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"SKIFF"

OPERATING & INSTRUCTION MANUAL

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PURPOSE

The craft is intended to be used [redacted] To accomplish this it has the following capabilities:

a. It can be sunk without personnel in depths up to 30 feet and left on the bottom for periods up to three to four weeks. It can subsequently be retrieved by a swimmer on a free dive or by a diver, by using the self-contained compressed air ballast blowing system which is part of the craft. The vessel can immediately thereafter be placed in operation.

b. It can operate with three men and cargo in either a semi-submerged condition or a fully buoyant condition with all water ballast tanks blown. It may also operate in any desired intermediate condition of water ballasting. The purpose of operating semi-submerged is to minimize the possibility of radar and visual detection.

c. Operating ranges:

Trim	R.P.M.	Speed	Range
Buoyant	2000	5 Knots	150 Nautical Miles
Semi-submerged	2000	4 Knots	110 Nautical Miles

GENERAL DESCRIPTION

The craft is arranged as shown in Fig. 1. The crew compartment is amidships with bolted access hatch on the after bulkhead, giving access to a watertight casing containing the engine and battery and with gasoline tank at after end. The hull is divided into three watertight compartments identified as forward trim compartment, main ballast compartment and after trim compartment. The main ballast compartment is further divided by a partial center line bulkhead intended to reduce effects of free surface water. A ballast pump, belt-driven from the shaft, is located in the after end of the main compartment. On each side of the engine compartment is an air flask for blowing ballast. A third air flask for purging explosive gases from the engine compartment is fitted in a well at after end of main ballast compartment. Access to the crew compartment is through a quick acting hatch operable from above or below. A plexiglass dome to provide vision for the operator is located in the after end. A watertight aluminum hatch is fitted over the engine compartment. In addition, deck plates, removable for inspection and maintenance purposes, are provided throughout the length of the boat. The craft is fitted with four lifting eyes and is provided with a lifting sling.

A 34" and a 47" snorkel are provided. The 47" is not needed unless unusually heavy seas, over six feet high, are expected to be encountered.

The Skiff can be shipped in a wooden crate, the lower part of which is in the form of a cradle. The crate can be cut down, leaving a hauling cradle, on which are mounted wheels. This cradle is useful for hauling the Skiff out of the water, on a ramp, and for resting the Skiff when docked for painting, storage, etc.

EQUIPMENT FURNISHED

1 - Wilfred C. White, Echo Depth Sounder, fathometer, 0-80 feet, portable.

~~1 - Raytheon gas fume detector, installed.~~

1 - Bendix Pioneer aircraft, Type 1823-5, compass, radium dial and electric light for 6 volts.

1 - Inclinometer (aircraft "turn and bank") installed.

1 - Air blower, electric, portable.

1 - Radio antennae and lead-in (installed), suitable for use with PRC-6 or PRC-10 radios or equivalent.

1 - Towing pendant.

1 - Wire propeller lock.

CAPABILITIES AND PERFORMANCE SPECIFICATIONS

Length overall (Hull)	19'-0-1/2"
Depth to top of Gas Vent	6'-9-1/2"
Beam (Over Guards)	5'-3"
Draft, buoyant (With Full Gas & Normal 608# Load)	2'-8"
Draft, semi-submerged (With full Gas & Normal 608# Load)	3'-8"
Max. submergence depth	30'-0"
Engine: Universal "Atomic Four"	2-9/16" x 3-1/8"
Engine H.P. (Maximum Rating)	25
Engine R.P.M. (Maximum Service Speed)	2700
Propeller	10" Diam. x 6" Pitch
Ballast Pump	Pos. Disp. Type
Permanent Ballast	932#
Semi-Permanent Ballast (Six Slabs)	120#
Number of ballast compartments	3
Forward trim tank capacity	46 Gals.
Main ballast compartment capacity - P. & S.	587 Gals.
After trim tank capacity	55 Gals.
Gasoline capacity	30 Gals.
Normal load in addition to semi-permanent ballast: (3 x 175#) + 83#	608#
Emergency load, no semi-permanent ballast on board: (3 x 175#) + 83# + 120#	728#
Engine R.P.M. Buoyant - Emergency	2600 -
Engine R.P.M. Buoyant - Cruising	2000
Engine R.P.M. Semi-submerged - Emergency	2600 -
Engine R.P.M. Semi-submerged - Cruising	2000 -
Buoyant Speed - Emergency	5.3 Knots
Buoyant Speed - Cruising	5.0 Knots
Semi-submerged Speed - Emergency	4.7 Knots
Semi-submerged Speed - Cruising	4.1 Knots
Ballast Pump Capacity at 2000 R.P.M. Engine Speed	90 Gal/min
Ballast Air Flasks — No.	2
Max. Working Pressure	2500 p.s.i.
Capacity Each	853 cu. in.
Gas ejection flask — No.	1
Max. Working Pressure	2500 p.s.i.
Capacity	505 cu. in.
Weight, lifting (No crew or cargo - but with all Permanent & Semi-permanent Ballast and full gas load aboard)	3650 lb. (Approx.)

