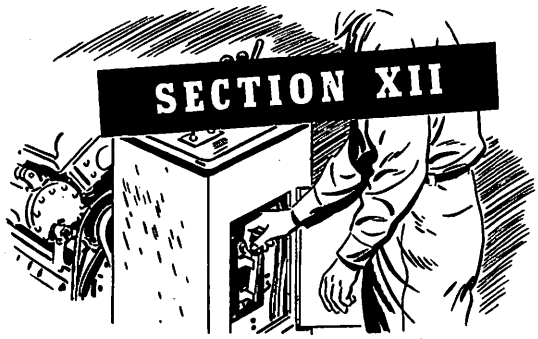


24-Volt Electrical SYSTEM

1. GENERAL.

Considerable variations in the wiring and arrangement of equipment exist among 85-foot boats built at different yards. The text which follows applies to a number of boats built at Dooley's Basin and Drydock Co., and for other boats the text will serve only as a general guide.

2. DESCRIPTION.

a. GENERAL. — The 24-volt starting and battery charging system consists of the following items:

(1) 24-volt storage batteries located under floor boards in the engine room. (See figure 94A.)

(2) A rotary selector switch at the base of the engine control pedestal. (See figure 94B.)

(3) Equalizer switches (circuit breakers) on the engine control pedestal, by which either engine generator can be isolated from the other.

(4) A 200-ampere knife switch which disconnects all circuits connected to the battery except the charging leads from each engine. (See figure 94C.)

(5) A battery charging generator on the driving end of each main engine.

(6) A voltage regulator for each engine. (See figure 94D.)

(7) An auxiliary charger (rheostat) through which current can be supplied from the 110-volt switchboard to charge the 24-volt batteries. (See figure 94E.)

(8) A distribution panel from which current is supplied to the space heaters and auto-pulse pumps in the fuel supply line to the heaters. (See figure 94F.)

(9) An auxiliary power plant, type HRU-28, by which the 24-volt batteries may be charged when other methods of charging fail. (See figure 94G.)

b. MAIN ENGINE WIRING DIAGRAM.—A schematic showing wiring of the main engines and instrument panels is given in figure 95. The main engine instrument panel (figures 96 and 97) is hung from ceiling brackets to the right of the door leading from the engine room to the cockpit. A pair of blackout lights (figure 98) are mounted over the instrument panel. These lights are turned on by a toggle switch (1, figure 97) which supplies current from the port engine junction box to a 24-volt vibrator inverter mounted on the instrument panel. (See figure 99.) A different mounting of the instrument panel used on some boats is shown in figure 100.

3. OPERATION INSTRUCTIONS.

a. GENERAL.—When the main engines are running, the rotary switch on the engine control pedestal (1, figure 101) should be on "PACKARD GEN" and both equalizer switches (2, figure 101) should be "ON." The engine generators will then operate in parallel and charge the battery through the voltage regulators and reverse-current cut-outs. If the engines are not run often enough to maintain proper battery voltage, the 24-volt batteries may be charged either from the 110-volt generator (through the main switchboard and auxiliary charger) or from the auxiliary power plant.

b. TO CHARGE THE 24-VOLT BATTERIES FROM THE 110-VOLT GENERATOR.—The following procedure applies to boats equipped with a breaker-type switchboard and a generator driven by a Kermath "Sea Chief."

(1) Start the Kermath engine and after 5 minutes running at 1000 rpm, bring it up to 2,250 rpm.

(2) Turn the generator main switch on the 110-volt switchboard to the "ON" position.

(3) Establish proper generator voltage (130 volts) by adjusting the main generator rheostat.

(4) Turn the battery charger switch on the 110-volt switchboard to the "ON" position.

(5) Turn the rotary switch on the engine control pedestal (figure 102) to "AUX GEN."

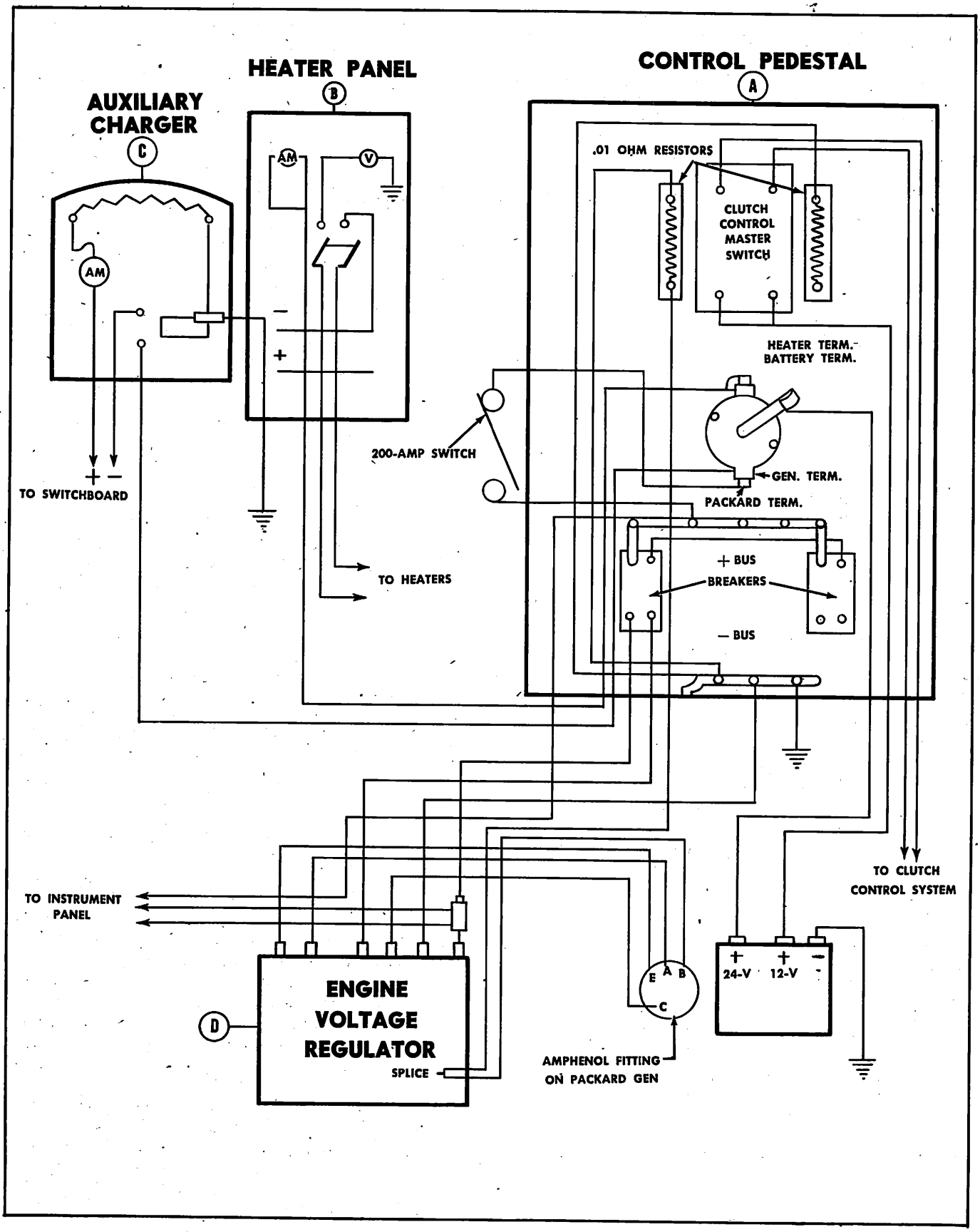
(6) Close the knife switch on the auxiliary charger (1, figure 103).

(7) Move the auxiliary charger lever to the right until proper charging current is indicated on the ammeter. (See 2, figure 103.) A charging current of 15 amperes should not be exceeded except in an emergency. It is desirable to use moderate charging current for a long period than high current for a short period.

Note

To avoid overcharging the 24-volt batteries in this operation, check the battery voltage from time to time. To do this, open the charging circuit by turning the battery charging switch off. The voltmeter on the heater panel (figure 94F) will then register actual battery voltage.

Figure 94 — BATTERY PEDESTAL, AND VOLTAGE REGULATOR WIRING DIAGRAM



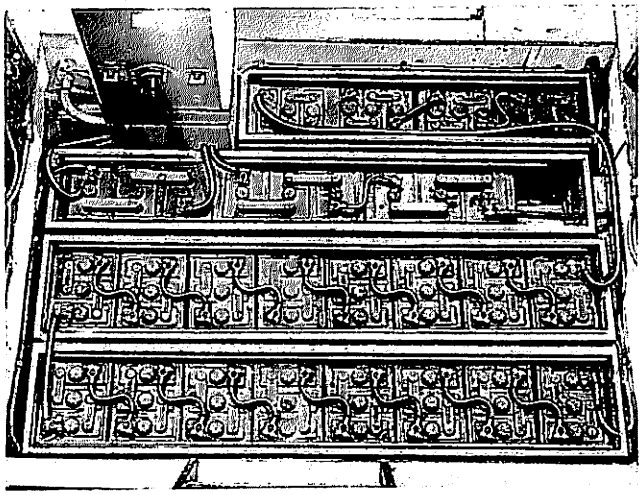


Figure 94A—24-Volt Batteries



Figure 94C—200-Ampere Knife Switch in Engine Control Pedestal

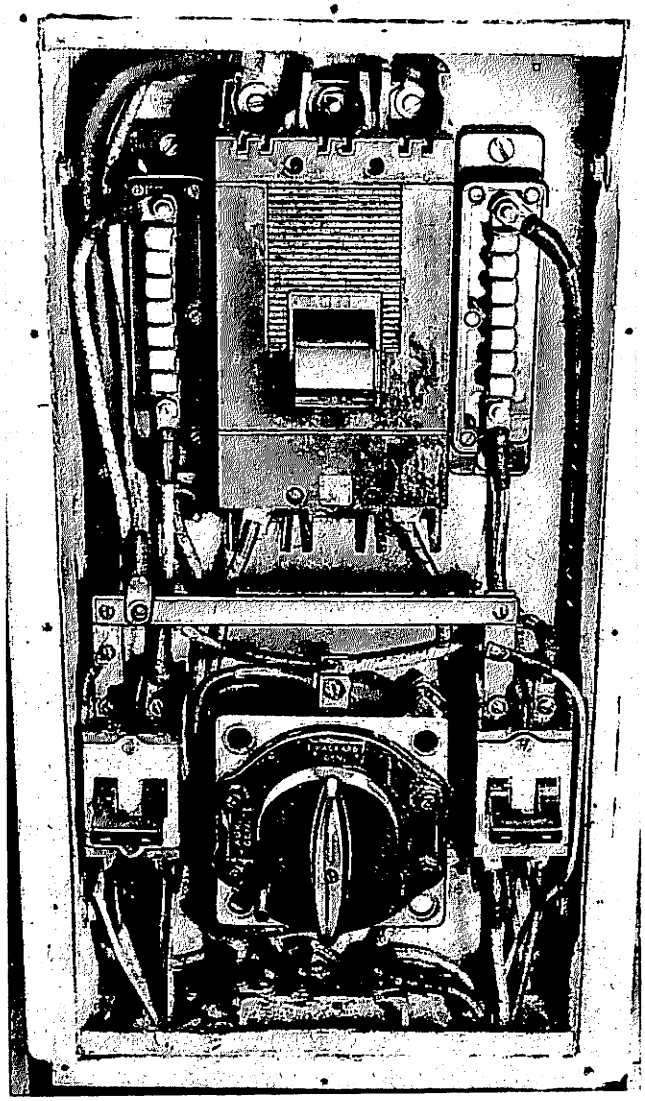


Figure 94B—Engine Control Pedestal

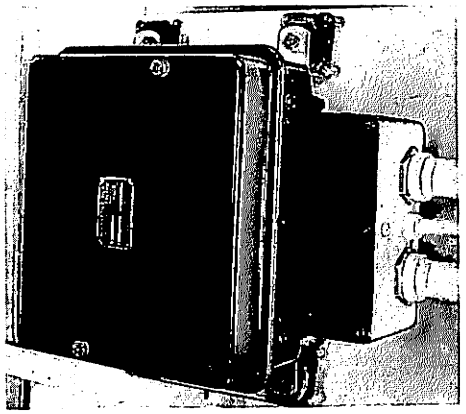


Figure 94D—Engine Voltage Regulator

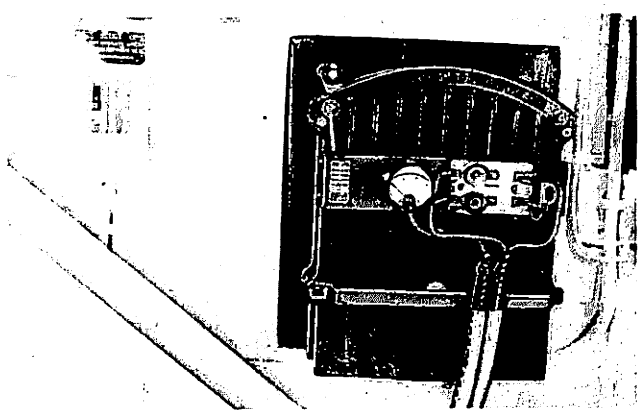


Figure 94E—Auxiliary Charger

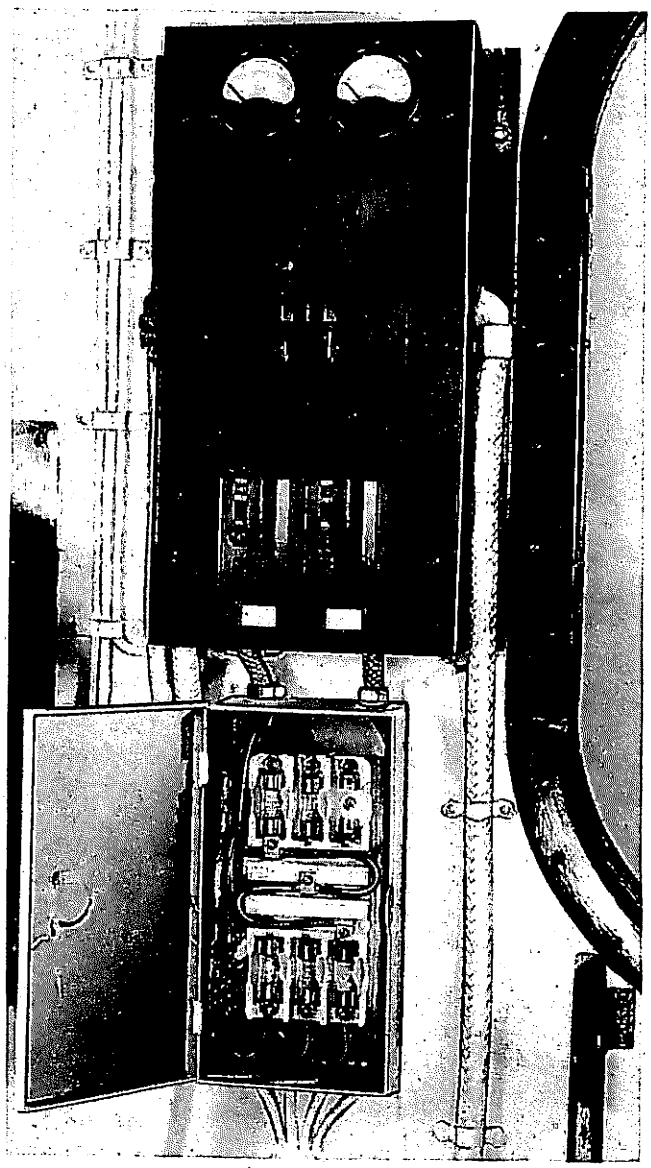


Figure 94F—Heater Panel

(8) When the batteries are properly charged (26 to 28 volts) turn the battery charger switch on the 110-volt switchboard off, turn the rotary switch (1, figure 101) back to "PACKARD GEN," open the knife switch on the auxiliary charger, and move the auxiliary charger lever back to its normal position.

c. TO CHARGE THE 24-VOLT BATTERIES FROM THE AUXILIARY POWER PLANT.—The auxiliary power plant is used only when the 24-volt batteries cannot be charged from the 110-volt generator. The main lead from the power plant is connected via a 50-ampere breaker (1, figure 94E) to the main charging lead at the auxiliary charger. *Do not operate the auxiliary power plant when the main engines or 110-volt generator are in operation.* Proceed as follows:

(1) Turn rotary switch on engine control pedestal (figure 102) to "AUX GEN."

(2) Prepare fuel and oil mixture for the auxiliary power plant. (Refer to Handbook AN 19-45-11 for detailed instructions on the auxiliary power plant.)

(3) Pour fuel mixture into fuel container.

(4) Adjust carburetor (cold weather only).

(5) Turn shut-off valve to "ON" position.

(6) Choke.

(7) Depress starting switch or start with rope manually.

(8) Once the power plant has started, the generator voltage is maintained at 28.5 volts automatically.

(9) After the 24-volt batteries are properly charged, stop the auxiliary power plant by turning the shut-off valve on top of the fuel container to "OFF." The unit will run for approximately half a minute until fuel is consumed in the carburetor.

(10) Open the switch (1, figure 94E) to disconnect the auxiliary power plant from the battery charging system.

(11) Turn the rotary switch back to the "PACKARD GEN" position.

4. SERVICE, INSPECTION, AND MAINTENANCE.

a. BATTERIES.—Normal battery voltage is 26 to 28 volts. When voltage drops below 23.5, batteries should be recharged. Level of electrolyte should be $\frac{3}{8}$ to $\frac{5}{8}$ inch above the top of the separators. Check the level and add distilled water as necessary twice a week or every 10 hours of engine operation, whichever is oftener. In extremely hot climates, it may be necessary to add water every day to replace evaporation loss. When the battery is fully charged, the specific gravity of the electrolyte should be 1.280 at 80°F. A rise in temperature of 30°F will lower the gravity reading .010 or 10 points, and a drop in temperature of 30°F will raise the gravity reading .010 or 10 points.

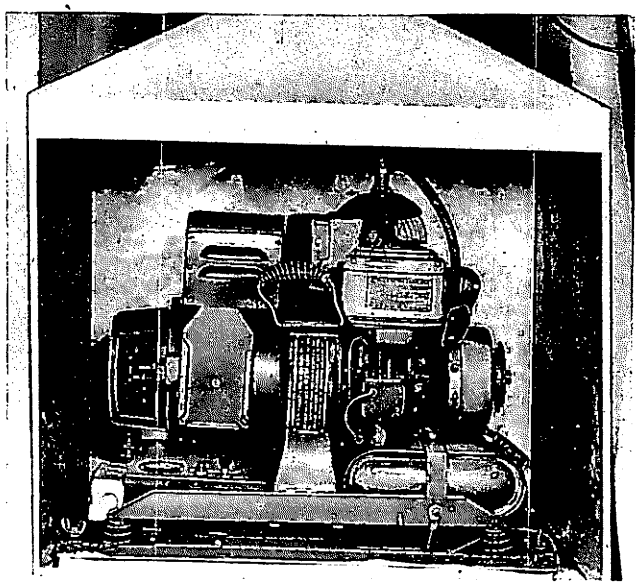
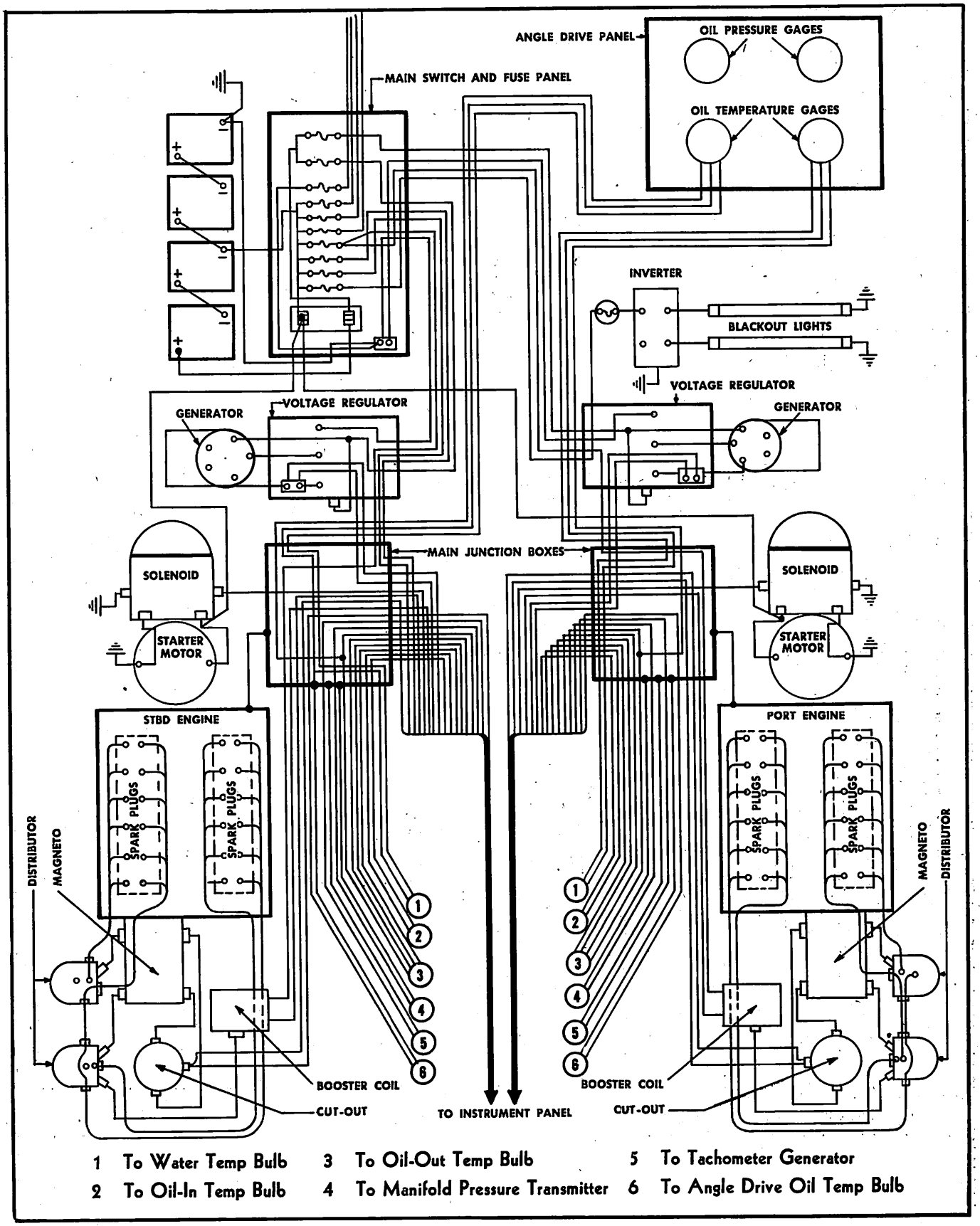


Figure 94G—Auxiliary Power Plant, Type HRU-28

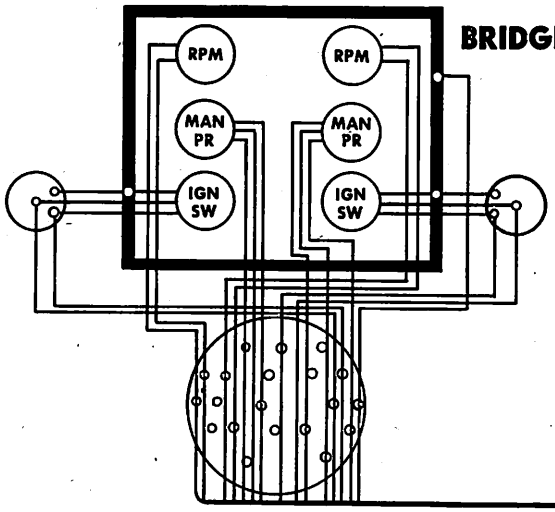
Figure 95 — ENGINE WIRING DIAGRAM

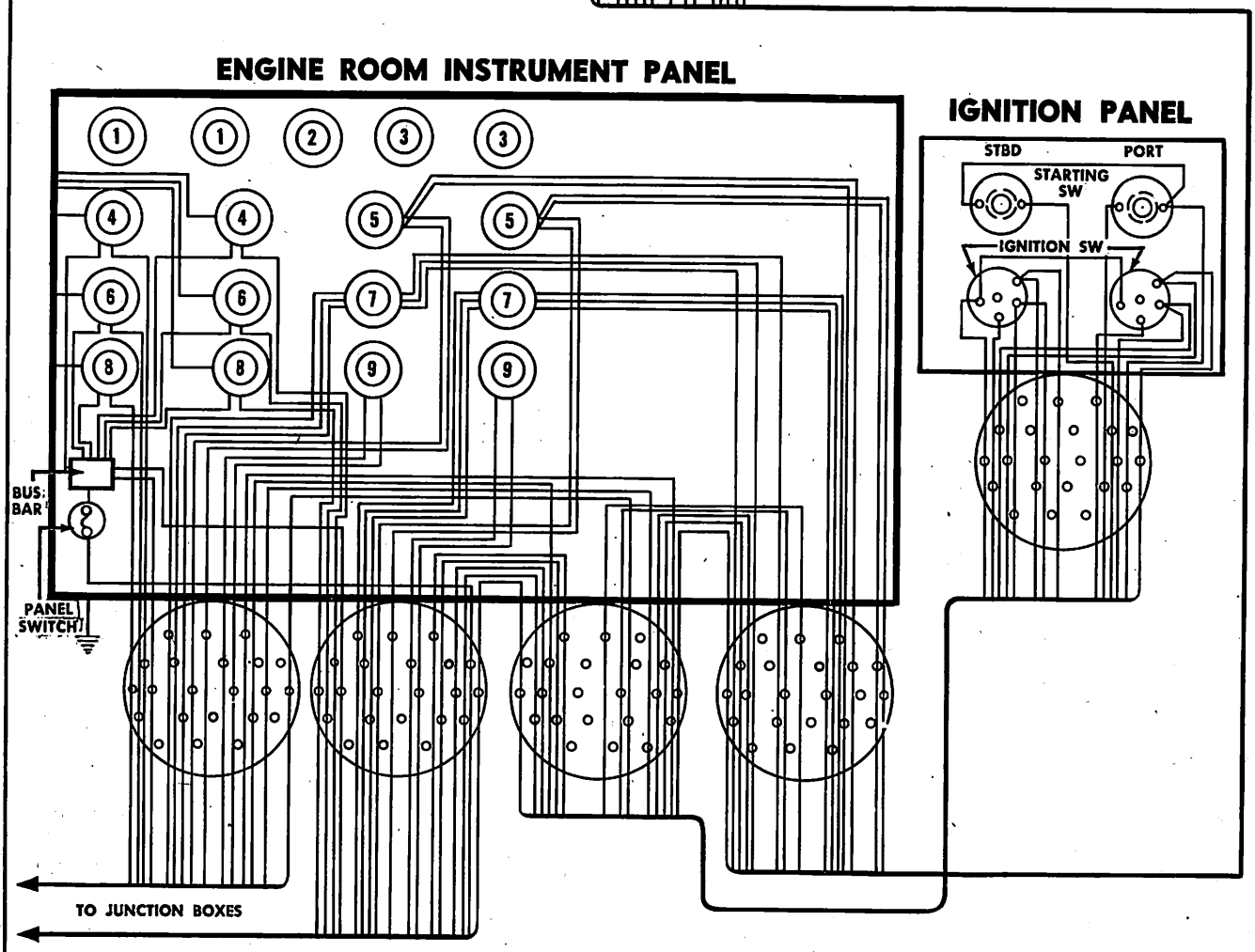


1 To Water Temp Bulb
2 To Oil-In Temp Bulb
3 To Oil-Out Temp Bulb
4 To Manifold Pressure Transmitter
5 To Tachometer Generator
6 To Angle Drive Oil Temp Bulb

Figure 96 — ENGINE INSTRUMENT PANEL WIRING DIAGRAM

1. Oil Pr
2. Clock
3. Fuel Pr
4. Oil-Out Temp
5. RPM
6. Oil-in Temp
7. Man Pr
8. Water Temp
9. Amps





b. ENGINE GENERATORS.—The charging current supplied by the engine generators is indicated on a pair of ammeters on the engine instrument panel. Should their readings differ while the main engines are running at the same speed, the generators must be equalized by adjusting one or both voltage regulators. To do this proceed as follows:

(1) Run both engines at 1,400 to 1,600 rpm.

(2) Open the "equalizer" switches (2, figure 102) on the engine control pedestal.

(3) Take the output voltage at each voltage regulator and by turning the adjusting knob marked "V" on the under side of the regulator obtain 28 volts on each. (See figure 104.)

Note

Under no conditions should adjustment of the knob marked "R" be changed.

(4) Close both "equalizer" switches on the control pedestal and observe the ammeter readings on the instrument panel. If they still do not read alike, raise the output voltage of one regulator or lower that of the other until like readings are obtained on both ammeters.

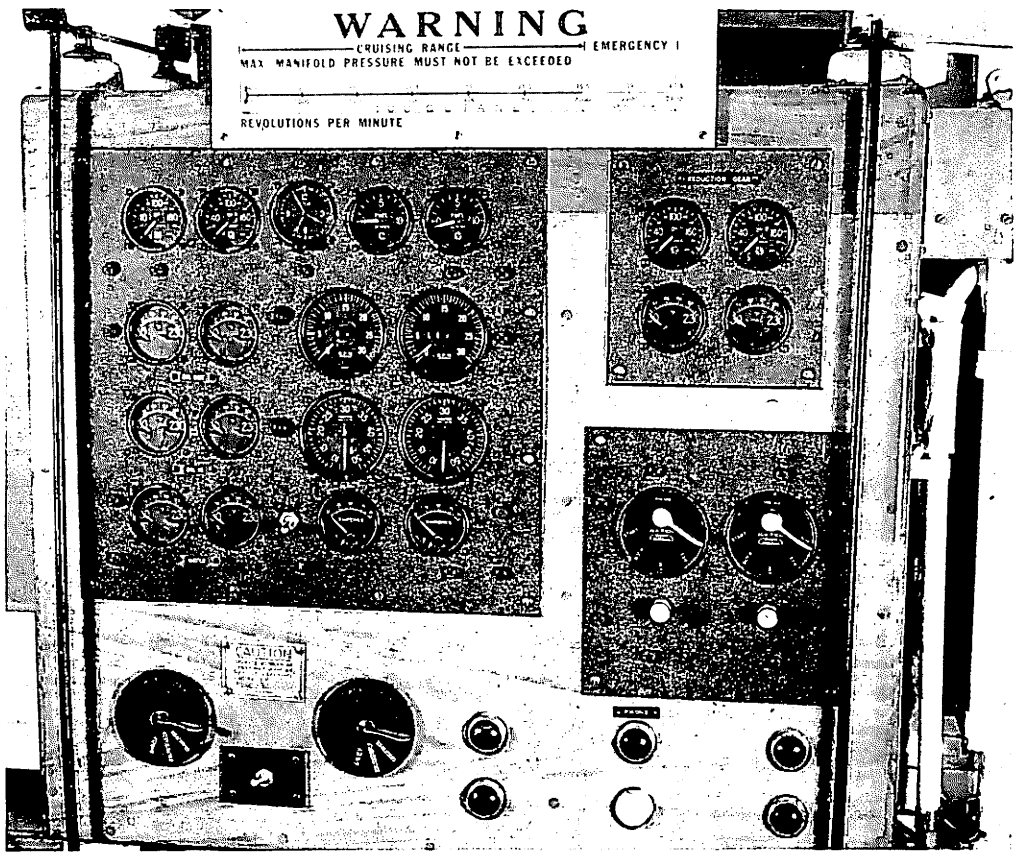


Figure 97—Engine Instrument Panel

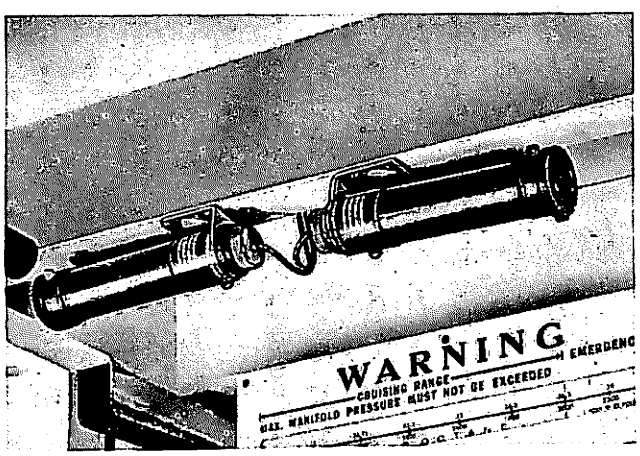


Figure 98—Black-Out Lights

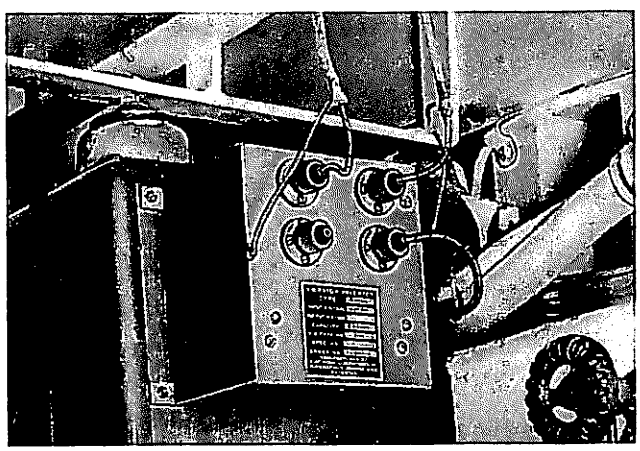


Figure 99—24-Volt Vibrator Inverter

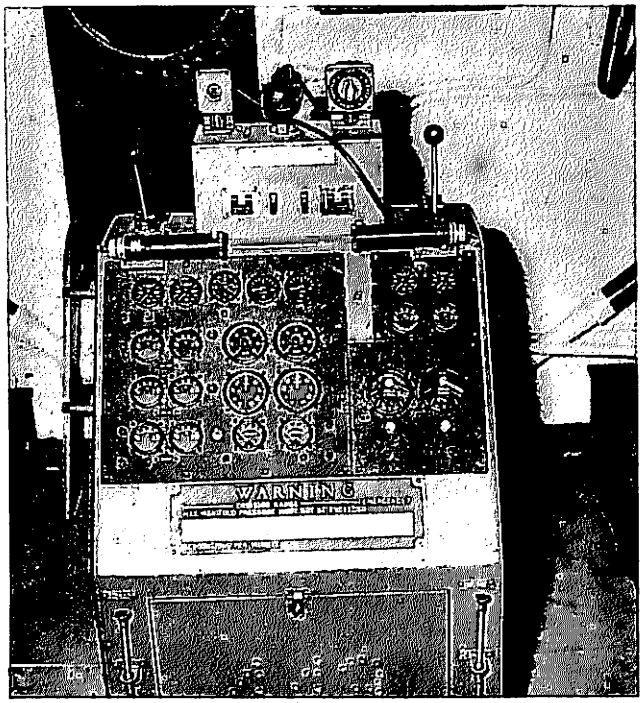


Figure 100—Alternate Instrument Panel and Engine Control Installation

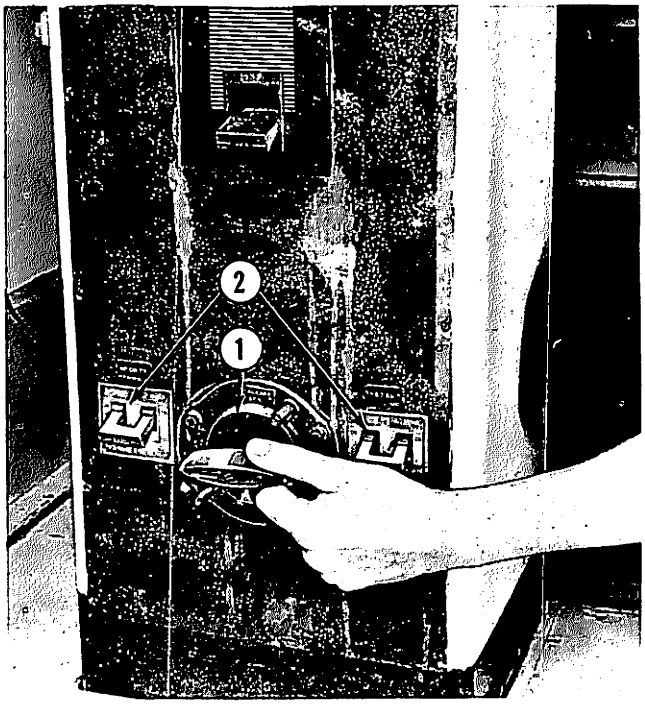


Figure 102—Turning the Rotary Switch to "AUX GEN."

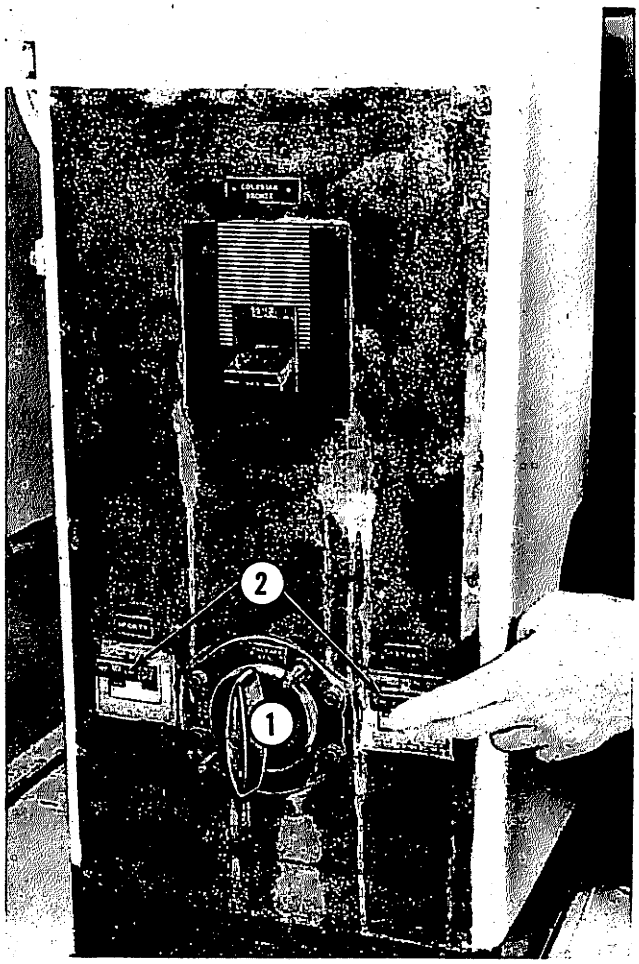


Figure 101—Engine Control Pedestal

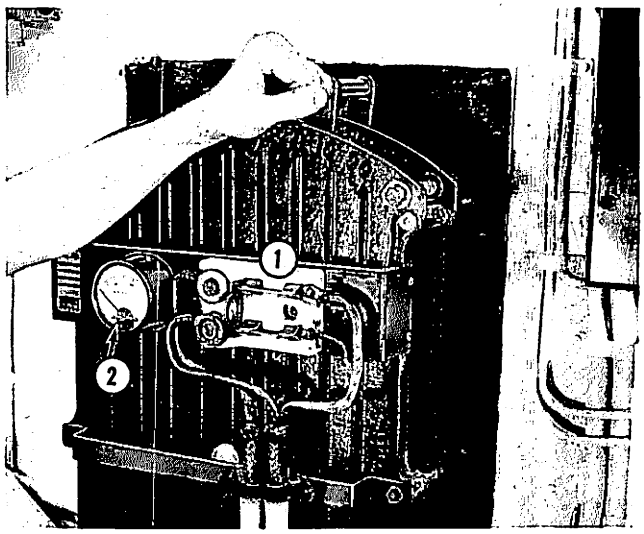
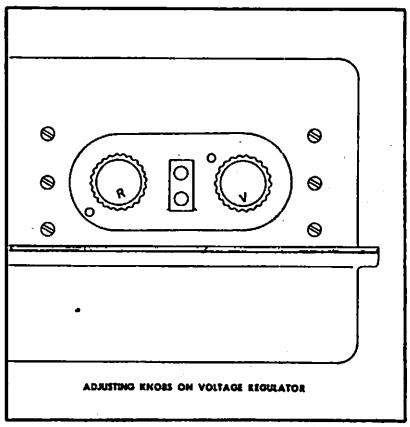
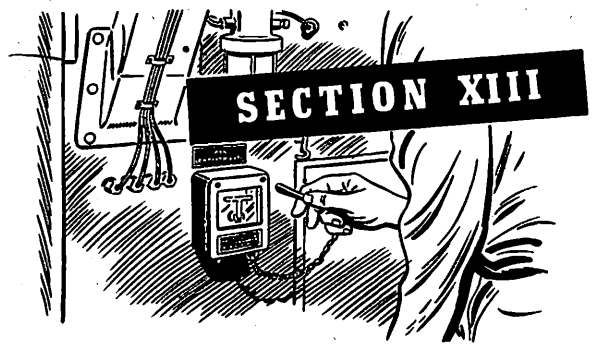


Figure 103—Auxiliary Charger

Figure 104—Adjusting Knob on Under Side of Engine Voltage Regulator





SHIP'S SERVICE Switchboard

1. GENERAL.

On 85-foot boats equipped with 5-kilowatt generators, two types of 110-volt switchboards have been supplied: those with breakers and those with rotary selector switches. Both types are discussed in this section. The addition of 10-kilowatt generators makes necessary substantial modifications of the 110-volt switchboard, and hence on those boats equipped with 10-kilowatt generators the following text will serve only as a general guide.

2. BREAKER-TYPE SWITCHBOARD.

(See figures 105 and 106.)

a. DESCRIPTION.

(1) The 110-volt service batteries are connected to the main buses via a 50-ampere breaker (A, figure 106) at the right of the switchboard. The 5-kilowatt generator connects via a 50 ampere breaker at the left of the switchboard. (See B, figure 106.) Direct current can be supplied from the lower buses (circuits 1 through 14) to the upper buses (circuits 15 through 23) only when the "generator and battery" switch is closed. Alternating current from the shore line connection can be supplied only to circuits 15 through 23 when the "a-c shore line" switch is closed. A plate (C, figure 106) prevents ac from being accidentally supplied to the lower (d-c) buses. A d-c voltage regulator maintains constant voltage on circuits 15 through 23 and prevents overvoltage on the lighting circuits.

(2) The meters at the upper right (D, figure 106) show battery voltage and rate of charge or discharge. The meters at the upper left (E, figure 106) indicate generator voltage and current. A pair of ground lights connected to the d-c buses burn dimly and of equal intensity when both buses are clear of grounds.

(3) Generator voltage is controlled by a rheostat (F, figure 106) with a main and vernier knob. A reverse-current relay keeps the generator disconnected from the board until the generator has built up to proper voltage.

b. OPERATION INSTRUCTIONS.

(1) When the boat is docked, a shore line power connection should be used whenever available, to reduce the load on the 110-volt batteries. After the shore line connection is made (figure 107), turn the a-c shore line switch to the "ON" position. (This energizes the buses for circuits 15 through 23 only.) In the absence of shore power, keep the a-c shore line switch in the "OFF" position and the generator and battery switch turned "ON."

(2) When the generator and battery switch is in the "ON" position, the buses for all circuits can be energized from the batteries alone, or from both the batteries and the generator.

(3) Battery power should be used without the aid of the generator at all times unless battery voltage has dropped to below 100 volts, or unless the load on the board is so great that the battery voltage will drop unduly in a short period. For example, the oven and both hot plates on the stove draw 4-½ kilowatts, or approximately 40 amperes at 110 volts. Thus when the stove is used, the generator should be run to avoid excessive drain on the batteries. *It is not necessary to run the generator at all times when the boat is being operated.*

(4) To supply battery power to the board:

(a) Turn the generator and battery switch to "ON."

(b) Turn the generator switch to "OFF."

(c) Turn the battery switch to "ON."

(5) To supply battery and generator power to the board:

(a) Turn the generator and battery switch to "ON."

(b) Turn the battery switch to "ON."

(c) Start the Kermath engine and permit it to warm up at 1000 rpm for 5 minutes.

(d) Open the throttle on the Kermath until it reaches 2250 rpm.

(e) Adjust the rheostat on the switchboard until the generator voltmeter reads 130 volts. (See figure 108.)

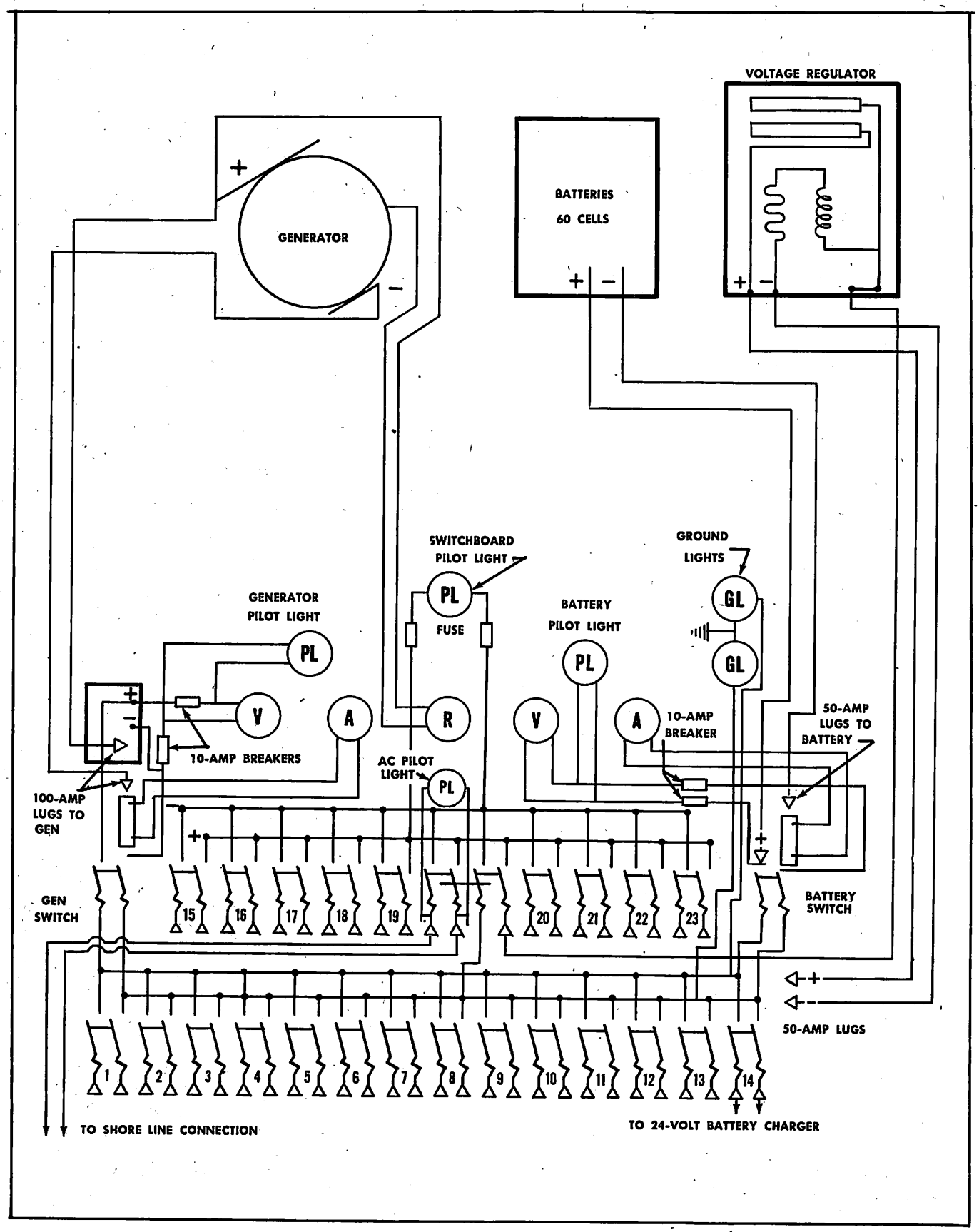
(f) Turn the generator switch to "ON."

