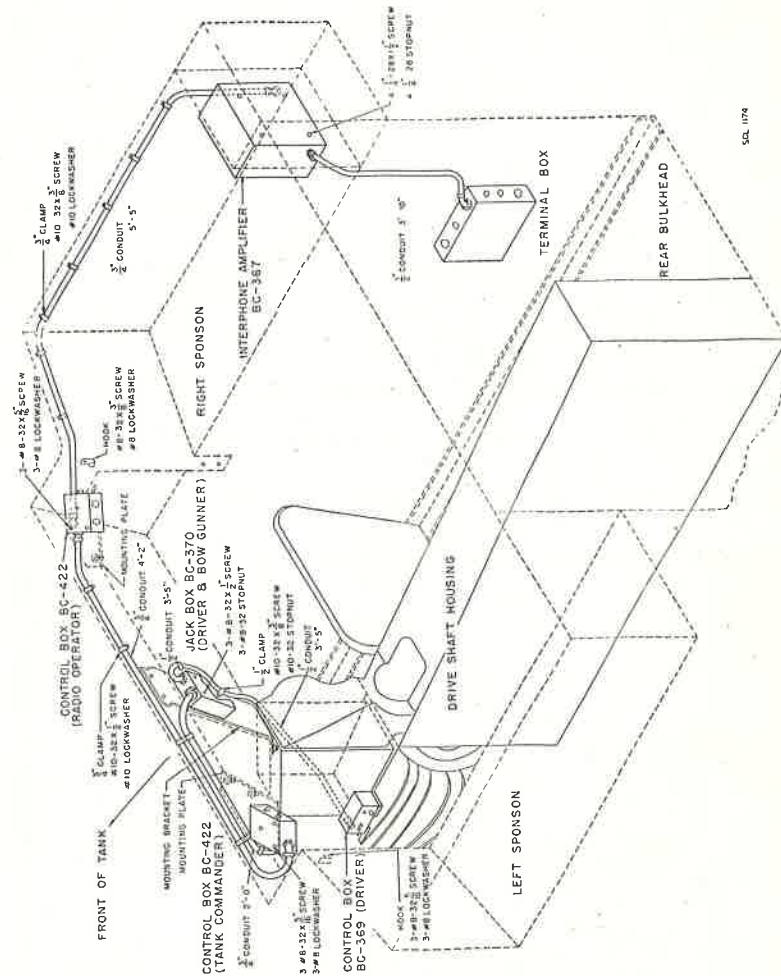


FIGURE 8.—Installation of interphone equipment RC-60 in light tank M1A1.

(2) Light tanks M1A1 and M2A4.

Part	Place	Method and material
Jack box BC-370 (driver and how gunner).	Mounting bracket	Attach jack box BC-370 to bracket by means of three machine screws (#8-32 by 5/8-inch) and stop nuts.
Mounting bracket for jack box BC-370.	Front center support	Secure bracket in place with the two 3/4-inch nuts.
Control box BC-422 (tank commander).	Mounting plate near front of left sponson.	Attach to mounting plate by means of three machine screws (#8-32 by 5/16-inch) and lock washers.