LIMITATIONS

The craft must never be submerged where the maximum depth of water exceeds 30 feet. Care must be taken to make due allowance for rise of tide or rise of water level in bays or rivers. Failure to observe this rule may result in -

(a) Structural damage or crushing of the engine casing.
(b) Inability to raise the craft.
(c) Excessive pressure in the crew compartment when surfacing.

The craft should not be left on the bottom for more than three to four weeks.

While air flasks are designed for 2500 lbs. working pressure, 2000 lbs. is recommended. Flasks should be tested to 3000 lbs. per sq. in. every 6 months.

The craft must not be overloaded and the fixed (permanent) ballast must not be tampered with. With the semi-permanent ballast in place the craft can carry a total normal load of 608 lbs., all but the weight of two submachine guns being in the crew casing. These guns may be lashed on each side of the casing amidships. A greater total load of crew and cargo may be carried up to 728 lbs. provided only that slabs of semi-permanent ballast in the bottom of the crew compartment are removed.

The craft is ballasted so that with a total load of 608 lbs., with semi-permanent ballast in place, and full gasoline tank., a minimum amount of reserve buoyancy is maintained. Any overloading therefore reduces this margin. It is not considered practical to compensate for overload by carrying less water ballast and this is strongly recommended against as a dangerous practice.

When operating in the semi-submerged condition, any trimming down by the head is never desirable. If it develops, it should immediately be corrected by adjusting water in trim tanks. An immediate method of reducing an excessive down angle is to reduce speed markedly or stop the propeller. The best operating trim lies between 0° and 1 or 2 degrees up by the bow. Other angles should be avoided.

DETAILED DESCRIPTION

Propulsion is by a "Universal" gasoline engine, direct drive. The engine, fuel tank and starting battery are installed in a cylindrical aluminum alloy compartment capable of withstanding an external working pressure of a head of 30 feet of sea water. There is a bolted cover on the top of the compartment, accessible through a second hatch on deck. This is for routine maintenance such as checking ignition, changing oil, checking battery, carburetor, clutch, generator, starter, etc. For major maintenance the after deck section is removable and the engine casing can be removed from the boat by unbolting from the crew compartment casing and disconnecting the drive shaft. The head of the casing may then be removed and the engine taken out of the front end for overhaul.

For routine operation the front end of the engine is accessible through an access cover with a dogged strongback on the inside of the crew compartment. Just inside this opening, forward of the engine, Fig. 3, is a small instrument panel with tachometer, ammeter, oil pressure gage, choke, throttle, gasoline cut off valve and gasoline settling bowl, starter switch, reverse lever, and gas fume detector. A battery cut-out switch is placed directly behind this panel on starboard side. There are four power outlets on panel, for accessories (air blower, fathometer, compass lighting, spare). The forward end of the gear shift rod is connected to the reverse gear control by inserting the control plate into the clevised end of the gear shift rod jaws and securing in place with toggle pin. Spark plugs may be changed through the opening.

A hose connected to a gas ejector is also stowed just inside the front end of the engine casing. The ejector is supplied by a small air flask C, Fig. 4 in the after end of the boat. To operate, place discharge end of hose out through access hatch so discharge will not blow back into boat. Open air valve 15, Fig. 4 on bulkhead for thirty (30) seconds until gas odor disappears. Then read fume indicator before starting engine, repurging if necessary. Then restow hose. See detailed operating procedures.

A double V-belt pulley drives the ballast pump. The ballast pump can empty water ballast when the propeller shaft is turning in the ahead direction and the main ballast control valves are in the "pump" position. Water ballast can also be emptied with propeller reversing and with control valves in the "flood" position.

WATER BALLAST SYSTEM

The schematic arrangement and main control valve arrangement are shown in Figures 2 and 3. The ballast pump is a positive displacement type made by Gross Mechanical Laboratories, Baltimore, Md. The pump is belt driven as previously described and a spare set of V-belts should be kept secured around propeller shaft, nearby, ready for use if needed. Belt tension may be maintained by adjusting positions of pump on base. When neoprene blades are replaced in pump rotor care must be taken to insert correct ends of blades into the slots.

The pump is connected to the water ballast system and will discharge overboard from the system when the engine is in ahead position. When the engine is in reverse, main ballast valves 1, 2 and 3 should be in the closed (45°) position, otherwise water will be pumped back into the boat, except that if these valves are in "flood" position, ballast will be discharged overboard.

The vessel is ballasted by gravity flooding. Placing the levers on valves 1, 2 and 3 in the down position floods forward trim, main ballast and after trim compartments. Flooding of main ballast is accelerated by opening valves 5 and 6. Valve 4 controls the amount of water on either side of the main ballast compartment, and therefore can be used to control athwartship trim, if necessary.

For pumping out, handles for valves 1, 2 and 3 are placed in the vertical position with the propeller shaft turning "ahead". When a ballast or trim tank is emptied (known by air appearing at pump discharge), its respective control valve must be placed in closed (45°) position, in order to maintain full pumping effect. If the bow is too low, pull handle No. 1 to a vertical position prior to moving the other valves. The bow will come up quickly due to the water being rapidly pumped from the forward trim tank. The same is true of trim down by the stern, using valve No. 3. When all water ballast is discharged and the craft is operating fully buoyant, valves 1, 2 and 3 should be placed in the closed (45°) position, at the marks provided.