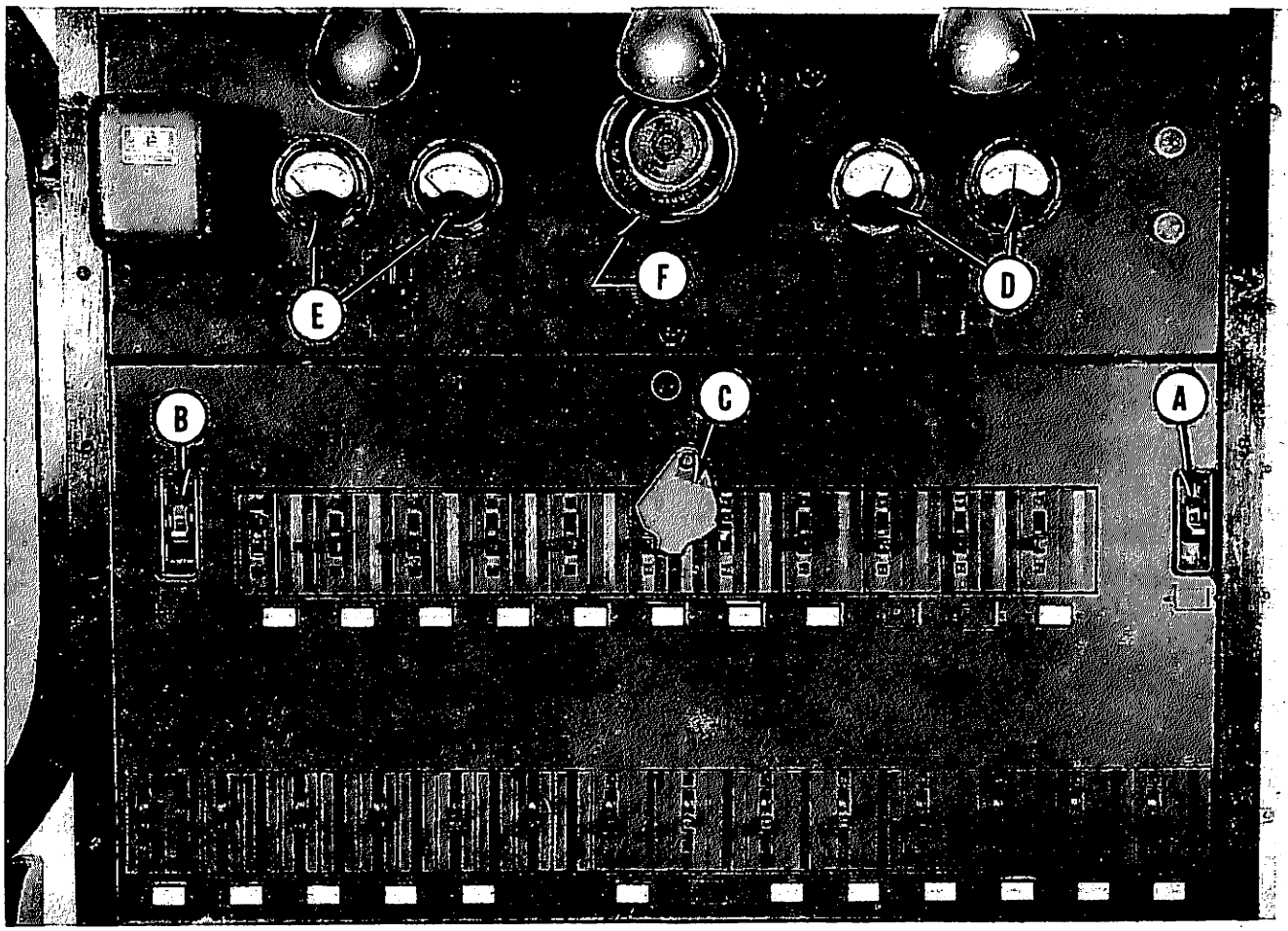
(g) By means of the rheostat, adjust the generator voltage so as to carry the load on the board and at the same time, charge the 110-volt batteries.

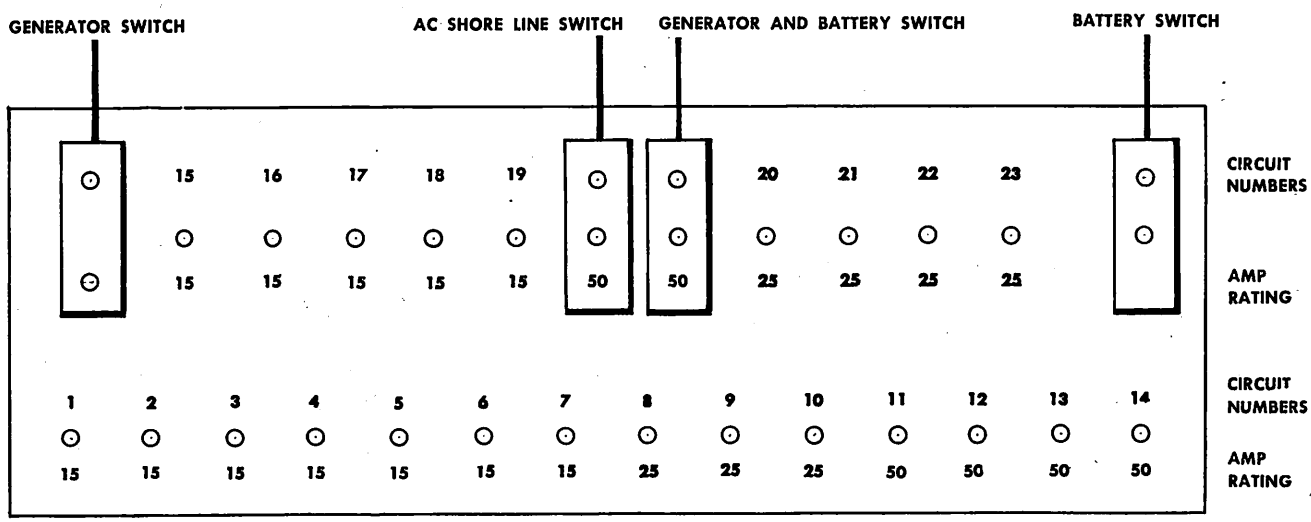
Note

The Kermath engine is not designed to operate on 91-octane gasoline; hence it should be operated only when necessary to charge the batteries or carry a heavy load on the switchboard. When the generator is running, adjust the voltage high enough to deliver current to the batteries, and thus take full advantage of the generator's output.

Figure 105—110-VOLT SWITCHBOARD (WITH BREAKERS)







NON CONTROLLED BUS

1	Crew Blowers	8	Spare
2	Galley Blower	9	Call Bells
3	Engine Room Blower	10	Radio
4	Dispensary Blower	11	Horn
5	Fresh Water Pump	12	Range
6	Spare	13	Refrigerator
7	Direction Finder	14	24V Batt. Charger

CONTROLLED BUS

15	Crews Qtrs. Lights	20	Tell-Tale Panel ("pilot lights" in wheel house)
16	Galley Lights		
17	Port Aft Lights	21	Spare
18	Stbd Aft Lights	22	Spare
19	Searchlight	23	Pilot House Lights

Figure 106—110-Volt Switchboard and Key to Circuits

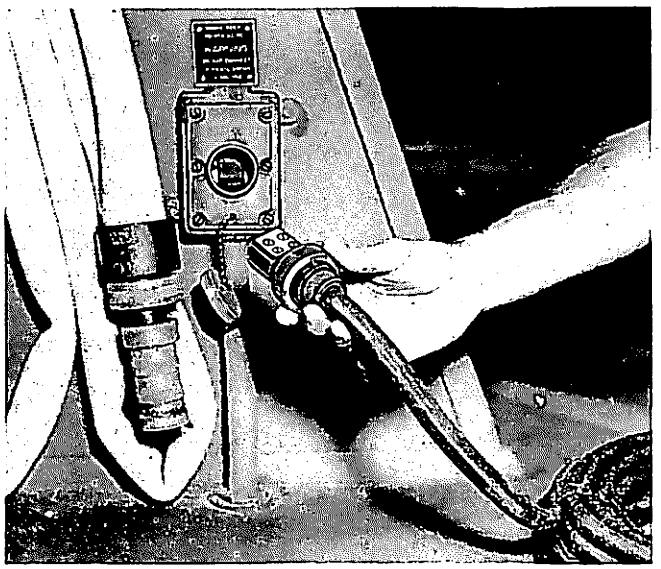


Figure 107—Shore Line Connection

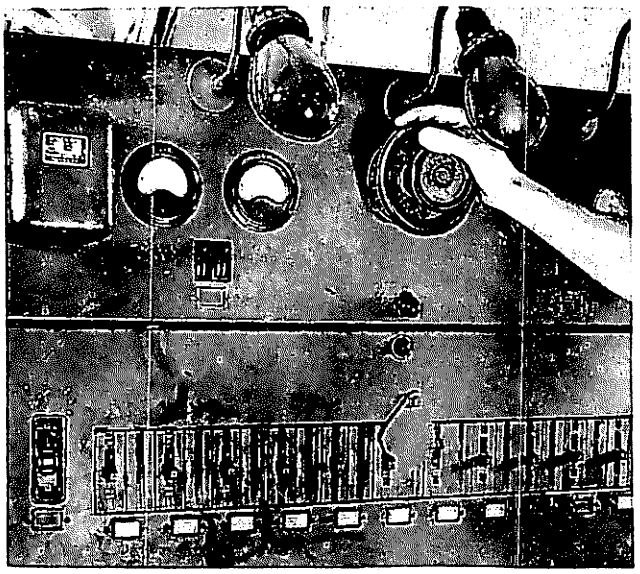


Figure 108—Adjusting Regulator Voltage

3. SWITCHBOARD WITH SELECTOR SWITCHES.

a. DESCRIPTION. *(See figure 109.)*—The instruments and controls mounted on the face of the switchboard are as follows: Voltmeter, top left side of switchboard (1); voltmeter selector switch, top center of switchboard (2); ammeter, top right side of switchboard (3); positive ground indicator light, directly below voltmeter (4); negative ground indicator light, directly below ammeter (5); rheostat control handle, directly below voltmeter selector switch (6); ground light switch, directly below rheostat control handle (7); ship's service and shore line selector switch, bottom left-hand side of switchboard (old-style board only) (8); voltage regulator selector switch, bottom center of switchboard (9); battery and generator selector switch, bottom right-hand side of switchboard (10).

(1) VOLTMETER.—The voltmeter (1) indicates voltage of the generator, battery, or regulated load, depending on the setting of the selector switch (2).

Note

The voltmeter will not operate unless the ground light switch (7) is in the "ON" position. To obtain battery voltage readings, it is essential that the generator be disconnected from the switchboard.

(2) AMMETER.—The ammeter (3) indicates the rate of charge or discharge of the battery. *Current being used through the emergency receptacle, however, will not register on the ammeter.*

(3) GROUND LIGHTS.—Ground lights (4) and (5) will, when the ground light switch (7) is on, indicate the following:

(a) Both lights burning dimly and of equal intensity: system is clear of grounds.

(b) Positive light (4) burning brightly: a ground exists in positive side of line.

(c) Negative light (5) burning brightly: a ground exists in negative side of line.

(d) Increased intensity of one lamp and corresponding decrease in the other: partial grounds.

(e) Either lamp out and other burning brightly: full voltage ground.

(f) Both lamps *out*: a bad lamp or loose connection.

b. OPERATION INSTRUCTIONS.

(1) To supply the system from the 110-volt batteries:

(a) Adjust the battery-generator selector switch to "BATTERY" position. This immediately feeds battery voltage to the d-c bus. (The d-c bus consists of circuits Nos. 1 to 4, inclusive, in the distribution panel mounted alongside the switchboard.)

(b) Adjust the voltage regular switch (9) to "AUTOMATIC" position. Also adjust ship's-service shore-service switch (8) to "SHIP'S SERVICE" position. This feeds d-c regulated voltage to the radio and the ac-dc bus. The radio is connected to circuit No. 11 in the distribution panel. The ac-dc bus consists of circuits Nos. 5 to 10, inclusive, and No. 12 in the distribution panel.

(c) The regulated bus voltage should be between 112 and 115 volts. If this is not the case, the carbon pile voltage regulator mounted above the switchboard should be adjusted to give proper voltage regulation.

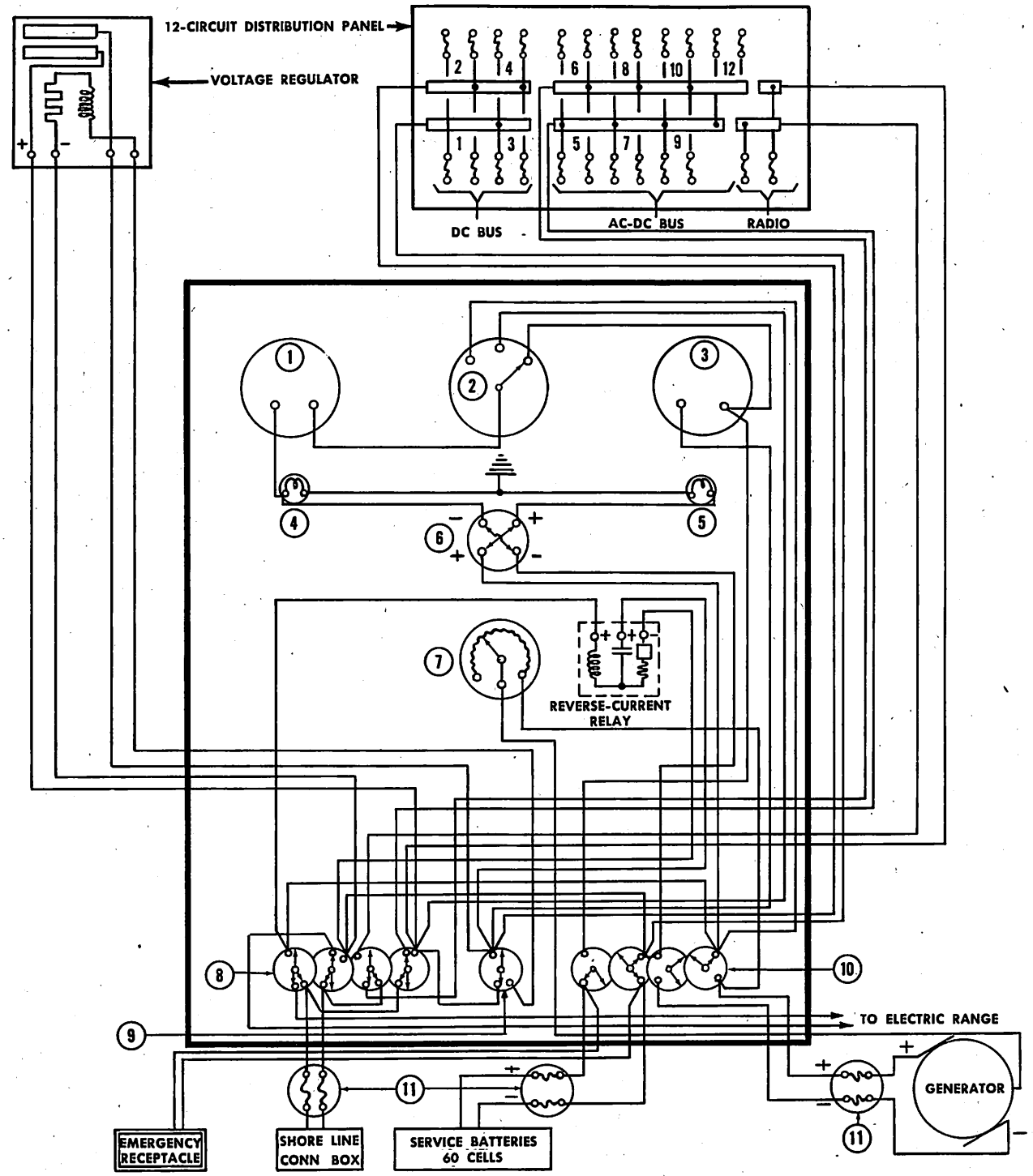
Note

The ship's-service, shore-service selector switch (8) is not installed on all boards. If it is not installed, disregard instructions pertaining thereto.

(2) To supply the system from the 5-kilowatt generator, proceed as follows:

(a) Start the Kermath engine and warm it up for 5 minutes at 1000 rpm before bringing it up to 2250 rpm.

Figure 109—110-VOLT SWITCHBOARD (WITH ROTARY SWITCHES)



1 Voltmeter
2 Voltmeter Selector Switch
3 Ammeter
4 Ground Light
5 Ground Light
6 Grounding Switch
7 Rheostat
8 4-Pole Double-Throw Switch (Shown in "Shore Line" Position)
9 Single-Pole Double-Throw Switch (Regulator Selector Shown in "Manual" Position)
10 2-Circuit Selector Switch (Shown in "Battery" Position)
11 Fuse Box

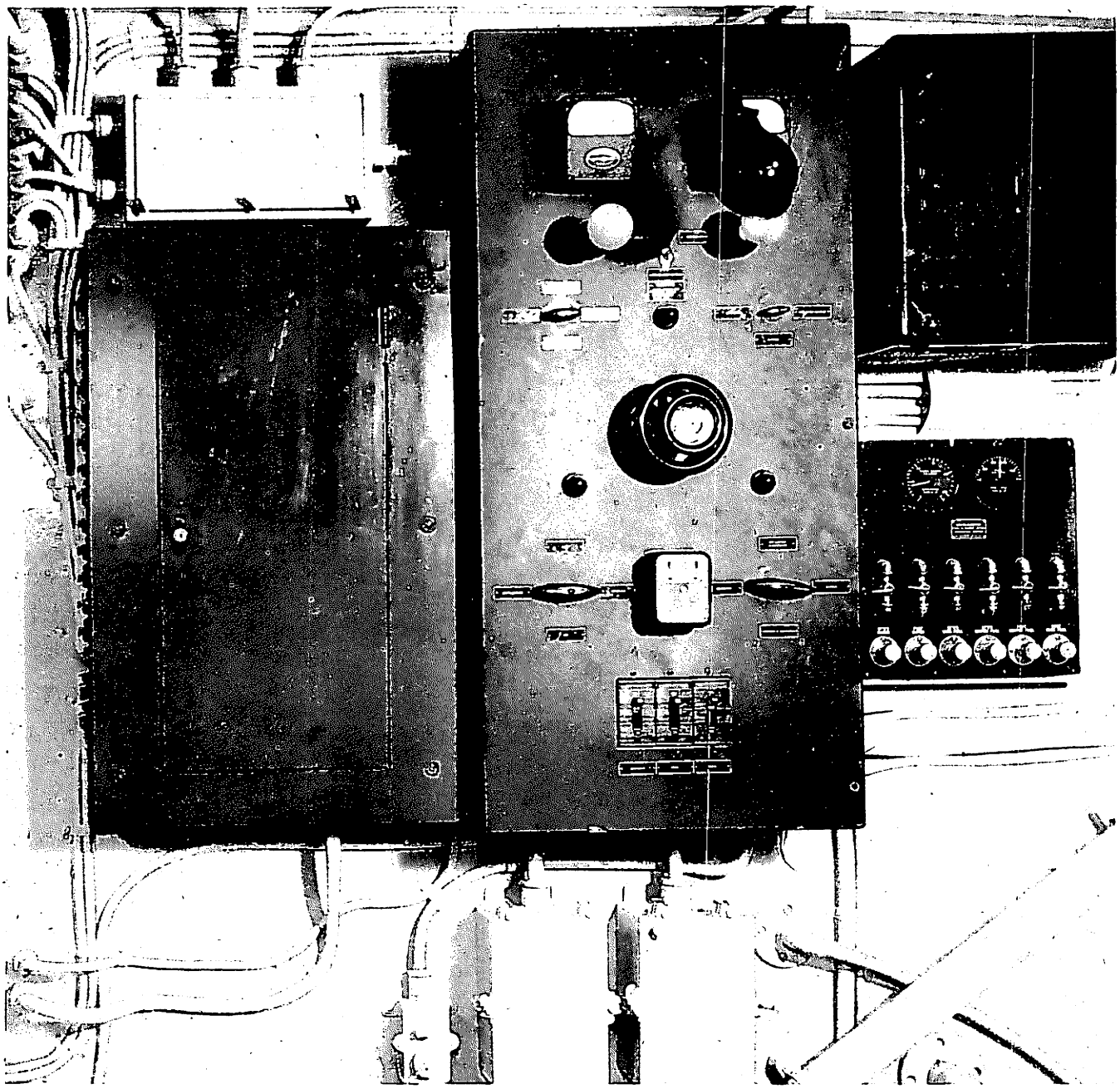


Figure 110—110-Volt Switchboard Installation (With Rotary Switches)

(b) Adjust the voltmeter selector switch (2) to "GENERATOR" position. Adjust the battery-generator switch (10) to "GENERATOR" position. This feeds the system from the generator. The generator rheostat control handle (6) should then be adjusted to give 120 volts on the voltmeter. The approximate setting of the generator rheostat handle to give 120 volts should be noted so that in starting the generator the electrical system will not be subjected to extreme voltage fluctuations.

Note

It is impossible to obtain a reading of the generator voltage unless the battery-generator switch is in either the "GENERATOR" position or the "BATTERY-GENERATOR" position.

(c) With the voltage regulator switch (9) in the "AUTOMATIC" position, regulated bus voltage should again be between 112 and 115 volts.

(d) If the voltage regulator gets out of order or fails to regulate the voltage properly, the voltage regulator switch (9) may be placed in "MANUAL" position. This short circuits the voltage regulator and puts battery or generator voltage, or both, on the regulated bus. If this is the case, be careful to limit bus voltage by means of the generator rheostat to not more

than 120 volts. If this voltage is exceeded, damage to the radio and other equipment may result.

(3) To use the generator and batteries at the same time:

(a) Under normal daytime operation with the stove in use, both the battery and the generator will be needed to supply the load. This is accomplished by first adjusting the generator voltage to be slightly above the battery voltage and then placing the battery-generator selector switch (10) in "BATTERY-GENERATOR" position. This places the generator and the battery in parallel on the line. If at any time generator voltage falls below battery voltage, there is provided inside the switchboard a reverse current relay which will open and prevent battery current from feeding through and *motorizing* the generator.

(b) The galley stove is connected in such a manner that with the ship's-service shore-service selector switch (8) in "SHIP'S SERVICE" position, the generator is the only source of power for the stove.

(c) When the stove is being used it may be that the generator is incapable of carrying the entire electrical load, and the rate of discharge of the battery will be indicated on the ammeter.

c. SERVICE AND MAINTENANCE.

(1) The battery installation in these vessels is known as the *floating battery* system. With the battery-generator switch (10) in "BATTERY-GENERATOR" position, the battery and generator are at all times connected in parallel through the reverse current relay. With this hook-up the battery will absorb loads in excess of the generator capacity and the generator will charge the battery during periods of light load. With this arrangement the batteries are kept as near fully-charged as possible at those times when they are given a high-rate discharge. During periods of light load the batteries should be used alone, with the generator shut down.

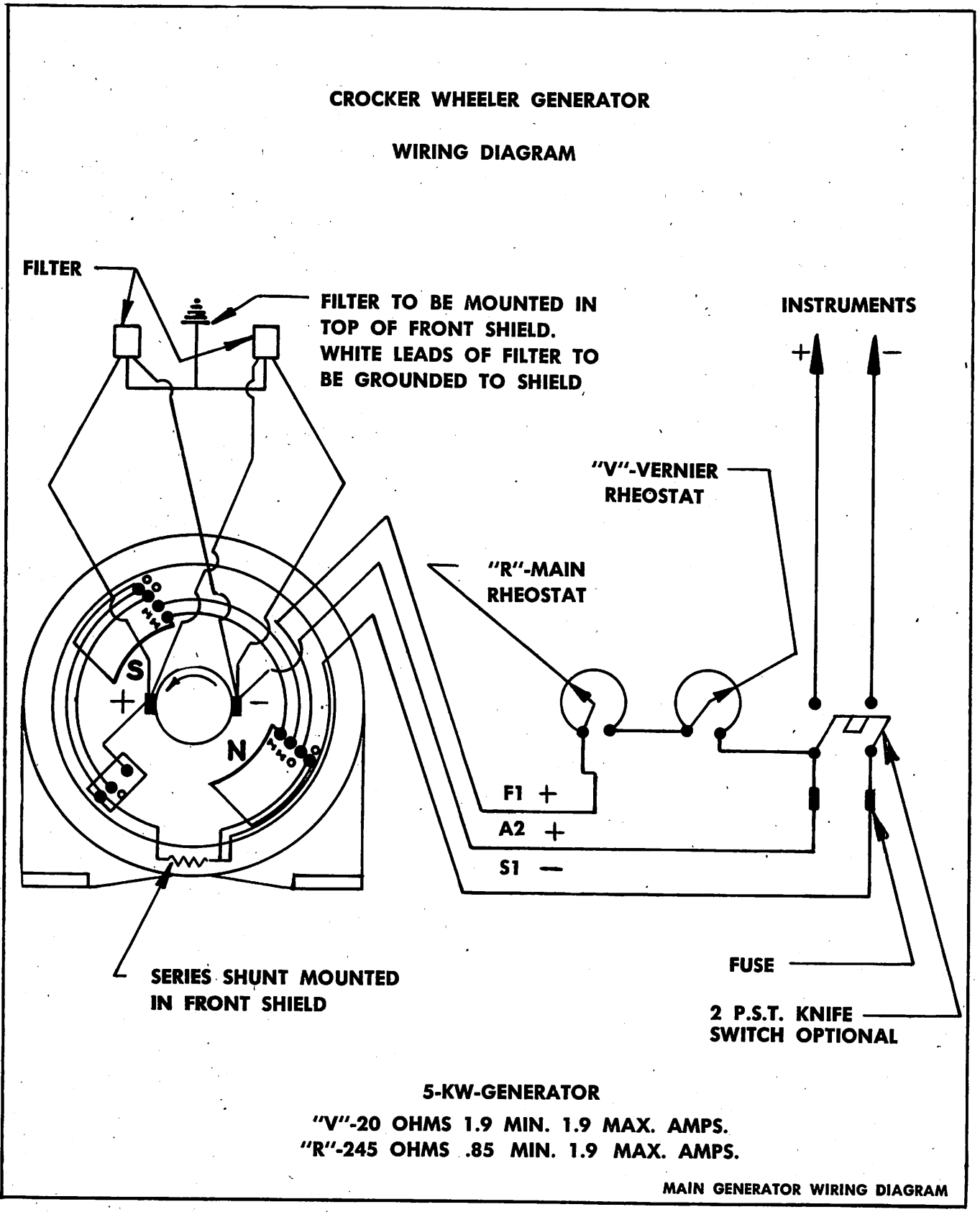
(2) Check the batteries every day with a hydrometer. The specific gravity when normally charged will read between 1.250 and 1.270. (The normal reading will be lower when the temperature is high.) Should the gravity go down to 1.150, it is desirable to discharge the batteries at a high rate (not exceeding 40 amperes) and then give them a full recharge. The initial charging rate in this case should not be in excess of 40 amperes, this rate being determined by the generator capacity and wire sizes. The charging rate must be reduced as the charge progresses until the finishing rate is reached. The finishing rate should be below 5 amperes and this should be continued until the cells are gassing freely and the specific gravity of the electrolyte is at least 1.275. As the charge progresses the battery voltage increases due to chemical action in the cells and for this reason it is necessary to watch closely both the generator voltage and charging rate and adjust the rheostat to increase the generator voltage as may be necessary. This periodical discharge and recharge should be made approximately once every 6 or 8 weeks. Be careful not to overdischarge the battery. The specific gravity should never fall below 1.120.

(3) The full charge specific gravity of each cell should be taken and recorded periodically. In normal operation it is sufficient to select one or two pilot cells and use these for determining the state of charge of the entire battery.

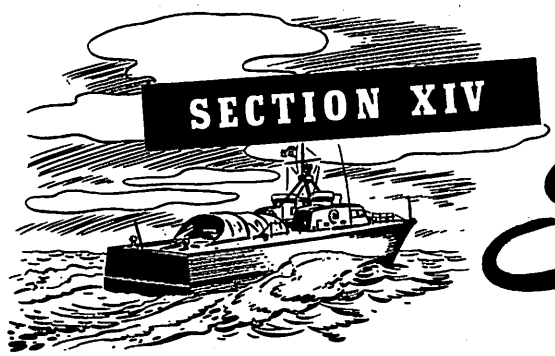
(4) Since the gas given off towards the end of a charge is an explosive mixture of hydrogen and oxygen, care must be exercised to have the engine room well ventilated during, and for some time after, the charging period.

(5) The only mechanical maintenance that should be necessary to the batteries, is to keep the terminals and cable connections clean and tight. It is also necessary to add pure, fresh, distilled water periodically to keep the electrolyte ¼ inch above the cell plates. If for any reason electrolyte should be spilled, chemically pure sulphuric acid (oil of vitriol) should be diluted with distilled water and added until the specific gravity of the cell is the same value as before the acid was lost or until it is the same as adjoining cells.

Figure 111 CROCKER WHEELER GENERATOR



MAIN GENERATOR WIRING DIAGRAM



SHIP'S Service Generator

1. GENERAL.

On boats equipped with Kermath engines (Sea Chief) 110-volt power is furnished to the main switchboard by a Crocker-Wheeler 5-kilowatt generator.

2. GENERATOR.

a. DESCRIPTION.—A detail wiring diagram of the Crocker-Wheeler generator is given in figure 111.

b. OPERATION.

(1) Before starting the generator, open the generator switch and adjust the rheostat so that all the resistance is in the circuit so that the voltage will not exceed that given on the name plate. Then bring the generator up to speed (2250 rpm) and adjust the rheostat until 130 volts is obtained, close the generator switch.

(2) Before disconnecting the generator, reduce the load or adjust the output voltage to avoid burning the contacts when the generator switch is opened.

c. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
GENERATOR CHARGING AT LOW RATE	Dirty commutator. Poor brush contact. High resistance in charging circuit. Loose or dirty terminals.	Clean commutator. Repair or install new brushes. Clean and tighten terminals. Clean and tighten.
GENERATOR CHARGING AT TOO HIGH RATE	Third brush improperly adjusted. Short in armature.	Adjust. Replace.

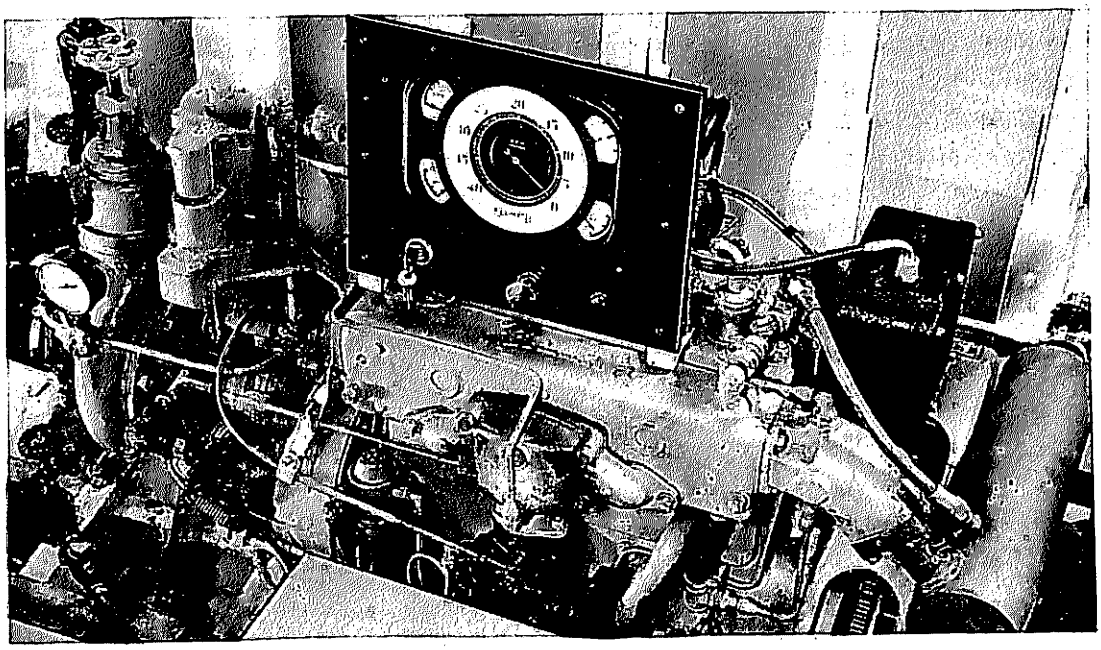


Figure 112—Kermath Engine, Front View

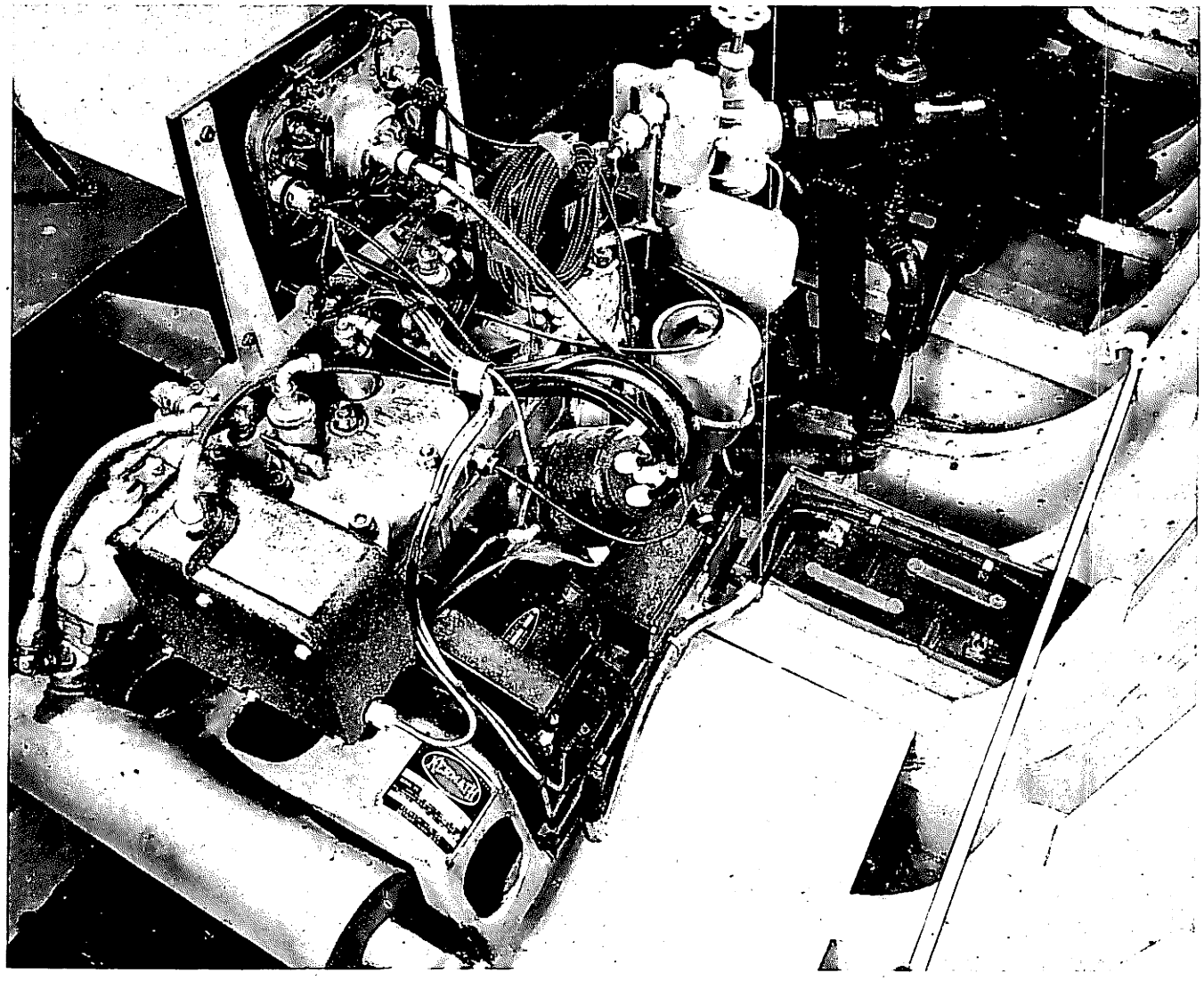


Figure 113—Kermath Engine, Rear View

d. SERVICE, INSPECTION, MAINTENANCE, AND LUBRICATION.

(1) Inspect and clean the generator at least once a month. Give particular attention to the brushes and brush holders. The commutator and windings should be free from oil or grease.

(2) The antifriction bearings and bearing sealing caps are filled with the proper amount of grease by the boat builder and normally require addition of grease only once a year. The grease should be fluid under ordinary operating temperatures.

Note

Use clean grease and only enough to cover the bottom balls. Too much grease causes friction and the excess may leak into the windings. Should it be necessary to pull off a bearing, be careful not to damage the bore of the sheet steel impeller. It must fit tightly on the shaft.

(3) The brush holder spring should keep the entire surface of the brush end in positive contact with the commutator. Never allow the brush to wear so short that the spring cannot feed it further. When replacing brushes, give the brush end the proper curvature by inserting a piece of fine sandpaper and moving it back and forth under the brush. Do not use any oil or compound on the commutator.

3. KERMATH ENGINE.

(See figures 112 and 113.)

a. SPECIFICATIONS.

Type	L Head
Number of cylinders	4
Bore	3 1/8 inches
Stroke	4 3/8 inches
Piston displacement	134.2 cu inches
Compression ratio	6.48 to 1
Horsepower max brake	38 at 2600 rpm
Compression	111 psi at 185 rpm
Maximum torque	82 lbs - ft at 1500 rpm
Firing order	1-3-4-2

b. OPERATION INSTRUCTIONS.—To start the engine, turn the ignition switch on and push the starting button. Run the engine at 1000 to 1500 rpm for approximately 5 minutes to warm it up before bringing it up to rated speed. Then pull the throttle way out. The governor will hold the speed at 2250 rpm. When the engine is running properly, instruments on the engine panel (figure 114) will normally read as follows:

(1) Oil temperature: 150°F

(2) Charging current: 15 amps

(3) Oil pressure: 20 psi

(4) Water temperature: 160° to 180°F

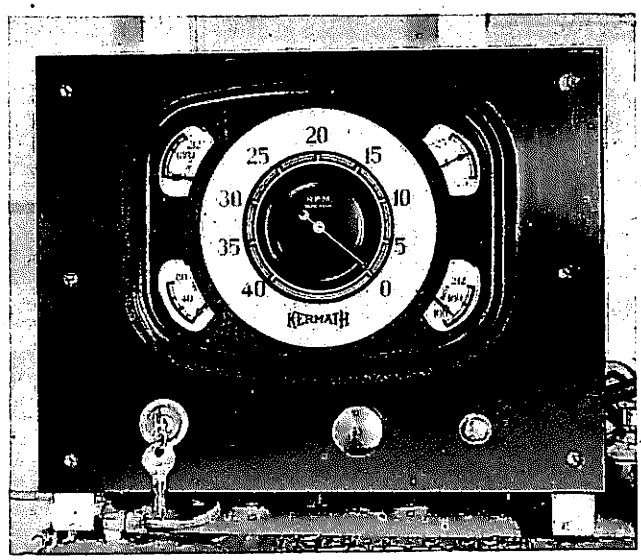


Figure 114—Kermath Engine Instrument Panel

c. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
STARTING MOTOR TURNS TOO SLOWLY	Discharged battery or shorted cell.	Recharge or repair.
	Loose or dirty terminals.	Clean and tighten.
	Dirty commutator.	Clean with No. 00 sandpaper.
	Poor brush contact.	Repair or install new brushes.
	Worn bearings.	Replace.
	Burned starter switch contacts.	Replace switch.
STARTING MOTOR TURNS PROPERLY BUT FAILS TO START ENGINE	Distributor points burned or pitted.	Clean points or replace.
	Breaker arm stuck on pivot pin.	Clean and lubricate.
	Breaker arm spring weak.	Replace.
	Points improperly adjusted.	Adjust .020 in.
	Spark plug points improperly set.	Adjust .030 in.
	Spark plug wire terminals in distributor cap corroded.	Clean.
	Loose terminals.	Check circuit.
	Condenser defective.	Replace.
	Improper ignition timing.	Set timing.
GENERATOR CHARGING AT LOW RATE	Dirty commutator.	Clean commutator.
	Poor brush contact.	Repair or install new brushes.
	High resistance in charging circuit.	Clean and tighten terminals.
	Loose or dirty terminals.	Clean and tighten.
GENERATOR CHARGING AT TOO HIGH RATE	Third brush improperly adjusted.	Adjust.
	Short in armature.	Replace.
OVERHEATING	Water pump inoperative.	Overhaul or replace.
	Incorrect ignition or valve timing.	Set timing.
	Excessive piston blow-by.	Check piston rings and cylinder walls.
	Water pump belt broken.	Replace.
	Excessive carbon formation.	Remove.
	Obstructed exhaust pipe.	Replace.
	Air leak in water suction line.	Locate and repair.
	Clogged sea water strainer.	Clean.
	Closed valve in water line.	Open.
	Water pump failing to prime.	Turn down grease cups.
		Inspect pump for worn gears.

d. SERVICE, INSPECTION, MAINTENANCE, AND LUBRICATION.

(1) OIL FILTER.

(a) The inlet line to the filter is connected to the oil distribution line by a tee on the port side of the engine. The outlet or oil return line to the engine is through a hole in the center stud of the oil filter discharging into the timing chain cover.

(b) When the oil on the level indicator becomes dark, remove the oil filter cover; remove the drain plug and drain out the sludge, then replace the drain plug. Next replace the element. Install a new cover gasket; reinstall cover, start the engine and check for leaks; then check the oil level and add to the oil supply if necessary.

(2) ENGINE GENERATOR (100-HOUR INSPECTION).

(a) Remove the cover band.

(b) Inspect the commutator. If the commutator is dirty or discolored it can be cleaned by holding a piece of 00 sandpaper against it while turning the armature slowly. Blow the sand out of the generator after cleaning the commutator. If the commutator is rough or worn the generator should be removed from the engine and completely overhauled.

(c) Inspect the brushes and brush holders. The brushes should slide freely in their holders. If the brushes are oil soaked or if they are worn to less than one-half of their original length, replace the brushes.

(d) Add three to five drops of medium engine oil to the oiler in the drive end head and fill the commutator end oil pocket to the combination oiler and overflow hole in the commutator end cover.

(e) Inspect all wiring from the generator to the cut-out relay, from the cut-out to the battery and from the battery to the ground for worn or frayed insulation, broken wires, and for loose or corroded connections. Repair or replace any defective wiring.

(f) Run the generator at about 50 percent of its maximum output and measure the voltage drop from the cut-out relay terminal to the battery terminal. This drop should not be more than .1 volt at a 10-ampere charging rate or .05 volt at a 5-ampere charging rate. There should be no voltmeter reading when the drop is measured from the generator frame to the battery ground post. If larger readings are obtained the high resistance should be eliminated.

(g) Run the generator at near maximum output and note the commutator action. If there is excessive arcing between the brushes and commutator remove the generator for overhaul.

(h) Replace the generator cover band.

(3) STARTING MOTOR (100-HOUR INSPECTION).

(a) Remove the cover band.

(b) If the commutator is dirty it can be cleaned by holding a piece of 00 sandpaper against it while turning the armature slowly. Blow the sand out of the motor after cleaning. If the commutator is rough or worn the motor should be removed for a complete overhaul.

(c) The brushes should slide freely in their holders and should not be oil soaked. If the brushes are oil soaked or are worn to less than one-half of their original length they should be replaced.

(d) The oiler in the commutator end cap should be given three to five drops of medium engine oil every 100 hours.

(e) Check the wiring for broken wires, frayed insulation, and corroded connections. Particular attention should be paid to the ground connections.

(f) Check the voltage drop across the starting switch to see that it does not exceed .4 volts per 100 amperes. Close the switch electrically without pressing the emergency button under the dust cap.

(g) Replace the cover band.

(4) CARBURETOR ADJUSTMENT.

(a) GENERAL.—If the engine, after running satisfactorily, suddenly ceases to perform properly, look over the intake manifold and carburetor flange gaskets, throttle, choke, and fuel connections. Make sure that throttle and choke valves open and close correctly and that fuel enters the carburetor in a free and steady stream. Do not change carburetor adjustments under other causes of trouble have been investigated. Changes in adjustment should be necessary only with change in fuel or climate. Before making any adjustments, warm up the engine thoroughly so that the intake manifold feels warm to the hand.

(b) STANDARD SETTING.

1. Throttle stop screw 1½ turns (to right) from fully closed position of throttle plate.

2. Idling needle valve one turn open (to left) from seat.

3. Main jet adjustment 2½ turns open (to left) from seat.

(c) IDLE AND LOW SPEED ADJUSTMENT.

1. Close the throttle slowly until desired idling speed is reached.

2. Turn idling needle valve gradually to right and left until the engine runs steady and as fast as this throttle position will permit. Turning the idling needle to right (in) makes the mixture richer, to left (out) leaner.

3. If a satisfactory adjustment cannot be obtained, examine the idling jet and the idle discharge plug to make sure that dirt or water does not obstruct the free flow of the mixture through these parts.

4. After completing the adjustments set throttle stop screw for desired idling speed.

(d) INTERMEDIATE AND HIGH SPEED ADJUSTMENT.—The mixture at intermediate and high speed is controlled by the main jet and the well vent. The main jet may be either of fixed size or adjustable. Whether fixed or adjustable, remove main jet and blow out with compressed air or rinse in clean gasoline to remove water or dirt which may obstruct the metering orifice. If adjustable, adjustment should be made as follows:

1. Open throttle about one-third.

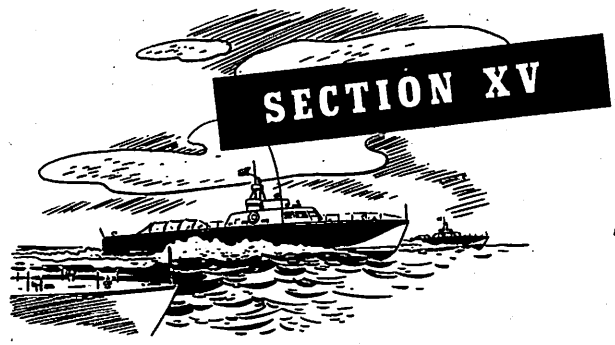
2. Loosen packing nut on main jet adjustment.

3. Turn main jet adjustment to right (in) until the engine speed is noticeably reduced.

4. Turn main jet adjustment slowly to left (out) until the engine runs smoothly and as fast as this throttle position will permit.

5. Hold the needle valve in position and tighten packing nut after completing the adjustment.

Compensation is controlled by the well vent. A richer mixture, at high speeds, is obtained with a smaller well vent and a leaner mixture with a larger well vent. If the mixture suddenly becomes too rich at high speeds, examine the well vent and make sure that it is not obstructed. Inspect these jets for water and dirt.



Fresh Water SYSTEM

1. DESCRIPTION.

(See figure 115.)

The fresh water system, which supplies drinking, cooking and washing water under pressure to various parts of the boat, consists of the following components:

a. Four 130-gallon galvanized-steel fresh water tanks (1, figure 115).

(1) The two forward tanks are located against the galley and senior officers' quarters aft bulkhead under the floors.

(2) The two aft tanks are located against the dispensary compartment forward bulkhead, under the dispensary forward bunks, port and starboard.

(3) Each tank is fitted with two baffle plates to prevent undue motion of the water, a drain plug, an inspection plate, connections for the filler pipe, vent pipe, and pressure gage line, and an outlet pipe leading in the top of the tank and down to within ½ inch of the bottom.

(4) Each tank has a 1¼-inch filler pipe (2, figure 115) leading to the deck above it. The filler caps for the tanks are located as follows:

(a) Aft tanks—aft end of the cockpit deck, port and starboard.

(b) Forward tanks—aft end of bridge deck inboard of bridge sides, port and starboard. (See figure 115C.)