Part	Place	Method and material
Control box BC-422 (radio operator).	Mounting plate in right right sponson.	Attach to mounting plate by means of the three machine screws (#8-32 by 5/16-inch) and lock washers.
Control box BC-369 (driver).	On transmission housing in front of tachometer.	Remove the two 3/4-inch hexagonal head bolts in the transmission housing plate in front of tachometer and mount the box with the same bolts. Couple the conduit to the elbow and solder the wires to their respective points within the box as follows: Black to 1, green to 2, blue to 3, yellow to 4, white to 5, brown to 6.
Interphone amplifier BC-367 (in light tank M1A1).	On rear wall of right sponson.	Remove battery box cover on deck of tank. Secure the amplifier box in place at the holes provided, with four machine screws (1 1/4 inches—28 by 1 1/2 inches) and stop nuts. Mounting screw heads are on inside of amplifier box.
Interphone amplifier BC-367 (in light tank M2A4).	Bracket on rear bulkhead.	Secure the amplifier box in place at the holes provided, with four machine screws (3/4 inch—28 by 1 3/8 inches) and lock washers.
Microphone T-30-A	To be strapped comfortably around throat above the larynx.	
Cord CD-318	Microphone cords for tank commander, radio operator, and loader.	
Cord CD-416	Microphone cord for driver.	
Headset HS-18	Installed in crash helmets.	
Cord CD-307-A (48')	Headset cords for driver and radio operator.	
Cord CD-307-A (65')	Headset cords for tank commander and loader.	
Tube VT-107	Three spares to be carried in box BX-21; 1 spare in interphone amplifier BC-367.	
Lamp LM-33	Three spares to be carried in box BX-21.	
Box BX-21 for spare tubes headsets, etc.	Supplied as part of normal radio equipment of vehicle.	

NOTE.—If radio control box BC-321 is used in the vehicular-radio installation, it must be removed before the interphone equipment is installed. The remote control features of radio control box BC-321 have been incorporated in the interphone equipment.