Valves 7 and 8, Fig. 3 are flood valves for the crew compartment and are to be used only when the craft is being cached on the bottom. At all other times they must be latched in the closed position.

Associated with the water ballast system are compartment vents for forward trim, main ballast, and after trim tanks. Valve 14, Fig. 2 is fitted to the main ballast vent. It remains open when cruising and when caching, and is closed only when blowing the main ballast with high pressure air. In addition, for sinking and retrieving the boat, vent valve 10, Fig. 2 to the crew compartment, is provided. This valve remains closed during cruising, is opened when caching the boat and is closed prior to retrieving. Forward and after trim tank vents do not have valves fitted.

COMPRESSED AIR SYSTEM

There are two independent compressed air systems, one for blowing water ballast and the other for purging gasoline vapors and/or bilge water from the engine casing.

The ballast blowing system consists of two air flasks A and B, Fig. 1, of 853 cu. inch capacity each, which carry 2000 lbs. p.s.i. working pressure. These flasks may be removed for recharging by removing securing straps and flexible hose. Schematic piping is shown in Figure 4. The port flask is arranged for blowing water from the crew compartment when the craft is submerged. Control is from the valve B on the flask. The starboard flask is arranged for blowing water, if desired, from the main ballast compartment or from the crew's compartment. The former may be desirable when additional freeboard is needed immediately after uncaching, or for any other reason such as to enter the craft when seas are high and it is in semi-submerged trim. This may be accomplished by closing the main ballast vent valve 14, Fig. 2, insuring that the cross-connection valve 18 remains closed and opening the starboard flask valve A and valve 17, Fig. 4. If the port bottle is empty, the starboard bottle can be used to blow the crew's compartment by seeing that valves 10, 17, and B are closed and then opening valve A, and the cross-connection valve No. 18.

The operation of the gas ejection flask system has been previously described under Detailed Description.

All 3 flasks should be removed for charging.

Before operating the craft, all 3 flasks should be charged to 2000 lbs. p.s.i. pressure and particular care must be taken to see that air connections are tight and that flask valves are not leaking. This must be done by submerging flasks in water, and observing for possible bubbles, just prior to re-installing.

FUEL SYSTEM

Gasoline flows by gravity from the gas tank through a gasoline settling bowl at the forward end of engine, to the fuel pump, then through a second gasoline settling bowl and then to the carburetor. Shut-off valves are located at the base of the gas tank and just before the first settling bowl.

Sediment or water may normally be cleared by turning off gas at first settling bowl and cleaning bowl. Excessive water may reach the second settling bowl and require cleaning.

Uncontaminated gasoline is essential and it is therefore strongly recommended that all gasoline filling be done through a chamois and funnel.

Grade of Gasoline - so-called "white", marine gasoline, non-leaded, octane rating 70-80, is the best for operations and is recommended. However, if temporarily unavailable, regular automotive gasoline is useable.

OPERATING PROCEDURES

A. Procedure Before Starting Engine After Overnight Lay-up.

1. Open cooling water intake valve 19, and discharge valve 12, engine exhaust valve 11 and valve C on purging bottle.

2. See fuel tank vent valve 9 is open and crew compartment vent valve 10 closed.

3. Open snorkel tube valve.

4. Remove manhole from engine compartment.

5. Open fuel valve at sediment bowl.

6. Sniff thoroughly for possible gas fumes.

7. Take gas fume indicator reading.

8. Carefully inspect and feel around gas bowl and its four fittings to insure no leaks and bottom nut tight. If leaking, rectify immediately. (When glass bowl is removed, a new gasket should be installed before securing Skiff that night.)

9. If gas fumes are noticeable (and not corrected under 8) and fume indicator reads other than "Safe", remove engine top hatches, find and rectify leak, pump engine bilges and air compartment thoroughly.

10. If fume indicator reads "Safe", purge 15 seconds with end of purging hose led through access hatch overboard. If other than "Safe", purge as necessary to insure pointer returns to and remains on "Safe".

11. Close battery cut-out switch, place gear shift in neutral and turn ignition on.

12. Adjust choke and throttle to mid-positions.

13. Press starter button or use hand crank, to start. In hand cranking, be sure to turn crank counter-clockwise (when facing aft), otherwise water could be drawn into cylinders.

14. Check battery charging and oil pressure gauges, and check engine circulating water at discharge end.

15. On additional starts during the day, follow above general procedure but purge only if evidence of gas fumes exists.

B. Procedure When Running Buoyant

1. All three air flasks charged and in place on board.

2. Crew compartment vent valve 10 closed.

3. Main ballast valves 5 and 6 closed.

4. Main ballast vent valve 14 open.

5. Crew compartment flood valves 7 and 8 latched closed.

6. Athwartship trim valve 4 in neutral (fore and aft) position.

7. Access hatch closed and secured.

8. Snorkel valve open.

9. Ballast valves 1, 2 and 3 closed (handles 45° forward).

C. Procedure When Running Semi-submerged

1. Adhere to first eight items in "B", "Procedure When Running Buoyant", and in addition:

2. Check ballast water pump for proper operation by opening valve 13 on pickup hose and insuring that an air suction exists at hose end.