(5) Each tank has a ¾-inch vent pipe (3, figure 115) leading straight up from the tank to just below the deck.

b. Supply lines of ¾-inch pipe and the necessary fittings leading from the tanks to the pump.

(1) The flow of water from each tank to the pump is controlled by a gate valve by each tank (4, figure 115).

(2) A check valve in the supply line at the pump prevents water under pressure from backing up into the supply lines (5, figure 115).

(3) A screen in the supply line at the pump prevents dirt from entering the pump and causing damage.

c. A hand pump in the galley is provided for use in the event of a failure in the pump or pressure lines. (See figure 115B.) The ½-inch tubing to the hand pump taps off the supply lines at the point where the two forward tank lines join to go to the pressure pump. A check valve (5, figure 115) in the line helps keep the line primed, and a gate valve (4, figure 115) under the pump keeps suction in the supply lines from leaking out through the hand pump.

d. A Westco RMX-310-1 centrifugal water pump driven by a ⅙ HP Marathon type DP, frame 163, 1750 rpm compound wound motor, and 7-gallon steel pressure tank is located on the forward port corner of the engine-room floor. (See figure 115A.)

(1) The pump motor operates from the 110-volt electrical system. It is controlled by a switch on the 110-volt switchboard and a switch in the line above the pump.

(2) The outlet line of the pump branches as soon as it leaves the pump. One line goes to the faucets, etc., throughout the ship; the other line goes to the pressure tank.

(3) The pump is operated by a Cutler-Hammer No. 10016 H 67B 2-pole pressure switch with overload protection, mounted on the pump body. A tube from the pressure tank enters the back of the switch. When the pressure in the tank reaches a set maximum (40 to 50 psi) the switch trips and stops the motor. When the pressure falls to a set minimum (20 to 30 psi) the switch trips back and operates the pump again. An adjusting screw regulates the cut-in and cut-out pressures, but the gap between cut-in and cut-out is constant, about 20 psi. A plunger on the switch is used as an emergency cut-off.

(4) The pressure tank is fitted with a Schrader air valve to regulate the air cushion and act as a safety valve.

(5) The pump and pressure tank are mounted together on a steel frame which is bolted to the engine room floor.

e. One-half inch pressure line piping.

(1) The pressure line runs from the pressure tank and pump to the following outlets:

(a) A faucet in the engine room near the pump.

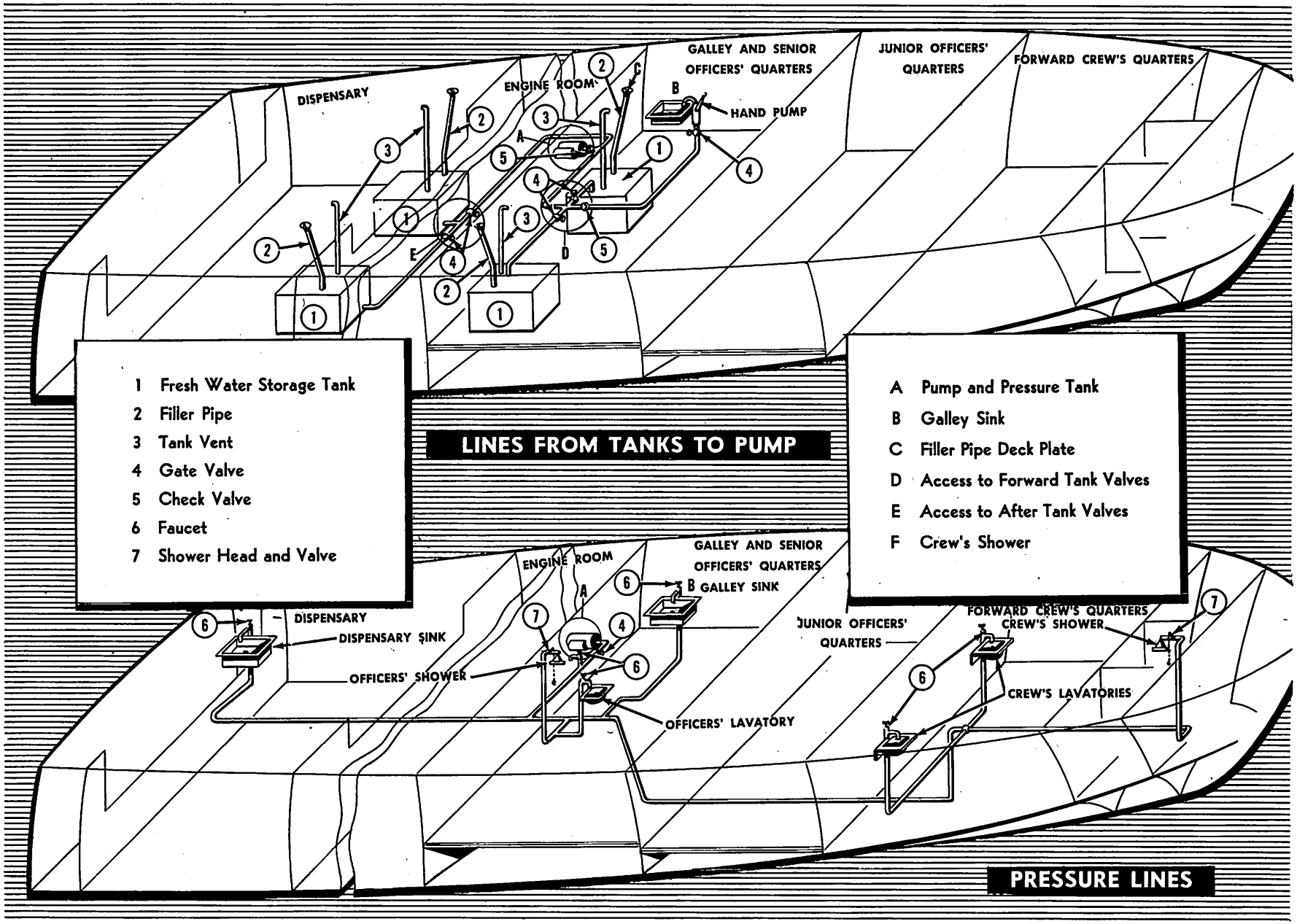
(b) A faucet at the dispensary sink, in the aft port side of the dispensary.

(c) A faucet at the galley sink on the port side of the galley. (See figure 115B.)

(d) A faucet at the senior officers' lavatory on the inboard side of the senior officers' quarters.

(e) A shower valve and shower head in the senior officers' shower in the inboard aft corner of the senior officers' quarters.

Figure 115 — FRESH WATER SYSTEM



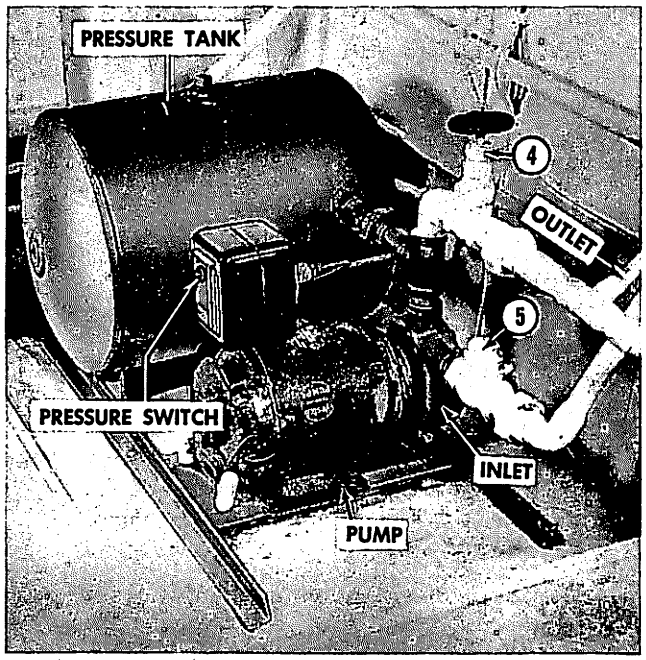
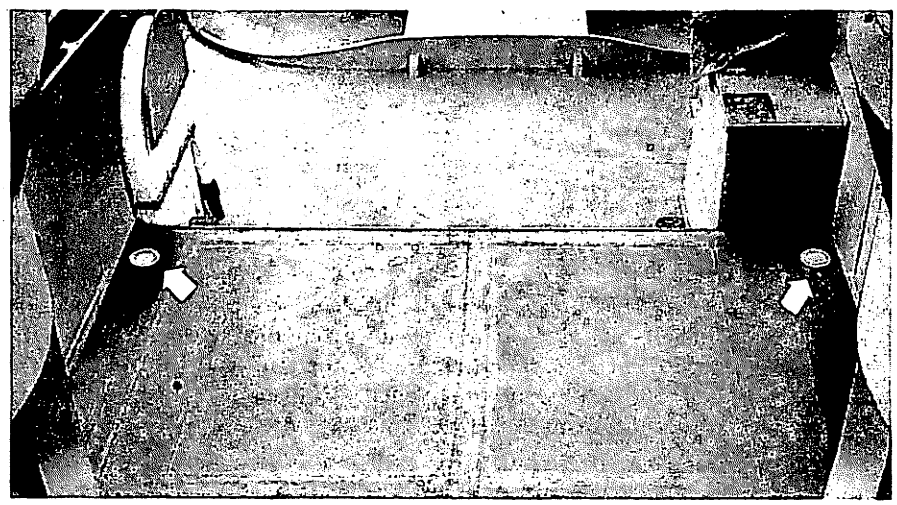


Figure 115A—Fresh Water Pump and Pressure Tank



Figure 115B—Galley Sink

Figure 115C—Forward Tank Filler Connections



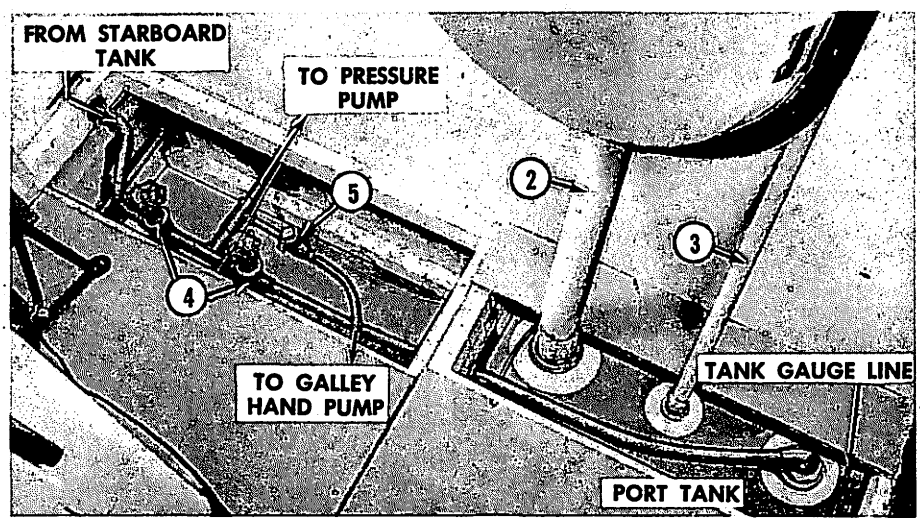


Figure 115D—Forward Tank Valves

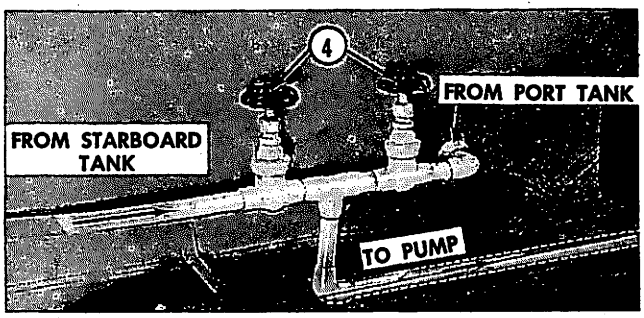


Figure 115E—Aft Tank Valves

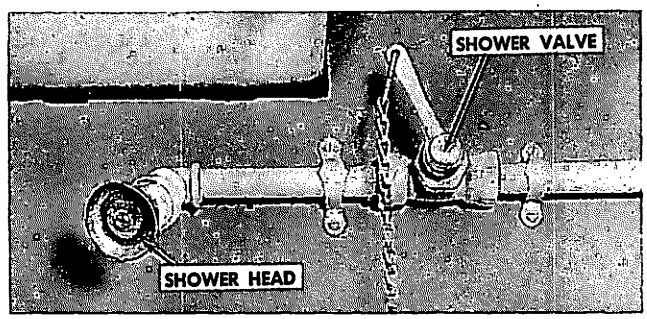


Figure 115F—Crew's Shower

(f) A faucet at the crew's port lavatory on the port side of the forward crew's quarters aft bulkhead.

(g) A faucet at the crew's starboard lavatory on the starboard side of the forward crew's quarters aft bulkhead.

(h) A shower valve and shower head in the crew's shower in the forward center end of the forward crew's quarters. (See figure 115F.)

(2) All the faucets are spring-closing to prevent waste and accidentally leaving them open.

(3) A gate valve in the pressure line at the pump controls the flow of water through the lines.

f. A Levelometer water level gage for each storage tank.

(1) The gages are mounted on the same panels as the fuel tank gages: those for the two forward tanks on the panel on the starboard side of the engine room forward bulkhead; those for the two aft tanks on the panel against the cockpit bulkhead in the engine room, starboard of the companionway. (See figure 116.)

(2) A ¼-inch tube for each tank leads from the gage panel to a point near the bottom through the tank and is controlled by a valve on the panel. The two tubes on each panel lead to the same gage instrument.

(3) A hand-operated air pump for each line is located on the panel below the valves.

(4) In operation, the valve in the line to a particular tank is opened and air is pumped into the line until it is cleared of water. Then, when the pumping is stopped, the pressure of the water in the tank drives some water back into the tube and compresses the air in it. The compression of the air operates an instrument which moves the dial handle. The dial registers in gallons of water.

2. OPERATION INSTRUCTIONS.

a. Open the valve controlling the storage tank from which water is to be pumped. Access to the valves is as follows:

(1) The after tank valves are on the engine room aft bulkhead behind the port engine. (See figure 115E.)

(2) The forward tank valves are reached through the access panel in the galley floor just under the engine room door. (See figure 115D.)

Note

In drawing water from storage tanks, do not draw from the port or starboard tank exclusively as it will interfere with the balance of the boat.

b. Make sure the pressure line gate valve by the pump is open.

c. Turn on the pump switches on the 110-volt switchboard and on the bulkhead over the pump. Make sure the plunger in the automatic pressure switch is pushed in. The pump should operate and build up pressure in the pressure tank. When the proper pressure is reached, the pump should stop.

d. Draw water from any faucet as needed.

Note

The four tanks on the boat together hold only 520 gallons of fresh water for drinking, cooking, and washing for the entire crew. On long trips especially, water discipline is of utmost importance and is the responsibility of the commanding officer.

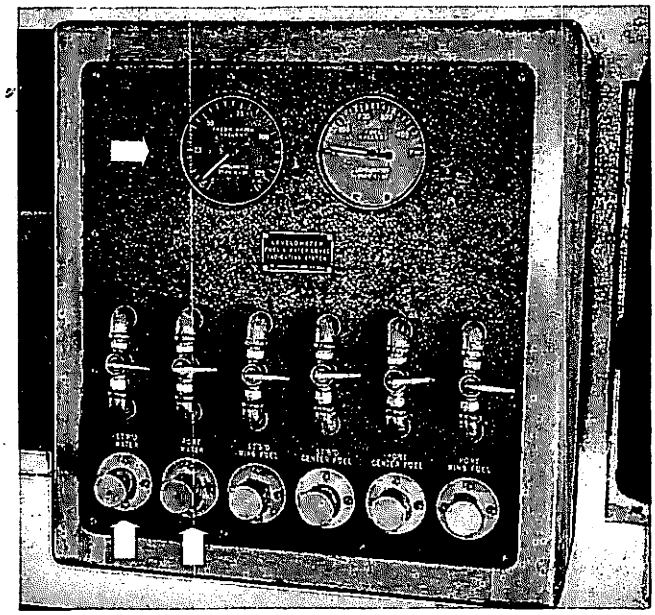


Figure 116—Aft Fresh Water Tanks Gage

e. As water is used, the pump should start and stop automatically to maintain the proper pressure.

f. Before leaving on a trip and at regular intervals while underway with the fresh water system being used, measure the water level of the tanks with the gage.

(1) Pull the valve lever, for the tank to be measured, out away from the panel to bleed air from the line. This will be indicated by the dial hand dropping to "E."

(2) Open the valve by turning the handle down to the vertical position.

(3) Turn the pump handle below the valve slightly counterclockwise to release it, and pull it out.

(4) Work the pump in and out until the dial hand returns to the same point after each stroke.

(5) When the dial hand reaches a stationary position it will register the amount of water in the tank.

(6) Push the pump handle in and lock it in place.

(7) Close the valve.

(8) Bleed the air from the line by pulling the valve handle out until the dial hand returns to "E."

(9) Do not try to measure both forward or both aft tanks at the same time. Do not measure one tank while the valve to another tank is open. Do not start to pump air into the line before the dial hand has returned to "E."

g. EMERGENCY MEASURING.

(1) If the Levelometer gage is not operating, the contents of the tanks may be measured (or "sounded") with a dip stick marked off in inches from 1 to 29. The calibration for each tank is as follows:

Depth of Water	*Contents*
1 inch	4.5 gallons
2 inches	9 gallons
3 inches	13.5 gallons
4 inches	18 gallons
5 inches	22.5 gallons
6 inches	27 gallons
7 inches	31.5 gallons
8 inches	36 gallons
9 inches	40.5 gallons
10 inches	45 gallons
11 inches	49.5 gallons
12 inches	54 gallons
13 inches	58.5 gallons
14 inches	63 gallons
15 inches	67.5 gallons
16 inches	72 gallons
17 inches	76.5 gallons
18 inches	81 gallons
19 inches	85.5 gallons
20 inches	90 gallons
21 inches	94.5 gallons
22 inches	99 gallons
23 inches	103.5 gallons
24 inches	108 gallons
25 inches	112.5 gallons
26 inches	117 gallons
27 inches	121.5 gallons
28 inches	126 gallons

(2) Sound the tanks through the tank inspection plates.

(a) The forward port tank inspection plate is reached through the access panel in the center of the galley floor against the galley and officers' quarters aft bulkhead.

(b) The forward starboard tank plate is reached through the access panel in the floor of the senior officers' toilet.

(c) The after tank plates are reached through the access panels under the forward dispensary bunks, port and starboard. Remove the mattresses from the bunks to uncover the access panels.

h. If, for any reason, the pressure pump must be turned off, water can still be supplied to the galley sink by the hand pump.

(1) Open the gate valve in the galley pump line, located in the locker under the sink drain board forward of the sink.

(2) Open the gate valve to either of the forward tanks.

(3) Operate the hand pump.

(4) Close the gate valve in the hand pump line when the pressure pump is again operating.

i. When a tank is empty, close the valve to that tank and open the valve to a full tank.

(1) The pressure of the water in the filling pipe and vent pipe of the full tank will drive the air out of the pump and prime it automatically.

(2) If there is no pressure of water in the filling pipe and vent pipe, the pump will not prime itself. In the case of the two forward tanks, the line can be primed by operation of the galley hand pump to fill the lines with water. In the case of the aft tanks, the tanks must be completely filled again to prime the lines.

3. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
PUMP DOES NOT OPERATE	Break in electrical line between switchboard and pump.	Make continuity test and repair wire.
	Switch burned out.	Replace switch.
	Pressure switch broken in the off position.	Repair switch.
	Pump motor broken.	Repair or replace motor.
	Pump broken, jammed, or clogged.	Disassemble, clean, and repair pump.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
PUMP STARTS AND STOPS MORE THAN IS JUSTIFIED BY THE AMOUNT OF WATER BEING USED	Leak in pressure lines, valves, or pressure tank. Pressure switch set too low. Check valve in storage tank line leaks.	Inspect and repair lines, valves, or tank. See paragraph 4.*c.* Repair check valve.
PUMP RUNS CONTINUOUSLY, BUILDING UP PRESSURE	Pressure switch tube to tank broken. Pressure switch broken so it will not turn off.	Repair tube. Repair switch.
PUMP RUNS BUT DOES NOT SUPPLY WATER TO FAUCETS	Break in pressure lines or pressure tank. Break in suction lines. Pump drawing from empty storage tank. Strainer clogged.	Repair lines or tank. Repair lines. Turn off valve to empty tank; open full tank. See paragraph 4.*b.*(3).
GALLEY PUMP DOES NOT OPERATE	Pump broken. Break in line between galley pump and tanks.	Repair pump. Repair line.
GALLEY PUMP IS DIFFICULT TO PRIME	Pump piston leaking. Check valve in galley pump line faulty. Leak in galley pump line.	Replace pump piston. Replace check valve. Repair line.
GALLEY PUMP LEAKS WHEN THERE IS PRESSURE IN THE PRESSURE LINES	Faulty gate valve under pump.	Repair valve.
TANK GAGE DOES NOT REGISTER ONE TANK PROPERLY	Leak in air line between gage valve and tank. Leak in valve to the other tank.	Repair line. Repair valve.
TANK GAGE DOES NOT REGISTER EITHER TANK OF A PAIR PROPERLY	Leak in line above valves. Broken instrument.	Repair line. Have instrument repaired.

4. SERVICE, LUBRICATION, AND MAINTENANCE.

a. FILLING THE TANKS.

(1) Make sure the fresh water supply is pure and fit for drinking.

(2) Wash the deck clean around the tank filler connection so that dirt will not fall into the tank when the connection is opened.

(3) Remove the cap from the filler connection. Use the special key. (See figure 117.)

(4) Run a hose from the shore connection to the tank. Do not turn on the water until the end of the hose is in the filler pipe. Turning it on sooner so that it spills on the deck may wash dirt into the filler pipe.

Note

A hose is the most convenient method of filling the tanks. If hose is not available, carry the water in any suitable clean vessel and pour it through a funnel.

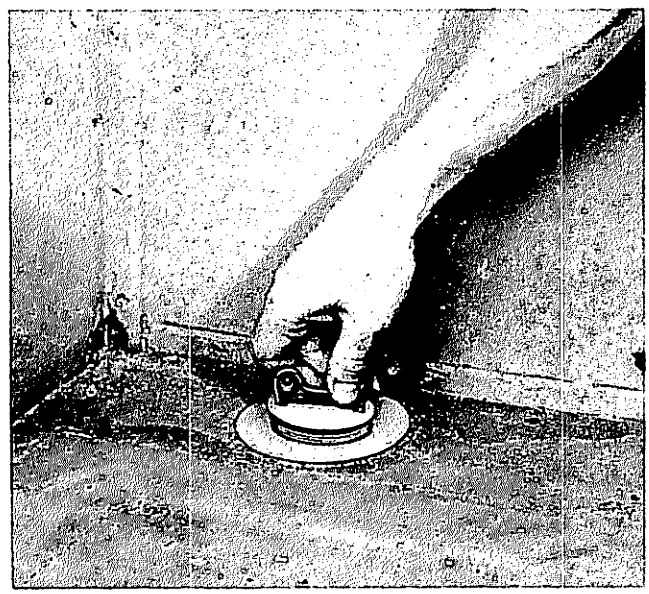


Figure 117—Removing Tank Filler Cap

(5) Fill the tank until water runs out the vent pipe over the tank just below the deck. This water will act as a pressure head to prime the pump.

(6) Reinstall the filler connection cap as soon as the tank is filled.

b. CARE OF THE PUMP.

(1) The ball bearings in the motor are packed with grease at the factory and should require no further lubrication during the life of the pump.

(2) Keep the stuffing box lubricated. Remove the pipe plug in the top of the stuffing box (between the pump and the motor) and fill in with SAE 10 oil.

(3) If the pump has difficulty drawing water from the tanks, the strainer may be clogged. Open the suction line at the check valve and remove and clean the strainer.

(4) Faulty operation of the pump may be caused by leaks in the stuffing box, causing water to mix with the stuffing box oil or oil and water to enter the motor. If water is found mixed with oil drained from the stuffing box (through the drain plug hole in the bottom of the stuffing box) or if the pump uses an unusual amount of oil, it indicates a leak around the rotary seal. Disassemble the pump. (Refer to paragraph 5.*d.*) Replace the seal assembly.

c. ADJUSTING THE PRESSURE SWITCH.—If the pump maintains too great or too little pressure, adjust the pressure switch as follows:

(1) Remove the single screw holding the cover on the switch and remove the cover.

(2) Loose the lock screw holding the adjusting screw plate at the top of the switch. Screw the adjusting screw in to increase the cut-in and cut-out pressures, or loosen it to decrease the pressures. (See figure 118.)

(3) Run the pump to test the pressures before locking the adjusting screw. The pressure can be measured with a suitable gage at the Schrader valve on the pressure tank.

(4) Tighten the lock screw to lock the adjusting screw in position.

(5) Reinstall the switch cover.

d. Most troubles with the storage tank gage should be remedied by an instrument specialist. If the trouble can be traced to a leak in the air line or connections (and don't overlook the possibility of a leak in the line inside the storage tank), it can be repaired on board the boat. If the trouble is in the instrument itself, remove the panel and have it inspected and repaired by an instrument mechanic.

e. If the water should become polluted with salt water or otherwise rendered unfit to drink, turn off the pump and clean the system as follows:

(1) Drain the polluted storage tank or tanks by removing the drain plug at the bottom of the tank.

Note

The water will drain into the bilge and must be pumped out by the bilge pumping system.

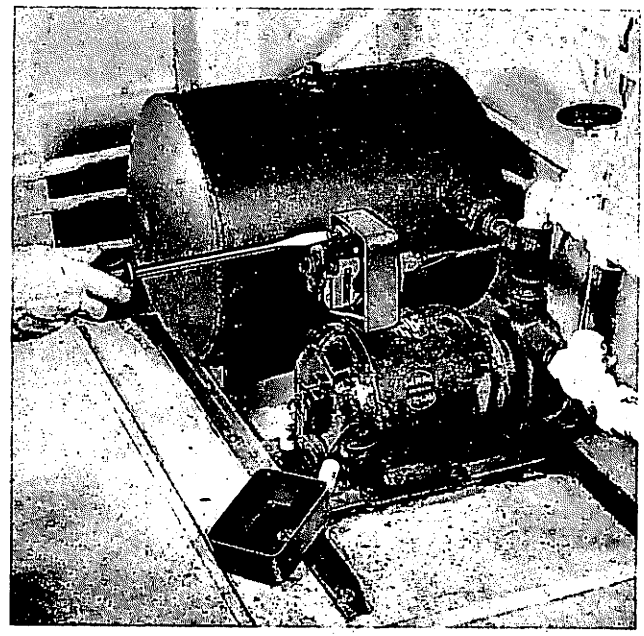


Figure 118—Adjusting Pressure Switch Setting

(2) Refill the tank with fresh water and drain it as many times as is necessary to wash it out. If dirt is stuck on the inside of the tank and doesn't wash out easily, open the inspection plate and scrub the inside of the tank with a clean brush or clean swab. Do not use soap, or any other cleaning agent, as it will require more flushing to remove that from the system.

(3) When clear water flows from the tank drain, reinstall the drain plug.

(4) Drain the pump and pressure tank by removing the drain plugs.

(5) With the pump drain plugs removed, open all the faucets to provide vents and let the pressure lines drain out through the pump.

(6) Reinstall the drain plugs in the pump and pressure tank and fill the storage tanks completely.

(7) Open the valve to one storage tank.

(8) Turn on the pump.

(9) Run water from the faucets one at a time until good water flows at each.

(10) As a final check, pump water from each of the storage tanks one at a time and test it at a faucet. When the forward tanks are being used, operate the galley hand pump also and test the water there. Refill the tanks completely when the check is completed.

5. REPAIR, REMOVAL, AND DISASSEMBLY.

a. GENERAL.—See section III, paragraph *6.b.,* for repairs of the pipes, valves, and fittings, and paragraph *6.g.* for repairs of the storage and pressure tanks.

b. REMOVAL OF PRESSURE PUMP AND PRESSURE TANK FROM BOAT.

(1) Turn the pump switches off.

(2) Close all the storage tank valves and the pressure line valve by the pump.

(3) Bleed the air pressure from the pressure tank through the Schrader valve.

(4) Remove the two drain plugs in the pump and allow the pump to drain.

(5) Remove the electrical connection at the pressure switch.

(6) Remove the inlet and outlet pipe connections and as much of the piping as necessary for accessibility.

(7) Remove the bolts holding the pump and pressure tank frame to the engine room floor, and lift out the pump and tank.

c. SEPARATION OF PRESSURE PUMP AND PRESSURE TANK.

(1) Remove the coupling nuts holding the switch tube to the tank and to the switch.

(2) Remove the pipe connections between the tank and the pump.

(3) Remove the bolts holding the pump and the tank to the frame and remove the frame.

d. DISASSEMBLY OF PUMP.

(See figure 119.)

(1) Remove the stuffing box plug (Q) and drain the stuffing box.

(2) Remove the six cover cap screws (J) and remove the cover (B) and gasket (G).

(3) Remove the pipe plugs (P and R) and loosen the set screws (N) to remove the outside liner (D).

(4) Pull the impeller (E) off the shaft.

Note

The impeller setscrew (M) is used in the manufacturing process only. Do not tighten it upon reassembly.

(5) Remove the Woodruff key (I) from the shaft.

(6) Remove the dowel pin (H) and the inside liner (C).

(7) Screw out the junk ring (V) and slide the carbon sealing ring off the shaft.

Note

If the old seal is to be used again, string the parts of the seal together so they will be replaced in the same order in which they were removed.

(8) Remove the junk ring spacer (V).

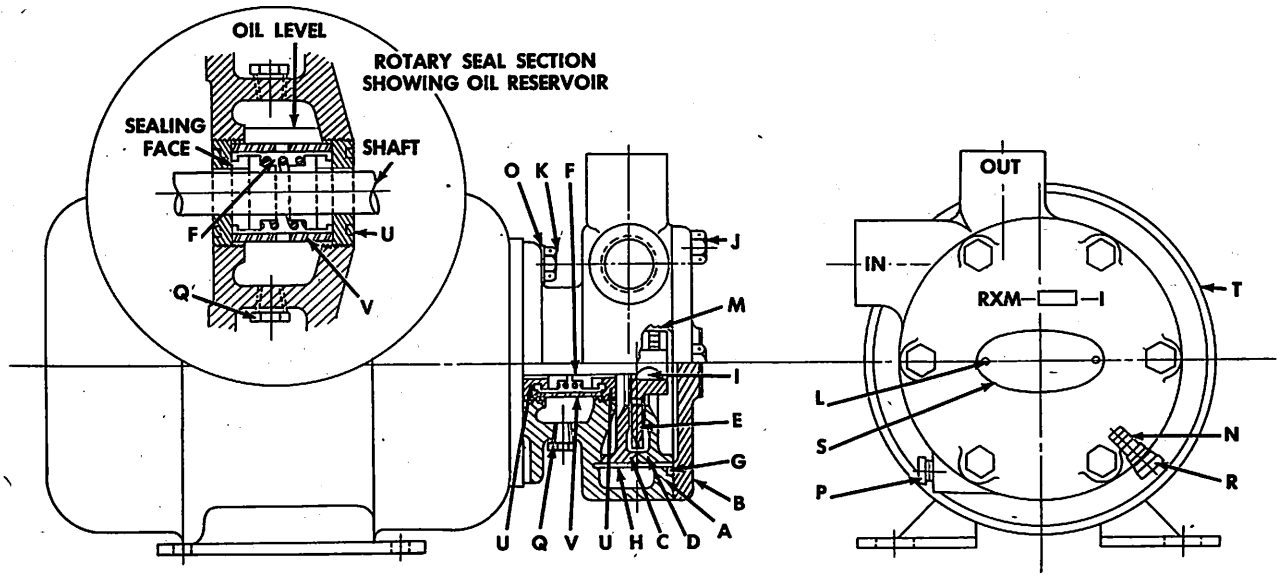
(9) Remove the rotary seal spring assembly (F).

(10) Remove the four motor cap screws (K) and remove the pump body (A) from the motor.

(11) Remove the second junk ring (V).

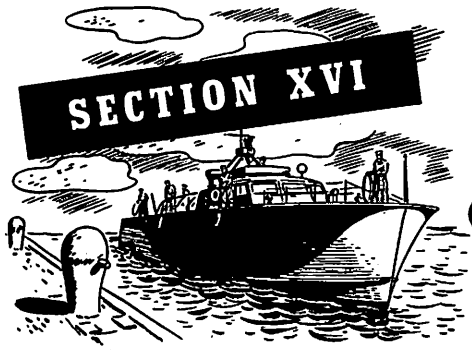
Note

When the pump is reassembled, replace the seal and junk rings, if possible. Put shellac or red lead on the threads of the junk ring next to the motor. Be careful to keep the seal surfaces free of foreign matter.



A Body
B Cover
C Body Liner
D Cover Liner
E Impeller
F Rotary Seal
G Pump Gasket
H Dowel Pin for Liners
I Woodruff Key-Impeller
J Hex. Hd. Capscrew Cover
K Hex. Hd. Capscrew Motor
L Drive Screws—Nameplate
M Set Screw—Impeller
N Set Screw—Body
O Motor Capscrew Washer
P Pipe Plug—Drain
Q Pipe Plug—Stuffing Box
R Pipe Plug—Body
S Nameplate
T Motor
U Junk Ring
V Spacer—Junk Rings

Figure 119—Cutaway View of Fresh Water Pump



Sanitary System

1. DESCRIPTION.

(See figure 120.)

The sanitary system consists of the following components:

a. SENIOR OFFICERS' TOILET.—A toilet located against the galley and senior officers' quarters rear bulkhead in the senior officers' quarters. (See figure 120A.)

(1) The toilet draws water from a sea chest aft of the engine room forward bulkhead. This intake line is controlled by a gate valve which can be reached through the starboard angle drive access panel in the engine room.

(2) Discharge is made through a pipe running along the engine room forward bulkhead to a through-hull connection on the starboard side of the engine room. (See figure 120D.) This line is controlled by a gate valve near the through-hull connection.

(3) The toilet mechanism includes a shut-off valve in the intake line. On some toilet models this valve is normally held closed by a spring. A foot pedal opens it when the toilet is to be flushed.

(4) A hand pump pumps water into the toilet when the shut-off valve is open. A two-way ball check valve in the inlet regulates the flow of water. The down stroke of the piston draws sea water into the top of the pump cylinder. The incoming water raises the ball from the inlet opening. When the ball is raised, it closes the line to the bowl. The upstroke of the piston drives the water out of the cylinder. This reverse flow of water drops the ball into the inlet opening, closing it and deflecting the water to the line which empties into the bowl.

(5) The bowl empties into the pump cylinder below the piston. A flap valve allows water to flow into the cylinder but not out the same way. The water outlet line taps off the bottom of the cylinder. Another flap valve in the outlet allows water to flow outward only.

(6) The up stroke of the piston closes the water outlet valve, opens the bowl valve, and draws the water from the bowl into the cylinder. The down stroke of the piston closes the bowl valve, opens the outlet valve, and drives the water into the discharge line.

b. JUNIOR OFFICERS' QUARTERS TOILET.—A toilet in the aft port corner of the junior officers' quarters. (See figure 120B.)

(1) The toilet draws water through a sea chest inboard of the toilet. This intake line is controlled by a gate valve reached through the access panel in the junior officers' quarters starboard passageway, just forward of the galley steps.

(2) Discharge is made through a through-hull connection near the toilet. This line is controlled by a gate valve behind the toilet.

(3) Although the models of the toilets may differ, they both work on the same principle.

c. CREW'S QUARTERS SHOWER DRAIN.—The drain from the crew's quarters shower to a through-hull connection in the port side of the forward crew's quarters. This line is controlled by a gate valve reached through the access panel in the floor of the crew's quarters port hanging locker.

d. CREW'S LAVATORY DRAINS.—The drains from the two crew's lavatories leading to through-hull connections near the forward crew's quarters aft bulkhead, port and starboard. (See figure 120C.) Each line is controlled by a gate valve near the through-hull connection, reached through an access panel in the lower aft bunk. Remove the mattress to get to the access panel.

e. GALLEY SINK DRAIN.—The drain from the galley sink to a through-hull connection directly outboard of the sink. This line is controlled by a gate valve reached through either locker under the sink drain board.

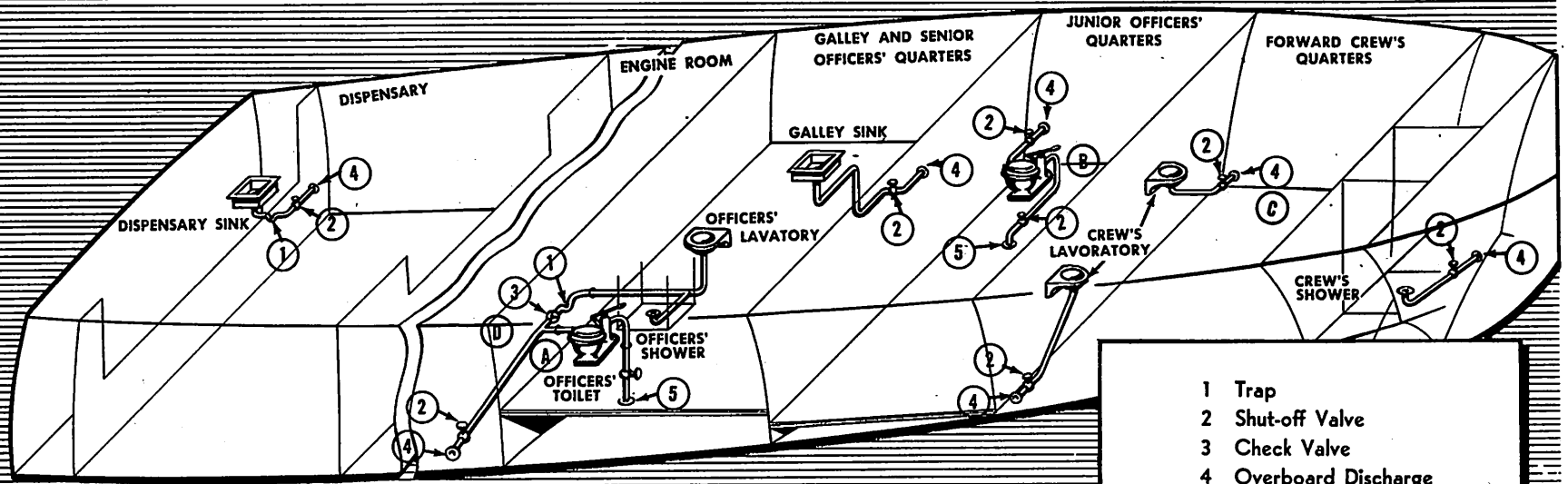
f. SENIOR OFFICERS' LAVATORY AND SHOWER DRAIN.—The drain from the senior officers' lavatory and shower. These two drains unite near the shower and pass through the bulkhead to the engine room. In the engine room it joins the drain line from the senior officers' toilet. (See figure 120D.) A trap in the line is provided for cleaning. A check valve near the connection with the toilet drain prevents discharge from the toilet from backing up into the lavatory and shower drain line.

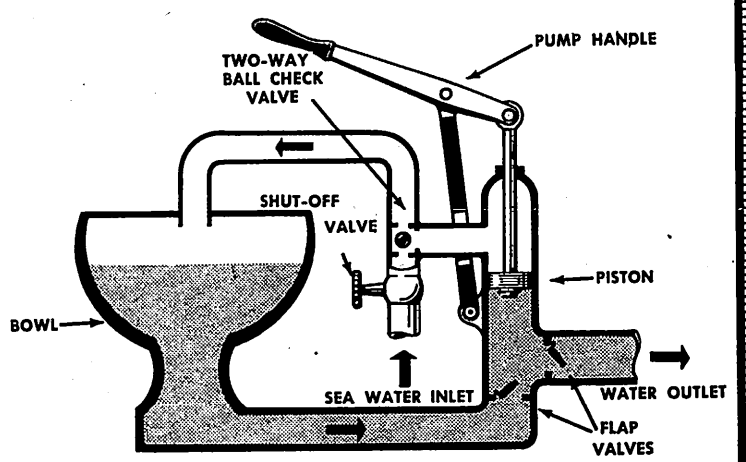
g. DISPENSARY SINK DRAIN.—The drain from the dispensary sink through a trap to a through-hull connection in the aft port side of the dispensary. This line is controlled by a gate valve near the hull, reached through the locker under the sink.

h. All the drains are protected by strainers.

i. Each drain line includes a rubber hose section to take up vibration without damage to the pipes.

Figure 120 — SANITARY SYSTEM





SCHEMATIC DIAGRAM OF TOILET

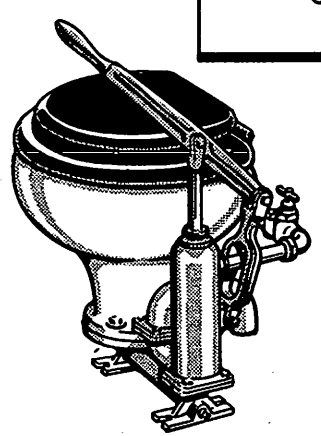




Figure 120A—Senior Officers' Toilet



Figure 120B—Crew's Toilet

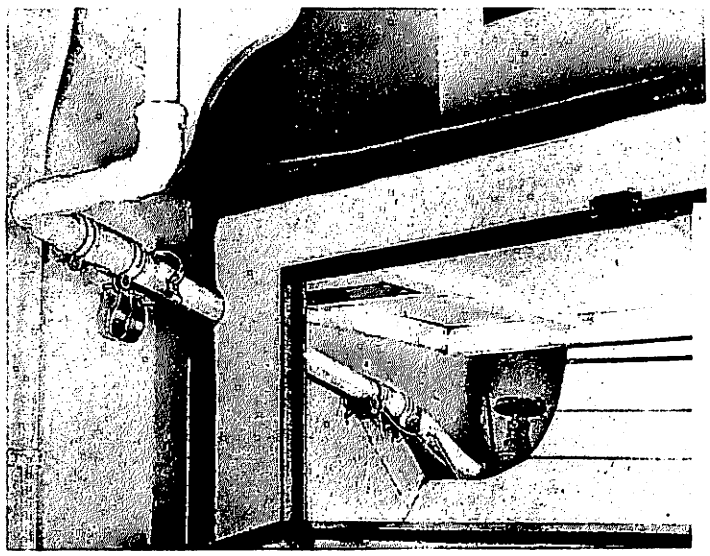


Figure 120C—Crew's Port Lavatory Drain

Figure 120D—Senior Officers' Shower, Lavatory and Toilet Drain Piping in Engine Room

2. OPERATION INSTRUCTIONS.

a. TOILETS.

(1) The gate valves in the intake and drain lines should be left open normally.

(2) The toilet shut-off valve should be left open normally except on foot pedal models which close automatically by a spring. On foot pedal models, step on the foot pedal to open the inlet while the toilet is being flushed.

(3) Operate the pump until the toilet bowl is flushed.

(4) If the discharge line becomes plugged up, turn off the toilet inlet valve (or release the pedal on pedal models) so all the pump pressure will be on the discharge line and it will not suck more water into the bowl.

(5) Do not throw matches, wads of paper, or other foreign matter into the toilet bowl; they will plug up the discharge line. Matches especially often catch in the flap valves and prevent them from closing fully.

b. DRAINS.

(1) The gate valves in the sink, shower, and lavatory drain lines are normally left open.

(2) The drains are gravity operated.

(3) Do not flush down grease, paint, or other materials which will coat or clog the pipes.

3. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
TOILET PUMP WILL NOT PRIME	Toilet dry. Faulty check valve. Plugged sea chest. Broken inlet line. Faulty piston gaskets.	See paragraph 4.*a.*(5). See paragraph 4.*a.*(10). Clean sea chest. Close inlet line valve and repair pipe. Replace piston gaskets.
TOILET PRIMES BUT DOES NOT SEND WATER TO BOWL	Faulty check valve. Faulty piston gaskets.	See paragraph 4.*a.*(1). Replace piston gaskets.
BOWL FILLS WITH WATER FASTER THAN IT IS PUMPED OUT	Faulty flap valves. Clogged drain line.	Clean or replace flap valves. Turn off inlet shut-off valve and operate pump.
DRAINS ARE SLUGGISH	Clogged strainer. Clogged trap (on senior officers' lavatory and dispensary sink drains). Clogged line.	Clean strainer. Clean trap. Flush line with lye solution.
DRAIN FROM OFFICERS' TOILET BACKS UP INTO OFFICERS' SHOWER AND LAVATORY DRAIN	Faulty check valve in lavatory and shower drain.	Replace check valve.

4. SERVICE AND MAINTENANCE.

a. TOILETS.

(1) The most frequent trouble with the toilets is due to faulty two-way ball check valves. Nicks in the ball, or dirt deposits on the valve seats can prevent the valve from operating. In such cases, replace the ball or clean the valve seats. The valve can be reached through a removable cap on the valve body.

(2) Leaking pump pistons should be removed and the piston gaskets replaced.

(3) Keep the packing nut around the piston rod tightened so it does not leak. When necessary, renew the packing under the nut. Ordinary cotton string is suitable for packing.

(4) Faulty flap valves in the discharge connections should be cleaned or replaced. If the toilet is allowed to dry and the flap valves dry and harden, they must be replaced.

(5) If the toilet is not used for a long period, it may lose its prime and will not pump. In such cases, pour a pail of water into the bowl and flush it down.

(6) In case of a break in the inlet line between the sea chest and the toilet, close the inlet line gate valve to prevent leakage into the boat until the break is repaired.

(7) If the boat lies idle for a long time and the toilets are not used, the sea chest may become clogged with marine growth and must be cleaned out.

(8) Each boat should carry at least one kit of spare parts for each toilet. These kits contain proper two-way ball check valves, piston gaskets, flap valves, and other parts which are replaced frequently.

b. DRAINS.

(1) In case of a leak or break in the pipe line between a toilet, sink, or shower, and the through-hull connection, turn off the gate valve near the hull to prevent water from splashing up through the drain and out the break in the pipe.

(2) If the flow of water out a drain is sluggish, remove and clean the strainer.

(3) If a trapped drain is working too slowly, remove the plug in the bottom of the trap and clean the trap.

(4) If the drain is still sluggish, flush it out with a lye solution.

(5) Flush all the drains with a lye solution at the time of every overhaul.

(6) Make repairs in pipes, valves, and fittings as in section III, paragraph 6.*b.*



Fire Extinguishing

SYSTEM - CO_2

1. DESCRIPTION.

(See figure 121.)

The CO_2 fire extinguishing system uses carbon dioxide gas to put out fires in the boat. It is designed to flood the forward and after fuel tank compartments and the engine room with CO_2 in case of fire.

The system consists of the following components:

a. Five 50-pound C-O-TWO Co. carbon dioxide cylinders, with type VC valves, bracketed against the hull in the aft port side of the engine room. (See figure 121A.) These cylinders are designated 1, 2, 3, 4, and 5, starting from the one farthest aft.

b. Four C-O-TWO Co. Type AP-3 discharge cylinder heads with low-type release levers, two of which (on cylinders 4 and 5) are connected with a yoke, and one discharge head (on cylinder 2) operated by back pressure in the line. (See figure 121B.) The heads and tops of the cylinders are protected from damage or accidental release by plywood panels fastened in front of them.

c. Five glass window pull release boxes located and labelled as follows:

(1) One on the bridge labelled "ALL COMPARTMENTS." (See figure 121F.)

(2) One in the pilot house labelled "ALL COMPARTMENTS." (See figure 121E.)

(3) One in the cockpit labelled "ALL COMPARTMENTS."

(4) One in the cockpit labelled "FORWARD TANK COMPARTMENT."

(5) One in the cockpit labelled "AFTER TANK COMPARTMENT." (See figure 121D.)

d. The following units of woven wire cable run through 3/8-inch conduits incorporating suitable corner pulleys:

(1) Cable connecting the cockpit "AFTER TANK COMPARTMENT" release box to the release lever on cylinder 1.

(2) Cable connecting the cockpit "FORWARD TANK COMPARTMENT" release box to the release lever on cylinder 3.