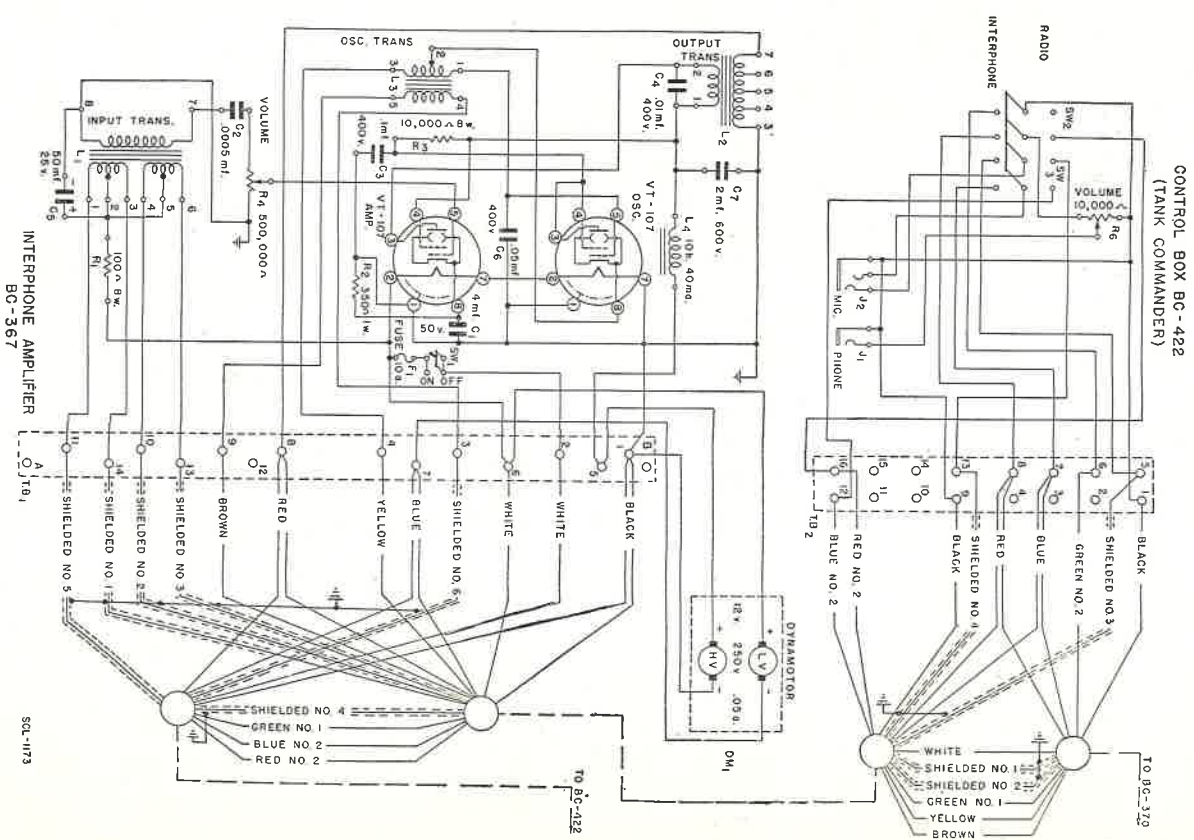
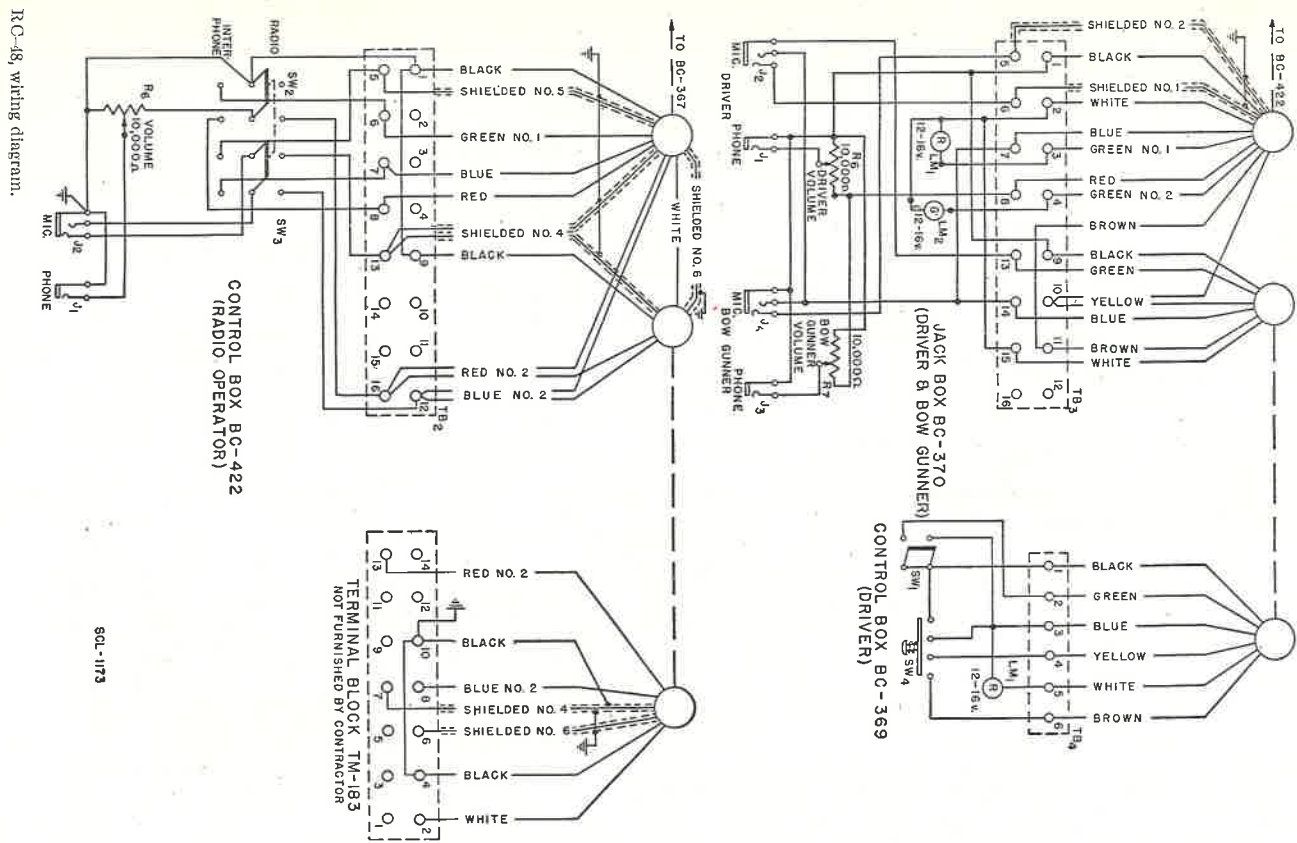


FIGURE 9.—Interphone equipment



RC-48 wiring diagram.