3. Place ballast valves 2 and 3 in open (handles horizontal), position. After 30 seconds open ballast valve 1 (handle horizontal).

4. Open main ballast valves 5 and 6 (handles fore and aft). Tanks will be completely flooded in about 14 minutes. Middle ballast should be allowed to flood completely, and ballast valve 2 should be left open. However, trim tank valves 1 and 3 should be manipulated to attain a running trim with angle between 0° and 2° up by the bow, and should be closed when desired trim is reached. (Inclinometer reads 0° when ball is centered, 5° when tangent to outside edges of wire, and 10° when ball has just reached end of travel.)

Precautions:

a. Never run with an angle down by the bow. If such an angle begins to develop, pump from forward trim compartment (handle of valve 1 vertical) and/or flood after trim (handle of valve 3 horizontal).

b. An angle of more than 2° up by the bow should also be avoided. (See parenthetical note in para. 4 above.)

c. If at any time excess water comes down the snorkel tube, close snorkel tube valve and then immediately shut down engine.

Note: If craft should assume a port or starboard list when flooding ballast tanks, correct by moving handle of athwartship valve 4 to starboard or port, respectively, until list is removed.

D. Procedure When Changing from Semi-submerged to Buoyant, Underway

1. Close main ballast valves 5 and 6 (handles athwartships).

2. Place ballast valves 1 and 2 in "pump" (handles vertical) position. After 30 seconds place ballast valve 3 in "pump" (handle vertical) position.

3. When water from pump discharge, previously "solid", starts surging, i.e., indicates air in system, close ballast valve 1 or 3 (by method of elimination) to regain full discharge.

4. When pump discharge water again shows air, close the trim tank valve remaining open (3 or 1).

5. When pump discharge reduces to a trickle, close main ballast valve 2. It takes about 20 minutes at 2000 r.p.m.

to empty the main ballast tank. Forward and after trim tanks empty in about 1 minute and 1 1/4 minutes respectively, when only one tank is on "pump" at one time.

Precautions:

a. Do not start pumping from after trim tank (valve 3) until an angle up by the bow is obtained - which will be about 30 seconds after beginning to pump from forward trim tank.

b. If craft should assume a port or starboard list when pumping ballast tanks, correct by moving handle of athwartship valve 4 to port or starboard, respectively, until list is removed.

E. Procedure in Securing Skiff at End of Day

1. See that engine choke and throttle levers are "In", gear shift in reverse, ignition and battery cut-out switches "Off".

2. Take gas fume indicator reading.

3. Turn off gas fume indicator switch.

4. Close fuel valve at sediment bowl.

5. Carefully inspect and feel around gas bowl and its four fittings to insure no leaks and bottom nut tight.

6. Close and secure manhole to engine compartment.

7. See that purging valve 15 in crew's compartment is in closed position.

8. Close snorkel tube valve.

9. See that all seven flood-control valves are in closed or neutral positions (2 of these valves are top-side).

10. Close and secure access hatch.

11. See that main ballast vent valve 14 is closed.

12. See that crew's compartment vent valve 10 and the five H.P. air valves on deck are in closed position.

13. Close cooling water intake (19) and discharge (12) and engine exhaust (11) valves.

14. See that fuel tank vent valve 9 is open.

15. Inspect waterline to insure proper freeboard, and check mooring lines. (Triangle markers at bow and stern indicate waterline in buoyant condition without crew and semi-permanent ballast.)

F. Procedure in Caching Skiff

1. If Skiff is not in semi-submerged trim, flood ballast tank and trim tanks as prescribed in paragraph "C".

2. Stop engine upon reaching desired site, using fathometer or lead line to check depth under 30'.

3. Throw battery switch to "OFF".

4. Close fuel valve at sediment bowl.

5. See gas fume detector switch off.

6. Remove air blower and fathometer (expendable items), and store compass in engine compartment.

7. If silica gel is to be used, unseal and stow silica gel bags on top and at front of engine, not in bilge.

8. Secure engine manhole.

9. See that purging valve 15 in crew's compartment is in closed position.

10. Close snorkel tube valve.

11. See that ballast valves 1, 2, 3, 5 and 6 are open.

12. Leave compartment, closing and securing access hatch.

13. Close gasoline tank vent valve and engine exhaust valve.

14. Close cooling water intake and discharge valves.

15. Check gas tank cap to see tight.

16. Open vent valve to crew's compartment.

17. Insure that main ballast vent valve is open.

18. Open flood valves 7 and 8 to crew's compartment.

19. Move forward or aft as needed to keep Skiff in level trim until it sinks. (This requires about 1 minute from time of opening flood valves.)

Note: Although bearings and ranges in line may be used for relocating Skiff, it is recommended that the best method is to:

Secure a line or preferably a flexible wire cable to the port after lifting eye and swim shoreward. Secure end by a spike or other means.