(3) Cable connecting the cockpit "ALL COMPARTMENTS" release box to the yoke connecting the release levers on cylinders 4 and 5.

(4) A cable branching off this cylinder's 4 and 5 cable and connecting with the pilot house release box.

(5) A cable branching off the pilot house cable and connecting with the bridge release box.

e. One-half inch pipe leading from the cylinders to the forward and after tank compartments and around the engine room, to carry the carbon dioxide gas.

f. A pneumatic switch in the pipe line. (See figure 121C.) This is an electric switch which is turned on by pressure in the line. It controls a red signal light on the bridge (figure 121G); the light turns on when pressure in the line shows that the CO_2 is being discharged.

g. Sixteen C-O-TWO Co. baffle-type nozzles in the pipe lines to discharge and spread the CO_2. (See figure 121H.)

h. Necessary pipe fittings, including two check valves.

2. PRINCIPLES OF OPERATION.

a. Carbon dioxide extinguishes fires by excluding oxygen. When the compressed carbon dioxide is released from the cylinders, it expands and blankets the fire and smothers it.

b. DISCHARGE HEADS. *(See figure 122.)*

(1) When the release lever on the cylinder discharge head is raised, it drives a hollow cutter down through the metal sealing disc in the cylinder valve. This releases the CO_2 which passes out through the pipe connection in the discharge head.

(2) Back pressure in the pipe line will also drive the cutter through the valve seal and release the CO_2 without moving the release lever.

(3) A ball check in the discharge head acts as a safety valve. The ball is raised by the pressure of the gas escaping from the cylinder when discharged. If the head is removed from a cylinder, however, and the rest of the cylinders are discharged, the ball will close the opening and prevent the gas from escaping through the removed head.

c. Pulling the release box handle pulls the release cable and raises the release lever on the discharge head, releasing the CO_2 from the cylinder.

d. Pulling the "AFTER TANK COMPARTMENT" release box handle discharges cylinder 1. The piping carries the CO_2 to four nozzles in the after tank compartment, under the dispensary bunks.

Figure 121—FIRE EXTINGUISHING SYSTEM—CO_2

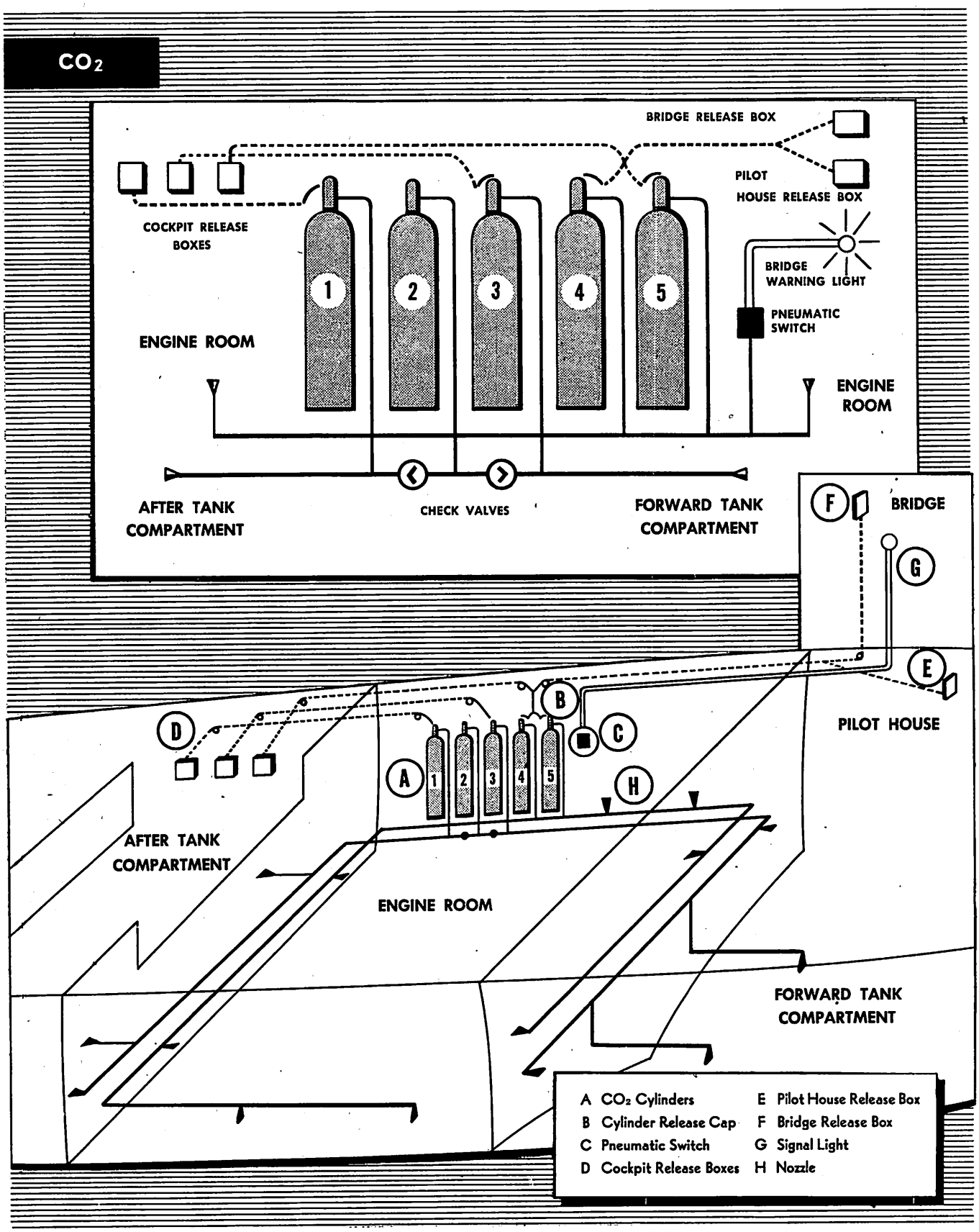




Figure 121A—CO_2 Cylinders, Protective Panels Removed

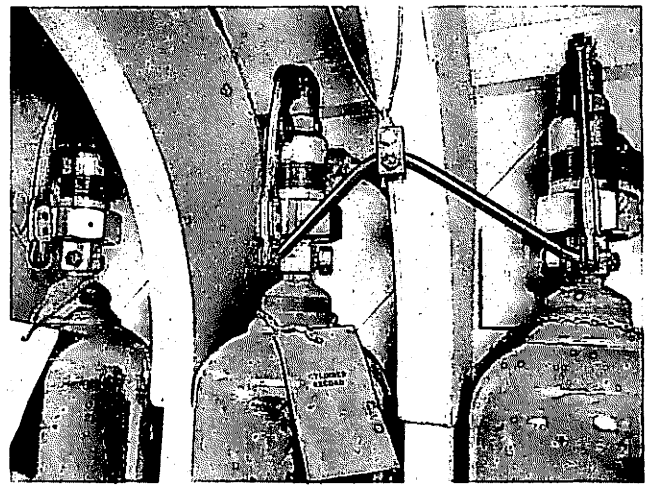


Figure 121B—Cylinder Discharge Heads and Levers

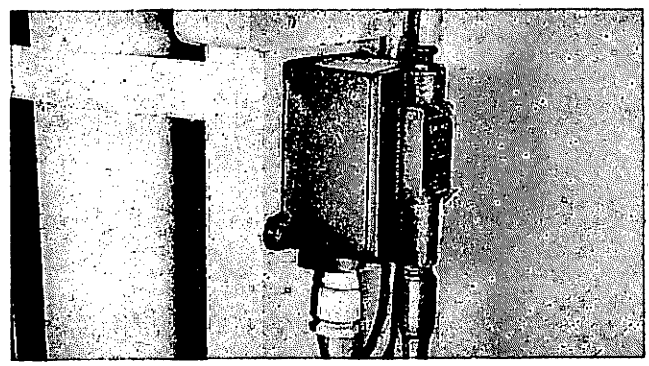


Figure 121C—Pneumatic Switch

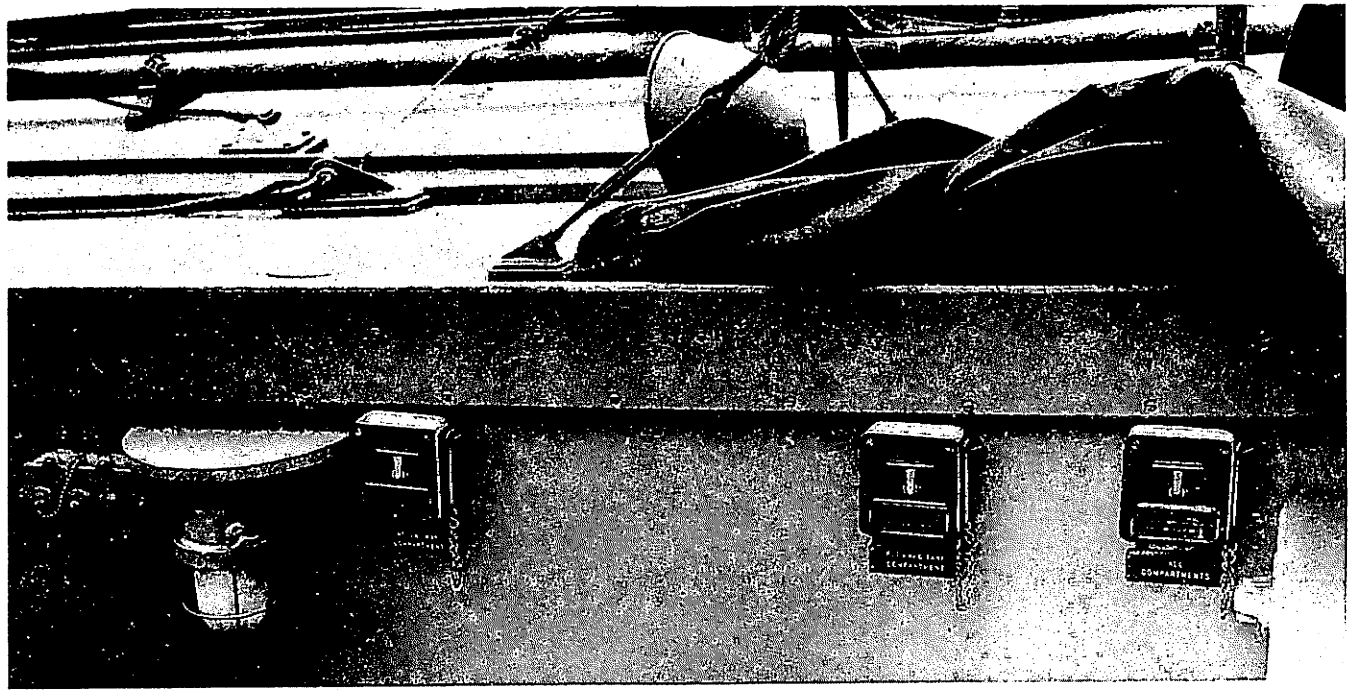


Figure 121D—Cockpit Release Boxes

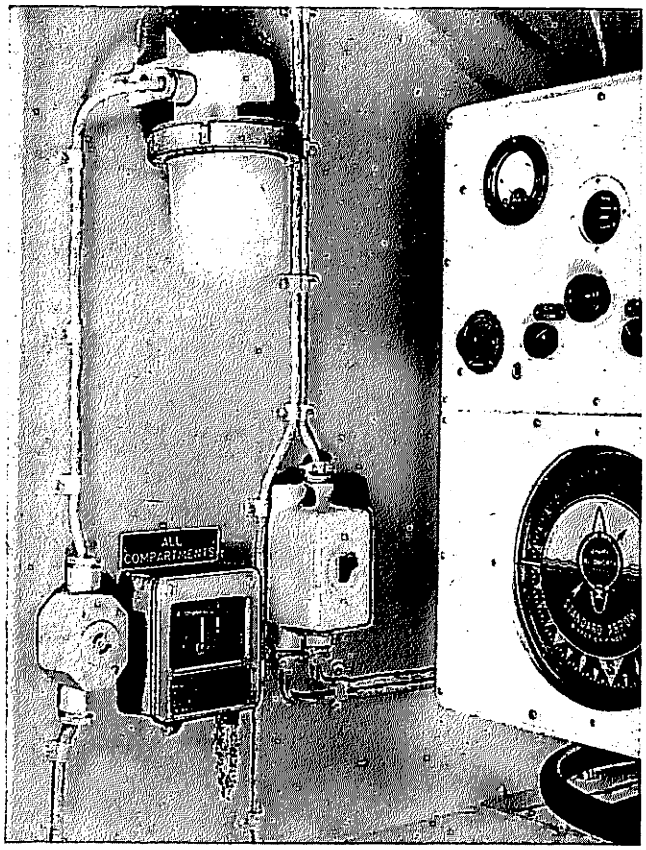


Figure 121E—Pilot House Release Box

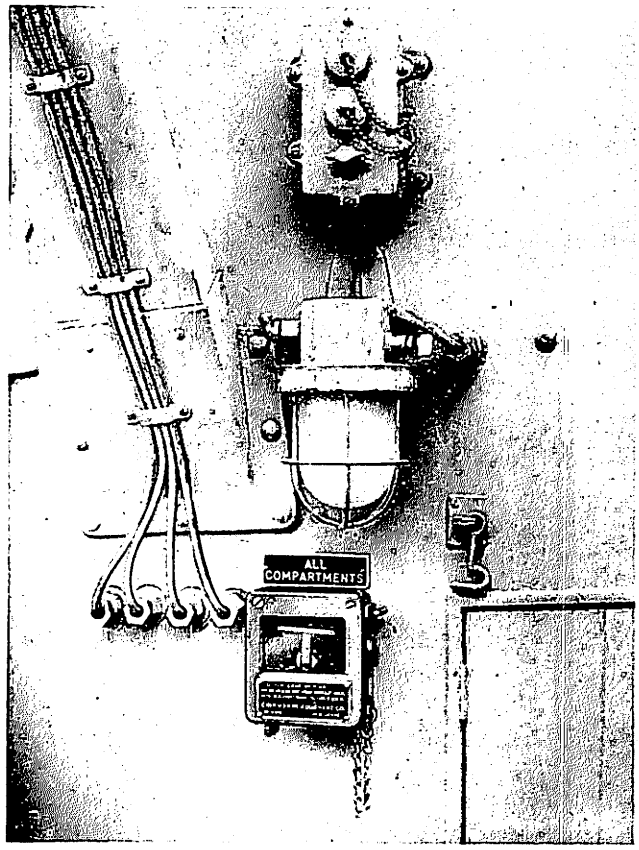


Figure 121F—Bridge Release Box

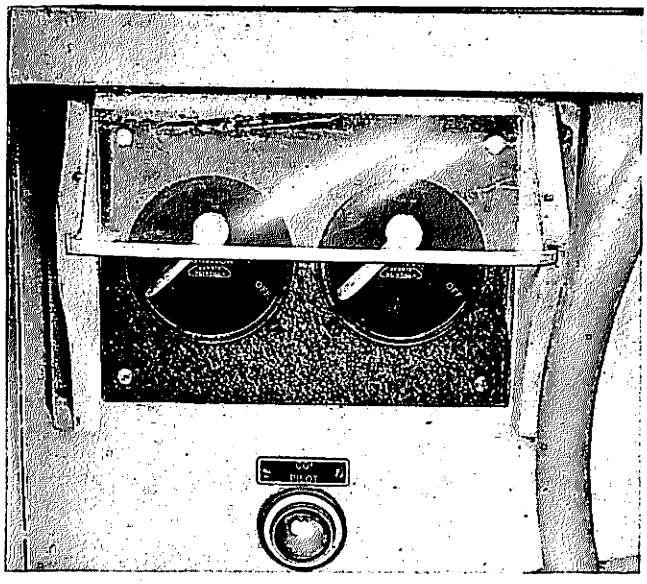


Figure 121G—Signal Light

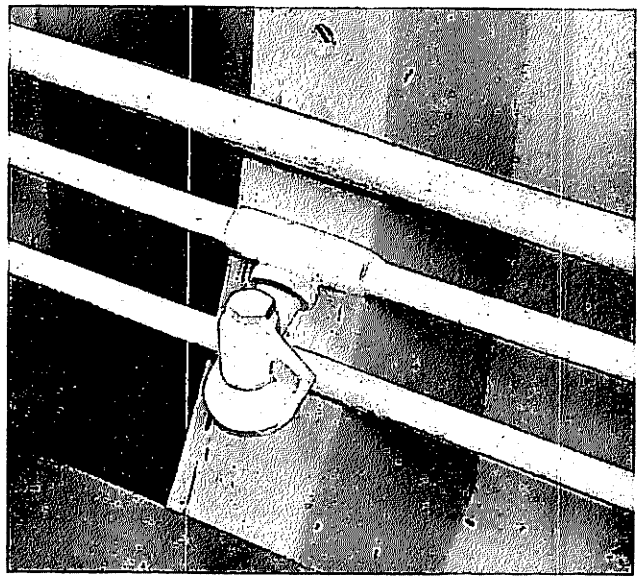


Figure 121H—Discharge Nozzle

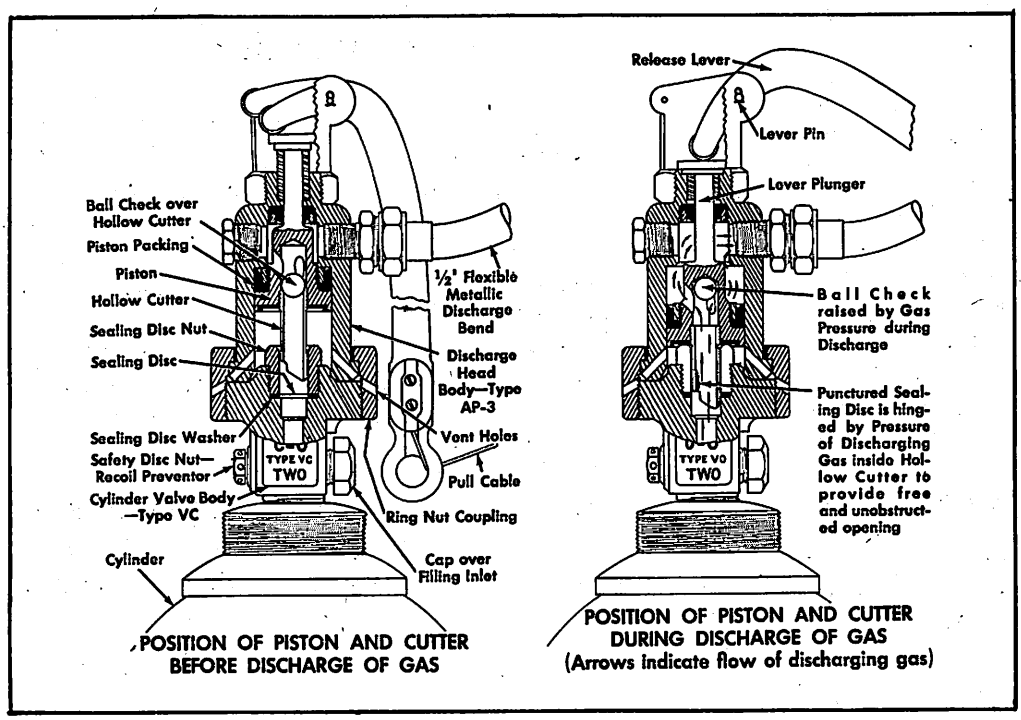


Figure 122—Cutaway View of Cylinder Discharge Head

e. Pulling the "FORWARD TANK COMPARTMENT" release box handle discharges cylinder 3. The piping carries the CO_2 to four nozzles in the forward tank compartment, under the galley and the officers' quarters.

f. Two check valves prevent the gas from discharging into the wrong compartment when only one cylinder is discharged.

g. Pulling any "ALL COMPARTMENTS" release box handle discharges cylinders 4 and 5 simultaneously. Pipe carries the CO_2 to six nozzles on the engine room floor.

h. Another pipe connects the line from cylinders 4 and 5 to cylinder 2. When cylinders 4 and 5 are discharged, pressure in this line discharges cylinder 2 and its gas is added to the other.

i. The line from cylinders 4 and 5 also connects to the forward tank compartment line and the after tank compartment line between the check valves. When cylinders 4 and 5 are discharged, the gas will flow through the check valves and into the forward and after tank compartments. The pressure will also flow to the heads of cylinders 1 and 3 and discharge them.

j. It will be seen that cylinder 1 can be discharged to the after tank compartment separately, and cylinder 3 can be discharged to the forward tank compartment separately; but when cylinders 4 and 5 are discharged to flood the engine room, cylinders 1, 2, and 3 will also discharge automatically and both tank compartments as well as the engine room will be flooded with CO_2.

k. The pneumatic switch (figure 123) is tapped off the engine room CO_2 pipe. When cylinders 4 and 5 are discharged, the pressure of the gas in the line pushes up a piston which trips a toggle switch to the "ON" position. This closes a circuit in the 110-volt electrical system to a signal light on the bridge. A plunger on top of the switch is pushed in to break the electric circuit and reset the switch.

3. OPERATION INSTRUCTIONS.

a. IN CASE OF FIRE.

(1) Break the glass of the release box controlling the compartment to be flooded. Use the small hammer chained to the box. Pull the release handle hard as far as it will go.

WARNING

If the fire is localized to either the forward or after tank compartments, release CO_2 to just that compartment. Once all the cylinders are discharged the system will not operate again until the cylinders are replaced, so do not release them all unless necessary. However, if there is any doubt as to the extent of a fire do not hesitate. Release all the cylinders. Hand CO_2 fire extinguishers located throughout the boat are to be used for small localized fires. Do not try to fight too large a fire with them.

(2) Clear all personnel from the compartment being flooded.

WARNING

Carbon dioxide is not poisonous but it will not support human life. The rate of expansion of the discharged gas is so great that a person in the same compartment will be overcome by it and become unconscious in a very short time. Therefore, immediately evacuate the dispensary

if the after tank compartment is being flooded, the galley and officers' quarters if the forward tank compartment is being flooded, and all these and the engine room if all compartments are being flooded.

b. The gas will make a loud hissing noise when escaping, similar to escaping steam. The system is not equipped with an automatic warning signal, but the sound of the gas being discharged should serve as a signal to evacuate to above decks.

c. Anyone overcome by carbon dioxide should be removed to fresh air immediately and given artificial respiration and first-aid treatment as in cases of drowning.

d. If it is necessary to enter a compartment flooded with CO_2, it may be done for a short period by taking a deep breath of fresh air and holding it while in the compartment. For longer periods, use a hose-type gas mask or portable oxygen breathing apparatus. Do not use a cannister-type gas mask.

b. AFTER A FIRE.

(1) Operate the ventilators in flooded compartments until all the carbon dioxide is removed. This can be tested, if necessary, by inserting a lighted Davy-type safety lamp into the compartment. If the lamp continues to burn, there is enough oxygen present to be safe.

WARNING

Do not make this test with an open flame because gasoline vapors may be present and cause an explosion.

(2) Remove the discharged CO_2 cylinders and install filled cylinders as soon as possible. (Refer to this section, paragraph 5.*a.*)

(3) Push in the plunger of the pneumatic switch to reset it.

(4) Replace the broken glass in the release box.

(5) If only cylinder 1 or 3 has been discharged, cylinder 2, 4, or 5 may be shifted to replace the discharged cylinder temporarily.

c. EMERGENCY OPERATION.

(1) If the cockpit "ALL COMPARTMENTS" release box does not release the cylinders, use the one on the bridge. If neither one works, use the one in the pilot house.

(2) If all the release boxes fail to discharge the cylinders, go to the engine room and discharge them by hand by pulling up the release lever.

(3) In discharging the cylinders by hand, remember that cylinder 1 floods the after tank compartment, cylinder 3 floods the forward tank compartment, and cylinders 4 and 5 flood all compartments.

4. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
PULL BOX DOES NOT DISCHARGE CYLINDER	Obstructed conduit. Broken cable. Broken release lever. Broken discharge head. Empty cylinder.	Blow out conduit. Replace cable. Replace lever. Replace discharge head. Have cylinder recharged.
"FORWARD" OR "AFTER TANK COMPARTMENT" RELEASE BOX OPERATION FLOODS ALL COMPARTMENTS	Leaking check valve.	Replace check valve.
"ALL COMPARTMENTS" RELEASE BOX OPERATION DOES NOT FLOOD FORWARD OR AFTER TANK COMPARTMENTS	Jammed check valve. Broken pipe line.	Replace check valve. Repair pipe.
"ALL COMPARTMENTS" RELEASE BOX OPERATION DOES NOT DISCHARGE ALL CYLINDERS	Broken cylinder heads. Break in cylinder pipe lines or connections.	Replace heads. Repair pipe or connections.
BRIDGE SIGNAL LIGHT DOES NOT LIGHT WHEN SYSTEM IS DISCHARGED	Broken pipe to pneumatic switch. Broken pneumatic switch. Break in pneumatic switch electrical wiring.	Repair pipe. Repair switch. Repair wiring.

5. SERVICE, INSPECTION, AND MAINTENANCE.

a. REMOVAL OF CYLINDERS.

(1) Remove the protection panels from in front of the cylinder heads.

(2) Remove the cotter pin and lever pin holding the release lever to the discharge head. Remove the lever. It is not necessary to unfasten the lever from the release cable.

WARNING

In all work with charged cylinders be on constant guard against accidentally discharging them.

(3) Unscrew the ring nut connecting the discharge head to the cylinder valve and remove the head. (See figure 124.)

(4) Inspect the head. Make sure that the cutter is in its full upward position and the blade is in good condition.

(5) Remove the nut and the clamp holding the cylinder against the hull.

(6) Lift the cylinder out.

b. WEIGHT CHECK.

(1) Make the cylinder weight check at every overhaul period, but in any case do not let more than 6 months elapse between these checks.

(2) Remove the cylinders, and weigh them one at a time.

(3) The "Cylinder Record" in the envelope fastened to the neck of the cylinder gives the full weight of the cylinder. If the measured weight is more than 5 pounds below the full weight, replace the cylinder and have the old one recharged.

(4) Enter the inspection date (or recharging date if the cylinder has been recharged) on the "Cylinder Record." Tie the record, in its envelope, back on the cylinder.

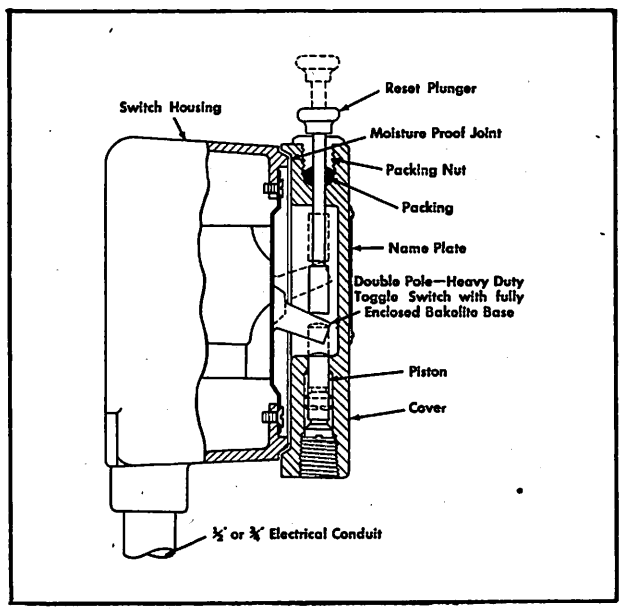


Figure 123—Cutaway View of Pneumatic Switch

c. RELEASE BOX AND CABLE TEST.

(1) Test the release box and cable operation at the same time the weight check is made.

WARNING

Make sure the release levers are removed from the discharge heads when making this test.

(2) Remove the two screws fastening the door of each release box and open the door.

(3) Pull the handle. It should pull freely and easily. If it does not, examine the cable conduit for obstructions or the cable off its pulleys.

(4) Pull the lever end of the cable until the handle is again in its box.

(5) Close the release box door and fasten it with the two screws.

(6) Perform this test on all the release boxes.

d. REINSTALLING CYLINDER.

(1) Place the cylinder in its proper position against the hull.

(2) Fasten the cylinder holding clamp with its nut.

(3) Make sure the discharge head cutter is fully retracted. Place the discharge head on the valve and fasten the ring nut. This nut should be tightened only handtight.

(4) If the cable has been removed from the release lever for any reason, refasten it before attaching the lever to the head.

(5) Place the lever in its downward position on the discharge head. Fasten it with the lever pin and cotter pin.

(6) When all the cylinders have been reinstalled, fasten the protection panels in front of the heads.

e. Keep the cylinders, pipes, conduit, release boxes, and the pneumatic switch painted red to aid in quick identification.

CAUTION

Be careful not to paint over the openings of the nozzles.

f. At every overhaul, remove the cylinders from the system and blow out the pipes with compressed air. Check the flow of air from all nozzles. Check the operation of the check valves.

g. Make repairs in the pipes or conduit as in other plumbing pipes. (Refer to section III, paragraph 6.*b.*)

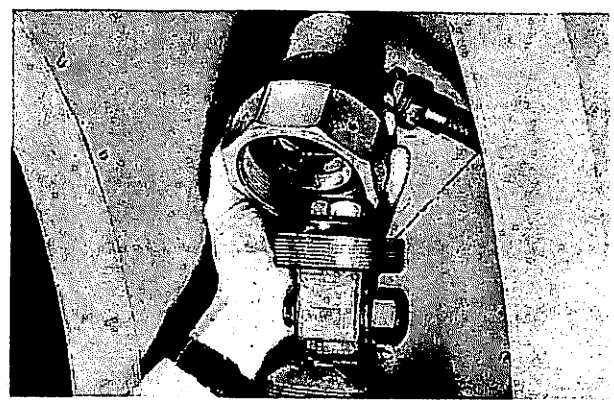
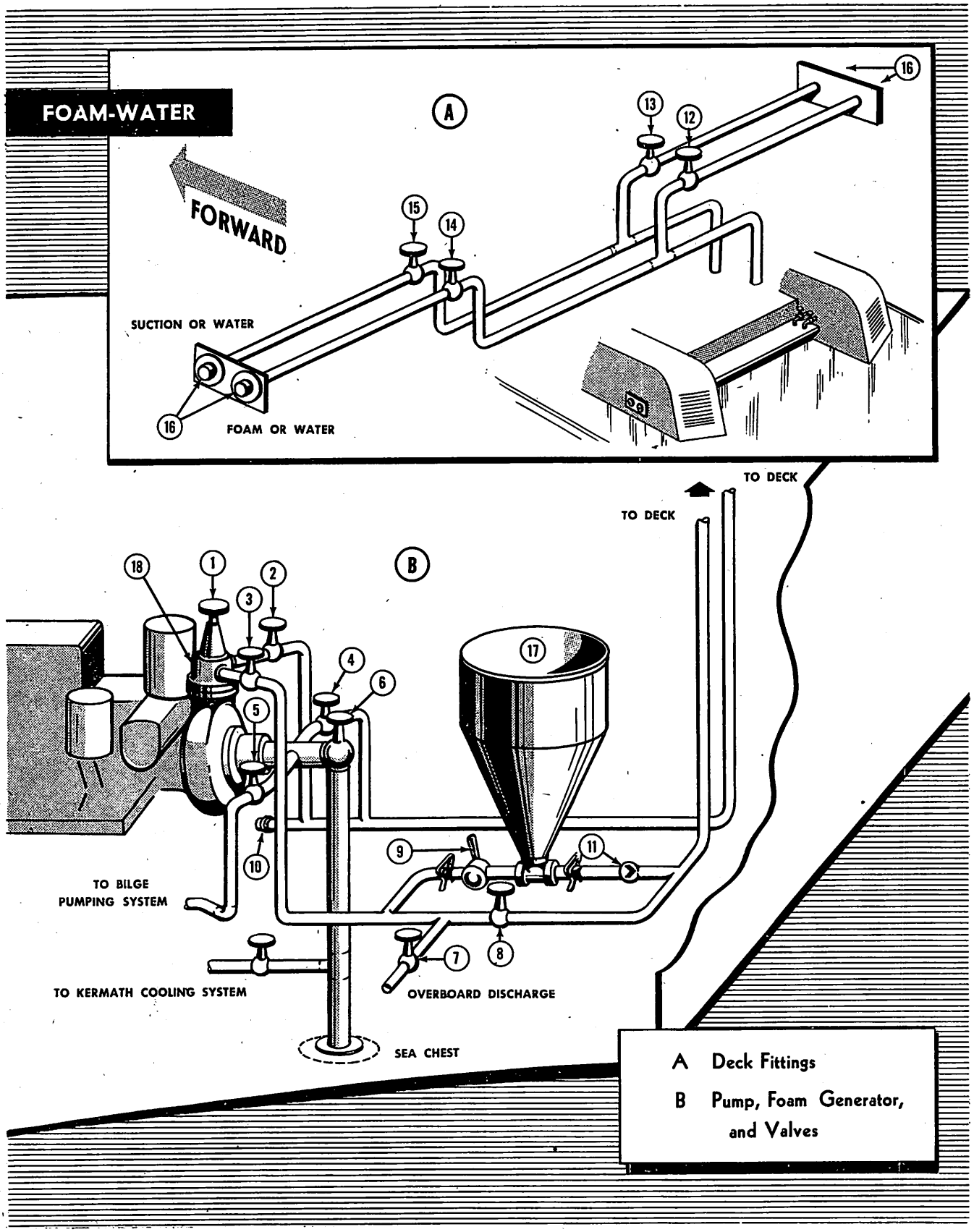


Figure 124—Removing Discharge Head From Cylinder Valve

Figure 125 — FIRE EXTINGUISHING SYSTEM FOAM-WATER





Fire Extinguishing

SYSTEM WATER-FOAM

1. DESCRIPTION.

The water-foam fire extinguishing system consists of the following items:

a. A Barton-American Marsh Type GF-250 single stage centrifugal pump. (See 18, figure 125B.)

(1) This pump is mounted on the Kermath engine, by which it is operated through a clutch.

(2) Water passes into the pump through a 3-inch inlet with a screen strainer and is pumped out through a "siamese head" with two 1½-inch discharge outlets.

(3) The discharge is regulated by a stop check valve. This is a self-closing rubber faced valve which is opened by the discharge pressure and drops closed when the pump stops, aiding quick priming. The valve handle (I, figure 125B) regulates the amount the valve can open and controls the volume of water the pump discharges.

(4) A vacuum primer primes the pump by the vacuum created in the intake manifold of the Kermath engine. When the primer line valves are opened, the vacuum sucks the air out of the primer chamber, which in turn is connected to the pump near the inlet opening. When the air is sucked out of the pump inlet, the water will enter the primer chamber and raise a float. This closes a valve and shuts off the vacuum line. A smaller chamber above the primer chamber operates in the same way for additional protection against letting water be sucked into the Kermath manifold. When the primer operating lever is released, the valves are opened and the primer chamber drains.

(5) A pressure and vacuum gage mounted on the pump registers from 30 inches Hg vacuum to 150 pounds pressure.

(6) The pump is equipped with the necessary oil fittings, vents, and drain cocks.

b. A foam generator, which mixes foam powder with water to produce a chemical foam capable of extinguishing oil and gasoline fires. (See 17, figure 125B.)

(1) Foam powder poured into the generator hopper is drawn into the water by the force of the water flow through the bottom part of the generator. The creation of foam takes place as soon as the powder and water mix.

(2) A quick acting gate valve (9) in the water inlet side controls the flow of water through the generator.

(3) A dial gage registers the inlet pressure of the water flowing through the generator.

(4) The generator hopper is removable and a valve is provided in the bottom of the generator for cleaning.

c. Pipes, valves, and fittings to direct and regulate the flow of water, foam, or suction. The sea suction line is of 3-inch brass pipe; all other lines are of 1½-inch brass pipe. The valves and fittings are brass or bronze. The hose connections are standard thread and are protected by caps when not in use. The pipe lines are divided into the following units.

Note

All reference numbers in the following subparagraphs refer to figure 125B.

(1) An inlet pipe which draws sea water through a 3-inch sea-chest in the bottom of the hull and delivers it to the inlet opening of the pump. This line is controlled by the sea suction angle valve (6). The Kermath engine cooling system taps off this line and the bilge pumping system line empties into it.

(2) The water or suction line which taps off one side of the pump siamese valve and carries the water to a deck base connection on either outboard side of the after part of the bridge (16). Another hose connection (10) is in this line near the pump to provide water or suction in the engine room. The flow of water through this line is controlled by the water or suction gate valve (2) and the two deck gate valves (13) and (15).

(3) The pump bypass line which connects the water or suction line with the inlet line and causes suction in the water or suction line. This line is controlled by the pump bypass angle valve (4).

(4) The foam or water line which carries water from the other side of the pump siamese head to a deck hose connection on either outboard side of the after part of the bridge (16). This line is controlled by the foam or water gate valve (3), the foam generator bypass gate valve (8), and the two deck gate valves (12) and (14).

(5) The foam generator line which taps off the foam or water line in front of the foam generator bypass valve (8), runs through the foam generator (17), and empties back into the foam or water line behind the

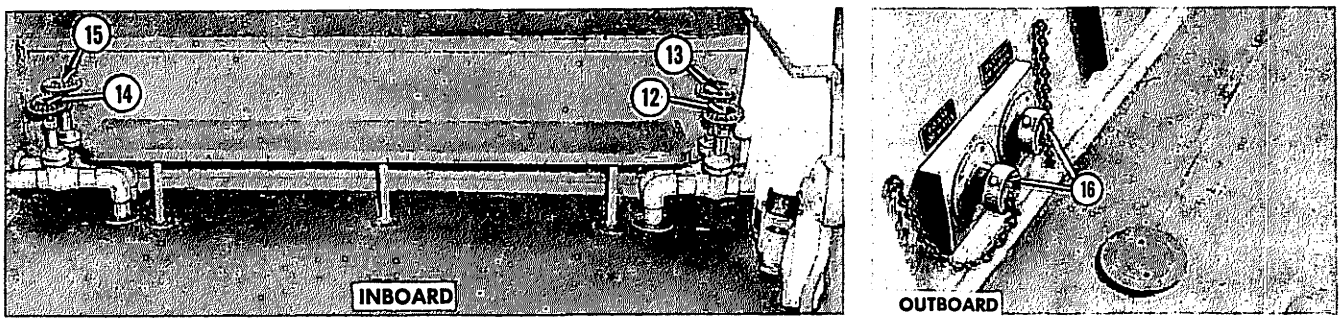
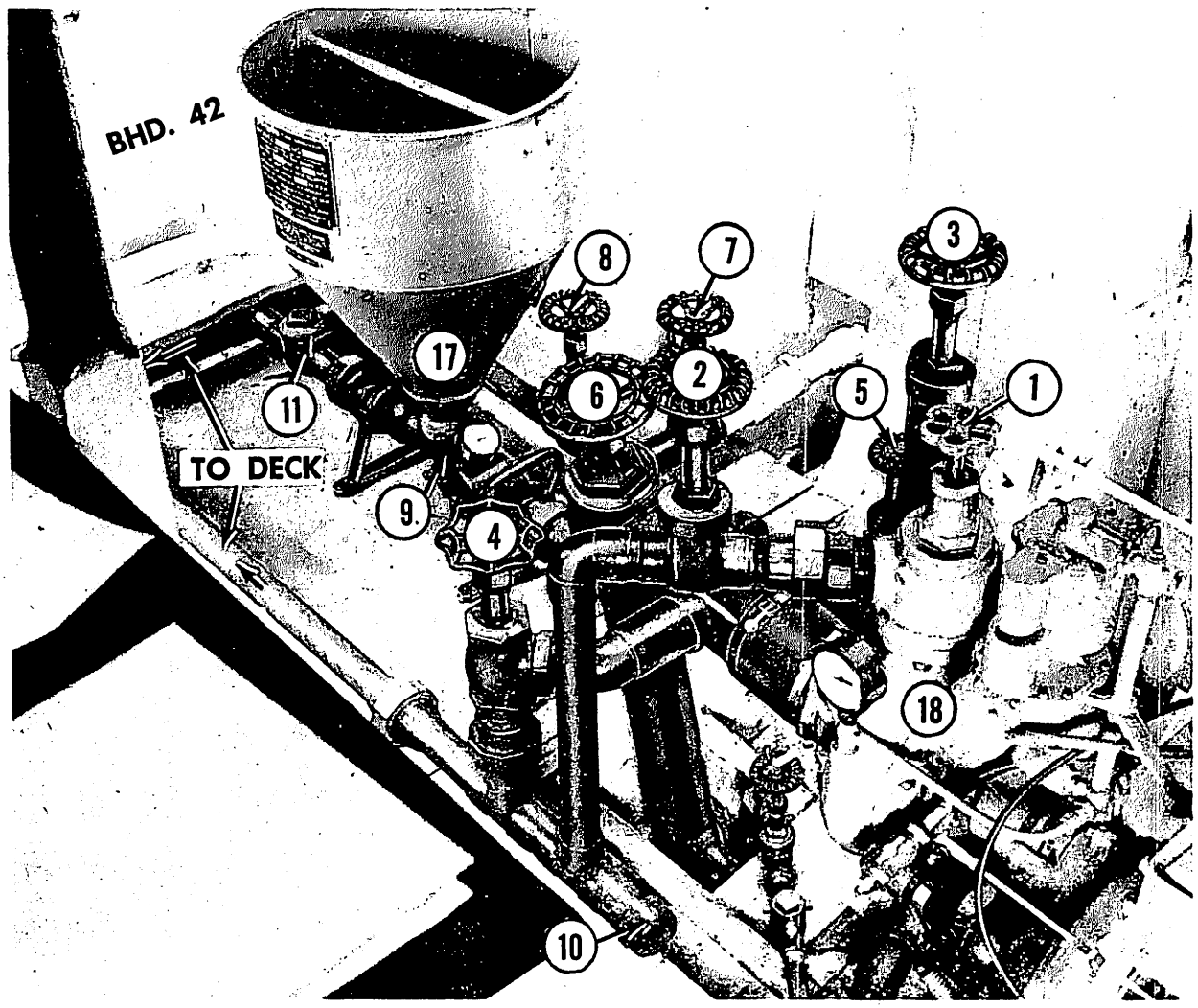


Figure 125A—Deck Fittings



1	Stop Check Valve	7	Discharge Valve	13	Starboard Water or Suction Valve
2	Water or Suction Valve	8	Foam Generator By-pass Valve	14	Port Foam or Water Valve
3	Foam or Water Valve	9	Foam Generator Valve	15	Port Water or Suction Valve
4	Pump By-pass Valve	10	Engine Room Connection	16	Deck Hose Connections
5	Bilge Suction Valve	11	Check Valve	17	Foam Generator
6	Sea Suction Valve	12	Starboard Foam or Water Valve	18	Pump

Figure 125B—Pump, Foam Generator, and Engine Room Fittings



Figure 126—Stowage of Foam Powder and Suction Hose

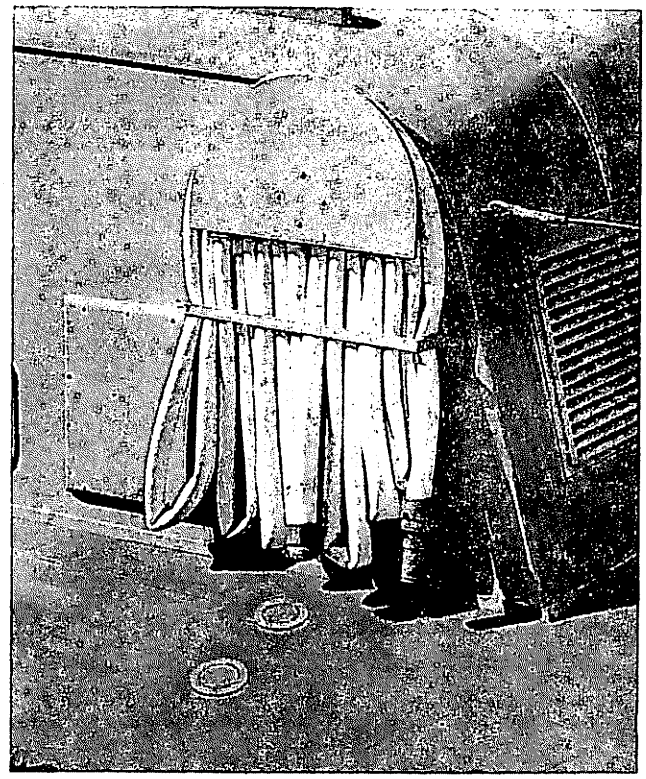


Figure 127—Stowage of Port Canvas Covered Hose

bypass valve. The flow through this line is controlled by the foam generator quick acting gate valve (9) and the bypass gate valve (8). A check valve (11) prevents a back flow of water to the foam generator when the line is closed.

(6) The overboard discharge line which taps off the foam or water line and discharges overboard through the hull in the engine room. This line is controlled by the overboard discharge gate valve.

d. The following accessories:

(1) Eight 50-pound cans of foam powder, stored along the after starboard side of the engine room. (See figure 126.)

(2) Two lengths, each of 50 feet, of rubber lined canvas hose with pin lug couplings, stored one length on the inboard starboard side of the after part of the bridge and the other on the outboard port side. (See figure 127.)

(3) Three lengths, each of 17 feet, of rubber smooth bore suction hose with pin lug couplings, foot valve, and strainer, stored on the engine room starboard wall over the foam powder.

(4) Two pressure nozzles with pin lug couplings and one smooth bore foam nozzle.

2. OPERATION INSTRUCTIONS.

a. SEQUENCE OF OPERATION.—The following is the general order for operating the water-foam fire extinguishing system. Detailed operating instructions for the various units of the system are given in later paragraphs.

(1) Check the valves to make sure they are in the normal position.

(2) Start the engine and run at idling speed.

(3) Engage the pump clutch.

(4) Prime the pump.

(5) Attach hose and nozzle (or suction hose and strainer if suction is to be used) to the proper deck connection.

(6) Open or close the valves to operate the piping system to be used.

(7) Pour foam powder into the foam generator hopper if foam is to be used.

(8) Raise the pressure to the desired point by increasing the engine rpm and by closing down the discharge valve if necessary.

(9) Operate the hoses and nozzles.

(10) To turn off the system, first run the foam generator hopper empty, if foam is being used.

(11) Throttle down the engine to idling speed.

(12) Turn the valves back to the normal position.

(13) Disengage the pump clutch.

(14) Turn off the engine.

(15) Remove the hose from its connection, drain and dry it before reinstalling it on its mounting. Reinstall the hose connection cap.

(16) Drain and oil the pump.

(17) Clean the foam generator if it was used.



Figure 128—Engaging Pump Clutch

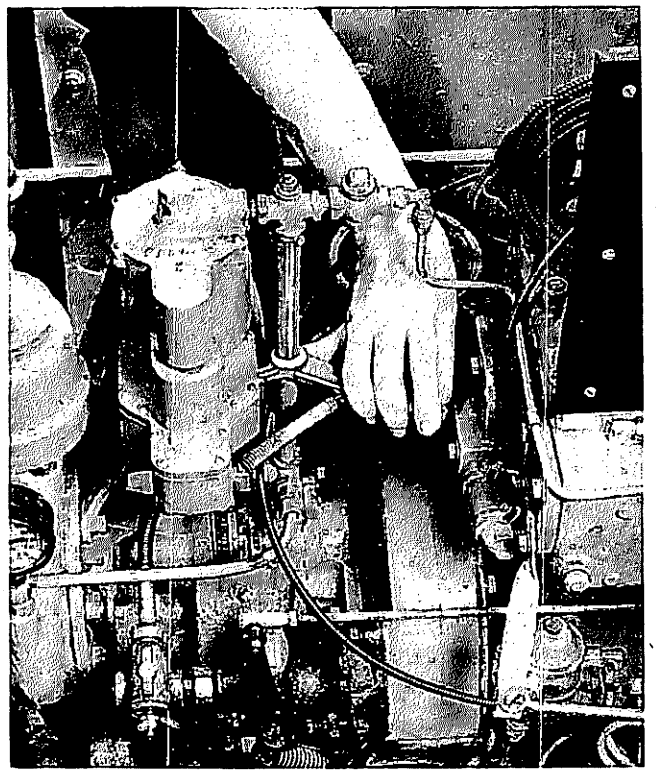


Figure 129—Priming the Pump

b. PUMP.