SIGNAL CORPS

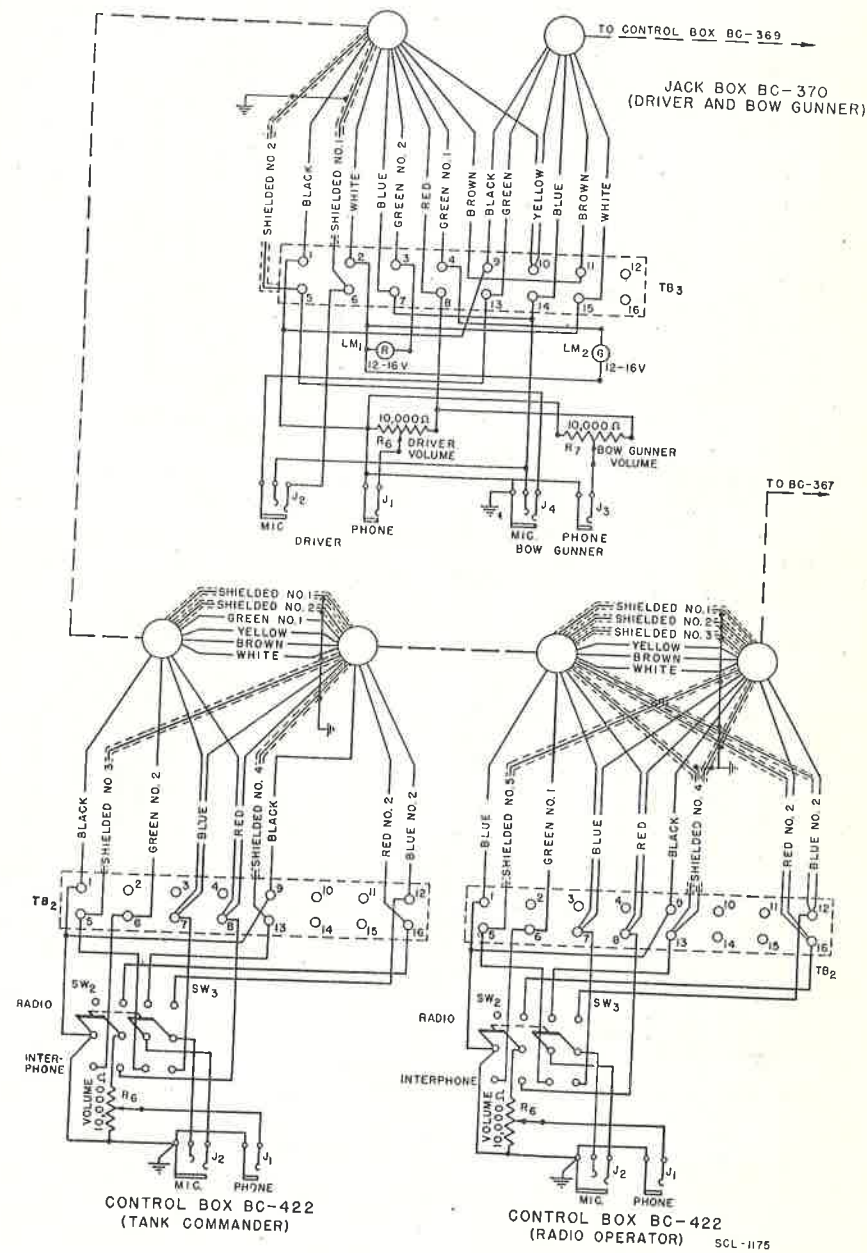
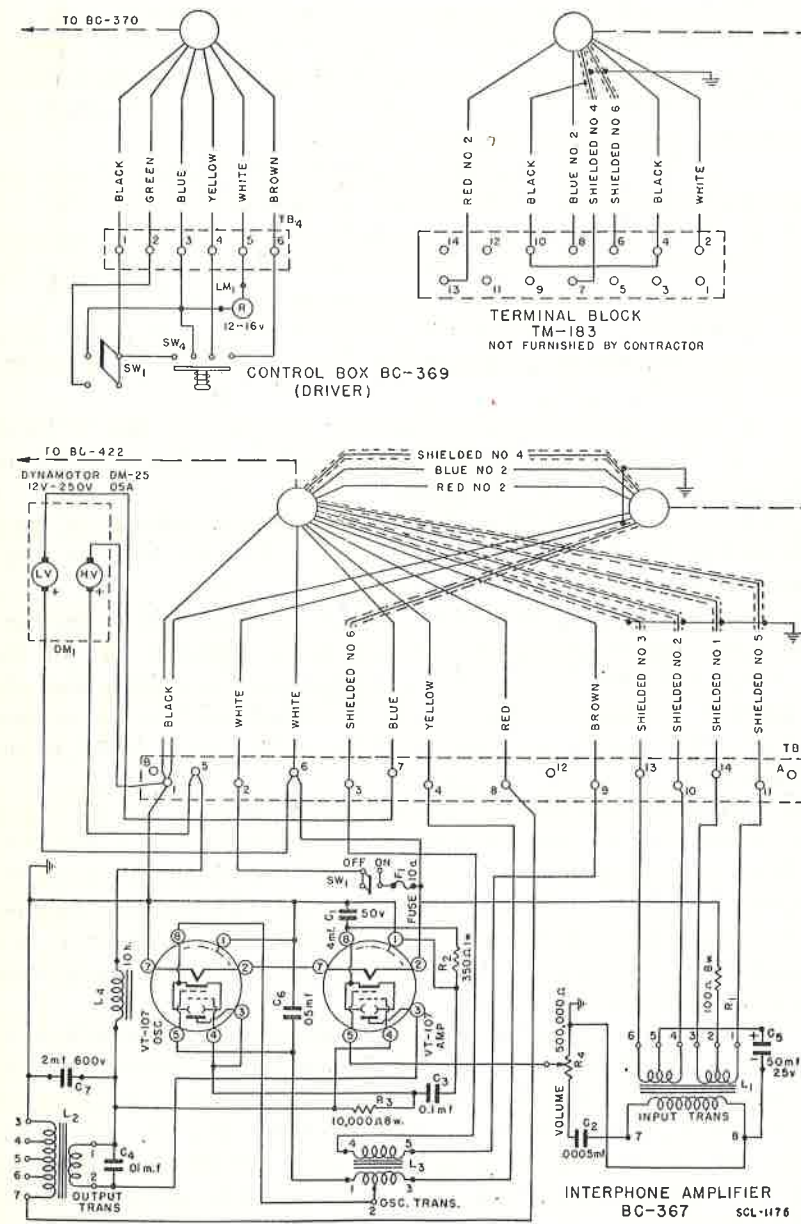