G. Retrieving Procedure

1. Upon reaching Skiff (using line or other guide), close crew's compartment air vent valve 10.

2. Then open port flask valve B.

3. Swim to surface holding line and await Skiff or accompany it to surface.

4. When Skiff breaks surface (about 45 seconds after opening flask valve B), sit on bow until air bubbles show from crew's compartment flood valves, then quickly close and latch crew compartment flood valves 7 and 8. (Keeping bow down allows more water to be blown from crew's compartment.) Then close air flask valve B.

5. Open crew's compartment air vent valve 10, vent compartment and then close valve.

6. Open gasoline tank vent valve 9, engine exhaust valve 11, cooling water intake (19) and discharge (12) valves and purging bottlevalve C.

7. Open access hatch. (If water level is above combing of engine manhole which might happen if flask B had not been full charged, close crew's compartment and use starboard bottle and cross connection to blow remainder of water overboard before opening manhole. In doing this, it is of course necessary to open flood valves and close vent valve of crew's compartment, again sitting on bow.)

8. Upon entering compartment open snorkel tube valve.

9. Remove manhole cover, open fuel valve at sediment bowl, replace compass, check for gas fumes and purge with valve 15 as necessary. Close battery cut-out switch, place gear shift in neutral and turn ignition on. (The procedure is similar to that used in starting engine after overnight lay-up).

10. Adjust choke and throttle to mid-positions and press starter button or use hand crank, to start.

H. Towing Procedure

1. Have Skiff in fully buoyant condition.

2. Lock steering lever in neutral position, using lock screw.

3. See that gear shift is in ahead position.

4. Close all ballast, air, snorkel tube, vent and water valves, and access hatch. (Similar to procedure in "Securing Skiff at End of Day", except for engine manhole.)

5. Unshackle towing pendant from snorkel base, shackle to towing line of tow vessel (not less than 1 1/2" circumference if manila) and take strain gradually.

6. Use tow length such as to place Skiff just abaft of crest of second stern wave, with slight angle up by the bow.

7. A maximum towing speed of 15 knots should not be exceeded, and this figure should be reduced as necessary in heavy seas.

8. If in an emergency, it is necessary to tow Skiff in semi-submerged condition, speed must be reduced, and short scope of towline must be used to keep an up angle by the bow, on Skiff, at all times.

MAINTENANCE PROCEDURES*

A. Daily Check-off List During Operating Periods

1. All air flasks charged to 2000 lbs.

2. Check quantity of gasoline in tank.

3. Check all air connections and valves for proper operation.

4. Lubricate both sides of steering rod stuffing box.

5. Take fume detector reading and purge.

6. Check for water in engine casing by inspection or purging.

7. Start engine and check battery charging and oil pressure gauges. (See para. A under "Operating Procedures".)

8. With zerk gun, grease (6-10 strokes), with propeller shaft turning, two zerk fittings. One under throttle serves forward shaft bearing in the tunnel. One on aft bulkhead (crew) on port side serves shaft bearing adjacent to ballast pump belts.

9. Operate all flood control and engine circulating water and exhaust valves.

10. Check operation of ballast pump.

11. Check operation of air blower.

12. Check operation of fathometer.

B. Semi-monthly Check-off List, or After 25 Hours Engine Operation, whichever is sooner.

1. Check oil level in engine sump. (More often during heavy operating periods.)

2. Check battery specific gravity, electrolyte level, and battery connections.

*Also see Operation and Maintenance Manual for Engine.

3. Check carburetor and fuel pump for leaks, by feel.

4. Check all wiring, spark plugs, distributor points, rotor, and all electrical connections.

5. Inspect fathometer transducer lead-in wire stuffing box for tightness.

6. Check all bolts, nuts and screws for tightness.

7. Check for possible water in fuel tank by drawing off gasoline from bottom by hand pump or sucking sample from bottom through copper tube to mouth.

8. Check freedom of movement of all six relief valves.

9. Lubricate snorkel tube valve, worm screw on access hatch and shackles on towing pendant and lifting slings.

10. Clean exterior sides of Skiff.

11. Check radio reception and transmission.

C. Monthly Check-off List

1. Oil generator, starting motor, distributor rotor (1 drop).

2. Put grease on springs of all six top-side relief valves. The two on crew's compartment lift at 18 p.s.i. and the trim and ballast tank reliefs lift at 4 p.s.i.

3. Inspect gaskets of access hatch, engine top hatch and manhole hatch.

4. Check steering mechanism, propeller, shaft bearings, and V-belts of ballast water pump.

5. Change engine oil.

6. Recharge battery if not fully up.

7. Remove deck hatches and inspect hull thoroughly. Paint when required.

8. Paint exterior as required.

D. Bi-monthly Check-off List

1. Remove valve stems and inspect seats, for condition and tightness, of the following exterior valves: gasoline vent 9, engine exhaust 11, engine water intake 19 and discharge 12, crew compartment vent 10, cross-connection 18, and main ballast blow 17.