(1) Start the Kermath engine. (See section XIV.) Run the engine at idling speed, not over 1000 rpm.

(2) Close the pump drain cocks, if open.

(3) Raise the clutch lever slowly to the horizontal position. (See figure 128.) This engages the friction clutch. If the pump turns when the friction clutch is engaged, raise the clutch handle further to the vertical position. This engages a set of interlocking jaw clutches in addition to the friction clutch. If the clutch lever cannot be raised past the horizontal position, the interlocking clutches are in such a position that they cannot be engaged; drop the lever back to the downward position and repeat the operation.

(4) Pull the primer lever over against the spring pressure as far as it can go. Watch the pump pressure gage. Pressure should be registered within 1 minute. If pressure is not shown in this time, disengage the clutch and check for air leaks.

WARNING

Do not operate the pump without water for longer than 1 or 2 minutes.

(5) When the pump is primed (steady pressure shown on gage), release the priming lever and open the necessary valves to operate the system.

Note

The pump will normally prime with the stop check valve open. If it does not prime readily, close the stop check valve for priming.

(6) Regulate the pressure and capacity by the engine rpm. For most pumping operations, 75 psi is the best operating pressure.

(7) After operation, throttle the engine down to less than 1000 rpm before disengaging the clutch.

(8) Drain the pump by opening the two oil cocks to provide vent and opening the draincock in the bottom of the pump.

(9) When the pump and lines have drained, engage the clutch and run the pump at idling speed for 30 seconds. While the pump is running dry, fill both oil cocks with medium engine oil. This will keep the seal rings lubricated. Close the drain and oil cocks.

c. LINES AND VALVES.

(1) NORMAL POSITION.

(a) When the pump is not running, and when it is being started, leave the valves in the following positions:

Note

The reference numbers refer to figure 125B.

Stop check valve (1)—open
Sea suction valve (6)—open
Foam or water valve (3)—open
Discharge valve (7)—open
Foam generator bypass valve (8)—open
Foam generator valve (9)—closed
Water or suction valve (2)—open
Pump bypass valve (4)—closed
Deck valves (12, 13, 14, 15)—closed
Engine room connection (10)—closed

(b) These positions of the valves will take care of the pressures developed in starting the pump. Leaving them in these positions when the pump is not operating will take care of any emergency such as starting the engine with the pump clutch engaged.

(c) The bilge suction valve is closed for all operations except pumping the bilges. (See section XIX.)

(d) When the pump is pumping, open the valves in the desired lines as described below.

(2) To pump water to "Water or Suction" connections on deck or engine room connections:

(a) Open port or starboard water or suction deck valve or engine room connections, as needed.

(b) Close down discharge valve or foam or water valve as needed to increase pressure.

(3) To pump water to "Foam or Water" connections on deck:

(a) Open port or starboard foam or water deck valve as needed.

(b) Close down discharge valve as needed to increase pressure.

(4) To pump foam to "Foam or Water" connections on deck:

(a) Open port or starboard foam or water deck valve as needed.

(b) Open foam generator valve.

(c) Close foam generator bypass valve.

(d) Operate foam generator.

(e) Close down discharge valve as needed to increase pressure.

(5) To suck through "Water or Suction" connections on deck or through engine room connection:

(a) Open pump bypass valve.

(b) Open port or starboard water or suction deck valve or engine room connection as needed.

(c) Close water or suction valve.

(d) Close down sea suction valve as necessary to create proper suction. It is usually necessary to leave it slightly open to maintain the pump prime.

(e) If it is desired to discharge the water through a deck connection rather than the through-hull discharge pipe, open one of the foam or water deck valves and close the discharge valve.

(6) Shutting down the lines and valves:

(a) Open the discharge valve fully if it has been closed.

(b) Turn the valves to the normal positions. (See paragraph 2.*c.*(1), this section.)

CAUTION

Do not close the system so there is no outlet for water while the pump is still operating. Make sure the discharge valve is open before closing deck valves or the engine room connection.

d. FOAM GENERATOR.

(1) Pump water through the foam generator to the "Foam or Water" deck connections as described in paragraph 2.*c.*(4), this section.

(2) As soon as water is flowing through the generator, empty a pail of foam powder into the generator hopper. The pails are equipped with "strip" covers and pull rings for quick opening.

(3) Keep the hopper filled with foam powder as long as necessary. Do not attempt to force the powder down into the hopper except at the end of the run when the powder may be pushed from the edges to the center of the hopper.

(4) Watch the inlet pressure on the generator pressure gage. It should be between 35 and 125 psi, depending on the size and force of the foam stream needed.

(5) After foam is no longer needed, allow the generator to empty itself of powder. Continue to pump water through the foam or water line until clear water runs from the hose or deck connection.

(6) After the pump is turned off, open the drain valve in the bottom of the foam generator and allow it to drain.

(7) Remove the hopper by turning it counterclockwise and lifting it off.

(8) Clean the hopper and generator thoroughly with clear water. Make sure all passageways are clear.

(9) Reinstall the hopper and close the drain valve.

(10) Replenish the powder supply as soon as possible.

e. ACCESSORIES.

(1) Use the special spanner wrench to fasten the pin lug hose connections to the deck fittings (figure 130) to fasten two lengths of hoses together, to fasten nozzles to hoses, and to remove and replace the deck connection caps. When not in use keep a spanner wrench in a bracket near each set of deck connections so it will always be readily available.

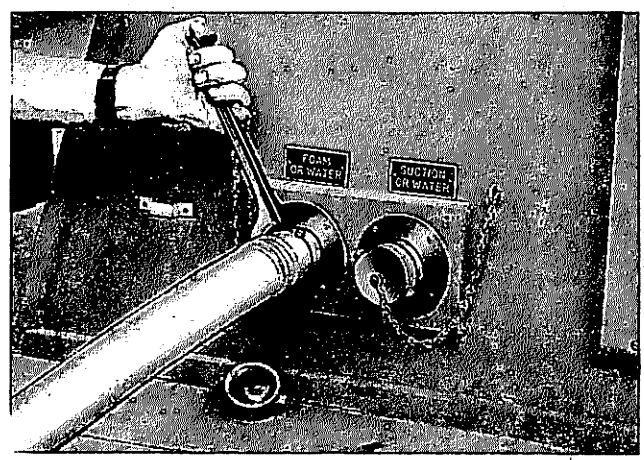


Figure 130—Fastening Hose to Deck Connection

(2) USE OF CANVAS-COVERED HOSE.

(a) The two lengths of canvas-covered hose can be used for either foam or water. Do not use this hose for suction as it will collapse.

(b) Use the adjustable nozzles for water. Regulate the stream by turning the nozzle in or out. Use the smooth bore nozzle for foam.

(c) Remove the hose from its mounting, fasten it to the proper deck connection, install the proper nozzle, straighten out any sharp bends or kinks, and aim it in the desired direction before opening the valve to let water through the hose.

(d) Avoid kinks and sharp bends in the hose while it is being used.

(e) After use, disconnect the hose from the deck fitting and remove the nozzle. Lay the hose out straight on an inclined surface to drain and dry.

(f) When the hose is perfectly dry, reinstall it on its mounting.

(3) USE OF SUCTION HOSE.

(a) Suction may be used for salvage operations (pumping out another boat), pumping from a shore tank, emergency bilge pumping, etc.

(b) Use the three lengths of smooth bore, non-collapsible hose for suction. This hose can also be used for pressure if necessary, but it is not flexible enough to be very satisfactory.

(c) Fasten the foot valve and strainer on the free end of the suction hose to keep the line primed and keep foreign matter from entering the pump.

(d) Fasten the hose to the deck or engine room connection and immerse the free end in the water to be pumped before opening the valves to create suction in the line.

(e) Keep the free end of the suction hose immersed all the time the line is being used to suck to avoid pumping air.

(f) If the line should become plugged, close the necessary valves, lift the hose from the water, and clean the strainer. Put the end of the hose back in the water before opening the valves again.

(g) Drain and dry the hose after each use.

3. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
PUMP DOES NOT PRIME	Priming line broken.	Repair priming line.
	Air leak in pump.	Refer to paragraph 4.*b.*(4), this section.
	Pump discharge valve not seated.	Refer to paragraphs 4.*b.*(4), and 5.*a.*(1), this section.
	Leak in sea suction line.	Repair line.
	Sea chest strainer clogged.	Refer to paragraph 4.*c.*(2), this section.
	Pump inlet strainer clogged.	Refer to paragraph 4.*b.*(2), this section.
PUMP NOT MAINTAINING PROPER PRESSURE AT A GIVEN RPM	Pump stuffing box leaks.	Refer to paragraph 4.*b.*(3), this section.
	Air leak in pump.	Refer to paragraph 4.*b.*(4), this section.
	Leak in sea suction line.	Repair line.
	Sea chest strainer clogged.	Refer to paragraph 4.*c.*(2), this section.
	Pump inlet strainer clogged.	Refer to paragraph 4.*b.*(2), this section.
PUMP MAINTAINING PROPER PRESSURE BUT PRESSURE NOT BEING DELIVERED TO HOSE CONNECTIONS	Pump bypass valve left open.	Close valve.
	Break in pipe line between pump and hose connection.	Repair line.
	Overboard discharge valve broken so it will not close.	Repair valve
WATER LEAKING INTO FOAM GENERATOR WHEN GENERATOR VALVE IS CLOSED. (Refer to paragraph 4.*d.*, this section.)	Faulty foam generator valve.	Repair valve.
	Faulty check valve.	Repair valve.

4. SERVICE AND INSPECTION.

a. GENERAL INSPECTION TEST.

(1) Once a week operate the pump and test all the operations of the system at normal operating pressure (about 75 psi). This test should include running water through both the water or suction and foam or water line to all connections on each, sucking water through the water or suction line, and the operation of all hose and nozzles. Run water through the foam generator also, but do not use foam powder for routine testing.

(2) Inspect all the lines, valves, and fittings for leaks, clogs, or excessive looseness.

b. PUMP.

(1) During the weekly inspection test run, examine the pump for any signs of leaking. Examine the packing gland around the shaft behind the pump impeller case for leaks. Watch the pressure gage to see if the pump produces sufficient pressure steadily without overspeeding the engine.

(2) CLEANING PUMP STRAINER.

(a) Remove the two hose clamps from the hose connecting the sea suction pipe to the inlet opening of the pump.

(b) Slide the hose back along the sea suction pipe until it is clear of the pump opening.

(c) Remove the strainer from the pump inlet opening.

(d) Clean and reinstall the strainer.

(e) Reinstall the rubber hose and hose clamps.

(3) CARE OF PACKING GLAND.

(a) If the packing gland leaks, tighten the two adjusting nuts evenly. Tighten the gland enough to stop the leak but not enough to make it run hot.

(b) When the gland has been tightened to the point where it nearly touches the case, back the gland off on the shaft and insert a new piece of braided graphited asbestos packing in the stuffing box.

(c) After new packing has been added twice, remove all the old packing and repack the stuffing box. Remove the gland for this operation by removing the two cap screws holding the two halves of the gland together.

(4) TESTING FOR AIR LEAKS.—Most centrifugal pump troubles are due to air leaks. If water pressure is not maintained properly, test the pump as follows:

(a) Start the engine and run it at idling speed. *Do not engage the pump clutch.*

(b) Drain the pump.

(c) Tighten the drain valve and make sure the oil cocks and other connections are closed. Leave the pump discharge valve open.

(d) Close the sea suction valve, the water or suction valve, the foam or water valve, the bilge suction valve, and the pump bypass valve.

Note

This test presumes that these valves are in good operating order. If any of these valves or the pipe connections between them and the pump leak, this test cannot be made.

(e) Move the primer handle to the priming position.

(f) Watch the pressure vacuum gage until it reaches a stationary position. This should be at about 15 inches Hg vacuum or over, depending on the vacuum producing capacity of the engines.

(g) Release the primer handle and watch the gage. If the hand stands stationary or moves back to zero slowly, it indicates no leak or a minor leak which will not interfere with the operation of the pump.

(h) If this test indicates a leak in the pump, the stuffing box may need repacking. (Refer to paragraph 4.*b.*(3), this section.)

(i) Open either the water or suction valve while the gage still registers vacuum. If the hand returns to zero faster than it did before the valve was open, it indicates improper seating of the self-closing pump discharge valve. (Refer to paragraph 5.*a.*(1), this section.)

c. FOAM GENERATOR.

(1) If the foam generator fills with water when the system is operating but the foam generator valve is closed, it may be due to either a faulty foam generator valve or a faulty check valve between the generator and the foam or water line. Close the foam generator bypass valve. If the water stops leaking into the foam generator, the leak is in the check valve; if it does not stop, the leak is through the foam generator valve.

(2) Keep foam powder dry. Do not open the pails if they are not to be used. Replace any pails of powder that have been opened, punctured, or split.

5. REPAIR AND REMOVAL.

a. PUMP.

(1) PUMP DISCHARGE VALVE.

(a) If the self-closing pump discharge valve is suspected of leaking, remove either the water or suction line connection, or both, and enough of the piping to allow access to either or both discharge outlets.

(b) Reach into the discharge outlet with a screw driver and lift the valve from its seat. Inspect the valve and seat and remove any foreign matter from the valve chamber.

(c) Lift the valve and let it fall back on its seat several times to check its freedom of motion.

(d) If the rubber valve face is torn or badly worn, remove the six nuts holding the valve body to the pump and lift off the valve body. Remove and replace the valve face and reinstall the valve body.

(e) After replacing or cleaning the valve but before reattaching the discharge piping to the pump, test the operation of the valve in this manner: Start

the engine and run it at idling speed, but do not engage the pump clutch. Close the pump drain valve and all valves in the intake line. Move the primer handle to the priming position. Hold the palm of the hand squarely over the discharge outlet, or both outlets, if both are open. If the hand is drawn tightly against the opening by the vacuum in the pump, it indicates a leak around the rubber discharge valve. If no vacuum is felt, the valve is in good condition.

(2) REMOVAL OF PUMP.

(a) Unfasten the hose clamps and slide back the rubber sleeve connecting the sea suction pipe to the pump inlet opening.

(b) Unfasten the foam or water line and the water suction line connections at the pump discharge openings.

(c) Remove as much of the piping around the pump as is necessary for accessibility.

(d) Unfasten at the pump the primer vacuum line, the governor link, the tachometer drive connection, and any other lines between the pump and the engine.

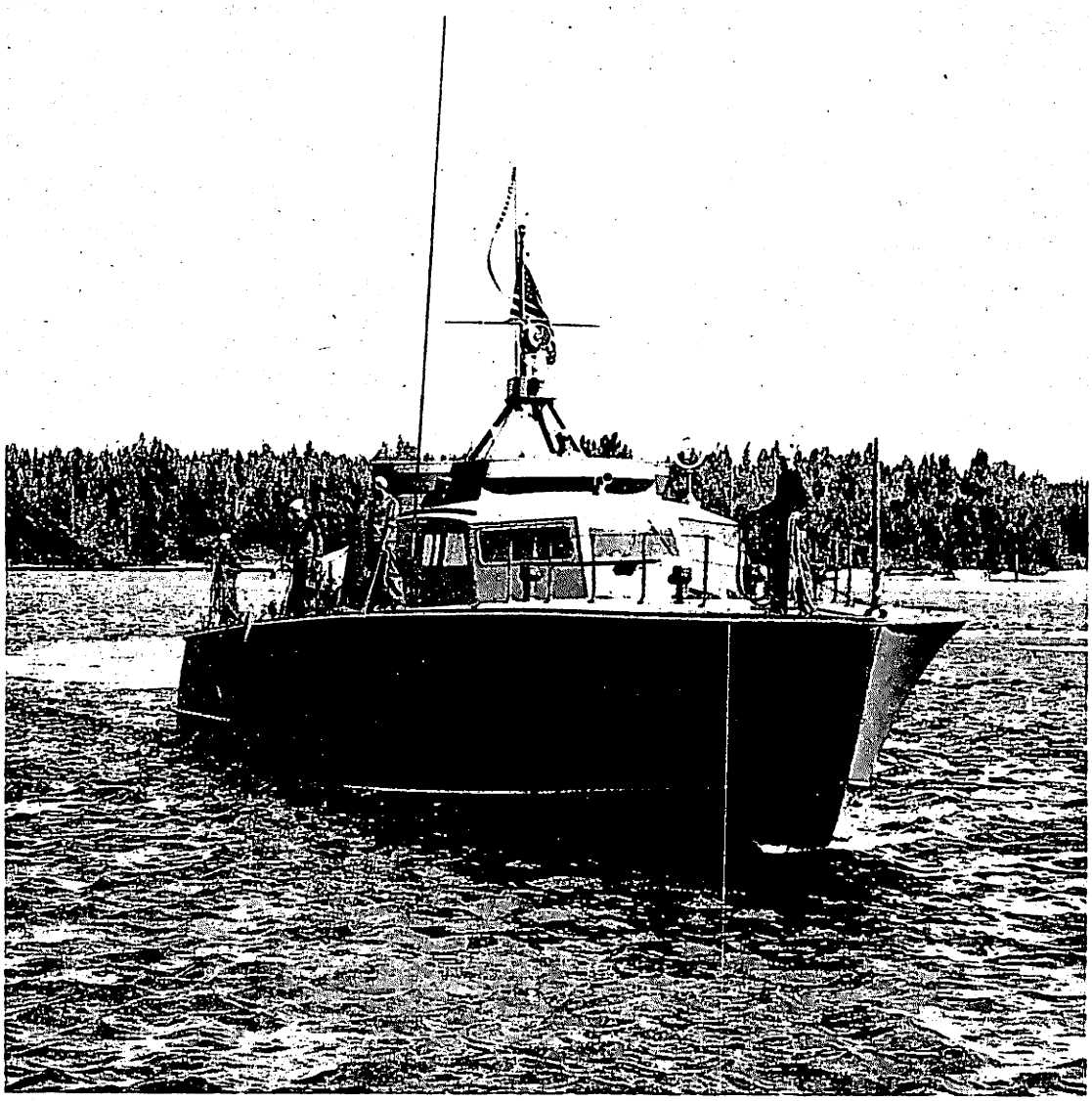
(e) Unfasten the cap screws holding the pump gear case to the engine and remove the pump.

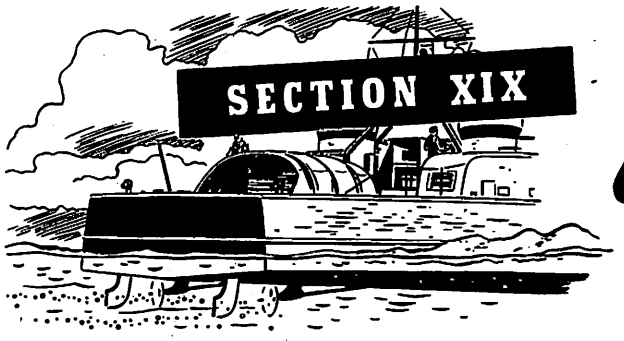
b. PIPE LINES.

(1) For repairs of pipes, fittings, and valves, see section III, paragraph 6.*b.*

(2) When the boat is hauled, inspect and clean the sea chest. If the strainer is badly clogged or it is necessary to clean the inside of the sea chest or sea suction pipe, remove the four flathead bolts holding the strainer to the chest and remove it for cleaning.

(3) While the boat is out of water, check the security of the sea chest and of the overboard discharge through-hull connection.





Bilge Pumping SYSTEM

1. DESCRIPTION.

(See figure 131.)

a. The bilges are pumped by the same pump that operates the water-foam fire extinguishing system. A Barton-American Marsh Type GF-250 single-stage centrifugal pump is mounted on the forward end of the Kermath auxiliary generator engine, by which it is driven. (See 8, figure 131A.)

b. A pipe from the bilge pumping system empties into the pump inlet opening through the water-foam system sea water suction pipe. The bilge suction line pipe is controlled by a gate valve. (See 3, figure 131A.)

c. Discharge is made into the foam or water line and overboard through the discharge through-hull connection. This line is controlled by the foam or water line valve (2), the foam generator valve (7), the foam generator bypass valve (6), and the overboard discharge valve (5).

d. From the pump line, a pipe line goes aft to the dispensary compartment and forward to the galley and senior officers' quarters compartment, the junior officers' quarters compartment, and the forward crew's quarters compartment.

e. At each point where bilge water is to be pumped, a branch pipe goes from the main line to the lowest point of the bilge by the keel. At the end of each branch pipe is a bilge strainer to keep foreign matter from entering the system and plugging it or damaging the pump. A rubber hose connection between the pipe and the strainer allows for vibration. Each branch pipe is controlled by an individual gate valve.

f. The dispensary compartment, the engine room compartment, and the galley and senior officers' quarters compartment bilges are each pumped out at either end; a branch pipe is located at the forward and aft bulkhead of each. The junior officers' quarters and the forward crew's quarters bilges are each pumped out only at the aft end.

g. The forepeak bilge is not pumped out directly. A through-bulkhead fitting at the bottom of the forward crew's quarters forward bulkhead allows water in the forepeak bilge to drain into the forward crew's quarters bilge from which it is pumped out. This drain is controlled by a gate valve. An extension handle on the valve makes it easily controllable from the forward crew's quarters.

h. Limber holes are cut through the bottom of each frame on either side of the keel except at bulkheads. These allow the bilge water to flow to the lowest points of the bilges, from which it can be pumped. A brass chain, mounted on springs, passes through each set of limber holes in each compartment. (See figure 132.) Agitating the chains clears the limber holes and keeps them from getting plugged.

2. OPERATION INSTRUCTIONS.

a. The bilge suction valve (3, figure 13), all the branch pipe valves, and the forepeak drain valve should be closed when the system is not being used.

b. Place the water-foam fire extinguishing system valves in the normal position. (Refer to section XVIII, paragraph 2.*c.*)

c. Start the engine, engage the pump clutch, and run the pump at normal pumping pressure, about 75 psi. (Refer to section XVIII, paragraph 2.*b.*)

d. Open the bilge suction valve. Close down on the sea suction valve to increase the bilge suction, but do not close it entirely. Leaving it slightly open keeps the pump primed and eliminates the danger of the pump pumping dry when a bilge is dry.

e. It is not necessary to change any other valves in the water-foam fire extinguishing system from the normal position. As long as the deck valves are closed, the water or suction valve, the pump bypass valve, and the foam generator bypass valve may be either open or closed. Be sure, however, that the stop check valve (1, figure 131) and the overboard discharge valve (5, figure 131) are open.

f. Open the branch pipe valves in the bilges to be pumped. Access to the valves is as follows:

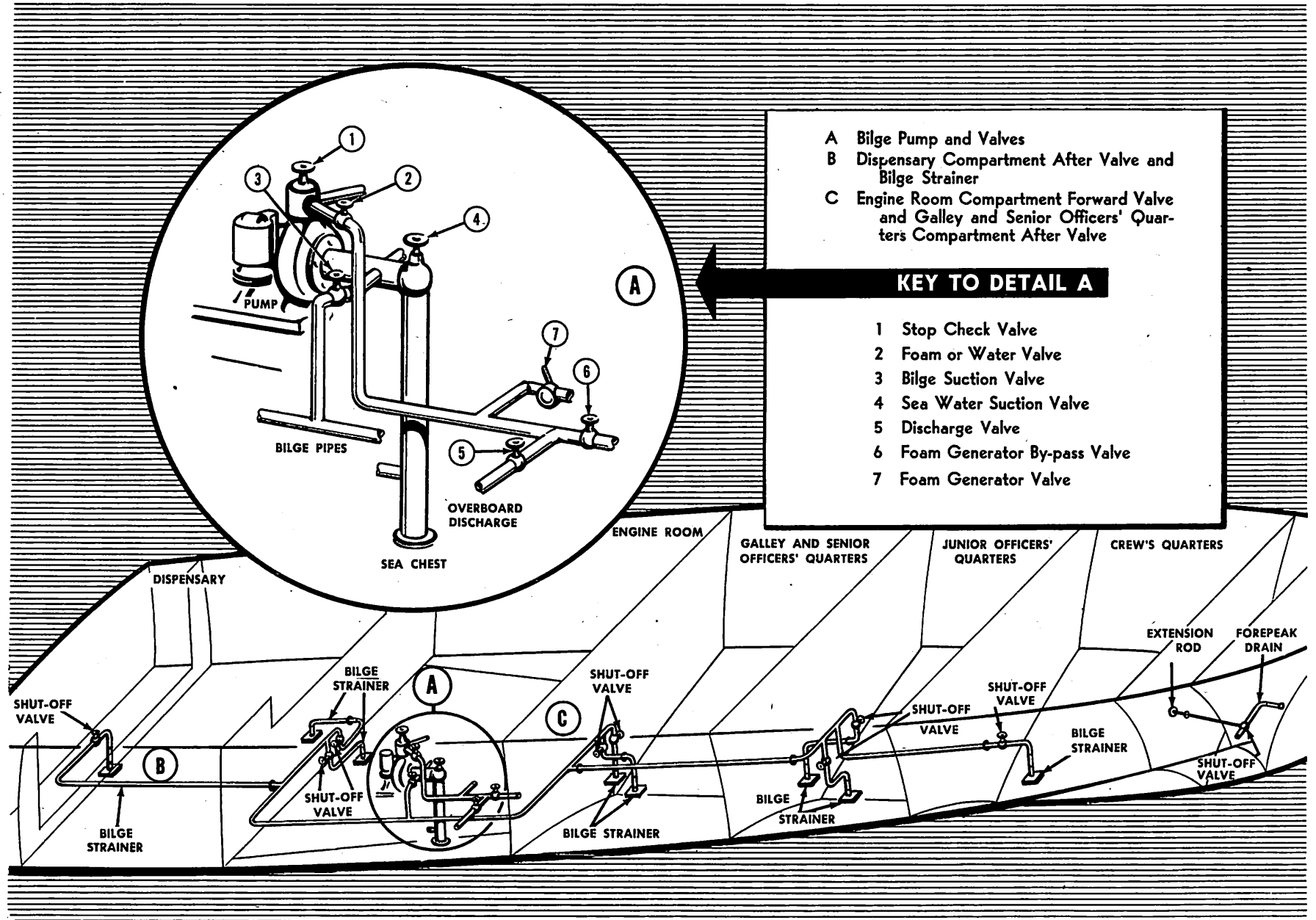
(1) Dispensary compartment after valve—through access panel in aft center floor of dispensary.

(2) Dispensary compartment forward valve—near bottom center of engine room aft bulkhead (the port valve). (See figure 131B.)

(3) Engine room compartment aft valve—near bottom center of engine room aft bulkhead (the starboard valve).

(4) Engine room compartment forward valve—through access panel in center forward floor of engine room (the port valve). (See figure 131C.)

Figure 131—BILGE PUMPING SYSTEM



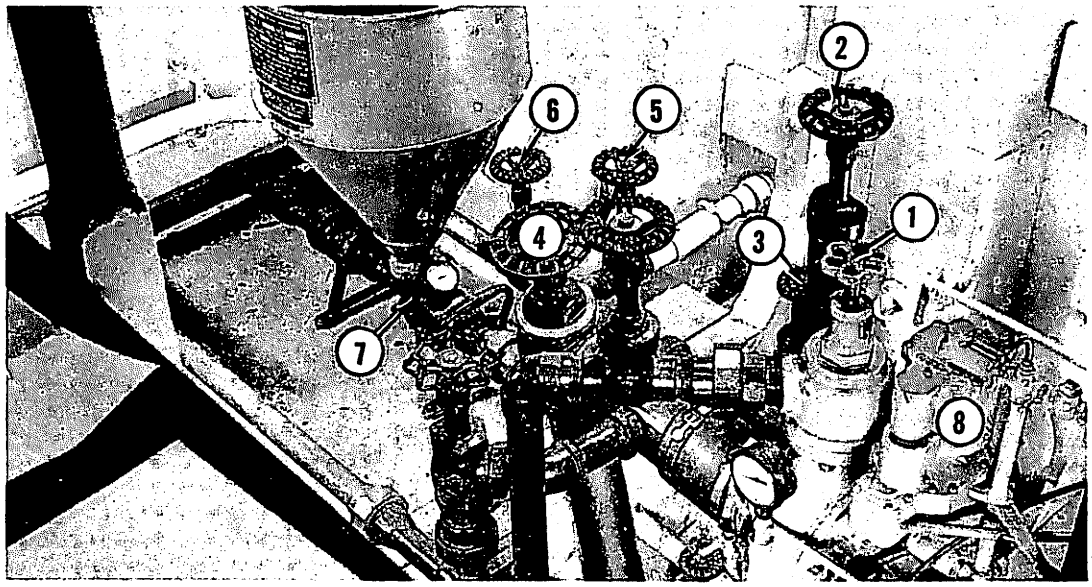


Figure 131A—Bilge Pump and Engine Room Valves

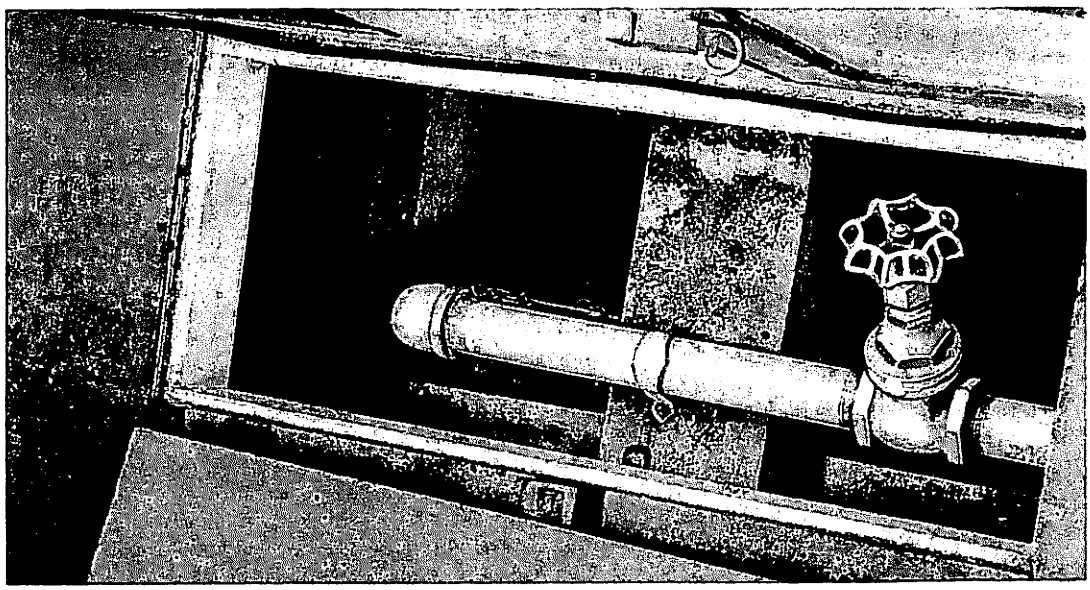


Figure 131B—Dispensary Compartment After Valve and Bilge Strainer

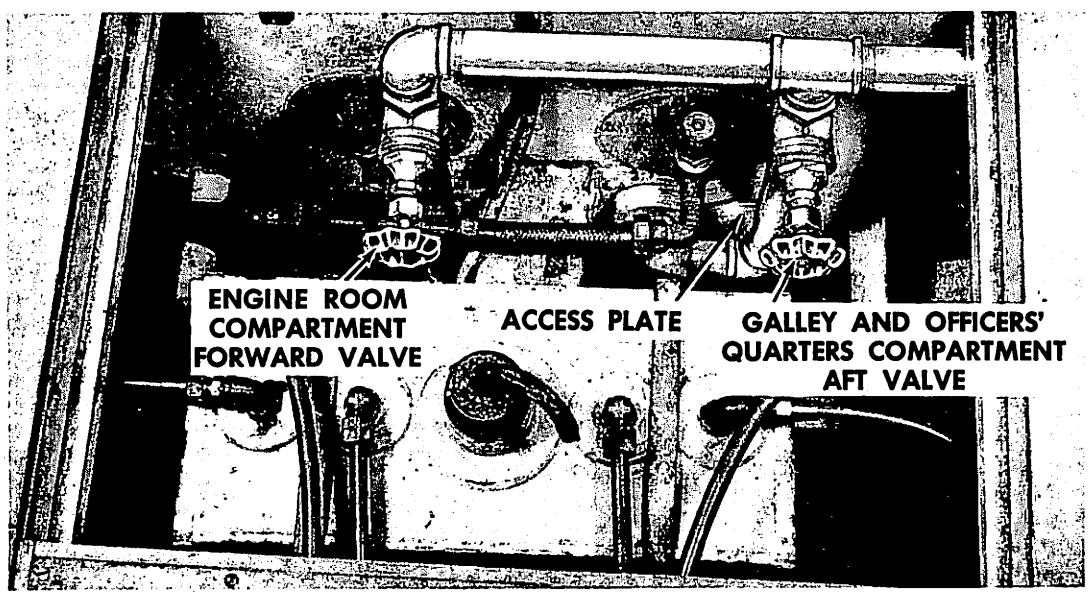


Figure 131C—Engine Room Compartment Forward Valve and Galley and Senior Officers' Quarters Compartment After Valve

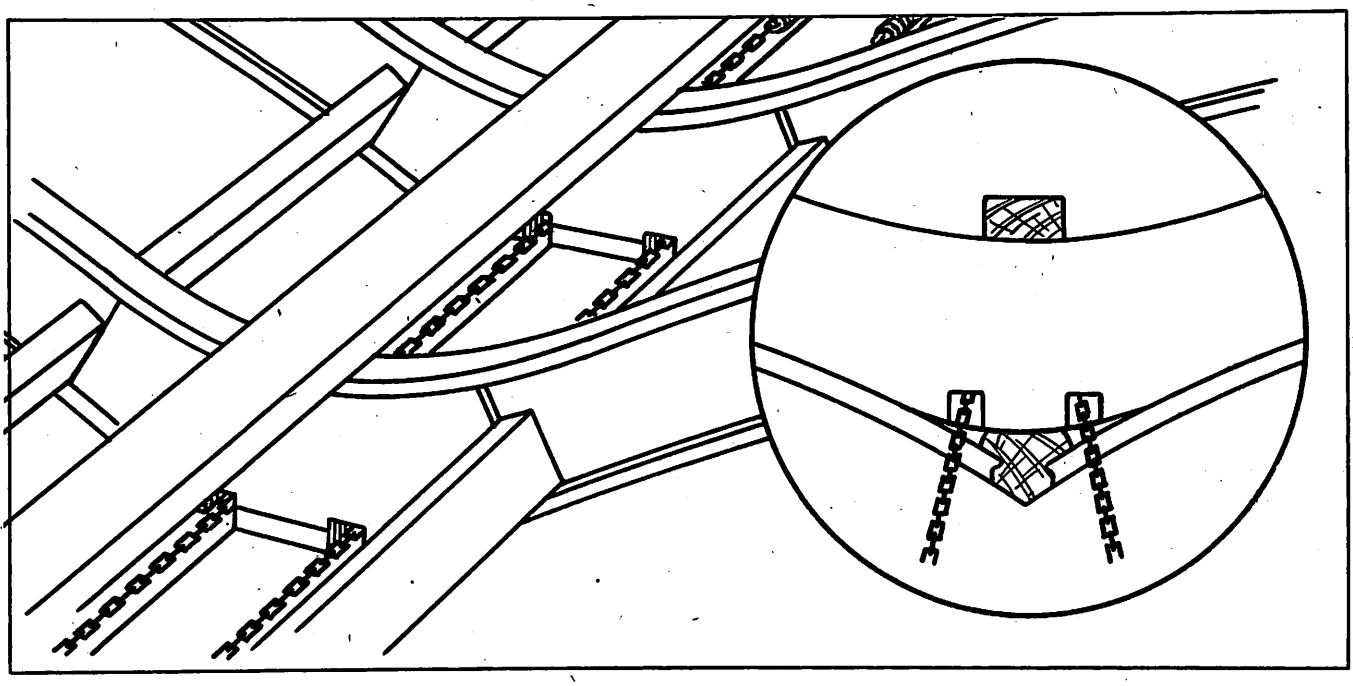


Figure 132—Limber Chains

(5) Galley and senior officers' quarters compartment aft valve—through access panel in center forward floor of engine room (the starboard valve).

(6) Galley and senior officers' quarters compartment forward valve—through access panel in center aft floor of radio room (the port valve).

(7) Junior officers' quarters compartment valve —through access panel in center aft floor of radio room (the starboard valve).

(8) Forward crew's quarters compartment valve —through access panel in center aft floor of forward crew's quarters.

g. Access to the forepeak drain valve extension handle is made through the access panel in the center forward floor of the forward crew's quarters.

h. To drain bilge water from the forepeak, open the forepeak drain valve and allow the water to drain into the forward crew's quarters compartment. Pump the water from the forward crew's quarters compartment.

i. While a bilge is being pumped, agitate the limber chains on either side of the keel in that compartment to clear the limber holes.

j. Turn off the branch pipe valve when the water level in the bilge is below the strainer and water is no longer being pumped. When pumping more than one bilge at a time, a branch pipe sucking air will stop the water suction at the other branch pipes.

k. To shut off the bilge pumping system, close all the branch line valves. Close the bilge suction valve in the engine room. Shut off the pump and engine. (Refer to section XVIII, paragraph 2.*b.*)

3. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
PUMP TROUBLES	Refer to section XVIII, paragraph 3.	
BILGES NOT BEING PUMPED OR PUMPING OUT SLOWLY	Branch pipe valve left open to a dry bilge.	Close valve.
	Leaking valve to dry bilge.	Refer to section XIX, paragraph 5.*e.*
	Break or leak in line between pump and branch pipes.	Refer to section XVIII, paragraph 4.*b.*(3)
ONE BILGE NOT BEING PUMPED, OTHERS BEING PUMPED SATISFACTORILY	Clogged strainer.	Refer to section XIX, paragraph 4.*c.*
	Leak or break in branch line.	Repair line.

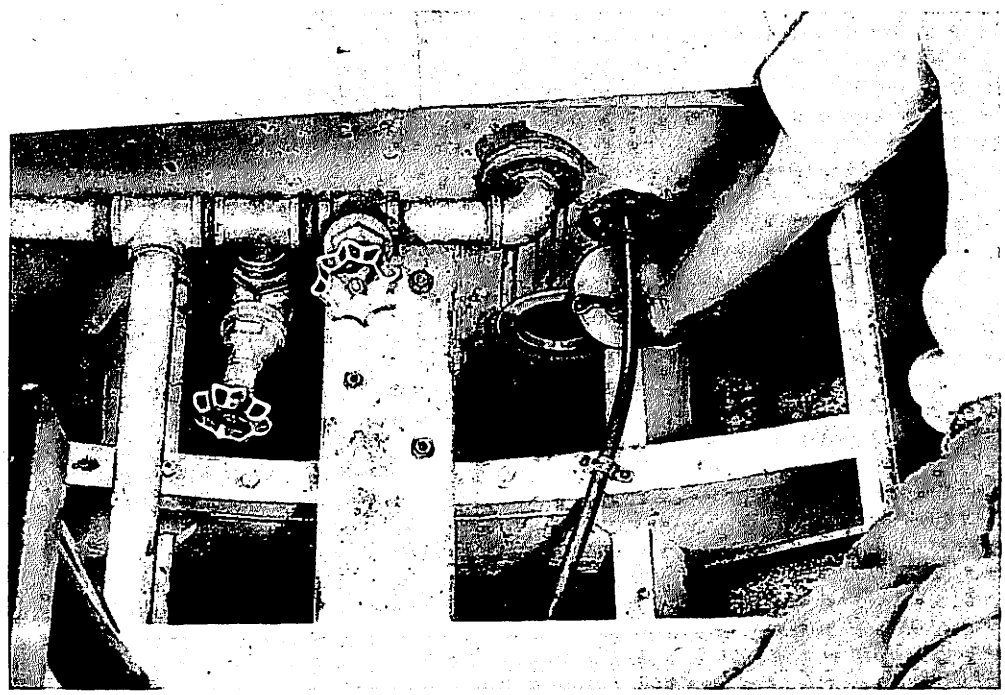


Figure 133—Access to Galley and Senior Officers' Quarters Forward Bilge Strainer

4. SERVICE, INSPECTION, AND MAINTENANCE.

a. For servicing and maintenance of the pump see section XVIII, paragraphs 4.*b.* and 5.*a.*

b. For repairs of pipes, valves, and fittings, see section III, paragraph 6.*b.*

c. Clean the bilge strainers whenever they appear to be clogged.

(1) Reach under the strainer and wipe it clean with the hand, a rag, or a stick. If necessary, bend up the rubber hose connecting the strainer to the pipe for better accessibility.

(2) Access to the strainers is made at the same places as access to the valves.

(3) The forward dispensary compartment strainer and the two galley and senior officers' quarters compartment strainers are reached by holes through the water-tight bulkheads, covered by 4-inch deck plates. These plates are located beneath the valves. Remove the plate with the special deck plate key (figure 133) and reach the hole to the bilge strainer to be cleaned. Be sure to screw the plate back tightly afterwards.

d. A break or large leak any place in the main bilge pipe line will cause the entire system to stop operating, as the pump will suck air rather than water. In case of such a break, turn off the system immediately and make the necessary repairs.

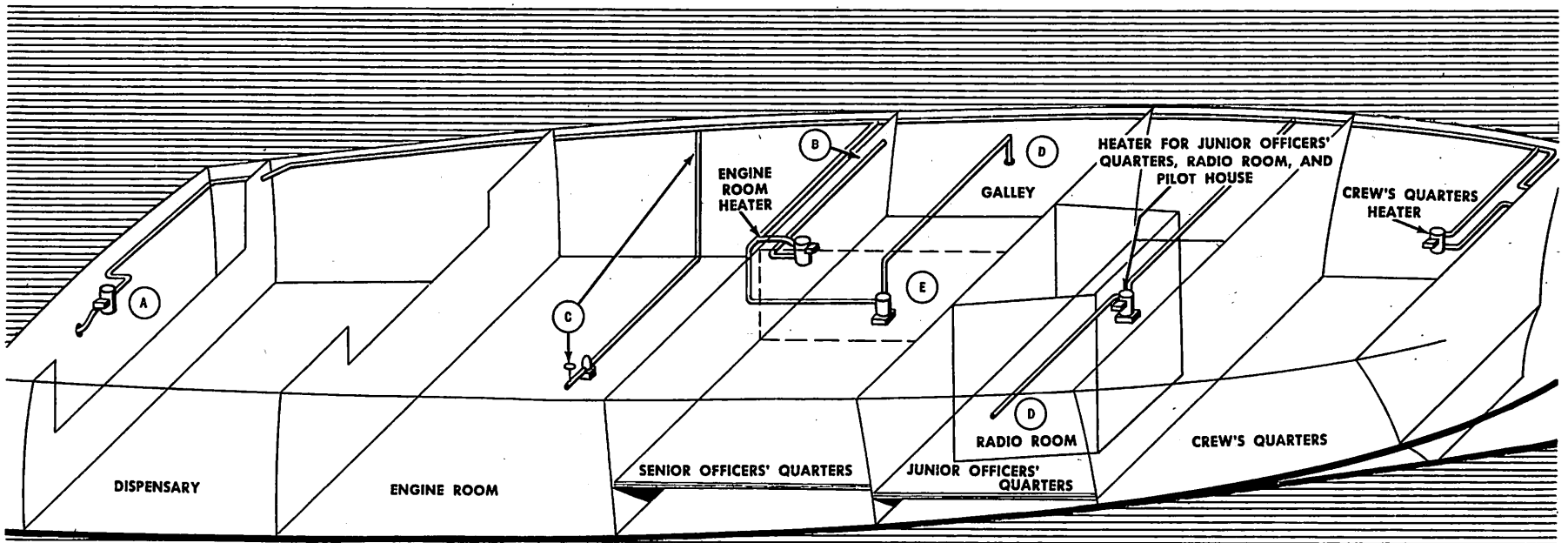
e. A leaky branch pipe valve will affect the system in the same way after the bilge in that compartment is sucked dry. In an emergency, when other bilges must be pumped, and there is no time to repair the valve, close the strainer on that branch with tape or rags, to keep it from sucking air.

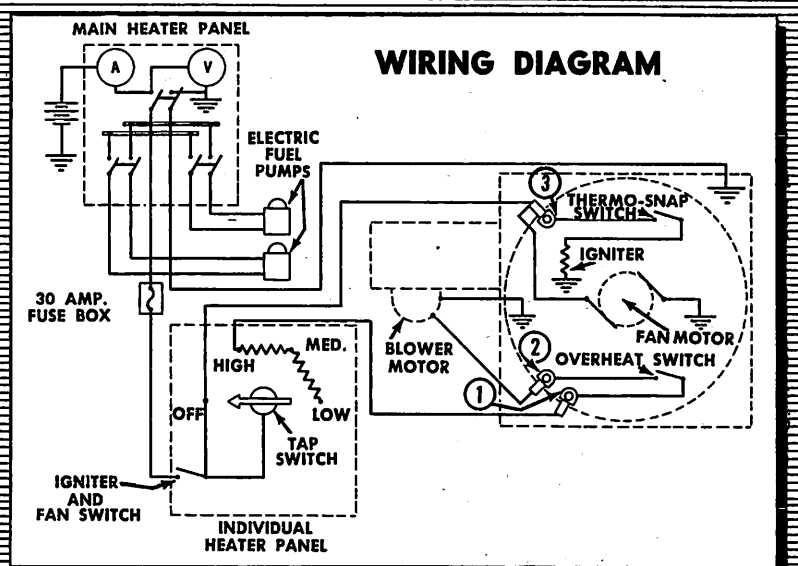
f. In case of a leak or break in a branch line between the strainer and the valve, close the valve. The rest of the system can continue operating.

g. In case of a leak or break in the overboard discharge line, the bilge water can be pumped out to a deck connection through the water or suction line of the water-foam fire extinguishing system.

h. If the bilge pumping system fails because of a break in the pipe line, the bilges can be pumped by the suction line and hoses of the water-foam system, where the hoses will reach.

Figure 134—HEATING SYSTEM





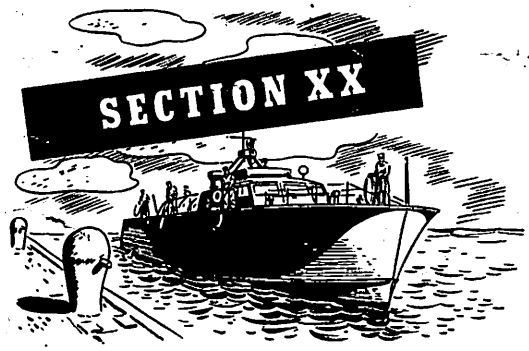
A Dispensary Heater

B Heater Control Panel

C Fuel Pumps

D Exhaust Cowl

E Galley Heater with Duct to Senior Officers' Quarters



Heating System

1. DESCRIPTION.

(See figure 134.)

a. GENERAL.—The boat's quarters are heated by five Stewart-Warner model 792-E internal combustion gasoline heaters (figure 134A). They are supplied with engine fuel from the main fuel manifold and require a 24-volt electric current for operation. Two electric pumps in the system maintain fuel pressure to the carburetor on each heater. Exhaust from the heaters is carried outboard by individual lagged pipes.

b. LOCATION OF HEATERS.—The heaters are located as shown in figure 134. Two of these units have dual outlets so that all quarters are supplied directly with heat. A heater of this type is shown in figure 134E.

c. OUTPUT.—The rated heat output for the 792-E heater is 20,000 Btu's per hour.

d. HEATER CONSTRUCTION AND OPERATION.

(See figure 135.)

(1) The model 792-E heater burns a fuel-air mixture in a hermetically sealed chamber. It consists of the following main assemblies:

(a) Electric motor driven blower.

(b) Carburetor and check valve.

(c) Heater, ventilating air fan, and housing.

(2) When the master electrical switch and the tap switch are turned on (see wiring diagram, figure 134) the fuel-air blower sends air through the elbow assembly to the carburetor. The air mixes with fuel in the carburetor and the resulting mixture passes through the check valve assembly and into the combustion chamber of the heater.