FIGURE 10.—Interphone equipment

INTERPHONE EQUIPMENTS RC-48 AND RC-60



RC-60, wiring diagram.

e. Conduit and wiring (fig. 8).—(1) The conduits are secured along the walls and ceiling with clamps, screws, etc., provided.

(2) The conduit with the seven wires is attached to the car terminal box through the upper right knock-out hole by means of the coupling nut. The terminal lugs are connected to the correspondingly numbered studs of terminal block TM-183.

(3) The radio receiver jumper cord CD-420 is plugged into the SPEAKER SECOND AUDIO jack of the radio receiver BC-312 and the other end connected to a 1/8-inch knock-out hole on the right side of the car terminal box. The terminal lugs are connected to the correspondingly numbered studs of terminal block TM-183.

7. Operation.—Insert headsets HS-18 or P-19 in all phone jacks of the system. Insert a microphone T-30-A or T-17 in all microphone jacks of the system.

a. Operation of the interphone system.—(1) Operate the OFF-ON switch of interphone amplifier BC-367 to ON and allow time for the tubes to heat up (usually 25 seconds).

(2) Set the INTERPHONE-RADIO selector switches of both control box BC-422 (radio operator) and control box BC-422 (tank commander) to the INTERPHONE position.

(3) Set all volume controls of the individual boxes to maximum and turn back approximately one-quarter turn. Pressing any of the microphone buttons should start the dynamotor and a slight hum will be heard in all headsets. Speak into the microphone in a normal tone of voice—this should cause the amplifier output to be heard in the headsets.

(4) Adjust the volume of the interphone amplifier BC-367 by inserting a screw driver through the opening marked VOLUME on the front panel and engaging the shaft of the volume control mounted directly behind the panel. Turning clockwise will increase the volume. Adjust the volume so that the output heard in the headsets is at a suitable level. Keep the volume below that level which would cause headsets to chatter.

(5) Start the tank engine and when it is running at approximately 1,800 rpm, check the operation of the amplifier. Speak into the microphone more forcefully now. If the volume is too high, readjust the amplifier volume control to a more comfortable level. Check the output of all the headsets to see that they are all operating satisfactorily. The red indicating lamp in control box BC-369 (driver) should be lighted.

(6) Test the controls at the driver's position by turning the microphone switch ON and speaking into the microphone. Adjust the microphone snugly around the neck if it is a T-30-A.

(7) Set the INTERPHONE-RADIO selector switch in control box BC-422 (tank commander) and control box BC-422 (radio operator) to the INTERPHONE position and check that the indicating lamps in jack box BC-370 (driver and bow gunner) light. The green lamp should light when the tank commander is on the interphone side of the circuit and the red lamp should light when the radio operator is on the interphone side of the circuit.

b. Operation of the radio control system.—Either the radio operator's or tank commander's INTERPHONE-RADIO selector switch should be turned to RADIO.

(1) *Radio receiver BC-312-() or BC-603-(), (radio sets SCR-210-C, SCR-210-E, SCR-245-F, SCR-245-K, SCR-508-(), SCR-528-(), and SCR-538-()).*—Turn the OFF-ON switch of radio receiver BC-312-() or BC-603-() to ON. With a strong signal being received either from a permanent station or another tank located in the vicinity, adjust the volume control of the radio receiver so that the signal received in both the radio operator's and tank commander's headsets is at a comfortable level. Do not change setting of individual volume controls on control boxes BC-422 to effect this as they have been properly set for interphone duty.

(2) *Radio transmitter BC-223-A (radio set SCR-245-F and SCR-245-K).*—Since radio transmitter BC-223-A has a "push-to-talk" microphone control, its OFF-ON switch may be left ON. With the TONE-VOICE-CW selector switch of radio transmitter BC-223-A in the VOICE position, transmitter plate and filament voltages are not applied until either the radio operator's or tank commander's microphone button is pressed. Radio transmitter BC-223-A may be completely controlled by means of the selector switch and either microphone button. It is to be noted that interphone equipments RC-48 and RC-60 have no provisions for keying radio transmitter BC-223-A; CW and TONE communication is carried on only by the radio operator from the transmitter in the normal manner. Depressing the microphone switch and talking modulates the transmitter. Transmitter sidetone should be heard at the radio operator's headset when he is on RADIO. If the tank commander is on RADIO, he also will hear sidetone.

(3) *Radio transmitter BC-604-() (radio sets SCR-508-() and SCR-528-()).*—Since radio transmitter BC-604-() has a "push-to-talk" microphone control, its OFF-ON switch may be left ON. Transmitter plate voltages are not applied until either the radio operator's or tank commander's microphone button is pressed. Depressing the microphone switch and talking modulates the transmitter. Transmitter sidetone should be heard at the radio operator's