2. Haul out and inspect bottom. Paint with anti-fouling paint.

E. Semi-annual Check-off List

1. Inspect "zincs" and bonding and change "zincs" where and if corroded beyond effective use.

2. Do any major repairs that appear necessary.

F. Preparing for Below-Freezing Weather

1. If it is intended that Skiff lie idle during below-freezing weather, drain all water from the engine, removing the pipe plug at the side of the manifold, opening the drain cock in the motor block back of distributor and removing the pipe plug at bottom of engine water pump. (See further, detailed instructions on page 16 of Operation and Maintenance Manual for engine.)

2. Insure also that ballast tanks are dry and that drain plug has been removed from bottom of ballast pump.

G. Check-off List Prior to Going on a Mission

1. Charge battery to full potential.

2. Replace spark plugs, distributor contact points, coil, and condenser.

3. Check syntron seal.

4. Change oil in engine sump.

5. All bottles charged to 2000 lbs. plus.

6. Inspect all six compartment relief valves for proper functioning. See para. C 2, page 21 for spring settings.

7. Repaint or camouflage Skiff if necessary.

8. Pump fuel tank dry and refill through chamois and funnel.

9. Have grease-gun, air blower, fathometer, cushions, and waterproof flashlight on board.

10. Check radio operation if required.

11. Install dome cover.

12. Place twelve pounds of silica gel (packaged in several bags for convenience) in an oven. Dry out, and seal bags in a moisture proof container. Stow in crew's compartment. (See paragraph 7, page 17).

13. Stow cargo, adhering to prescribed weight limits.

14. If needed, stow single bottle aqualung and regulator in crew compartment or lash down top side.

15. Lash waterproofed machine guns top side if required.

16. Have screw driver, pliers, spark plug wrench, knife, pipe wrench, monkey wrench, and spare spark plugs on board.

17. Have sufficient length of flexible wire or line on board to lead shoreward after caching, as a marker. Have securing spike also.

18. Install semi-permanent lead ballast as cargo governs.

19. Have tow line pendant in place.

20. Check compass readings.

Note: See also Operation and Maintenance Manual for Engine.

Pretesting Engine Compartment with Compressed Air:

A machine threaded pipe plug has been fitted on the Engine Room hatch cover plate. Prior to planned caching operations after a period of inactivity, this plug may be removed and 5 lbs. air pressure applied to the closed-up engine compartment for one hour, with a gauge, graduated to 1/4 lb. or less, in the charging line. Care should be taken not to exceed five lbs. pressure. No air drop should occur in one hour. If there is a drop, locate leak (using soapy water, if necessary), remedy, and retest. When assured of Engine Room tightness, warm up engine, run boat for 1/2 to 1 hour, and give craft a 1-hour trial caching in water of about 10 feet depth.

HINTS ON TROUBLE-SHOOTING

Engine - (See also Operation and Maintenance Manual for Engine.)

A. Starting Motor Fails to Crank Engine.

1. Check battery cut-out switch to see closed.
2. Check electric leads and connections and starting button switch.
3. Check for "dead" battery.
4. Start motor by hand crank. (Turning counter-clockwise, facing aft.)

B. Engine Turns Over by Starting Motor but Fails to Fire.

1. See choke rod partly out.
2. Insure flow of fuel by removing forward sediment bowl. Inspect for possible water in fuel, before replacing bowl.
3. Check spark plug connections.
4. Insure wiring and spark plugs are dry.
5. Check distributor - points - condenser - coil.
6. Check fuel pump and carburetor.

C. Engine starts but runs "rough".

1. Check spark plugs and wires for tightness and dryness.
2. Check for water or other foreign matter in forward sediment bowl.
3. Check adjustments of carburetor, distributor, timing, spark plug gap.
4. Check fuel pump operation.

D. Water in Engine Cylinder(s).

1. Could be caused by leaky exhaust valve when cached, by leaky head gasket, cracked block, or by reversing engine when hand cranking.

2. Correct cause of leak, remove spark plugs, turn over engine to clear water, dry and replace plugs and start engine.

E. Engine Stops after Satisfactory Operation.

1. Check for fuel in tank.

2. Check for water in sediment bowl and carburetor.

3. Check cooling system, to see open.

4. Inspect propeller and drive shaft for freedom of movement.

Water Ballast Pump

F. Water Ballast Pump Fails to Pump.

1. Belts too loose, or too tight.

2. Impeller blades worn and need replacing.

3. Impeller blades or intake blocked by foreign object, screws, rag, etc.

4. Pump shaft bent or broken.

G. Water Ballast Pump Suddenly Stops Pumping.

1. Ballast or trim tank on line is empty.

2. Vent to tank on line is closed.

3. Lines clogged.

4. Pump failure from causes in F.

Ballast-Trim System

H. Ballast or Trim Tank Fails to Flood.

1. Vent valve on main ballast tank closed, or vent lines plugged.

2. Flooding line may be clogged by foreign matter.

High Pressure Air System

I. Air Flask Loses Pressure.

1. Leaky valve. Always check valve tightness by submerging flask in water before installing it.

J. Air Flask Fails to Blow a Compartment.

1. Check flask for air pressure and insure proper valves are in prescribed position.

2. Inspect for leaks in system.

3. Check to see vent valve closed.

4. Inspect relief valves to see none stuck open.

K. Engine Compartment Purging System Fails to Work Properly.

1. Flask valve C or valve 15 not open.

2. Air leak in system.

3. Venturi pick-up is clogged.

Raytheon Fume Detector

L. If Doubt Exists as to its Reading.

1. Detector head may require renewal.

2. Plug-in wire may be parted.

3. Adjustment screw set improperly.

4. Test reading, if it reads only "safe" by sprinkling a few drops of gasoline on a rag, leaving it for one minute on top after section of cylinder head, and see if pointer moves.