(3) The fuel-air mixture enters the combustion chamber through the burner tube which breaks up and distributes the mixture for more efficient combustion. The electric igniter (figure 135) on the side of the combustion chamber operates on the same principle as an electric cigarette lighter. It has a resistance coil which comes to a glow and ignites the fuel-air mixture. In the end of the combustion chamber, directly in the flame, is an Inconel metal reigniter which becomes red hot. After the electric igniter is shut off by the thermostatic igniter switch, the reigniter will ignite the mixture in case of a momentary interruption of the fuel-air flow. The reigniter will remain red hot for about 10 seconds after combustion has stopped.

(4) From the combustion chamber the burning mixture passes into the heat exchanger where it is extinguished on coming in contact with the baffle-end of the crate or oven assembly. The resulting hot gases then circulate through the flues of the oven assembly and heat the copper fins in the outer chamber, or heat exchanger, by conduction. The ventilating air, blown over the hot fins by the electric fan, is heated and leaves through the bottom of the heater housing. The burned gases leave the heater through the exhaust assembly.

(5) HEATER SPECIFICATIONS.

TYPE OF MECHANISM—Hermatic Combustion Gasoline Heater.

MODEL—792-E

WEIGHT—Approximately 30 lbs.

DIMENSIONS—15 5/16 inches high x 14 13/16 inches long x 7 9/16 inches wide. Mounting bracket holes .257 diameter on 9 25/32 inches centers.

MOUNTING BRACKET LOCATION—On case 2 5/32 inches center from bottom and top of heater case.

HEAT OUTPUT—20,000 Btu's per hour.

FUEL CONSUMPTION—1 3/4 quarts per hour.

HEATED AIR OUTPUT—300 cfm.

BLOWER MOTOR—15-V, dc, 2.5 amp, 7000 rpm, ball bearing, clockwise rotation.

FAN MOTOR—22-V, dc, 1.7 amps, 7000 rpm, ball bearing, counterclockwise rotation.

e. FUEL SYSTEM.

(1) Any grade of gasoline may be used in this type of heater. However, when leaded fuel is used, as in this installation, the heaters must be regularly checked and cleaned to keep them free of lead deposits.

(2) The carburetor used on the model 792-E heater has a fixed jet which is correctly and permanently set at the factory. No change in this setting should be attempted. A choke knob on the control panel is connected to the heater carburetor by a control wire.

(3) ELECTRIC FUEL PUMPS.

(a) Fuel pressure is supplied to the carburetor of each heater by two electric pumps in the main fuel

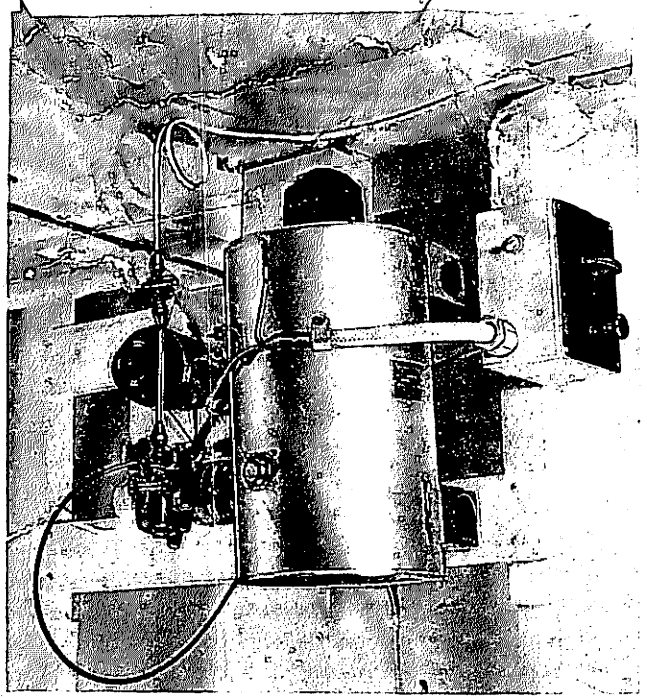


Figure 134A—Dispensary Heater

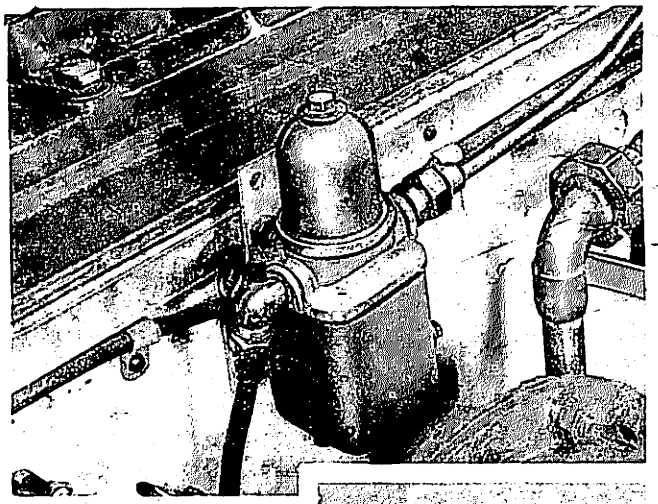


Figure 134C—One of Two Identical Electric Fuel Pumps in the Main Fuel Line to the Heaters

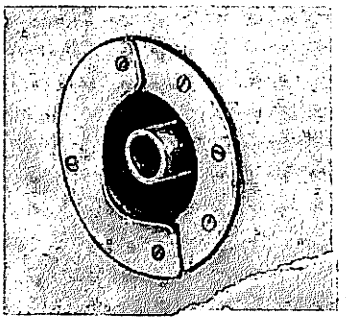


Figure 134D—Outboard Vent of Heater Exhaust

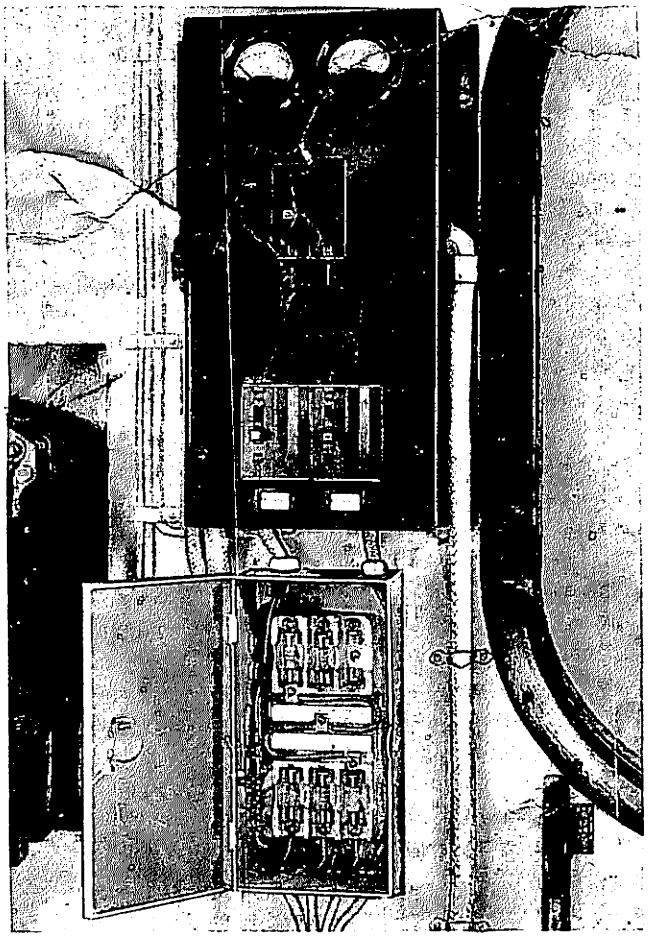


Figure 134B—Main Heater Control Panel with Fuse Box Protecting Circuits

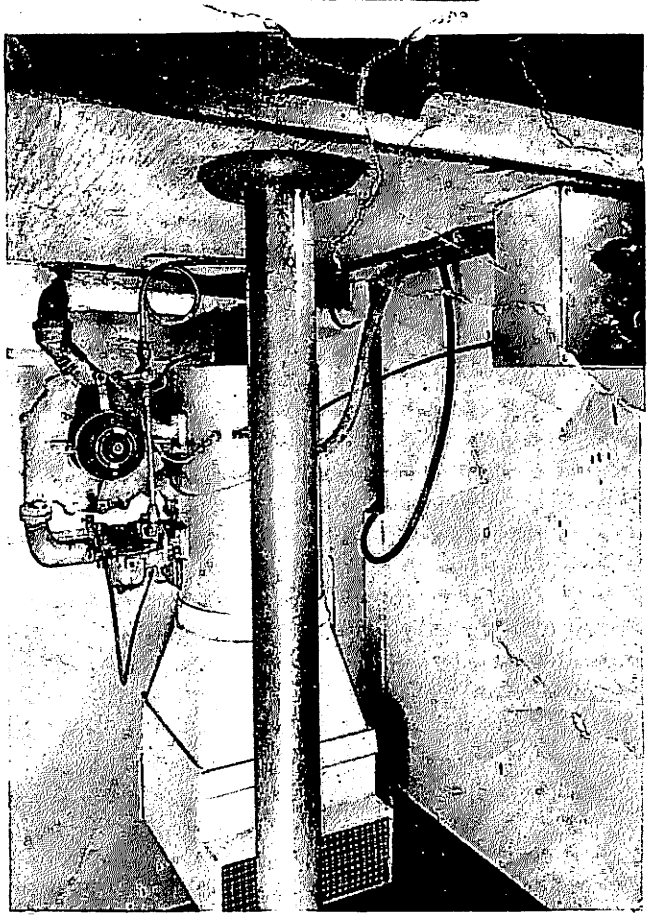


Figure 134E—Heater Installation in Galley with One Vent of Dual Outlet Passing Through Bulkhead to Senior Officers' Quarters

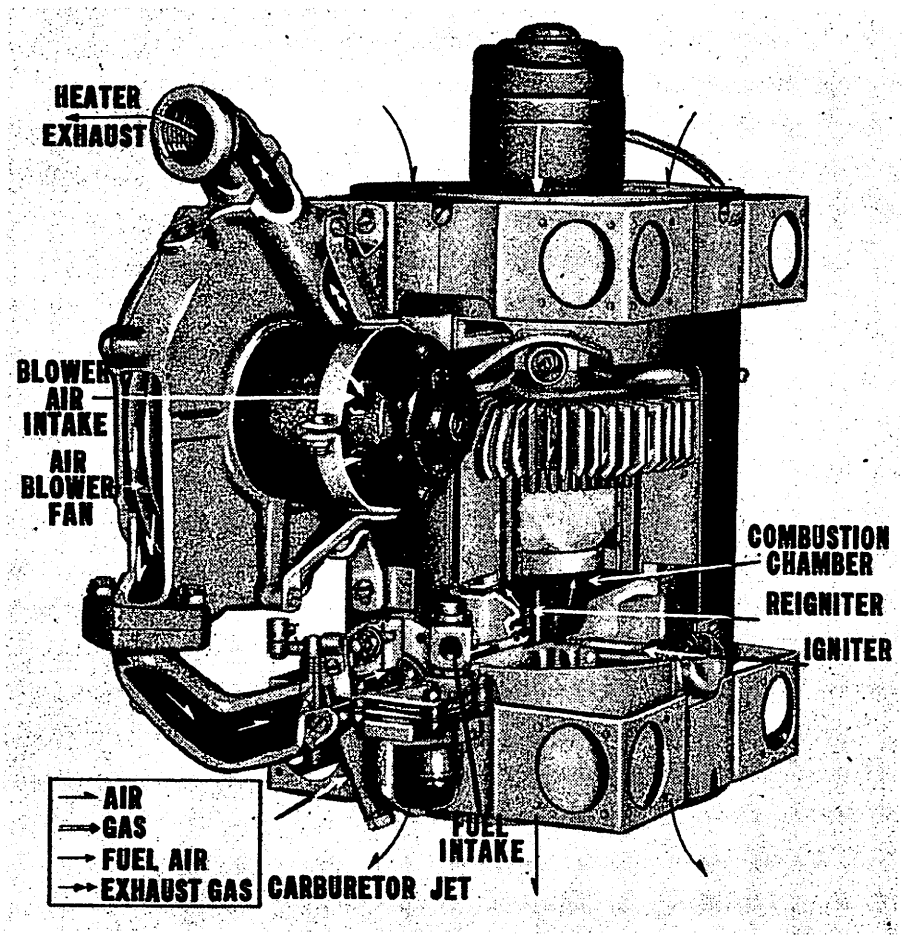


Figure 135—Cutaway View of Heater

line of the heater system (figure 134C). Each pump is controlled by an individual switch on the main heating system panel, since one pump will provide a sufficient flow of fuel for two or three of the heaters. The other pump, which is connected into the same line and acts as a booster, must be switched on when all of the heaters are in operation.

(b) The two pumps are identical. Each is set at the factory to provide a specified pressure, and the pumps cut in and out automatically to maintain that pressure.

(4) VALVES. — A fuel shut-off valve is located in the fuel line at each heater. A master valve controls the flow from the fuel manifold to the heating system fuel line. If the heaters are used when the boat is secured, it is also necessary to open the valve from the main fuel tanks to the fuel manifold.

f. ELECTRICAL SYSTEM.

(1) The 24-volt heater electrical system is wired in accordance with the diagram in figure 134.

(2) A central switch on the main heater panel (figure 134B) controls current to the switch panels of the individual heaters. Two switches near the bottom of the main panel operate the two electric fuel pumps in the system.

(3) Each heater has a control panel on which is mounted the igniter and fan toggle switch, the tap switch which regulates the heater output, and the choke button.

(4) One lead from the igniter switch is connected to terminal 3 of the heater; the other is connected to the terminal on the igniter.

(5) In operation, current from heater terminal 3 also flows to the fan motor. Current from terminal 1 flows to the top blade of the overheat switch which (at normal operating temperatures) is in contact with the center blade. From the center blade current flows through terminal 2 to the blower motor.

(6) After the heater has warmed up, the electrical circuit to the igniter is broken by the action of a bi-metal disc within the igniter switch.

(7) If, for any reason, the heater should become hotter than normal, the bi-metal (lower) blade of the overheat switch will bend toward the heater until the contact between the center and top blade is broken. This will cause the blower motor to stop, shutting off the fuel-air mixture to the combustion chamber. The fan motor, however, will continue to operate and cool the heater.

(8) When the heater cools sufficiently, the overheat switch will again close the circuit to the blower motor, supplying fuel-air mixture to the combustion chamber. The igniter switch circuit will also close, starting the electric igniter. This is called recycling.

g. EXHAUST OUTLETS.—The heater exhaust contains carbon monoxide and is highly poisonous. Exhaust gases are carried outboard by pipes which vent to the atmosphere (figure 134D).

2. OPERATION INSTRUCTIONS.

a. TO START HEATER.

(1) Make sure that a valve from main fuel tanks to fuel manifold is open.

(2) Open valve between fuel manifold and heater fuel line.

(3) Open valve in fuel line by heater to be used.

(4) Turn main 24-volt switch on.

(5) Turn main heater panel switch on. (See figure 134B.)

(6) Turn one or both electric fuel pump switches on, depending on how many heaters are to be used. One pump is sufficient for two or three heaters, depending on their location. Both pumps may be used at any time since they will cut out if desired pressure is exceeded.

(7) Turn on the individual heater switches as follows:

(a) Turn on the toggle switch to start fan motor and electric igniter.

(b) Turn tap switch from "OFF" to "LOW" position. This starts the blower motor. When combustion is indicated by heat delivery, turn tap switch to "HIGH" until temperature sufficient to open the thermo-snap switch is reached (approximately five minutes). Obtain desired heat output by turning tap switch.

(8) When starting the heater in extremely cold weather, use the choke as follows:

(a) Hold choke knob all the way out for about two seconds.

(b) Push choke half way in for another 7 to 10 seconds.

(c) Return choke to normal operating position (all the way in).

Note

Use of choke may cause popping and sputtering of heater.

b. TO SHUT HEATER OFF.

(1) Turn tap switch to "OFF" position. This cuts off the current to the blower motor. The fan motor will continue operating to cool heater.

(2) When heater is cooled sufficiently, turn off toggle switch at individual heater panel and close fuel valve at heater.

(3) If all heaters are shut down, turn off remaining switches in heater system and close fuel valves.

3. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
HEATER OPERATING, NO HEAT DELIVERY	No fuel.	Check supply tank, lines, and valves.
	Carburetor clogged.	Clean and adjust.
	Fuel-air blower not operating.	Check electrical connections and switches.
	Blower operating-igniter not operating.	Check ignition.
	Fan motor not operating.	Check fan motor.
HEATER CONTINUALLY RECYCLING (STARTING AND STOPPING)	Fan motor not operating properly.	Check fan motor.
	Overheat switch defective or out of adjustment.	Check overheat switch.
HEATER SPUTTERS IN OPERATION	Carburetor check valve not correctly spaced.	Adjust valve.
	Choke partly out.	Close.
ELECTRIC PUMP KEEPS OPERATING	Break in fuel line.	Inspect and repair.
ELECTRIC PUMP NOT PUMPING	Clogged screen.	Remove and clean.
	Hole in diaphragm.	Replace diaphragm or replace pump.

4. SERVICE.

a. GENERAL.

(1) All fuel and electric lines should be constantly checked to avoid chafing or looseness.

(2) Before removing any item from the heater fuel system, drain the fuel line at the lowest point (the first electric pump connection). After reinstalling item, bleed air from the line at the highest point.

(3) Before adjusting electrical system, open main switch.

b. ELECTRIC PUMPS.—To remove strainer screen for cleaning, remove nut, bolt, and cap at top of pump. (See figure 136.) If additional servicing is required, replace pump, as faulty assembly may cause a leak and consequent fire hazard.

c. FAN MOTOR.—If fan motor does not operate, make certain that all connections are tight and that there are no short circuits. If motor still does not operate, it must be replaced.

d. BLOWER MOTOR.

(1) If blower motor fails to operate, inspect all wiring to make certain all connections are tight and that there are no short circuits.

(2) If after examining the wiring the blower motor still does not operate, disconnect the blower motor lead from heater terminal 2 and connect direct to heater terminal 1. If blower motor then operates, the overheat switch is out of adjustment. If blower motor does not operate when connected to heater terminal 1, motor is defective and must be replaced.

e. CARBURETOR.—The carburetor is not adjustable. It is a fixed-orifice type, calibrated for the heater to which it is attached. Do not attempt to change this adjustment. If the carburetor does not function properly, however, it should be removed for the following possible adjustments:

(1) Checking of float level.

(2) Cleaning of float bowl and screen.

(3) Adjustment of opening between fiber disc and seat in check valve.

f. EXHAUST OUTLETS.—Exhaust pipes occasionally burn through and leak. Replace burned pipes. Check carefully whenever heaters are operated to insure that connections are tight and that there are no leaks.

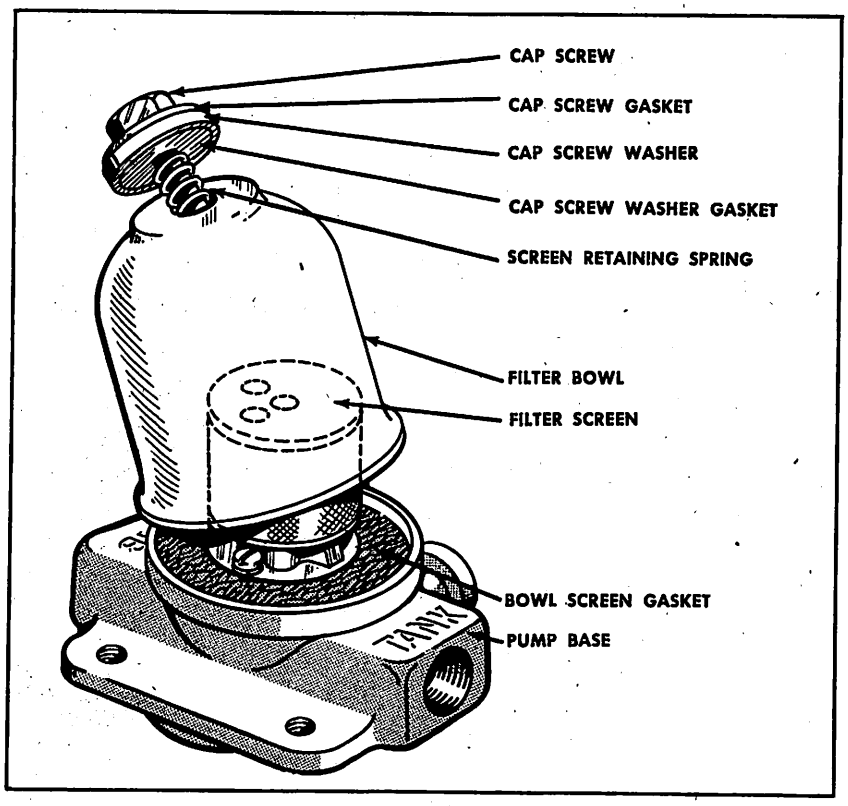
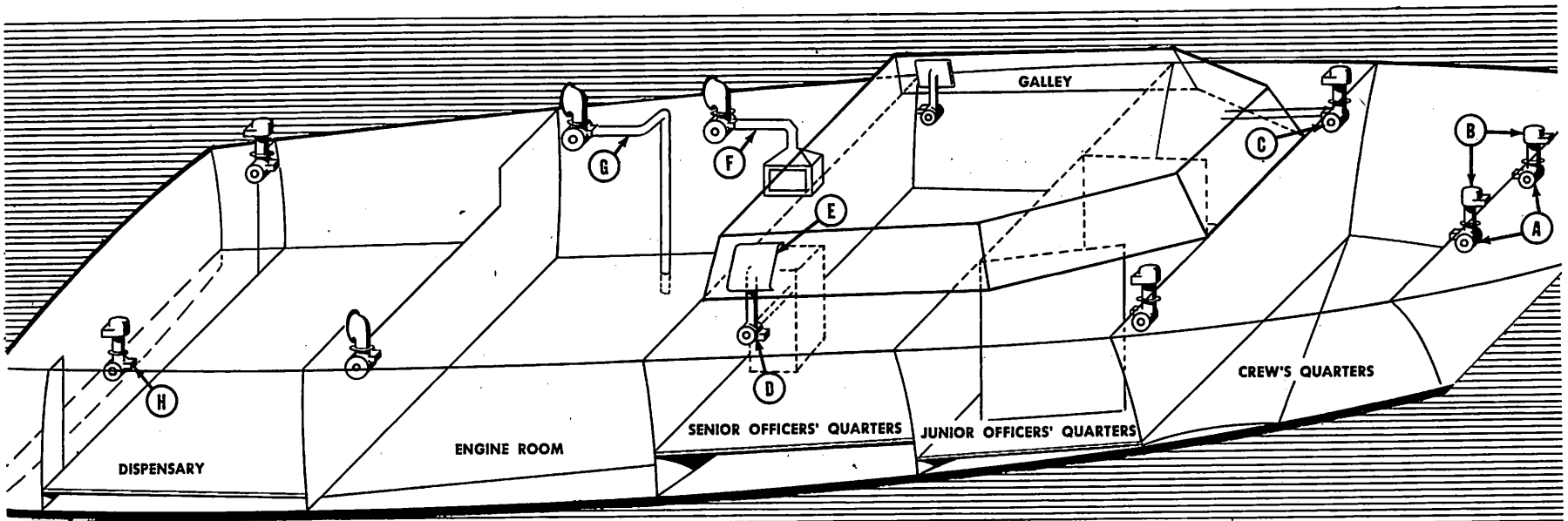
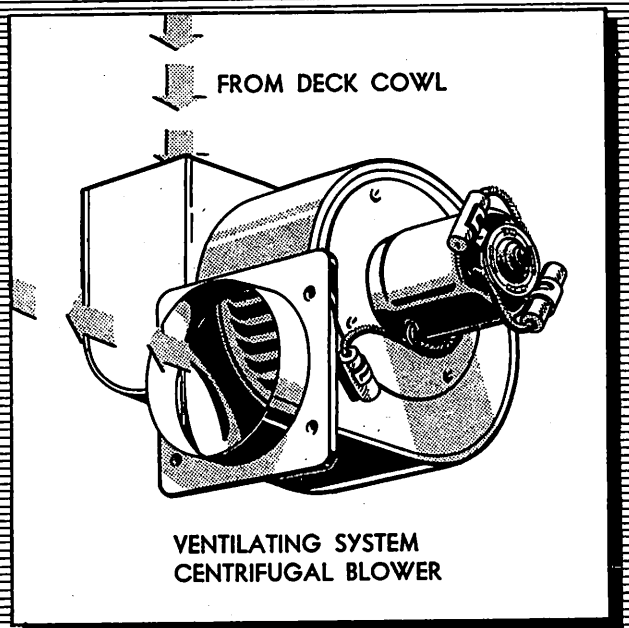


Figure 136—Removal of Fuel Pump Cap

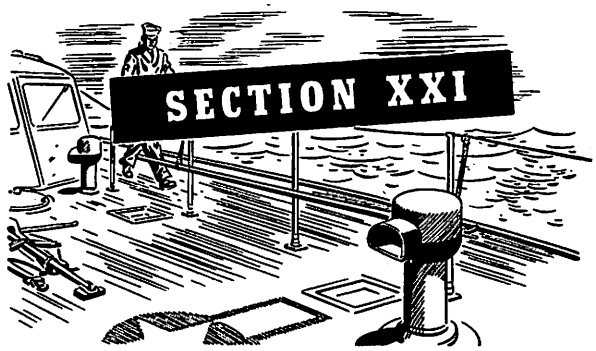
Figure 137—VENTILATING SYSTEM





VENTILATING SYSTEM
CENTRIFUGAL BLOWER

- A Forward Crew's Quarters Ventilators
- B Forward Crew's Quarters Ventilator Cowls
- C Junior Officers' Quarters Port Ventilator and Duct
- D Senior Officers' Quarters Ventilator and Duct
- E Senior Officers' Quarters Ventilator Cowl
- F 24-Volt Generator Hood and Ventilator
- G Engine Room Port Ventilator and Duct
- H Dispensary Starboard Ventilator



Ventilating SYSTEM

1. DESCRIPTION.

(See figure 137.)

Eleven ventilators, each comprising an electric blower and cowl, and four of which have attached ducts, provide circulation of air within the compartments of the 85-foot rescue boat. (Some of the ventilators force air into the boat; others force air from the boat to the outside.) Screens installed at deck level prevent foreign matter from being blown into the boat through the ducts by the intake ventilators. The 11 ventilators are located as follows:

a. FORWARD CREW'S QUARTERS.—Two 180-cfm (cubic-feet-per-minute) blowers are located port and starboard just aft of the forward bulkhead. (See figure 137A.) They have nonrigid cowls (figure 137B) and both take air into the quarters.

b. JUNIOR OFFICERS' QUARTERS. — The port ventilator (figure 137C) blows outward to ventilate the crew's toilet closet. A duct connects the blower to the toilet closet. The starboard ventilator blows air into the junior officers' quarters. Both have nonrigid cowls. Both are 180 cfm.

c. SENIOR OFFICERS' QUARTERS. — A 180-cfm blower on the outboard side of the after bulkhead is connected to the toilet closet by a duct (figure 137D). It blows the air out. The cowl (figure 137E) is a rigid panel on the starboard side of the bridge structure, and opens aft.

d. GALLEY.—A ductless 180-cfm blower on the aft outboard side blows out through a panel cowl like that shown in figure 137E. This panel also opens aft.

e. ENGINE ROOM.—Two 500-cfm blowers with rigid cowls are located in the port and starboard aft corners of the engine room. The port blower has a duct to the bilge (figure 137G) and the starboard blower is ductless. A third 500-cfm blower on the center port side of the room is connected by a duct to the 24-volt battery charging generator and engine compartment. (See figure 137F.) All three of the engine room blowers blow outward. Air enters the room through two screened ventilating panels, one on each side of the bridge structure. (See figure 138.)

f. DISPENSARY.—Two 180-cfm blowers in the stern port and starboard corners of the dispensary blow air in from the outside. (See figure 137H.) Both have nonrigid cowls. The starboard cowl, however, may not be installed until the boat reaches its permanent base and the spare propeller shafts removed from the deck. Until then the cowl is carried on board and the hole is plugged with a deck plate so that the spare shafts may extend over the spot.

Note

On boats having a toilet in the stern port corner of the dispensary, an out-blowing ventilator with a duct, similar to that used for the other toilets, is located on the port side.

2. PRINCIPLES OF OPERATION.

Whether a ventilator blows air into the boat from the outside or discharges it out of the boat depends on the mounting of the blower. Air is always taken into the side opening in line with the rotor shaft and exhausted through an opening in the housing at right angles to the intake.

3. OPERATION.

a. SWITCHES.—All ventilation fans and blowers are equipped with thermal-type overload switches for motor running protection. If, for any reason, a blower stops, its controlling switch should first be inspected. If the handle is in the "TRIPPED" position, it should be thrown to "OFF" and, after an interval to allow the element to cool, thrown to "ON." If there is still a fault in the wiring or motor, the switch will again trip out, in which case the switch should not be turned on until the trouble is found and corrected.

(1) TURNING ON SWITCHES.—The 110-volt master switch and the appropriate breaker switches on the switchboard—marked "CREW'S BLOWERS," "GALLEY BLOWERS," "ENGINE ROOM BLOWERS," and "DISPENSARY BLOWERS" (figures 7 and 8)—must be turned on before any of the blower switches can operate the ventilators.

(a) The switches for the two aft engine room blowers are on the engine instrument panel. (See figure 9.) These switches have four positions: "OFF," "BLOWER," "BLOWER AND IGNITION," and "IGNITION." These two switches also control the circuit to the

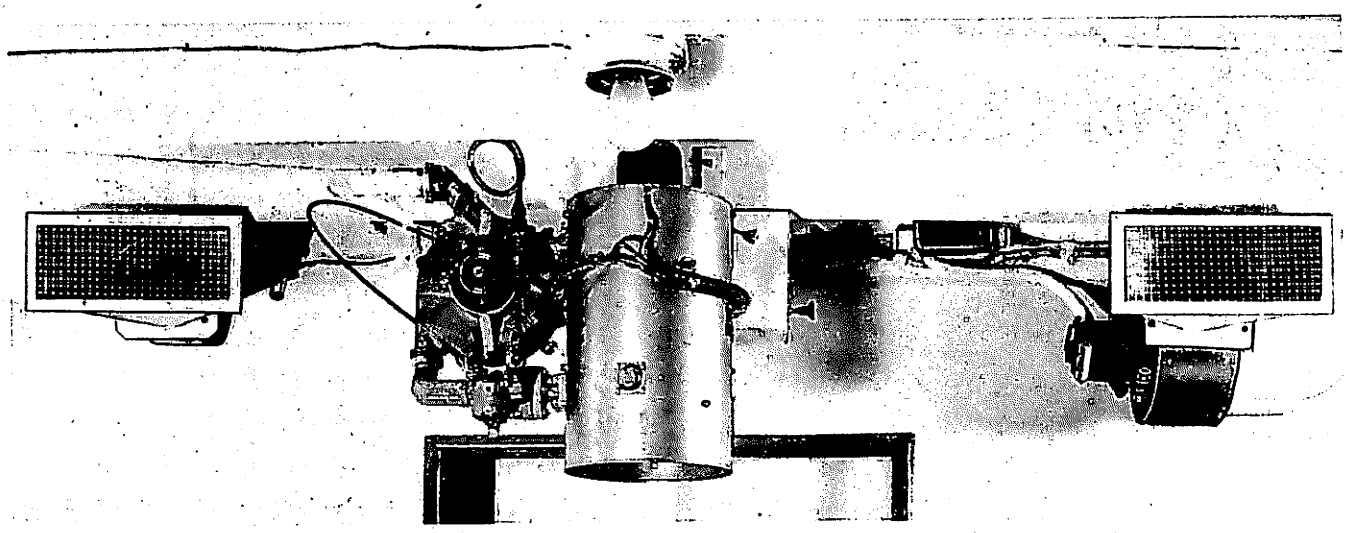


Figure 137A—Forward Crew's Quarters Ventilators

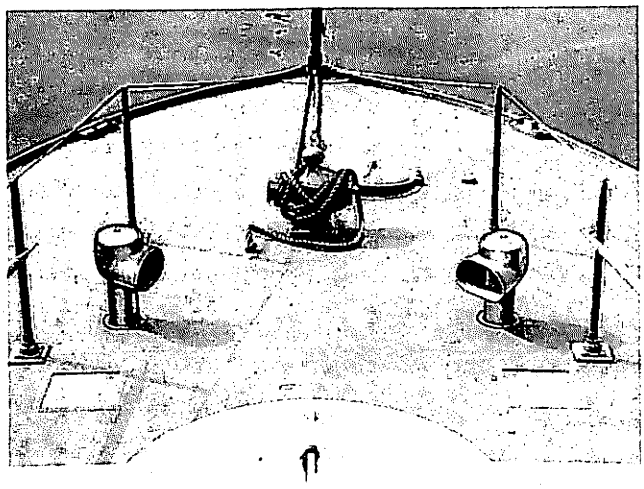


Figure 137B—Forward Crew's Quarters Ventilator Cowls

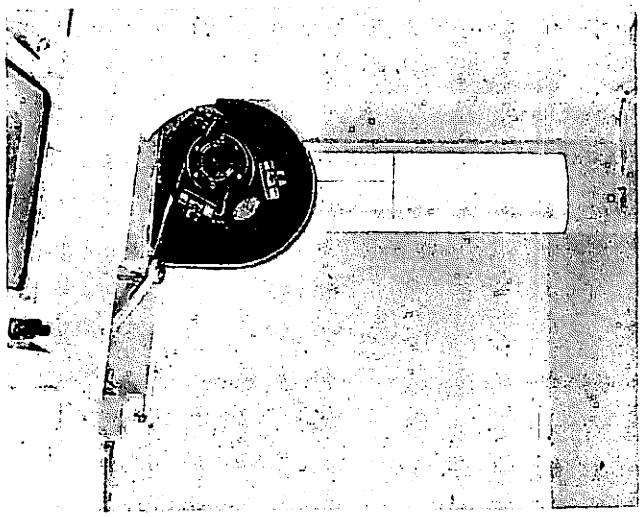


Figure 137D—Senior Officers' Quarters Ventilator and Duct

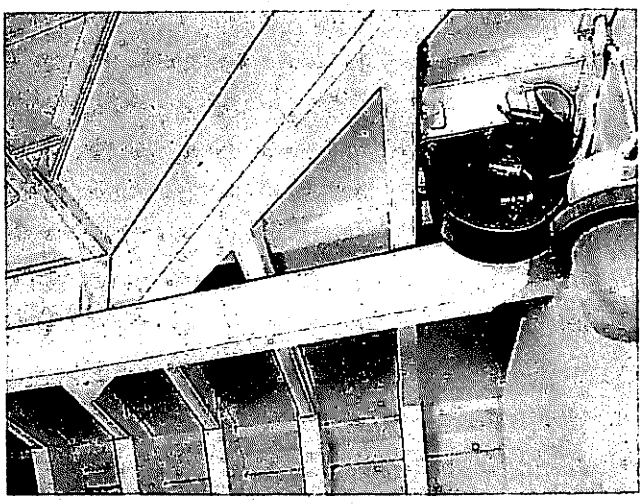


Figure 137C—Junior Officers' Quarters Port Ventilator and Duct

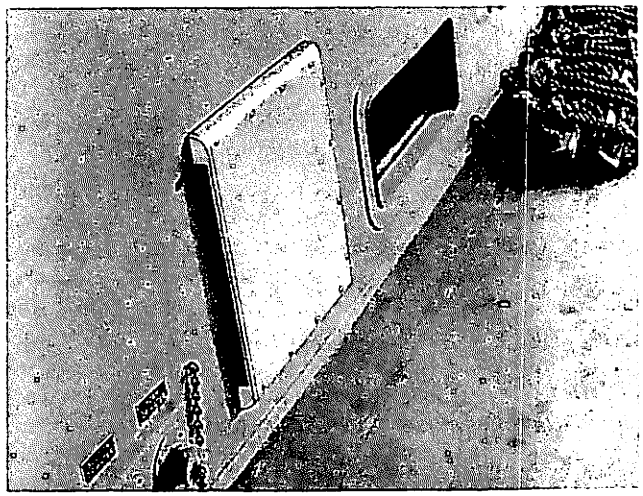


Figure 137E—Senior Officers' Quarters Ventilator Cowl

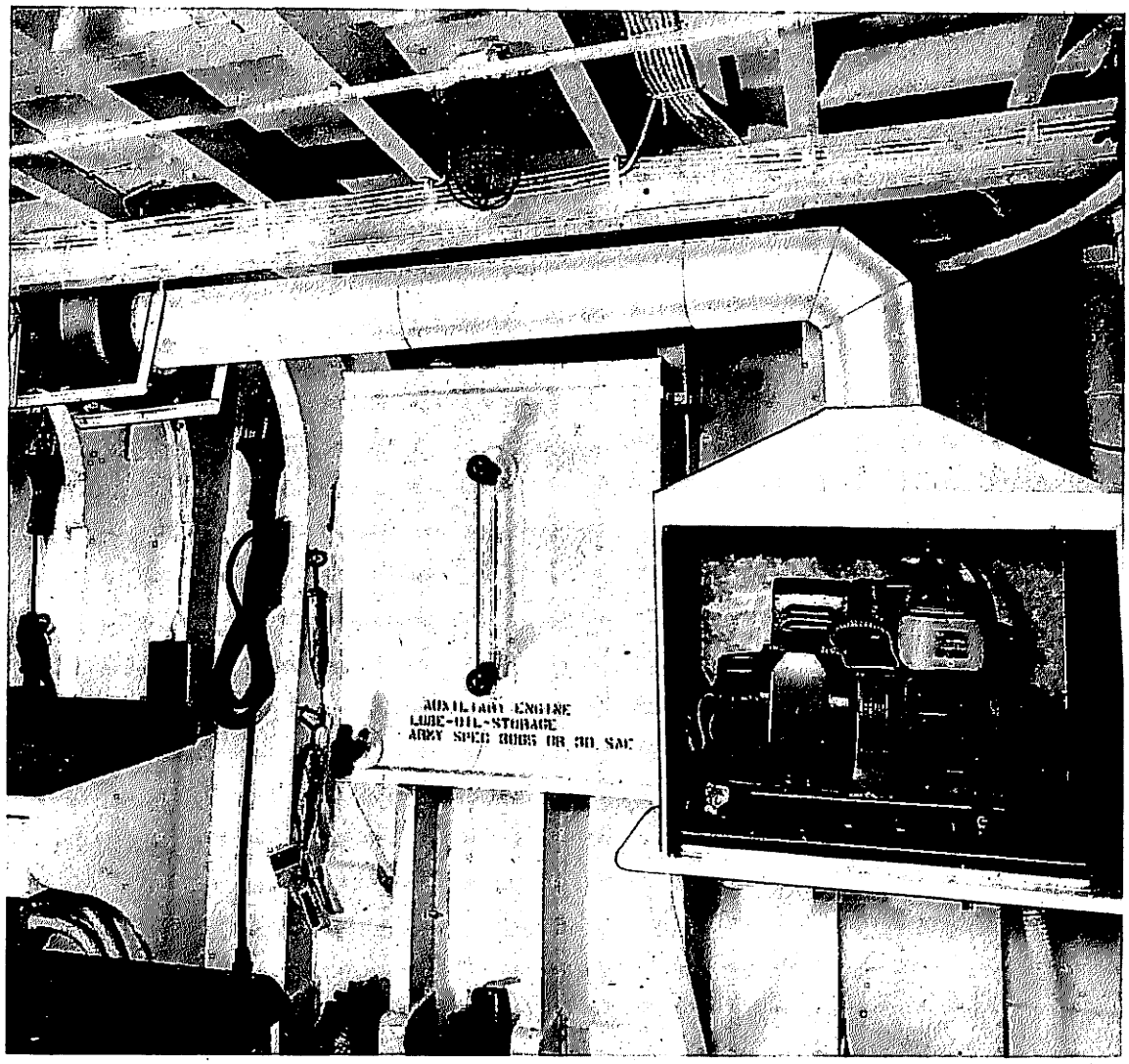


Figure 137F—24-Volt Battery Charger Hood and Ventilator

engine ignition switches, so that the engines cannot be started without the blowers first being turned on. In the event of an overload on either of these two blowers, the breaker switch on the main switchboard will be tripped and must be reset according to the instructions in paragraph 3.*a.* of this section.

(b) The blower for the 24-volt generator ventilator is operated by the switch for the generator engine, so that it will operate whenever the engine is running.

(c) The switches for all the other ventilator blowers are like the switch shown in figure 137H. These are breaker switches, and may be reset according to the instructions in paragraph 3.*a.* of this section.

b. COWLS.—When the boat is at the dock, the movable cowls should be turned into the wind in order to ventilate the compartments without operating the blowers. When the boat is under way, all the cowls should be turned with openings aft.

4. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
BLOWER AUTOMATICALLY STOPS RUNNING	Overloaded circuit.	Turn switch "OFF" for a few minutes, then turn it "ON."
BLOWER WILL NOT START	Electric motor brushes worn out. Electric lines broken.	Replace brushes. Repair lines.
BLOWER RUNS TOO SLOWLY	Commutator surface burned.	Dress down or replace commutator.

5. SERVICING AND MAINTENANCE.

a. LUBRICATION.—Once a week, place a few drops of oil in the oil cups at each end of the motor shafts. Do not over-oil. Use a light engine oil, such as SAE 20.

b. SPARE PARTS.—Spare brushes are carried on board to replace brushes that burn or wear out. Spare commutators also are carried to replace those that may be burned so badly that they cannot be made serviceable by dressing down the surface.

6. REMOVING THE VENTILATORS.

a. Turn off the main switchboard breaker switch controlling the electric circuit to the ventilator that is to be removed.

b. Disconnect the electric leads to the blower motor. On the smaller blowers, this disconnection usually can be made easiest at the blower switch nearby.

c. If the blower is fastened to a duct, disconnect the duct.

d. Unfasten and remove the blower from the bulkhead or frame on which it is mounted.

e. Remove the deck cowls, when necessary, by unscrewing them.

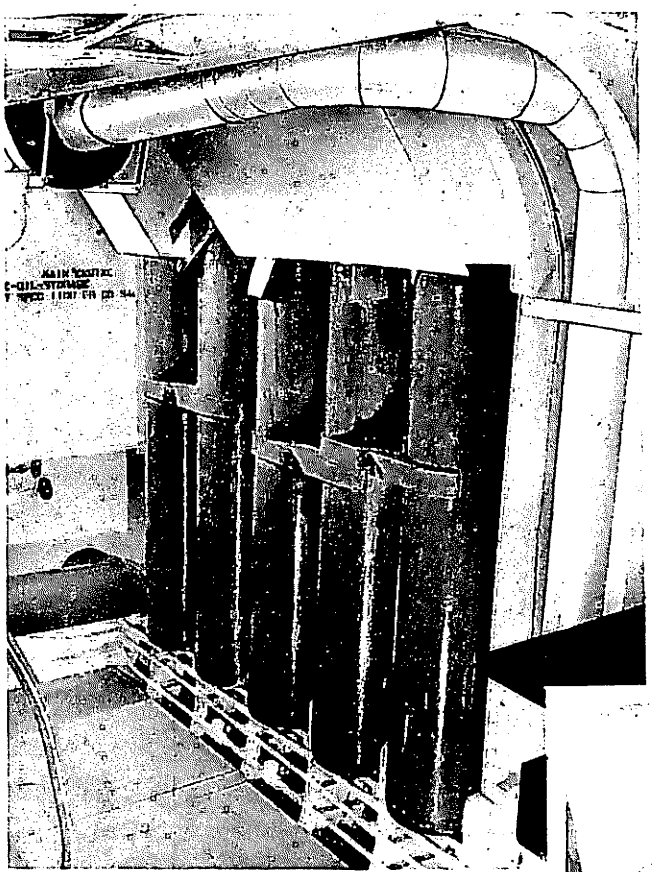


Figure 137G—Engine Room Port Ventilator

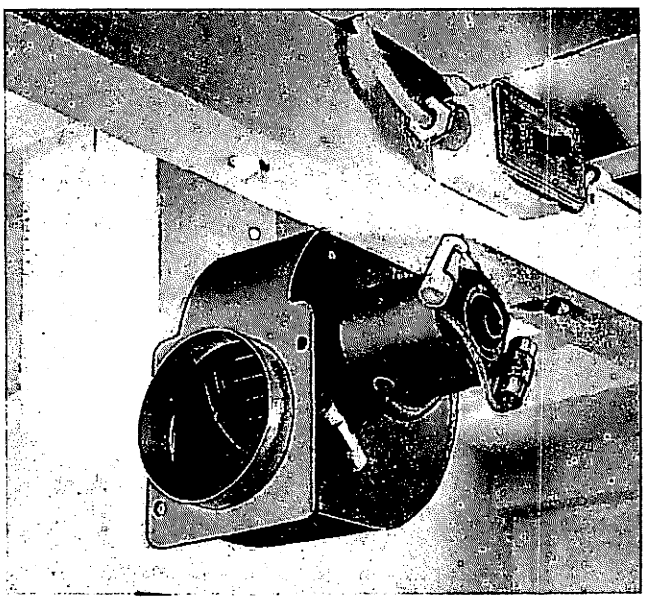


Figure 137H—Dispensary Starboard Ventilator

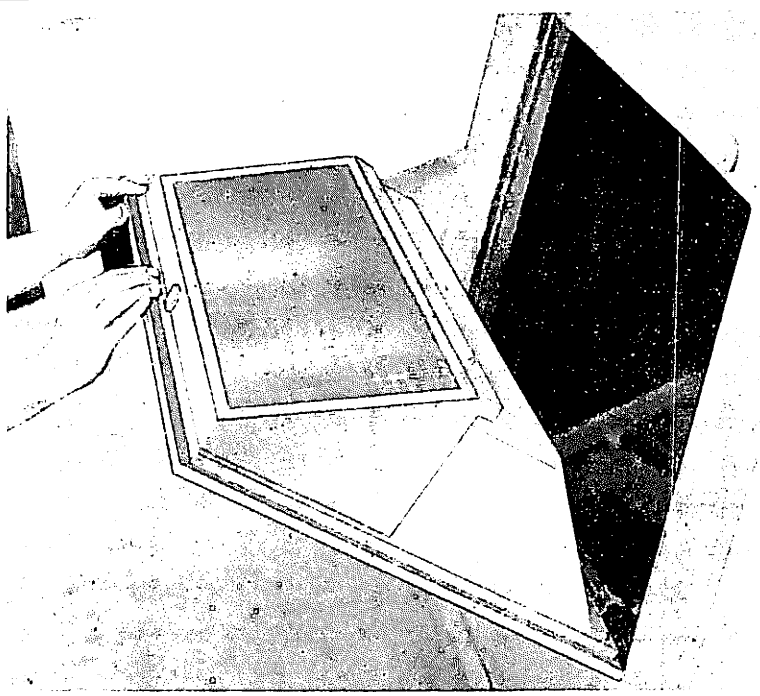
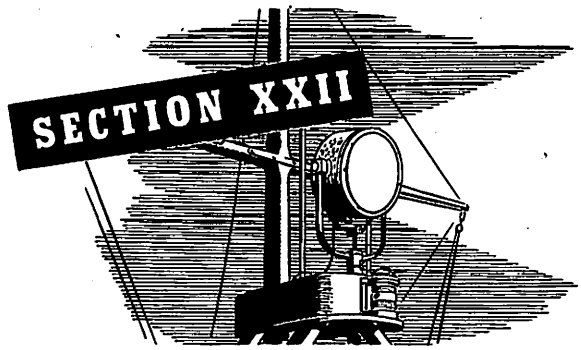


Figure 138—Engine Room Air Intake Removed From Its Mounting



Lighting AND Signaling SYSTEM

1. INTERIOR LIGHTING.

a. DESCRIPTION.

(1) The interior lamp fixtures are located and wired as shown in figure 139.