Fathometer

M. If it Does Not Operate Properly:

1. Move volume dial through entire range to attempt to get a correct reading.

2. Check all electrical connections for dryness and tightness. Check particularly the coaxial cable plug, for tight connections.

3. Replace tubes as necessary.

Engine Compartment

N. An Unusual Amount of Water is in the Bilge (More Than About Two Inches)

1. Check syntron seal.

2. Check for leaks in engine circulating water pump and lines.

3. Check fathometer transducer lead-in wire stuffing box.

4. If skiff has recently been cached, check engine compartment overhead hatch, manhole and compartment gaskets.

5. Check exhaust and water pipe lines thru compartment wall for tightness.

Fuel System

O. Water or Sediment in Fuel System

1. Check tightness of filler cap.

2. Check lead-in fittings of vent and filler lines.

3. Check vent valve if it has recently been underwater.

4. Check fuel supply source.

5. Use clean chamois and funnel at each refilling of gas tank.

6. Check inside walls of fuel tank for sediment. Tank may require steaming and cleaning.

Steering Mechanism

P. Frozen or Stiff.

1. Lubricate moving machined parts.

2. Check for possible bent rudder post or rudder obstruction.

3. Check for bent steering rod.

Propeller Shaft

Q. Binding or Unusual Vibration

1. Insure proper lubrication of both zerk fittings.

2. If necessary, pull shaft and inspect for straightness, inspect bearings and syntron seal.

3. Bent propeller.

Note: When shaft is pulled, a new, spare set of V-belt drives for ballast water pump, should be slipped over the shaft and secured to bulkhead near the pump, if the previously spare set has been used.

SKIFF No. 1 (In Continental U.S.)

Compass Deviation Record (Date - 1 Sept. '54)

Course	Deviation
0°	1/2° E
45°	1/2° E
90°	1° W
135°	1/2° W
180°	0°
225°	1/2° E
270°	0°
315°	1/2° W

SKIFF No. 2 (At an overseas Base)

Compass Deviation Record (Date - 1 Sept. '54)

Course	Deviation
0°	1/2° W
45°	1° E
90°	1/2° E
135°	1° W
180°	2° W
225°	2 1/2° W
270°	1 1/2° W
315°	1° W

Locations and Weights of Lead Ballast, and Instructions for Loading the Skiff

Piece No.	Permanent Lead Ballast Weight (lbs.)	Frame Location
1	100	4-7 Port
2	100	4-7 Stbd.
3	100	7-10 Port
4	100	7-10 Stbd.
5	100	7-10 Port
6	18	7-10 Stbd.
7	67	7-10 Port
8	67	7-10 Stbd.
13	60	16-18 Port
14	16	18-19 Stbd.
15	10	18-19 Port
16	6	18-19 Stbd.
17	80	18-21 Port
18	11	19 Stbd.
19	50	21-23 Port
20	25	19-21 Stbd.
22	22	21-23 Stbd.

Total weight of Permanent Lead Ballast - 932 lbs.

Note: See Drawing 1035-C3-23 for linear positions of above frame locations.

Piece No.	Semi-Permanent Lead Ballast Weight (lbs.)	Frame Location	Location Aft of Crew's Comp't Forward Bulkhead
9	20	10-11 Port	5 inches
10	20	10-11 Stbd.	5 inches
11	20	11-13 Port	10 inches
11	20	11-13 Port	10 inches
12	20	11-13 Stbd.	15 inches
12	20	11-13 Stbd.	15 inches

Total weight of Semi-Permanent Lead Ballast - 120 lbs.

Normal load - includes:

a. Regular operating equipment (full tank of gasoline, fathometer, compass, 17 lb. radio, etc.)

b. Operator - 175 lbs.

c. Two passengers - 350 lbs.

d. Two machine guns - 32 lbs. (on deck 24" aft of forward bulkhead of crew's comp't).

e. Two dunnage bags - 34 lbs. (12" forward of after bulkhead of crew's compartment).

f. One packaged radio - 17 lbs. (12" forward of after bulkhead of crew's compartment).

Total - 608 lbs.

In all cases where normal load (608 lbs.) is carried, 120 lbs. semi-permanent lead ballast must additionally be carried.

Emergency load -

120 lbs. of additional cargo may be carried if desired. In this event, the semi-permanent ballast must be removed from the crew's compartment before departure on operations.

Total emergency load is therefore 728 lbs., with all semi-permanent lead ballast removed from Skiff.

Less than normal load -

If only one, or no passengers are on board, the weight of the passengers should be replaced by adding an equal weight of lead in the crew's compartment, so that the Skiff will be in proper trim and ballast when operating. 350 lbs. of lead ballast is supplied for this particular purpose.