(2) Most interior fixtures are standard marine fixtures with the lamp bulb and socket enclosed by a watertight glass globe. The globe is held against the socket and switch housing by a screwed-on retainer ring. One metal and two rubber gaskets make the fitting shockproof and watertight. (See figure 140.)

(3) Other fixtures in places high enough to avoid being hit or bumped into are of the reflector and bare-bulb type.

(4) The binnacle light on the bridge has a rheostat switch wired so that the light can be dimmed.

(5) The lighting fixtures are controlled in the following groups by switches on the 110-volt switchboard in the engine room.

(a) Crew's quarters lights.

(b) Galley and officers' quarters lights.

(c) After port lights.

(d) After starboard lights.

(e) Pilot house lights.

(6) The light fixtures are controlled individually by switches on their bases.

b. OPERATION.

(1) Turn on the proper group switch on the 110-volt panel before turning on the individual lights.

(2) Turn off the lights at the individual switches first to avoid wasting current if the 110-volt switchboard group light switch is accidentally turned on later.

c. SERVICE AND MAINTENANCE.

(1) Replace burned out light bulbs as necessary.

(2) To reach the bulb in the watertight fixture, unscrew the retainer ring and remove the ring, the metal gasket, the flanged rubber gasket, and the glass bowl.

(3) Replace the rubber gaskets when they show signs of excessive wear or deterioration.

(4) Locate troubles with the circuits by continuity test.

(5) The following spare parts should be carried on the boat:

(a) 5 percent of the light bulbs installed.

(b) 5 percent of the glass globes installed.

(c) 5 percent of the fixture parts installed, such as gaskets, retainer rings, and sockets.

2. EXTERIOR LIGHTING.

a. DESCRIPTION.

(1) Exterior lights are located and wired as shown in figure 139.

(2) Bridge and cockpit light fixtures are of the same watertight type used inside, with globe guards fastened to the retainer rings. (See figure 141.)

(3) A clear glass globe anchor light is mounted on the top of the mast. This is a standard marine fixture, giving a white light signal in all directions.

(4) Clear glass lens running lights are mounted on the forward and after edges of the crow's nest platform, and a colored glass lens running light is mounted on either outboard side of the bridge, forward of the gun barbettes, red on the port side, green on starboard. The white mast running lights have a 180-degree angle of vision and the colored side lights have a 90-degree angle. (See figure 142.)

(5) The anchor and running lights are wired through two switches (one for the anchor light and one for the running lights) to a fuse box in the pilot house. (See figure 143.) Current to the fuse box is controlled by a switch on the 110-volt switchboard marked "TELL-TALE PANEL." The fuse box in the pilot house is provided for quick servicing of these circuits.

b. OPERATION.

(1) Turn on the "TELL-TALE PANEL" switch on the 110-volt switchboard.

(2) Turn on the "RUNNING LIGHTS" switch in the pilot house when the boat is under way at night.

(3) Turn on the "ANCHOR LIGHT" switch in the pilot house when the boat is at anchor at night.

c. SERVICING AND MAINTENANCE.

(1) Keep the glass lenses clear and clean. Polish them daily and after each trip with a chamois and fresh water.

(2) Replace burned-out bulbs as necessary.

Figure 139 — LIGHT SYSTEM WIRING

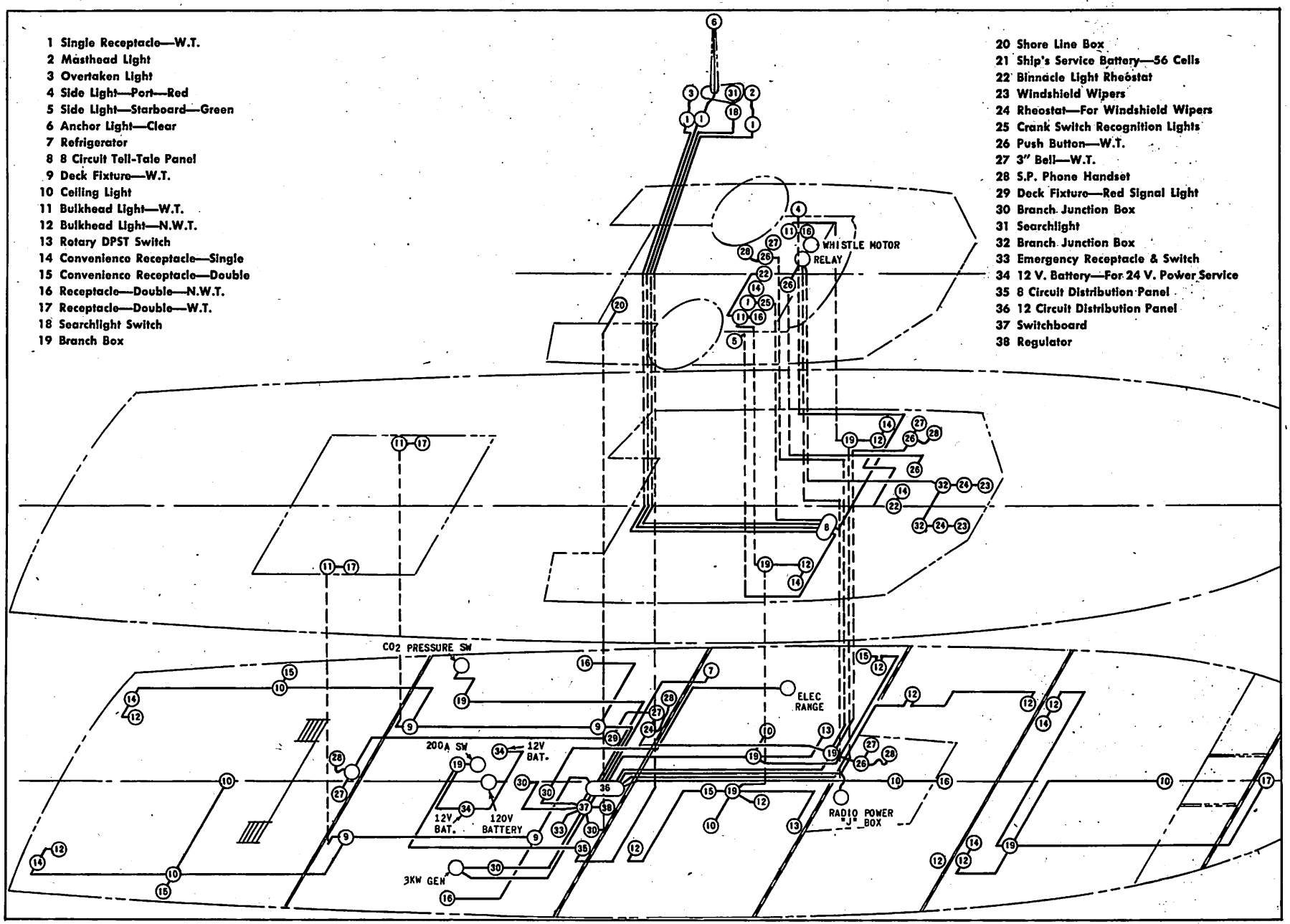




Figure 140—Interior Lighting Fixture with Globe Removed

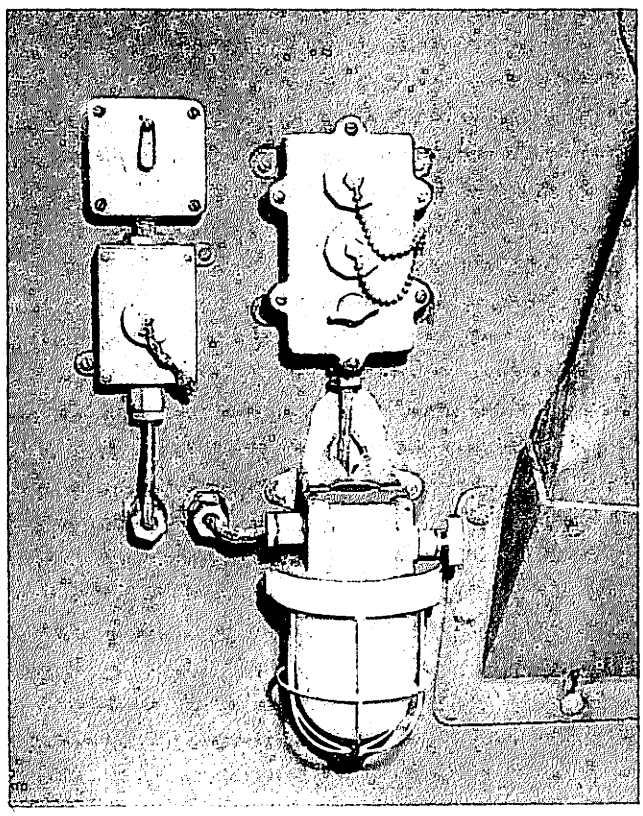


Figure 141—Bridge Deck Light Fixture

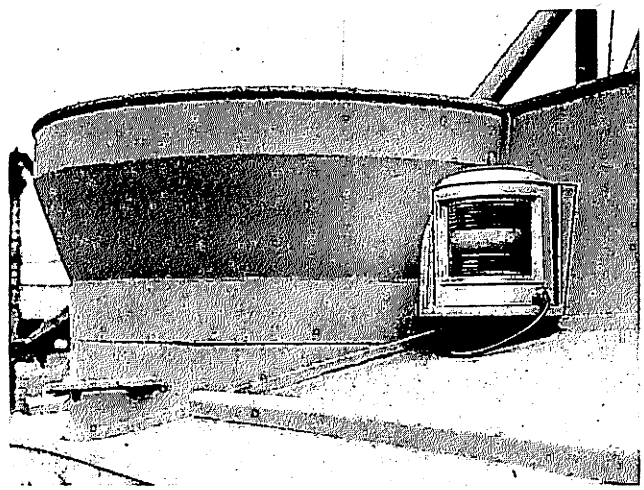


Figure 142—Starboard Running Light

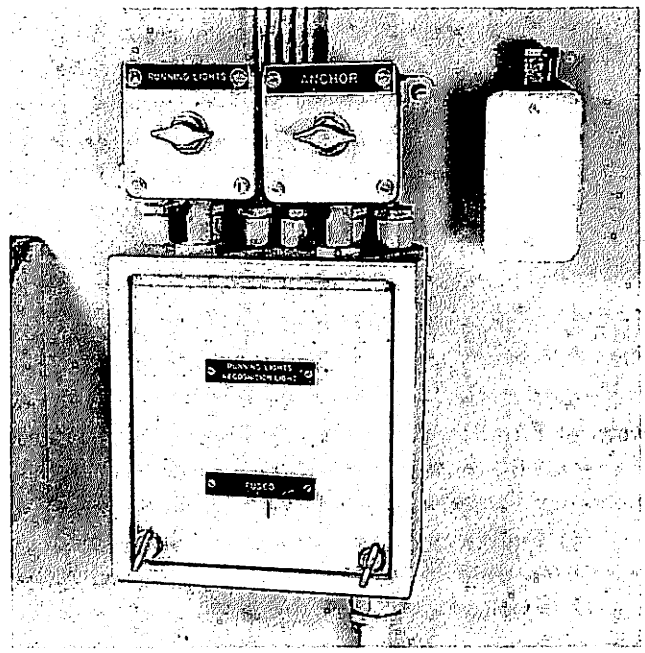


Figure 143—Running Lights and Anchor Light Switches and Fuse Box

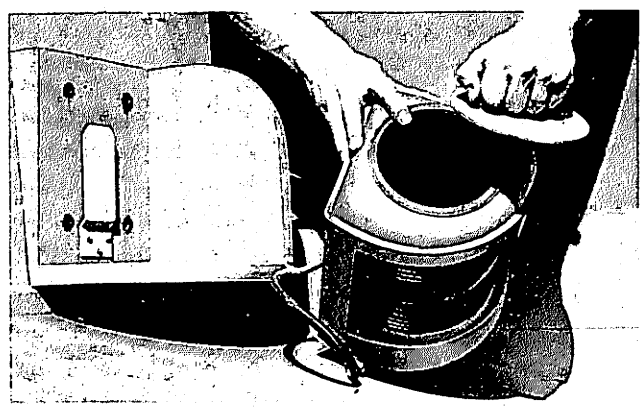


Figure 144—Access to Running Light Bulb

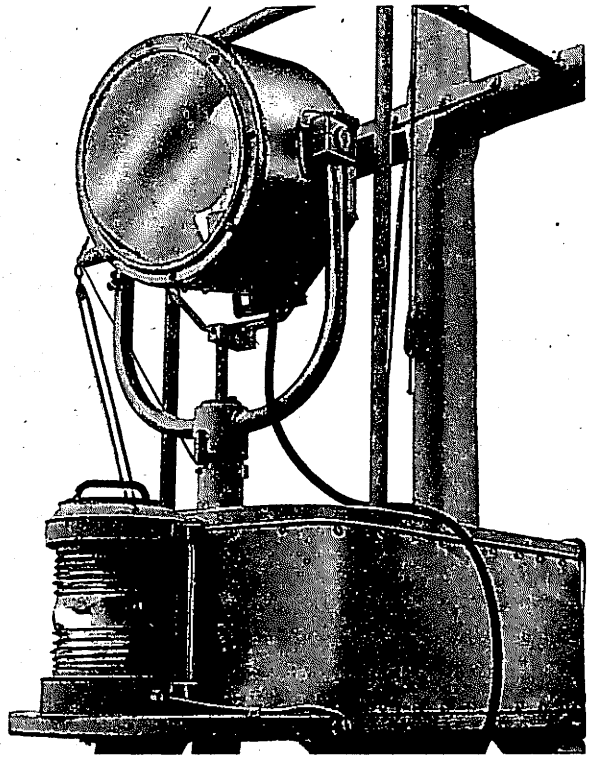


Figure 145—Searchlight Installation

(3) Access to the running light bulbs is made by removing the cover at the top of the fixture. (See figure 144.)

(4) Replace the cover gasket when it becomes worn or torn.

(5) The running lights may be lifted from their mountings for servicing. (See figure 144.)

(6) Replace blown fuses in the pilot house fuse box. Spare fuses should be carried in the pilot house.

(7) Locate troubles in the system by continuity test.

3. SEARCHLIGHT.

a. DESCRIPTION.—The searchlight (figure 145) is mounted on the crow's nest and connected to the 110-volt switchboard via a plug and receptacle on the underside of the crow's nest platform. The optical system consists of a spherical reflector, lamp, and parabolic mirror. The assembly is adjusted prior to installation for the lamps specified on the name plate.

b. OPERATION.—The searchlight is aimed by moving the control lever at the end of the shaft (figure 146) or with the handle at the rear door of the lamp housing. The light may be locked in any position by means of the vise handle (figure 145). The searchlight should be locked when not in use.

Note

Do not operate the searchlight in positions for which the lamp is unsuited. For example, T-bulbs and C-13 type of filament construction should be burned only within 25 degrees to base down. The voltage rating of the lamp should be the same as the circuit voltage; burning lamps at higher than rated voltage will increase the candle power values and decrease lamp life.

c. SERVICE, MAINTENANCE AND LUBRICATION.

(1) GENERAL.—Keep searchlight clean. Clean the mirror and both sides of the door glass at least once a week and more often if necessary. Keep the electrical connections tight. Blackened lamps should be removed before they burn out.

(2) ADJUSTMENT OF SPHERICAL REFLECTOR AND LAMP.—For best results the lamp and spherical reflector must be aligned first. The unlighted filament of the lamp and its inverted image in the spherical mirror is viewed from the rear door opening. Adjust by the following procedure:

(a) Raise or lower the lamp by loosening the proper screws on the support and adjust the lamp filament and its image until both are in line with the center of the spherical reflector.

(b) Move the lamp towards or away from the spherical reflector, until the filament and its image are approximately the same size. The reflection of the filament should also be slightly displaced to right or left of the filament itself.

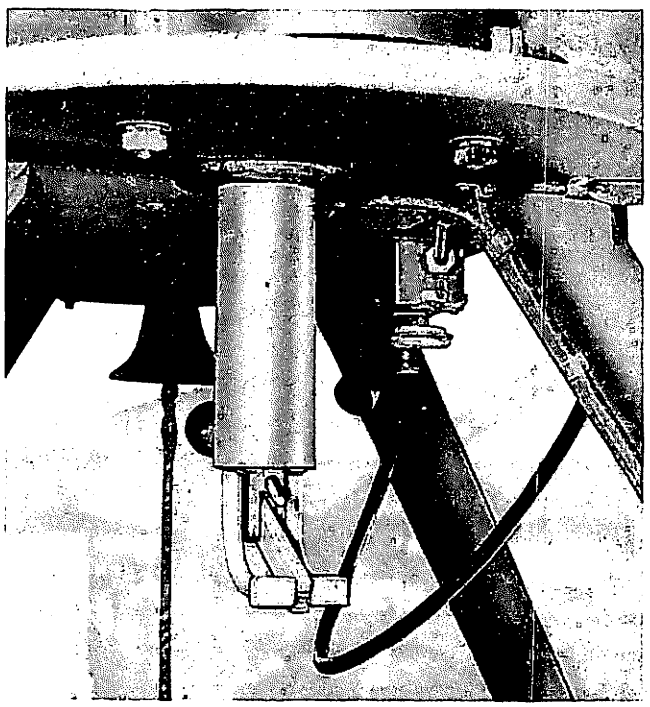


Figure 146—Searchlight Power Receptacle and Control Lever

(3) FOCUSING FOR MINIMUM BEAM SPREAD.—After adjusting the lamp in relation to the spherical reflector, it may be necessary to adjust the lamp and reflector assembly in relation to the parabolic mirror. To obtain maximum candlepower values, the lamp filament must be at or near the focal point of the parabolic mirror. When this adjustment is made properly the beam spread is at minimum. To make this adjustment proceed as follows:

(a) Clamp the rear door securely in place.

(b) Light the lamp and observe beam pattern on any convenient vertical surface at 100 feet or more away.

(c) Loosen the four screws which hold the socket support carriage to the drum.

(d) Insert a screw driver in the hole of the drum underneath the support carriage, and move the entire lamp and reflector assembly towards or away from the mirror until the beam diameter appears at a minimum.

(e) When the beam is properly focused, the secondary beam formation from the spherical mirror should appear approximately the same size as the main beam and should be superimposed on the main beam. If the secondary beam formation can be seen to the side, above, or below the main beam, then it will be necessary to realign the lamp and spherical reflector again.

(f) Retighten the four holding screws and in so doing make sure that the beam pattern does not change.

(g) Monoplane or biplane type of filaments should all be oriented so that the plane of the filament always is parallel to the mirror opening. Bipost or prefocus sockets are arranged for the proper orientation of the filament. With screw base lamps, a plate is provided underneath the socket by means of which the socket and lamp can be rotated to make the orientation when a new lamp is installed in the searchlight.

(4) LUBRICATION.—All moving parts should be lubricated once a month or oftener depending on the severity of service. All of the mountings are grease lubricated. Fittings are provided where required. Use a light grease or any grease which will meet Navy Specification 14G1.

d. INSTALLATION.—Should replacement of the entire assembly become necessary, proceed as follows:

(1) Remove lever screw, vise handle, lock wedges, control handle, and three fulcrum bracket screws.

(2) Slide pipe and deck plate assembly off trunnion bracket.

(3) Assemble pipe and deck plate through hole in roof or deck. Use suitable calking compound between deck plate and roof mounting plate, and bolt in place. Locate the clamp lever so that it will be in the least-used portion of the searchlight travel. Lower the searchlight trunnion bracket control stem through pipe and deck plate assembly.

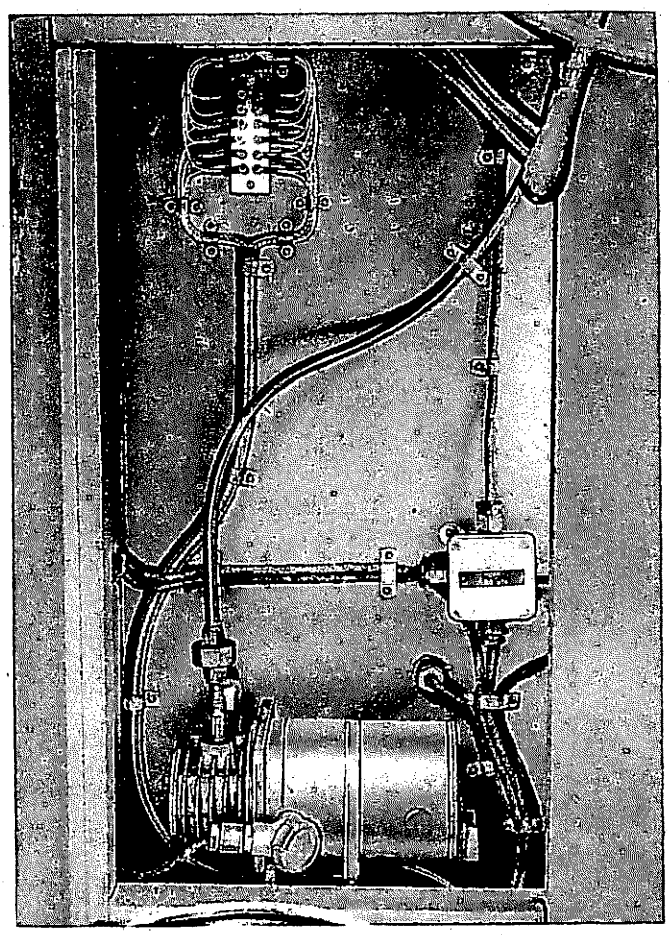


Figure 147—Horn Motor and Compressor Unit

(4) Replace fulcrum bracket, lock wedges, vise handle, and control handle.

4. HORN.

a. DESCRIPTION.

(1) The horn assembly comprises a ¾ HP continuous rating universal-type motor directly driving a rotary vane type air compressor. (See figure 147.) The horn is connected by a short length of pipe. (See figure 148.) The blast promptly follows the operation of the motor.

(2) The horn is mounted on the pilot house roof. The compressor unit is fastened to the floor of the bridge, accessible through a panel behind the steering wheel.

(3) There are two buttons for operating the horn, one on the bridge and one in the pilot house. Voltage is supplied by the 110-volt electrical system and controlled by the "HORN" switch on the 110-volt switchboard.

b. OPERATION.

(1) Turn on the "HORN" switch on the 110-volt switchboard in the engine room.

(2) Push the horn button on the bridge on in the pilot house as necessary.

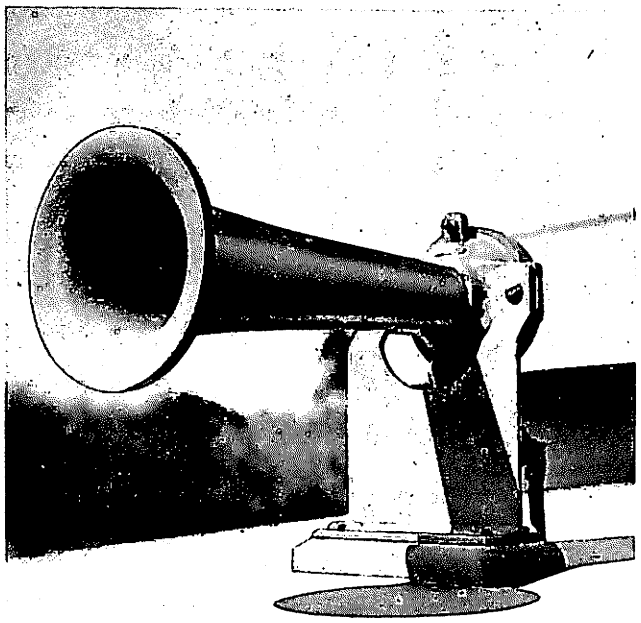


Figure 148—Horn



Figure 149—Removing Horn Diaphragm

(3) If one push button fails, remember that there are two which operate independently.

(4) Always carry a mouth horn in the bridge locker for use in case of a failure in the horn.

c. SERVICE AND MAINTENANCE.

(1) Keep the visible oil reservoir on the compressor unit filled with light oil.

(2) Adjust the tone of the horn when necessary. Loosen the lock nut and adjusting screw at the back of the horn and turn the diaphragm housing inwards or outwards until the desired tone is achieved. Lock the diaphragm housing in position with the adjusting screw and lock nut.

(3) The button points may fuse together because of the high amperage flowing through them when they are held together too long. In such a case, either open the horn switch on the 110-volt switchboard and use the emergency horn, or remove the switch cover and pry the points apart, and then use the other horn button. The fused horn button must be replaced.

(4) Sea water and spray blowing into the horn may eventually corrode the diaphragm and stop the horn from operating. In such cases, remove the diaphragm housing and the diaphragm. (See figure 149.) Clean or replace the diaphragm.

5. INTERCOMMUNICATION SYSTEM.

a. DESCRIPTION.

(1) Communication between various compartments of the boat is provided by a system of electric call bells and sound powered telephones.

(2) The connections of the system are as follows:

	Bridge	*Pilot House*	*Engine Room*	*Radio Room*	*Dispensary*
Bridge		x	x	x	x
Pilot House	x		x	x	x
Engine Room	x	x			
Radio Room	x	x			
Dispensary	x	x			

(3) At each intercommunication station the following are provided: a call bell, buttons for bells in the other compartments, a telephone socket, and a telephone and a telephone rest. (See figures 150, 151, and 152.)

(4) Power for the call bells is provided by the 110-volt electrical system and is controlled by the "CALL BELL" switch on the 110-volt switchboard.

b. OPERATION.

(1) Turn on the "CALL BELL" switch on the 110-volt switchboard.

(2) Plug the telephone wire into the telephone socket.

(3) Push the button to ring the bell in the desired compartment.

c. SERVICE AND MAINTENANCE.

(1) Stow the bridge telephone in the bridge locker when it is not in use and screw the watertight cap on the telephone socket.

(2) Locate troubles in the call bell or telephone system by continuity test.

(3) The telephones are interchangeable with each other so that an unused telephone can be substituted for a damaged one in an emergency.

(4) One complete spare bell and spare parts for telephones should be carried on board.

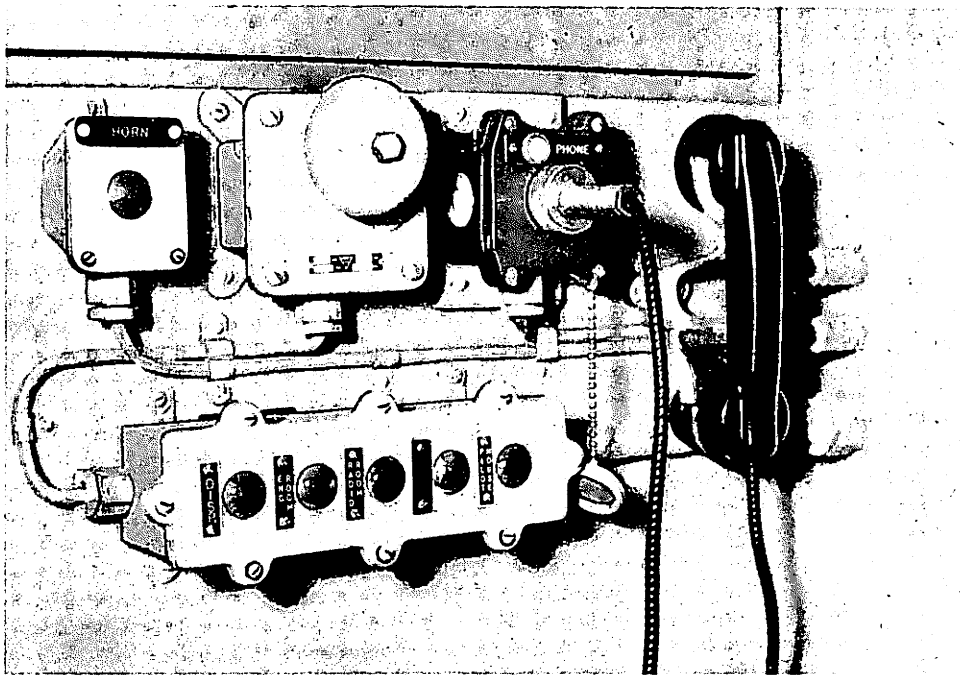


Figure 150—Bridge Intercommunication Station

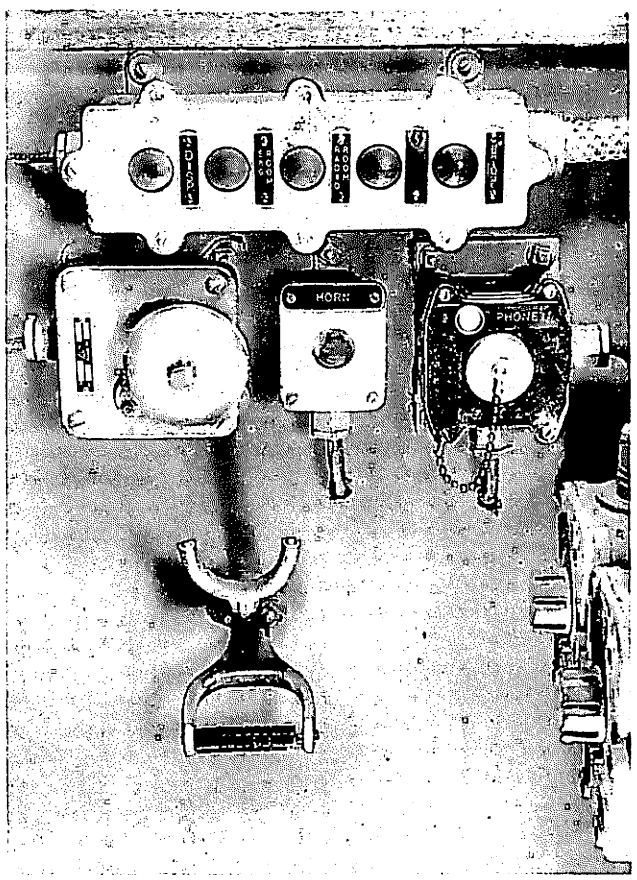


Figure 151—Pilot House Intercommunication Station with the Telephone Disconnected

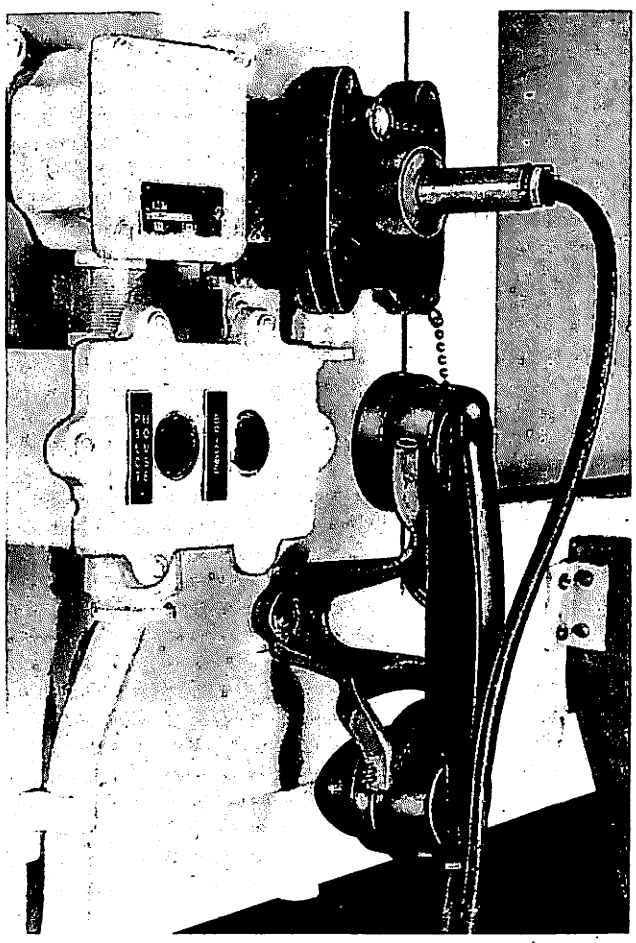


Figure 152—Dispensary Intercommunication Station

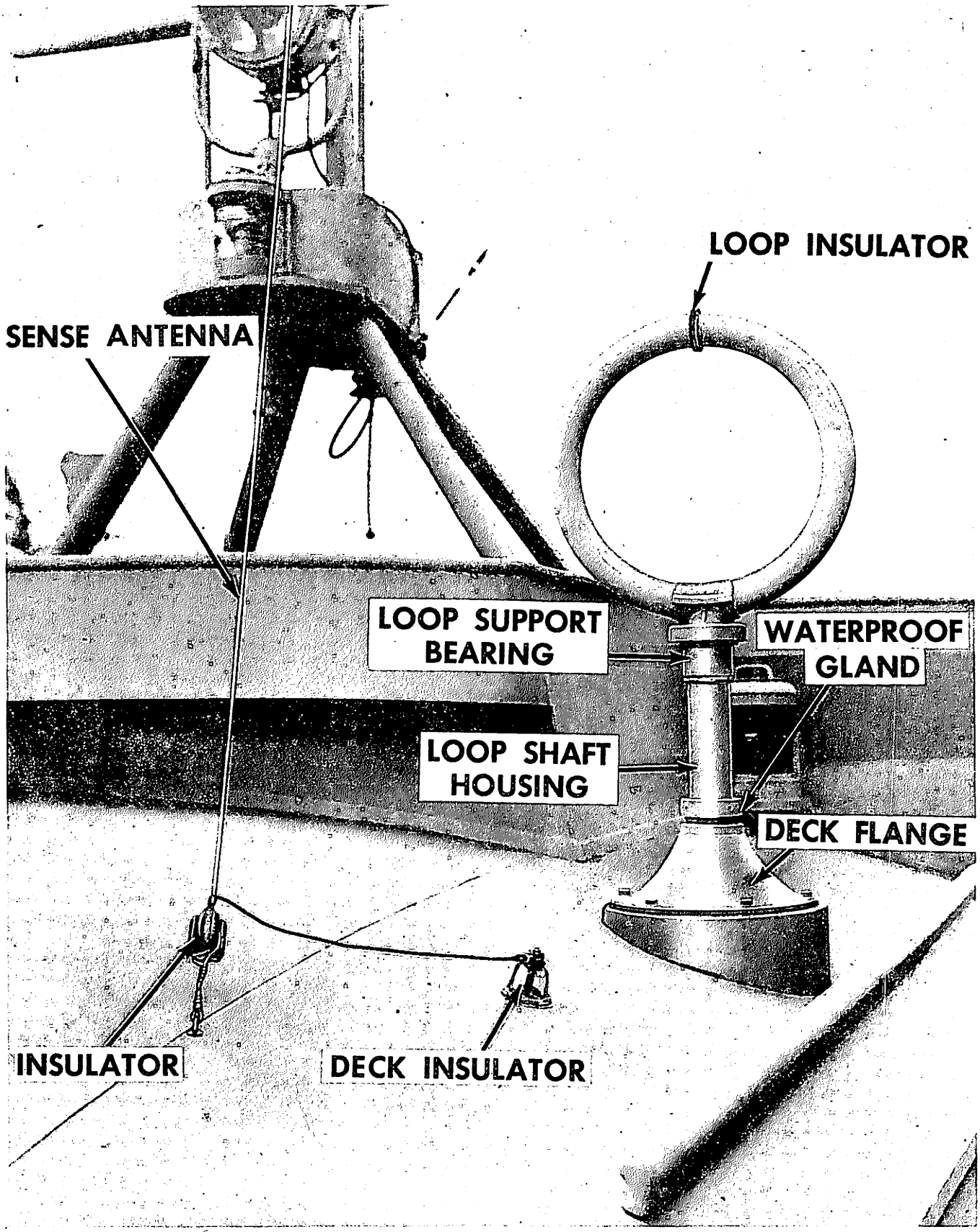
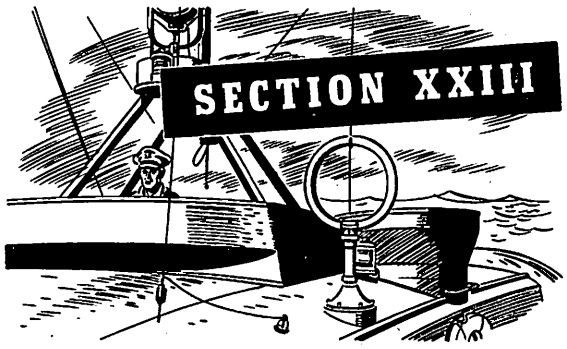


Figure 153—Above-Deck View of Direction Finder Installation



Direction Finder

1. DESCRIPTION.

a. GENERAL. — The direction finder, Bludworth model DF-1016, furnished as standard equipment, comprises the following items:

(1) A directional loop.

(2) A sense antenna (figure 153), of the conventional cable type, connected to the instrument through a deck insulator.

(3) A sensitive radio receiver or tuner which operates in the 1000-meter or 300-kilocycle radio beacon band. (See figures 154 and 155.)

(4) An index or pointer coupled to the loop.

(5) A mechanical compensator.

(6) A dummy compass card.

(7) A pair of sensitive telephone receivers for identifying signals and determining the null position of loop rotation.

(8) A separate 6-volt storage battery for current supply. (See figure 157.) An automatic battery charging circuit is connected to the 110-volt switchboard.

b. DIRECTIONAL LOOP. — The directional loop (figure 153) is circular and enclosed in a seamless copper shield of 18-inch outside diameter and 2-inch cross section. The loop rests on a bronze deck flange and is supported by a roller bearing. The loop is continuously rotatable about its vertical axis by means of a handwheel. A locking clamp or brake (figures 154 and 156) on the handwheel provides a smooth even drag and locks the loop shaft at any desired position with no backlash. Loop leads, completely shielded, terminate directly at the receiver, and are connected to the receiver through silver collector rings and contact brushes.

c. CONSTANT POINTER AND DUMMY COMPASS CARD.—A constant pointer is attached to the

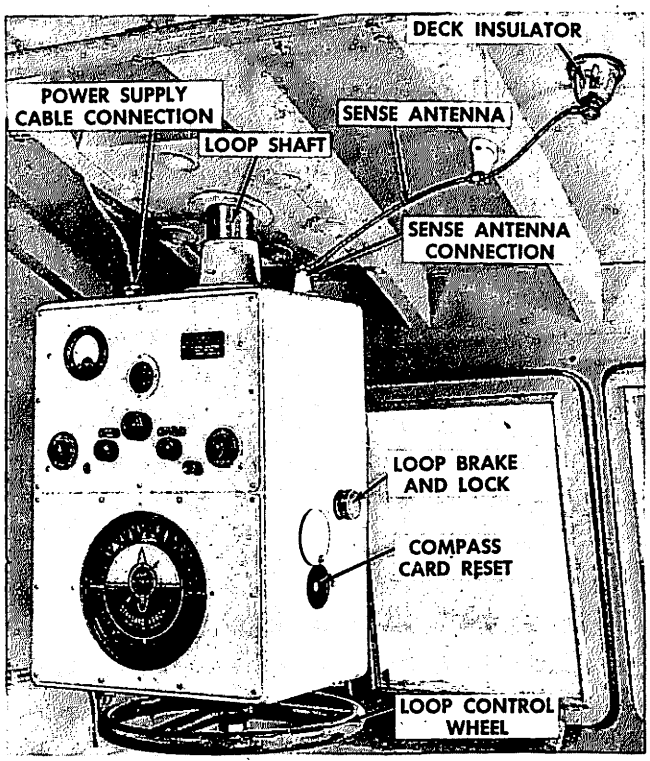


Figure 154—Tuner Case and Connections

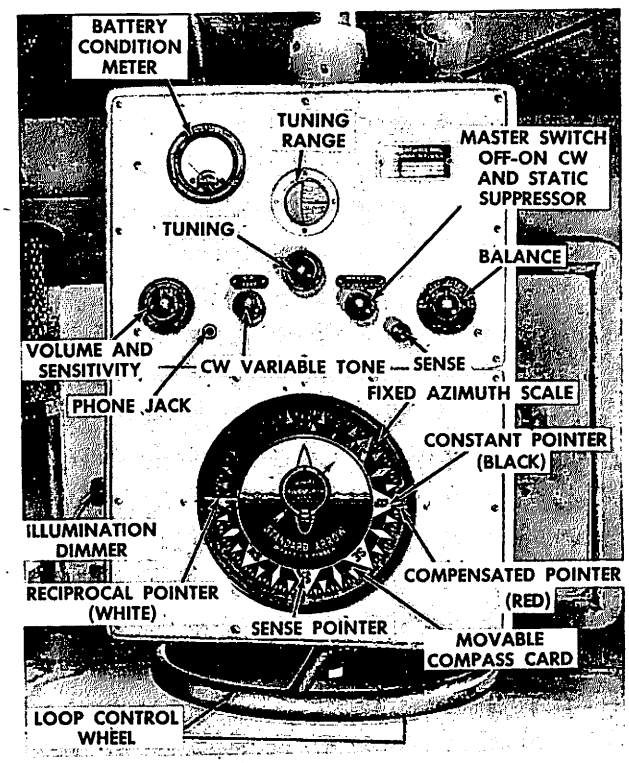


Figure 155—Front View of Tuner Case

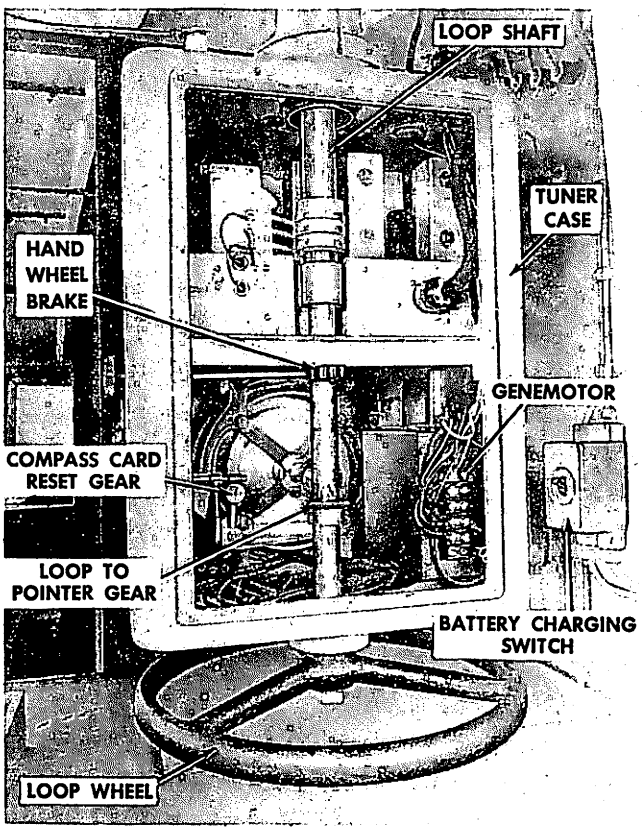


Figure 156—Rear View of Interior of Tuner Case

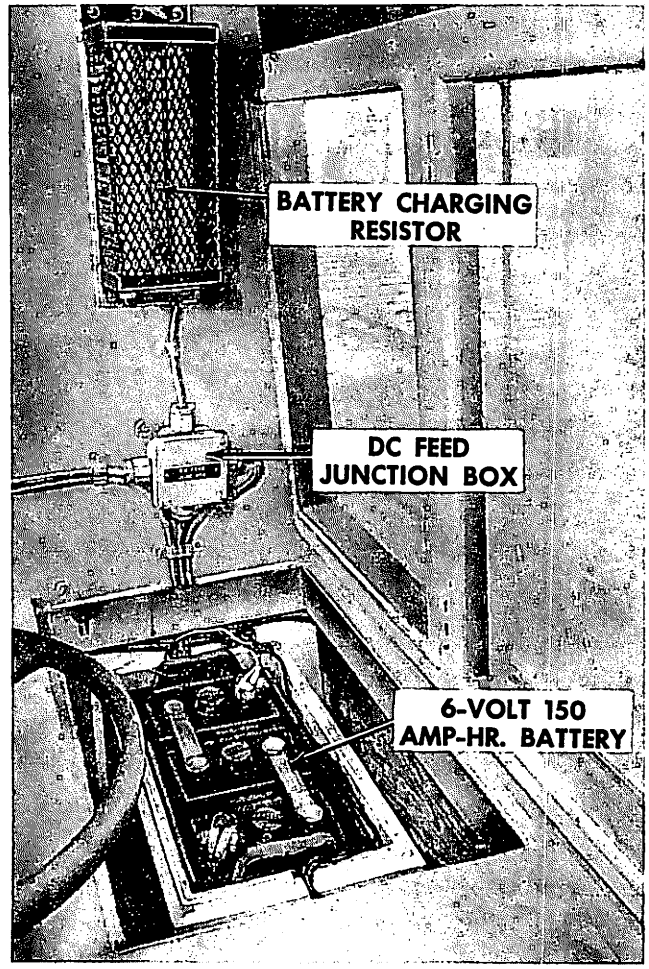


Figure 157—Battery and Battery Charging Resistor for Direction Finder

loop shaft at right angles to the plane of the loop. The loop is so mounted that the pointer swings over an etched dummy compass card. The compass card is rotated within a ring on which the lubber's lines are marked, directly providing a magnetic or gyro meridian and course reference.

d. COMPENSATED POINTER. — A compensated pointer is linked to the constant pointer by means of a mechanical compensator consisting of levers, a roller, and a circular band which can be distorted by means of adjusting screws. The linkage is such that as the loop rotates, the compensator automatically adds or subtracts predetermined corrections. When the band is properly adjusted, the compensated pointer exactly follows the correction curve pattern throughout 360-degree rotation and indicates the true bearing at every fractional degree of rotation.

e. RADIO RECEIVER OR TUNER. —The tuner (figure 155) is enclosed in a case which excludes the electric component of the radio waves and allows the instrument to respond only to the more dependable magnetic component. The tuner is a superheterodyne, balanced type, with constant alignment, and has a range from 280 to 520 kilocycles. The tuning dial is directly calibrated in kilocycles accurate to ± 1 kilocycle. The beacon sector of the band is etched on the red background of the tuning dial. The tuner also contains a CW oscillator with variable beat frequency or tone control, a built-in static suppressor eliminating interference above and below the modulation frequency of the beacons, a battery voltmeter, and nine tubes: one VR-105-30, four 6SK7, one 6SJ7, one 6SA7, and two 6C5. The null is within ± 1 degree 80 miles from a 200-watt beacon.

f. SENSE.—A cable-type sense antenna (figure 153) is connected to the tuner through a deck insulator. By means of this antenna, the operator can balance out unwanted signals and determine the true direction of transmitting stations. The sense indicator is the large red arrow on the dial at right angles to the compensated pointer.

g. BATTERY AND BATTERY CHARGER.—Current is supplied to the genemotor in the instrument case from a 6-volt storage battery in a lead-lined box. (See figure 157.) Charging current to the battery is supplied from the 110-volt switchboard via a snap switch, shielded cables, and a resistor.

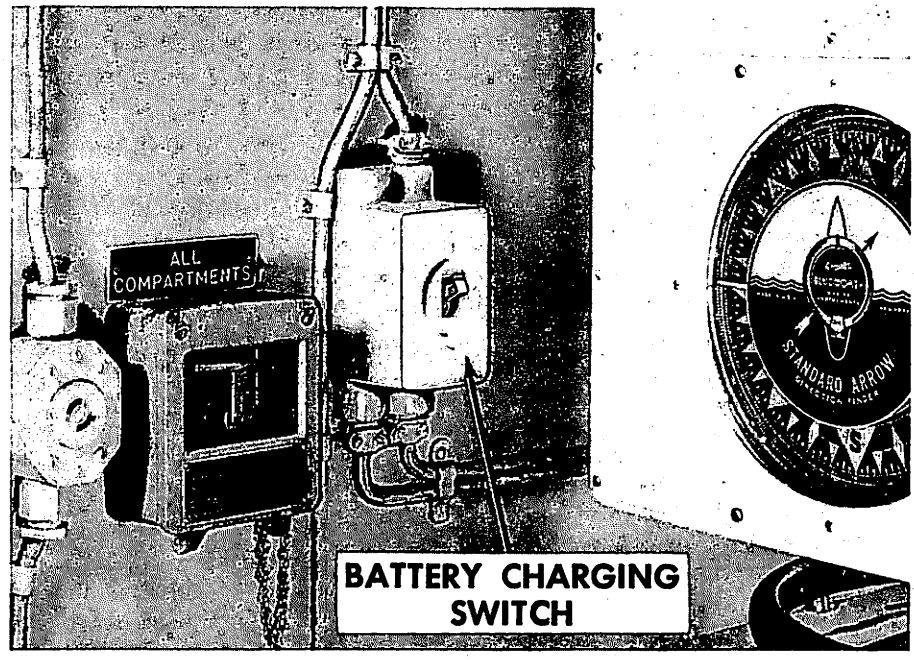


Figure 158—Battery Charging Switch

2. OPERATION INSTRUCTIONS.

a. GENERAL.—Once the radio beacon is tuned in and proper volume established, rotate the loop until a sharp null is obtained. Note the position of the compensated pointer, depress the sense button, rotate the loop to the position at which signal strength is greatest. The sense pointer will then show the quadrant in which the true bearing will be found. Then obtain a null with the compensated pointer on the true bearing of the beacon in the quadrant indicated by the sense observation.

b. STARTING PROCEDURE.

(1) See that the battery charging switch (figure 158) is in the "OFF" position.

(2) Turn the master switch to the "ON" position. (See figure 155.)

(3) Note the meter indicating the battery voltage.

(4) Plug in the headphones.

(5) Adjust the tuning control to the beacon signal desired. If the signals are weak, turn the master switch to "CW" position and adjust "CW TONE" control to a moderately high pitch. If static interferes, turn the master switch to static suppressor ("SUP") position to improve reception.

(6) Set the balance control to zero.

c. USE OF SENSE POINTER.

(1) When the beacon signal is tuned in, rotate the loop control wheel slowly until the signal diminishes to minimum volume.

(2) Note position of the indicating pointer with respect to the compass card or fixed azimuth ring.

(3) Depress the sense button and hold in this position while the loop control wheel is being rotated to place the sense pointer in the former position of the indicating pointer.

(4) Note the beacon signal strength and rotate the sense pointer 180 degrees. If the strongest signal is noted in the first position of the sense pointer, the true bearing is in that quadrant. If the strongest signal is noted in the second position of the sense pointer (180 degrees from the first), the true bearing is in that quadrant.

CAUTION

This observation does not indicate a true bearing, but is essential to determining the direction toward which the final bearing is observed.

d. DETERMINING FINAL BEARING.

(1) When the sense observation has been made, rotate the loop control wheel to place the compensated pointer in the quadrant indicated.

(2) Observe the minimum signal volume.

(3) Carefully adjust the balance control (figure 155) to the right or left of zero while finely adjusting the indicating pointer to obtain a sharp null or complete diminishing of the signal.

(4) When the sharpest null has been observed, read the compensated pointer on the compass card or azimuth ring for true or relative bearing to the radio beacon used.

3. TROUBLE SHOOTING.

TROUBLE	*PROBABLE CAUSE*	*REMEDY*
NO VOLTAGE ON VOLT-METER	Dead battery. Poor contacts on switch or relay.	Charge or replace. Clean switch or relay contacts.
LOW VOLTAGE ON METER	Low battery. Genemotor shorted. Poor connections on batteries or in wiring.	Charge battery. If genemotor is shorted, it will run slowly. Take red lead off genemotor and see if it still runs slow. If so replace filter or genemotor. Check connections.
NO NULL	Sense antenna grounded or not in circuit. Balance control inoperative. Chassis brushes not making good contact with collector rings.	Look for poor contacts in lead-in insulator. Put balance control at "0" position. Check brush contacts.
NULL TOO WIDE	Defective or weak tubes. Sense antenna too long. Chassis has low sensitivity.	Check all tubes, or replace with spares. Shorten sense antenna by cutting jumper on antenna series condenser. Remove chassis and check sensitivity.
NO SIGNAL EVEN THOUGH BATTERY VOLTAGE IS NORMAL	Output transformer phones may be open.	Replace output transformer or phones.

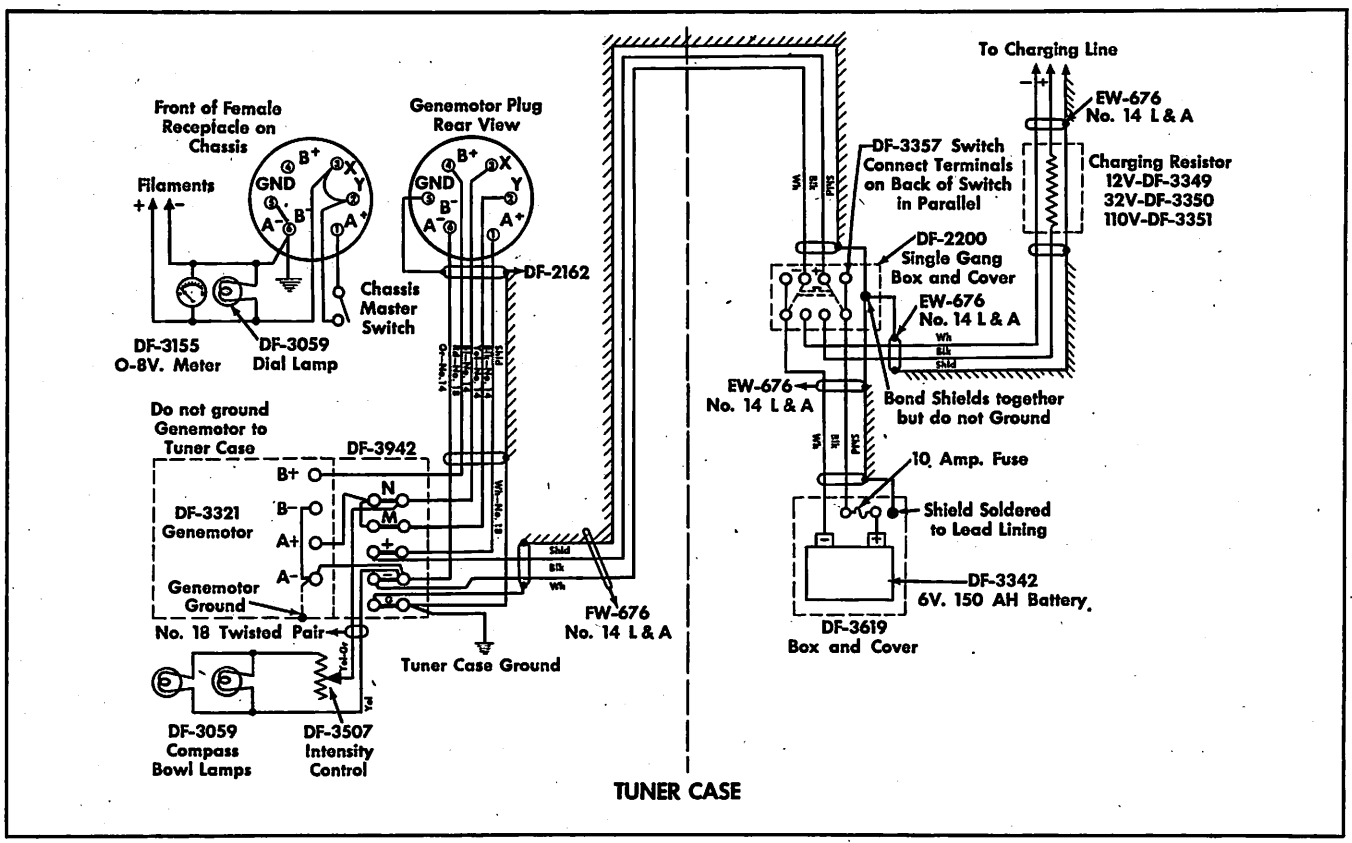
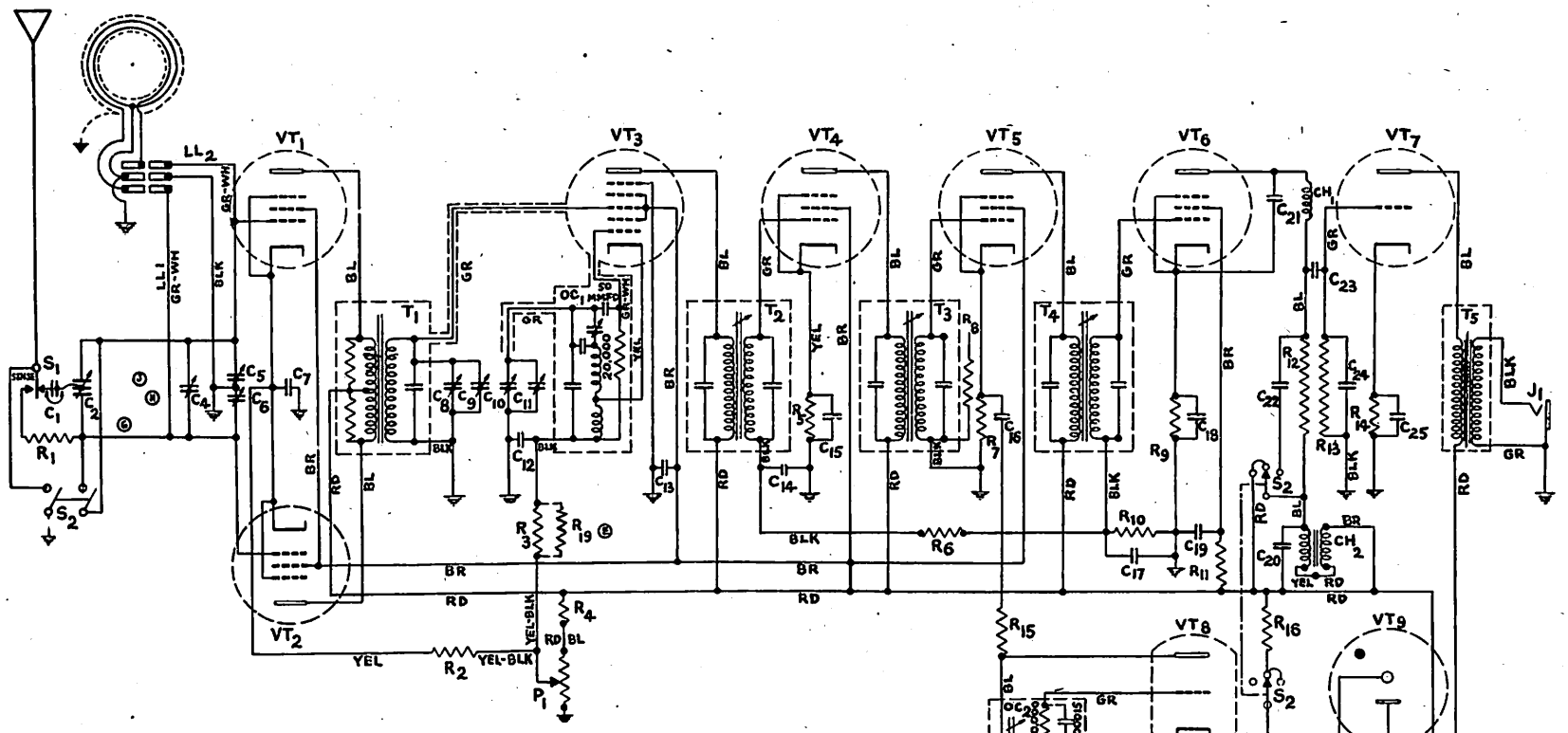


Figure 159—Direction Finder Installation Wiring Diagram



SCHEDULE

DESIGNATION	PART No.	APPARATUS	DESIGNATION	PART No	APPARATUS
C1	DF-3075	CAPACITOR 10-70 MMFD VARIABLE	R1-7-9	DF-3121	RESISTOR 25,000 ½ WATT BT½
C2	DF-3888	" 16.5/16.5 MMFD BALANCE	R2	DF-3116	" 300 " "
			R3-14	DF-3118	" 1,000 " "
C4	DF-3196	" MIN. CAP. 13 MMF. MAX. CAP. 75 MMF.	R4	DF-3124	" 35,000 1 WATT BT-1
C5-6-8-9-10-11	DF-3885	" 4 GANG TUNING	R5	DF-3885	" 15,000 ½ WATT BT½
C7-12-13	DF-3097	" 0.1 MFD. (THREE IN ONE CAN)	R6-8-11-12-13	DF-3125	" 250,000 " "
C14-15-17	"	" " " " " "	R10-5	DF-3127	" 2 MEG. " "
C16	DF-3896	" .000005 MFD "	R16	DF-3123	" 75,000 " "
C18-25	DF-3088	" 1.0 "	R17	DF-3119	" 10,000 " "
C19-22-26	DF-3086	" .08 "	R18	DF-4023	" 2,000 10 WATT AB
C20	DF-3967	" .0043 "	T1	DF-3956	TRANSFORMER R.F. PLATES
C21	DF-3091	" .0005 "	T2	DF-3975	TRANSFORMER I.F. 115 K.C.
C23-28	DF-3087	" .01 "	T3	DF-3976	" I.F. " "
C24	DF-3093	" .001 "	T4	DF-3102	" I.F. " "
C27	DF-3099	" .000035 " VAR.	T5	DF-3779	" AUDIO OUTPUT
C29	DF-3089	" .03	OC1	DF-3958	OSCILLATOR COIL R.F.
			OC2	DF-3103	OSCILLATOR COIL C.W.
			P1	DF-3991	VOLUME CONTROL, TAPERED 3,000
VT1-2-4-5	DF-3128	TUBE 6SK7	CH1	DF-3106	CHOKE COIL 15mh
VT3	DF-3884	" 6SA7	CH2	DF-3139	FILTER " (SUPPRESSOR)
VT6	DF-3132	" 6SJ7	LP1	DF-3059	LAMP No. 47 MAZDA
VT7-8	DF-3131	" 6C5	M1	DF-3155	VOLTMETER 0-8 V.
VT9	DF-3897	" VR-105-30			
			PS1	DF-3941	POWER SOCKET
S1	DF-3889	SWITCH SPDT TOGGLE, SENSE	J1	DF-3107	TELEPHONE JACK
S2	DF-3898	" MASTER	R19	DF-4047	RESISTOR 2,500 ½ WATT BT-½

Figure 160—Direction Finder Circuit Wiring Diagram

Note

Various other troubles may be encountered such as open or shorted resistances and condensers in various circuits. For all electrical work follow the installation diagram (figure 159) and the circuit diagram (figure 160).

4. SERVICE, INSPECTION, AND MAINTENANCE.

a. BATTERY MAINTENANCE.—Check the liquid level of the storage battery at least once a week. Replenish as necessary with distilled water only, keeping the level above the battery plates. The battery charging switch (figure 158) should be placed in the "ON" position for about 3 hours in each 24 hours during which the direction finder has been used intermittently. During periods of more frequent operation more charging time is necessary.

CAUTION

When any change is made in the 110-volt batteries or generator, great care should be exercised to maintain proper polarity of the direction finder connections. (See figures 159 and 160.) A reversal of polarity will ruin the batteries and the genemotor and render the direction finder inoperative.

b. CARE OF LOOP.—The loop should be kept painted at all times with one coat of silver enamel, one coat of clear lacquer, and a coat of sea blue boat paint. Clear lacquer only should be applied to the black ring at the top of the loop.

5. CALIBRATION PROCEDURE.

a. PREPARATION.

(1) For the calibration of the direction finder, place a sight pelorus on top of the pilot house or on the bridge with its lubber's lines lined up exactly with the keel of the boat. The distance between the boat and the beacon should be as great as possible to reduce the parallax introduced by the separation of the direction finder loop from the pelorus. Keep all persons, including the sight pelorus observer, well away (6 feet or more) from the loop while calibrating. Do not attempt calibration in rough weather. The vessel must be held steady on some headings for ½ minute or more to permit an accurate check between the direction finder and the sight bearings.

(2) Two experienced observers and a checker are required to do a good job with the least delay. The sight pelorus observer directs the helmsman as the ship is swung and signals with a whistle or by singing out "mark" the instant the beacon bears true, on each consecutively, 0, 10, 20, 30 degrees, etc. At the same instant the direction finder observer reads and calls out his bearings to the checker, as 12, 24, 36 degrees, or whatever they may be. The checker records both in two or four parallel columns of the calibration sheet, and in the third column makes entry of the difference between the pelorus and the direction finder bearings. Values of the fourth column cannot be determined until the curve is plotted on cross section paper. A sample work sheet is shown in figure 161.

Col 1	Col 2	Col 3	Col 4
True Bearing	DF Bearing	Deviation	Correction
0	0	0	0
10	12	−2	−1.7
20	24	−4	−3.3
30	35.5	−5.5	−4.8
40	46	−6	−5.8

Figure 161—Sample Work Sheet

b. LINE UP LUBBER'S LINE.—When in a position to maneuver the vessel, the helmsman should be directed to head for the beacon at idling speed and change his course slightly to the right or left as directed by the observer at the sight pelorus until the beacon bears dead ahead. At the same time the direction finder observer should take a simultaneous radio bearing. Sight pelorus and direction finder bearings must be made to agree on dead ahead or zero degrees heading. This may require adjusting the direction finder constant pointer, or the mechanical compensator, or both.

c. FIX SENSE.—The next operation is to orient or fix the sense of the direction finder. The large red pointer, at right angles to the constant pointer, is the sense indicator. To test the sense, reduce the volume, press the sense button down, and turn the loop so that the sense arrow points to the beacon. Now observe the volume in the headphones, then quickly rotate the loop exactly 180 degrees. The volume should be louder when the sense pointer points toward the beacon. If it is not, set the constant pointer on zero (dead ahead), lock the loop, loosen the pointer head, and rotate the pointer 180 degrees. Recheck the sense and then proceed with the calibration.

d. SWING THE SHIP.

(1) Set the dummy compass dead on zero. Then start the vessel swinging very slowly. The beacon will bear consecutively, 10, 20, 30, 40 degrees, etc, through 360 degrees. Check the radio bearing simultaneously on each 10-degree change of heading and note the deviation, if any. Be sure to establish a good, clean null every 10-degree swing of the ship.

(2) Extreme caution is required in noting and setting down the observed bearings and differences. It is the best practice to use a ruled sheet of four columns. (See figure 161.) In the first column are set down the true bearings in degrees as 0, 10, 20, 30, 40, etc., through 350. The true bearings may be written in before starting the calibration, and as the work progresses the radio direction finder observer, or checker, simply writes his

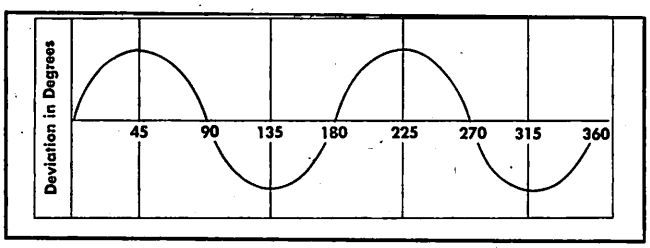


Figure 162—Typical Direction Finder Deviation Curve

bearings in the second column, headed "Direction Finder Reading." The third column is marked "Deviation" and when the work of swinging the ship is completed, the difference between the direction finder bearing and the sight pelorus bearing is set down in this column as +5, −4, etc. For example, on the 40-degree heading, if the radio direction finder bearing is 35 degrees, the deviation is +5. If on the 130-degree heading the direction finder bearing is 137 degrees, the deviation is −7. The value in the "Deviation" column must always be that number which, added to or subtracted from the direction finder bearing, increases or reduces it to the true bearing.

e. PLOT CORRECTION CURVE.—In general, the bearing indicated by the direction finder is less than the true (sight bearing) in the starboard bow quadrant, and greater than the true bearing in the starboard quarter quadrant. When plotted on cross-section paper, the plotting points will follow the general form of sine curve shown in figure 162. The correction curve should be plotted on cross-section paper, similar to that shown in figure 163, with 10 lines to the inch, every tenth being a heavy line. The sheet should not be smaller than 15 x 20 inches. Prepare the curve as follows:

(1) Name the center, horizontal line zero. (See A, figure 163.)

(2) Name seven heavy horizontal lines above the zero line +1, +2, +3, +4, +5, +6, +7. (See B, figure 163.)

(3) Name seven horizontal lines below the zero line −1, −2, −3, −4, −5, −6, −7. (See C, figure 163.) Vertically, above and below the zero line, each small square will be one-tenth of 1 degree of deviation.

Note

If deviation is greater than ±7 degrees, adjust the scale to bring the curve within desired limits.

(4) Name 36 vertical lines (left to right) 0, 10, 20, 30, 40 degrees, etc, through 350 degrees so that each small square across the sheet represents a 1-degree angle of departure from the line of the ship's keel, 20 degrees to the inch.

(5) Plot the points for the correction curve from the figures in columns 2 (Direction Finder Reading) and 3 (Deviation) of the work sheet (figure 161). Place the point on the vertical line which corresponds to the direction finder reading and on the horizontal line which corresponds to the deviation. The sample correction chart (figure 163) shows 3 points plotted from the work sheet.

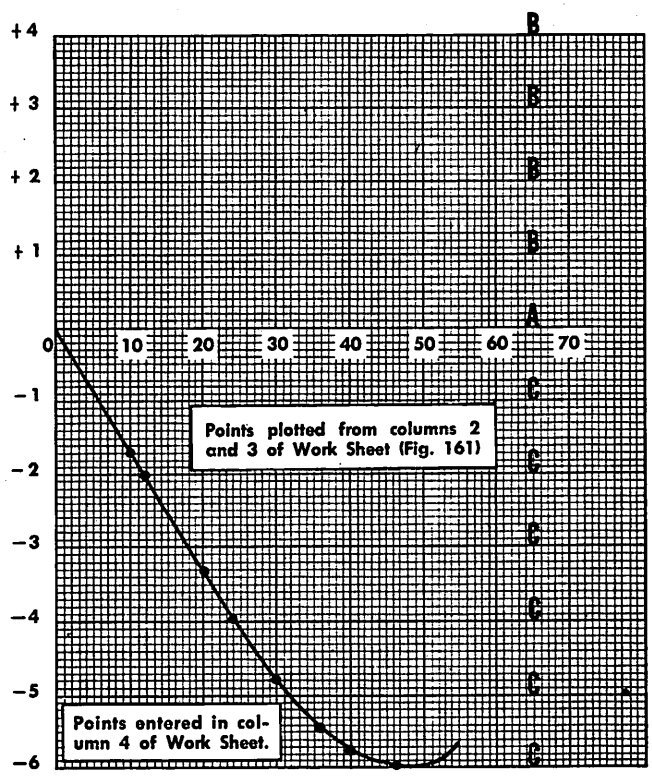


Figure 163—Correction Curve Chart

(6) Draw a smooth curve through all the spotted points. The shape of the curve should rise until 45-degree keel angle, or broad on the starboard bow, is reached and then should fall gradually to zero at or near 90 degrees, or the starboard beam, etc.

f. DETERMINE CORRECTIONS FROM CURVE.—Follow each vertical keel angle line (10, 20, 30, 40 degrees, etc) upward or downward until it crosses the curve. The name of the intersecting horizontal deviation line will be the value of the correction for each 10-degree heading, or keel angle. Values for these corrections should be entered in the fourth column of the work sheet.

g. ADJUST THE MECHANICAL COMPENSATOR. *(See figure 164.)*—The compensating mechanism consists of a system of levers and a roller in contact with one face of an unbroken adjustable soft brass band. Distortion of the band (by means of 36 adjusting screws at 10-degree intervals around its circumference) causes the roller to move in such a way that the compensated pointer leads or lags behind the constant pointer. The adjusting screws are accessible from the front face of the compass card after the compass glass and holder have been removed. Prior to calibration as described in

paragraph 5, the zero position of the constant pointer is established by locking the loop in dead-ahead position and setting the constant pointer on zero. The compensated pointer should also read zero. Proceed as follows:

(1) Turn the loop so that the constant pointer is on 10 degrees and lock it.

(2) Turn the adjusting screw so that the compensated pointer indicates the corrected bearing. Turning the screw clockwise causes the compensated pointer to lead (add the correction) the constant pointer; counterclockwise turning causes it to lag (subtract the correction).

CAUTION

Do not turn any adjusting screw more than two-fifths of a turn at any one time. If this is insufficient, proceed with partial adjustments at 10-degree intervals completely around the compass card; then, start again at the 10-degree position and make another series of adjustments. Use only the special screw driver provided and do not move the constant pointer while the screw driver is in position.

(3) Having made partial or complete adjustment at the 10-degree position, proceed with adjustments at the other positions and make as many complete circuits as necessary. Be positive that the black pointer is exactly on the radian of the screw through which you are applying correction, and that it does not drift while the screw is being adjusted. Do not allow yourself to become confused by the compensated pointer. *Nonobservance of this precaution will result in kinking the band and will be evident in a jumpy, uneven motion of the compensated pointer when the loop is revolved.* Replace the glass cover and cover band when calibration is completed.

(4) The corrections will be greatest at or near 45 degrees (plus correction); 135 degrees (minus correction); 225 degrees (plus correction); and 315 degrees (minus correction). The minimum corrections will occur at or near 90, 180, and 270 degrees. Ordinarily, no correction should be made at zero. Thus, the corrections applied should taper off gradually toward these points. A smoother curve will be developed by working from dead astern or 180 degrees, toward the bow or zero, alternating port and starboard, particularly toward the finish of the operation. *Do not hurry.*

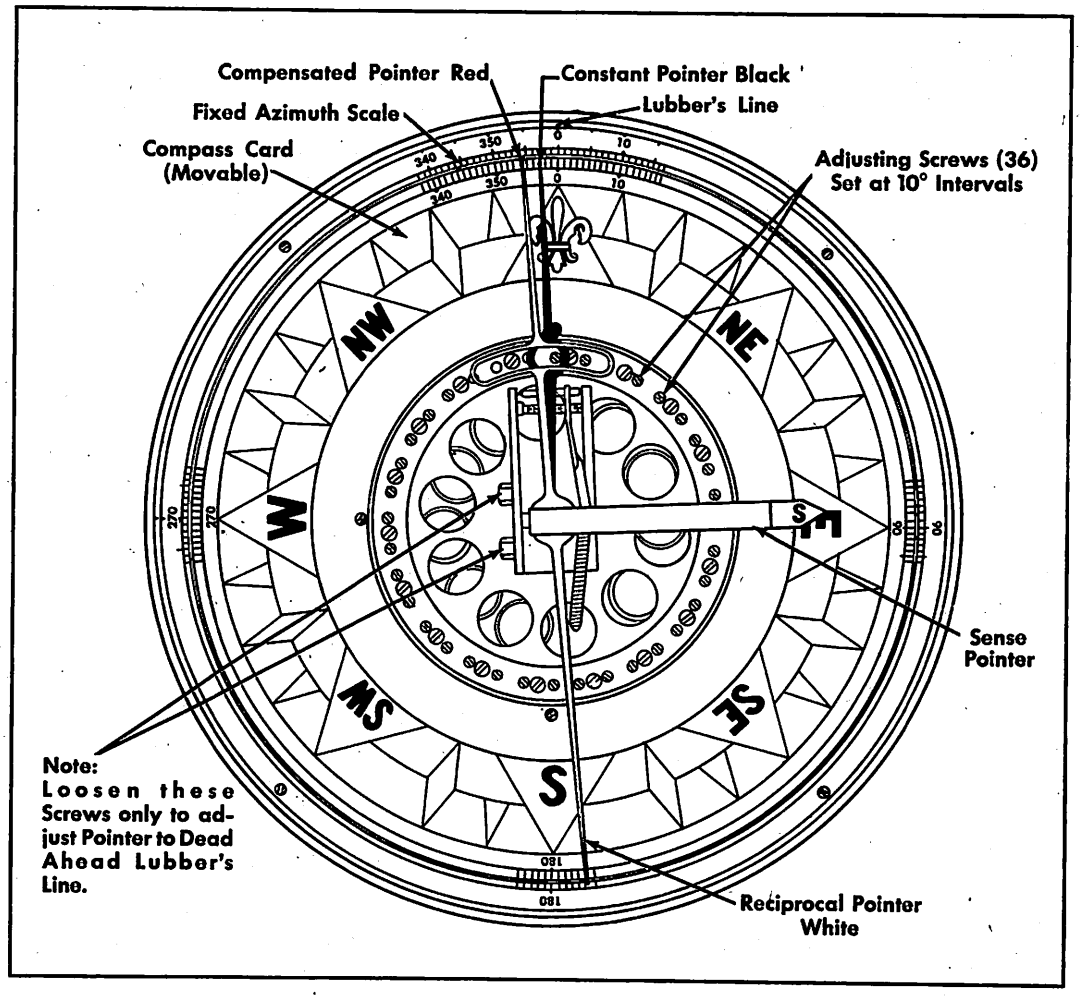
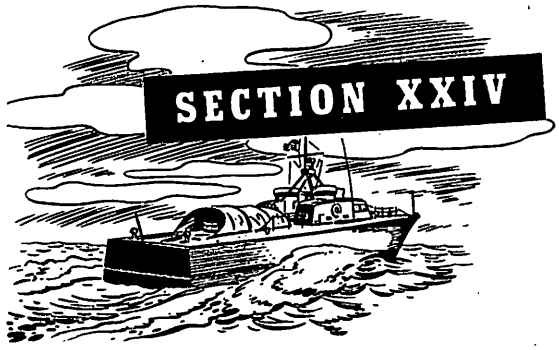


Figure 164—Mechanical Compensator



Miscellaneous EQUIPMENT

1. REFRIGERATOR.

a. DESCRIPTION.

(1) The refrigerator is located aft in the galley. (See figure 165.)

(2) Power for the refrigerator is supplied by the 110-volt electric system. It is controlled by a switch on the 110-volt switchboard and a switch near the refrigerator motor.

(3) Refrigerator models and installations vary greatly. Some models have the motor and compressor unit located in the engine room; others are standard cabinet models with the motor and compressor in the same cabinet with the freezing unit.

(4) All the refrigerators, however, can be roughly divided into two classes:

(a) Open unit models have the compressor belt-driven by the motor, which is mounted separately.

(b) Sealed unit models have the motor mounted integral with the compressor and freezing unit.

b. OPERATION.

(1) Fill the ice trays with water to not over 1/4 inch of the top.

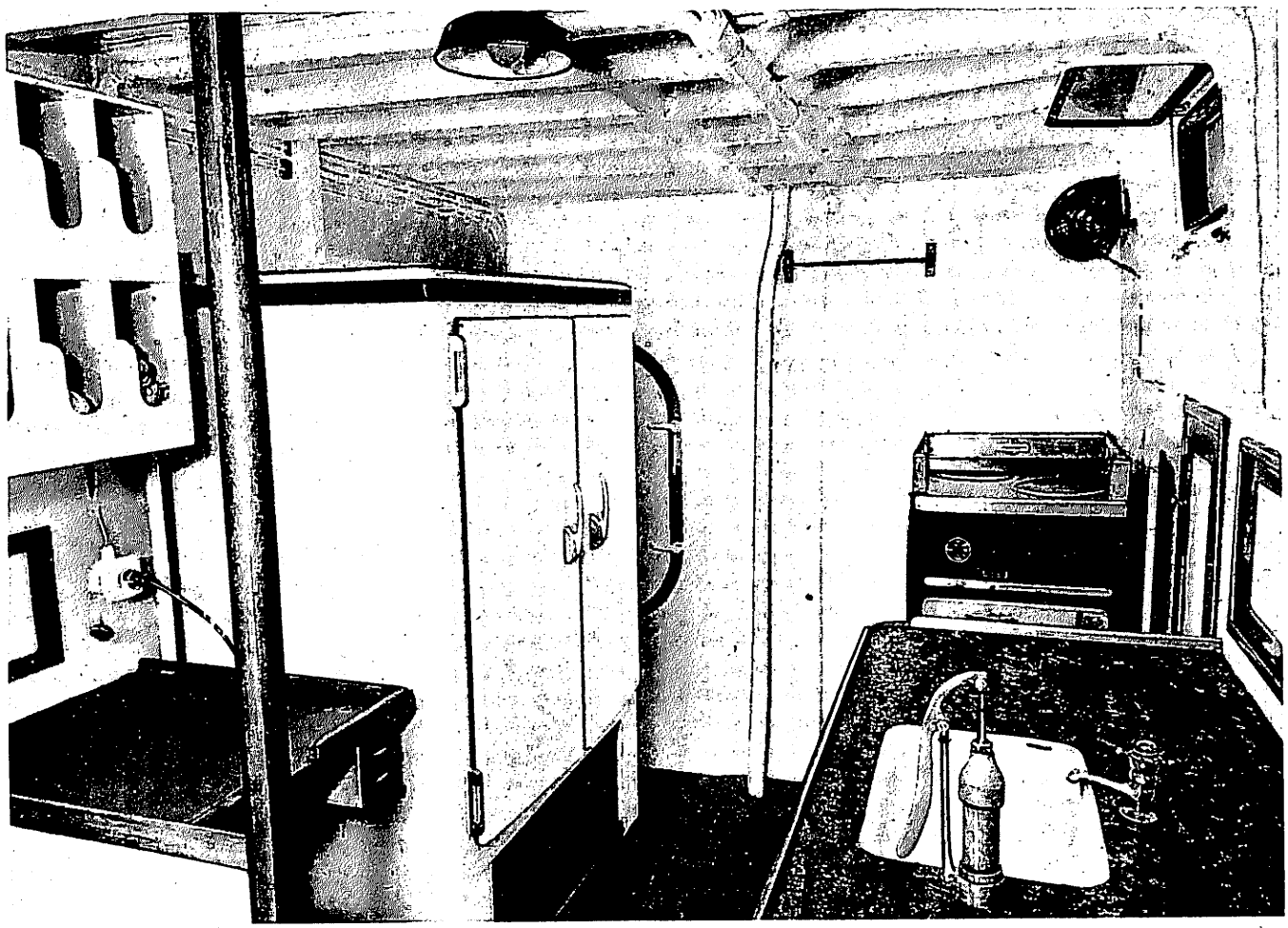


Figure 165—View of Galley Looking Aft, Showing Refrigerator and Range

(2) Set the thermostat control to the desired temperature.

(3) Turn on the switches controlling the refrigerator.

(4) Do not leave the cabinet doors open while the refrigerator is operating. Do not open the doors any more than is necessary for use.

(5) Keep wet foods and liquids covered in the refrigerator to prevent excessive moisture condensation on the freezing unit.

c. SERVICE, LUBRICATION, AND MAINTENANCE.

(1) Defrost the refrigerator once a week. On models with a "DEFROST" position on the switch, turn the switch to that position. On models with no such provision, turn the switch "OFF." When all the ice has melted from the freezing unit, remove the water and clean the cabinet.

(2) Clean the inside of the refrigerator and the freezing unit with a baking soda solution.

(3) On open unit models, oil the motor every 3 months with SAE 20 motor oil. Clean the condenser grill with a brush to remove all dust and dirt clogging it. Clean the compressor drive belt and tighten it if necessary.

(4) Sealed unit motors are usually grease packed at the factory and require no additional lubrication. Consult the service instructions pertaining to the particular refrigerator model.

(5) Open unit motors can be removed for maintenance operations such as replacing the brushes or cleaning the commutator. On some open unit models the compressor and freezing unit can be removed from the cabinet for maintenance, but on others, and on sealed unit models, it is built integral with the cabinet.

(6) No further repair work, other than continuity testing and motor repair, is recommended, since refrigeration is such a specialized branch of mechanics. In case of trouble in the compressor and freezing unit, remove the unit, if possible, and replace it. If the unit cannot be removed, replace the entire refrigerator. Have the old refrigerator or unit repaired by a refrigeration specialist.

2. ELECTRIC RANGE.

a. DESCRIPTION.

(1) The Electromaster Model 39-1MS electric range is located in the after section of the galley. (See figure 166.)

(2) Power for the range is supplied by the 110-volt electric system through the 110-volt switchboard. The range is rated at 4.7 kilowatts.

(3) The two surface units on the top of the range are controlled by individual switches on the front. One surface unit is rated at 2 kilowatts, the other at 1.2 kilowatts.

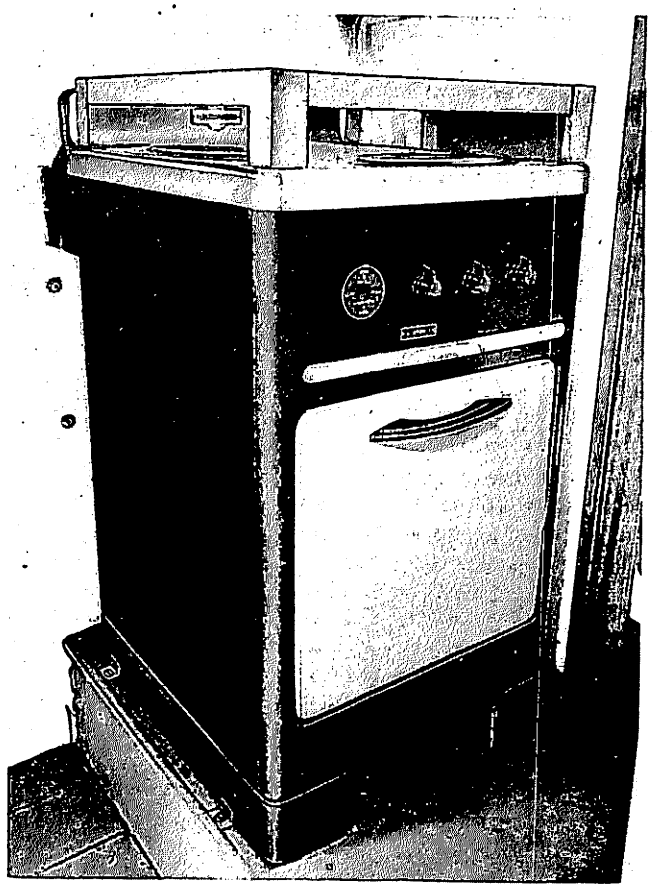


Figure 166—Electric Range

(4) The oven is controlled by the third switch on the front. The three heats of the oven are: high, 1.5 kilowatts; medium, 750 watts; low, 375 watts.

(5) A removable sea rack is provided as a safety measure around the top.

(6) A drip pan over the oven door aids in keeping the range clean.

(7) The oven is insulated with rock wool. The oven door is spring-operated.

b. OPERATING INSTRUCTIONS.

(1) Since the range draws so much current from the 110-volt system, always operate the auxiliary generator while any unit on the range is being used.

(2) Turn on the range switch on the 110-volt switchboard.

(3) Turn on the switch controlling the unit to be used to the desired heat.

(4) Operate the galley blower over the range to carry off cooking odors.

(5) When the surface units are being used while the boat is underway, use the sea rack to prevent pots or pans from being shaken off the range. The rack may be removed when the units are used while the boat is secured.

(6) Clean the range after each use. Remove and clean the drip pan.

c. SERVICE AND MAINTENANCE.

(1) Locate the source of trouble by a continuity test. Remove and repair or replace any faulty heating unit, switch, or unit of wiring. When disconnecting any wires on the range, tag the free ends to aid installation of the new or repaired unit.

(2) REMOVAL OF OVEN UNIT.

(a) Remove the plate at the rear of the range covering the oven unit terminals.

(b) Disconnect the two lead wires on the terminals.

(c) Remove the two screws in the front and the one at the rear which hold the unit to the oven liner.

(d) Lift out the oven unit.

(3) REMOVAL OF SURFACE UNIT.

(a) Lift out the surface unit to be removed.

(b) Disconnect the lead wires to the unit.

(4) REMOVAL OF SWITCH.

(a) Pull the switch handle out and turn it counterclockwise.

(b) Remove the nut in the back of the handle.

(c) Lift out the front surface unit and lay it to one side on the range top. It is not necessary to remove the lead wires to the unit.

(d) Disconnect the lead wires and buses from the switch and remove the switch.

3. WINDOW WIPERS.

a. GENERAL. — Two Kearfott pendulum window wipers, operated from the 110-volt electrical system, keep the pilot house forward windows free of spray, rain, or ice formation. The starboard wiper housing is mounted outboard below the window; the port wiper is mounted inboard above the window. (See figures 167 and 168.)

b. DESCRIPTION.

(1) The wiper is a motor-driven pivoted arm type with a totally enclosed mechanism. The installation includes the drive assembly, the wiper arm, the motor, and the rheostat switch.

(2) The motor is a $\frac{1}{30}$-horsepower, 110 to 120 volt ac to dc universal series wound, ventilated 5000-rpm ball-bearing unit with a 40:1 single worm gear reduction. Its two leads are attached to the terminal screws and are connected directly with the rheostat switch terminals.

(3) The motor gear drives a crank disc. A connecting rod drives the wiper arm drive lever from the crank disc. The connecting rod is offset on the crank disc to convert the circular motion of the disc to the pendulum movement of the drive lever. A shaft from the drive lever passes outside the housing and is connected to the wiper arm. The housing has a drain or breathing hole in the bottom side. On the outboard wiper a tube from this hole leads inside the pilot house to assure the intake of dry air.

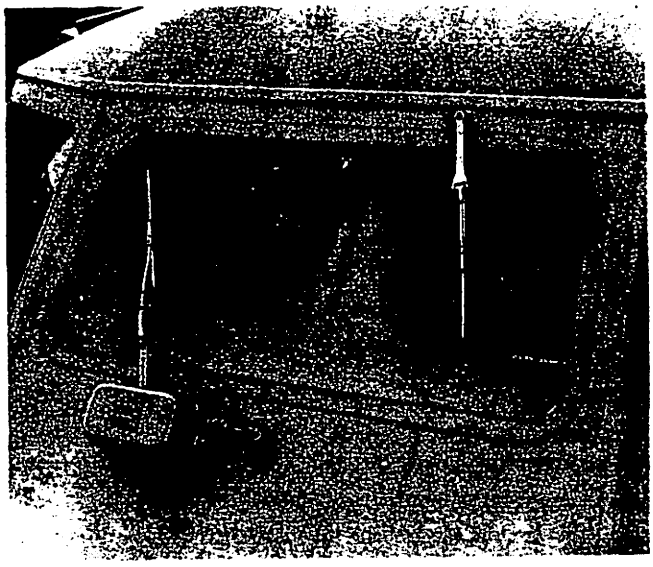


Figure 167—View of Outboard Installation of Window Wipers

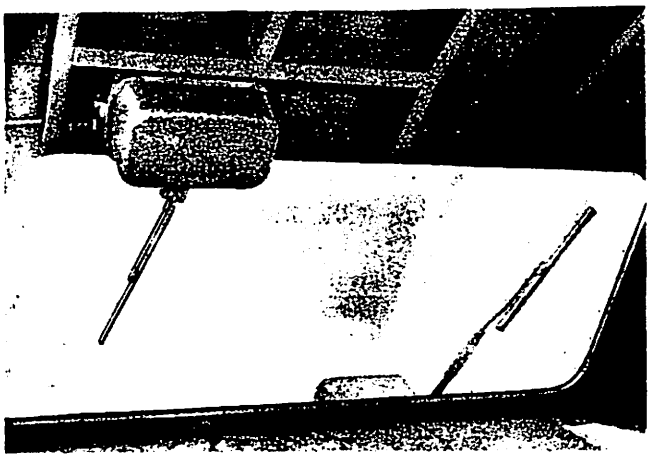


Figure 168—View of Inboard Installation of Window Wipers

(4) The wiper arm is keyed to the wiper arm shaft and secured by setscrews. The wiper blade is held against the glass by a spring. Two wiper blades are provided: a rubber one for ordinary use, and a felt one with a reservoir for use in freezing weather.

(5) A 360-ohm, .525-ampere, 190-volt ring-type rheostat and shut-off switch for each wiper is mounted on the port side of the pilot house wheel. (See figure 169.) The switch handle moves from "OFF" (the rheostat blade in a nonconducting position), through "INCREASE SPEED" (gradually cutting out the rheostat resistance), to "ON," so that the wiper is always started slowly and can be adjusted to any desired speed.

c. OPERATION INSTRUCTIONS.

(1) Turn on the direction finder switch on the 110-volt switchboard in the engine room.

(2) Turn the rheostat switch to the right from the "OFF" position. The speed of the blade gradually in-

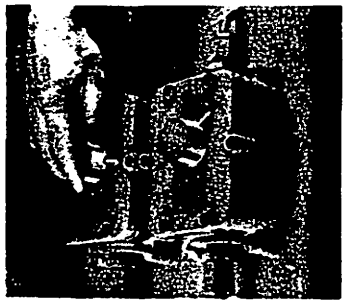


Figure 169— Rheostat-Switches for Window Wipers

creases until it reaches the maximum when the rheostat knob is in the "ON" position.

(3) In freezing weather when ice is forming on the window, use the felt blade. Saturate the blade with a a mixture of one-half glycerin and one-half alcohol. Fill the blade reservoir with the same mixture.

(4) If salt is being deposited on the window, use the felt blade with fresh water in the reservoir. In cold weather, use a water and alcohol solution.

d. SERVICE, LUBRICATION, ADJUSTMENT, AND MAINTENANCE.

(1) Oil the wiper arm shaft every 2 weeks of operation. Fill the oil cup on the outside of the housing with medium body oil.

(2) The motor is grease-packed and should not require attention more than once a year. Use D. A. Stuart Co. Sturoco No. 1 HMP Special Grease or equal.

(3) For servicing of the drive mechanism or motor, remove the housing screws and lift off the housing.

(4) If the wiper arm is impeded while in operation, it may slip and change the angle of sweep. To reposition it, remove the housing, loosen the bolt which tightens the friction joint between the wiper drive lever and the shaft, and reset the angle of sweep.

(5) If the width of the wiper blade sweep is to be increased or decreased, remove the connecting rod from the crank disc and reposition it in another hole in the crank disc.

(6) If the window streaks under the wiper blade, wipe the window clean of oil and wipe off the wiper blade.

(7) If the edge of the rubber blade becomes hard and glazed from use, sandpaper the cleaning edge with fine sandpaper.

4. PORTABLE FIRE EXTINGUISHERS.

a. DESCRIPTION. — Eight 4-pound hand-operated portable fire extinguishers containing carbon dioxide are placed on the boat in the following positions: one each in the crew's quarters, officers' quarters, galley, radio room, bridge, and dispensary, and two in the engine room.

b. OPERATION.

(1) Lift the fire extinguisher from its brackets and carry it to the fire.

(2) Pull the pin from the valve cap and turn the valve to open it completely.

(3) Hold the extinguisher by its handle in the left hand and, holding the nozzle at the hose end of the handle, direct the discharge into the fire at close range.

(4) Direct the gas first at the edge of the fire nearest the operator, or, if the fire is on a vertical surface, at the bottom of the fire.

(5) As the flame is extinguished on the nearer edge or bottom of the fire, slowly advance the discharge further toward the center of the fire. Be sure that the first portion of the fire is out before advancing farther.

(6) Continue the discharge after all flames are out in order to coat the hot material with the snowlike precipitation from the gas.

(7) Close the valve and insert the pin, which is attached to the neck of the extinguisher by a chain, to safety the valve cap.

(8) Have the cylinder recharged at the earliest opportunity.

(9) Observe the following precautions in operating the portable extinguishers:

(a) Do not open the valve until in position to direct the discharge onto the fire.

(b) Do not stand the extinguisher on the deck. Always hold it by the carrying handle.

(c) Do not hold the nozzle near the discharge end.

(d) Do not first direct the discharge at the center of the fire and then attempt to work to the edge.

(e) Do not direct the discharge haphazardly over various sections of the fire.

(f) Do not shut off the extinguisher just as soon as the fire is out, but wait until the heated material is thoroughly coated with the precipitate.

(g) Do not forget to have used extinguishers recharged at the earliest opportunity.

c. SERVICE AND MAINTENANCE.

(1) When not in use, the portable fire extinguishers should be installed upright in their mountings. Inspect the mountings for security at every overhaul.

CAUTION

Do not let the cylinders lie on their sides or remain in any position but upright.

(2) To make sure that every portable fire extinguisher will be ready for emergencies, they should be weighed at every major overhaul period or at least every 6 months, and the weight recorded on the tag attached to each extinguisher. The complete extinguisher with a full charge of 4 pounds of gas will weigh 18½ pounds. The extinguisher should be recharged fully when its weight drops to 18 pounds or less.

Note

If the hose and nozzle are removed from the extinguisher before weighing, the fully-charged extinguisher will weigh 1½ pounds less, or 17 pounds.