SPARE PARTS AND EQUIPMENT LIST

1.	Starting motor.	1
2.	Generator.	1
3.	Solenoids (set).	1
4.	Distributor points (set).	2
5.	Condensers.	2
6.	Coils for distributor.	2
7.	Electric wiring (set).	1
8.	Rubber shields for spark plugs and wires (set).	1
9.	Spark plugs.	8
10.	Carburetor, complete.	1
11.	Carburetor float.	1
12.	Complete set of gaskets for engine, including reverse gear housing.	1
13.	Fuel pump	1
14.	Engine circulating water pump.	1
15.	Packing for circulating water pump (set).	1
16.	Water pipe valve (engine cooling system).	1
17.	Cooling system discharge pipe valve	1
18.	Storage battery, 6 V., dry condition.	1
19.	Electrolyte for battery (9 gals.)	1
20.	Hand crank.	1
21.	Gas strainer bowl (complete).	1
22.	Gaskets for strainer bowl.	8
23.	Gas tank vent pipe valve.	1
24.	Engine exhaust hose (flexible).	1
25.	Air flasks for blowing compartments.	2
26.	Air flask for purging engine space.	1
27.	Syntron seals, complete.	2
28.	Gasket for engine compartment manhole.	1
29.	Gasket for engine compartment forward bulkhead.	1
30.	Gasket for engine compartment overhead cover	1
31.	Gasket for crew compartment access hatch	1
32.	Tools, set, in tool box.	1
33.	Plywood sheets for patching, with screws	
34.	Bedlast, can.	1
35.	Assortment of hull fastenings.	
36.	Assortment of nuts, bolts, cotter pins and washers.	
37.	Replacements for each zinc block.	2
38.	Bonding wire (feet)	10
39.	Snorkel tubes - 34" and 45" (2" O.D.)	1 each
40.	Zinc chromate paint (quarts).	4
41.	Hull and interior paint (quarts).	12
42.	Dome covers (canvas).	2
43.	Blower with cord.	1

44.	Ballast pumps, complete.	2
45.	Ballast pump blades, sets.	3
46.	Double belts for water pump (set)	1
47.	Hand grease gun.	1
48.	Propellers	2
49.	Spare part kit for fathometer.	1
50.	Spare part kit for gas fume detector.	1
51.	Lifting slings with shackles (set)	1
52.	Towing pendant.	
53.	Wire propeller lock	1

List of Blue Prints of Design Plans of Skiff

Drawing No.	Subject	Date
1035-3-Alt II	Construction Sections	3/24/53
1035-4-Alt II	Construction Profile and Beam Plan	2/5/53
1035-5-Alt IV	Engine Compartment	2/5/53
1035-11-Alt V	Crew Compartment	2/5/53
1035-15-Alt I	Rudder	2/5/53
1035-16-Alt I	Steering Gear	5/8/53
1035-17-Alt III	Ballast Water Pump Sheaves	2/20/53
1035-20-Alt 0	Deck Hatches	6/16/53
1035-21-Alt I	Lifting Tang	7/1/53
1035-3A	Fastening Schedule	4/3/53
1035-C3-4	Profile and General Arrangement	9/2/54
1035-C3-6	Machinery Arrangement	8/27/54
1035-C3-7	Ballast Piping	8/6/54
1035-C3-22	Air and Vent Piping	8/3/54
1035-C3-23	Lead Ballast Stowage	7/23/54

Note: Two sets of the above blueprints are furnished with the Skiff.

Procedure in Laying Up Skiff

a. Dry out hull thoroughly with sponge.

b. Drain all water from engine jackets and water pump, and ballast pump.

c. Disconnect engine water pump. After draining engine water system, insert wood plug in line to engine. Remove pipe plug in exhaust header and fill engine water system with a light fuel oil, to minimize corrosion while in storage.

d. Fill engine water pump grease cup with grease.

e. Drain gas tank and lines. Steam out gas tank after draining.

f. Remove spark plugs and squirt a sufficient quantity of thin lubricating oil on top of pistons to insure a protective film on pistons, rings, and cylinder walls. The motor should then be cranked for two minutes to insure complete covering.

g. Remove engine coil and store in a dry place.

h. If the place of storage is damp, it is suggested that the starter, generator, and spark plug and distributor wiring be removed and stored in a dry place.

i. Remove battery, compass, fathometer, blower and snorkel and store in dry place.

j. Grease all six topside relief valve springs.

k. Clean skiff both inside and outside, repainting as required.

l. Wipe down all metal parts with oily cloth to insure a light film of oil on all such parts that are exposed.

m. Hatch covers should be taken off and hatches left open for ventilation. Leave crew compartment hatch in open position.

n. Store in a weatherproof building or shed, under a canvas or similar cover that is spaced far enough above craft to avoid impairing ventilation.

Quarterly Checks While Laid Up

a. Inspect inside and outside for evidence of corrosion and condensation.

b. Wipe down to remove dust.

d. Remove spark plugs, squirt thin oil on top of pistons, and turn engine over with hand crank for two minutes to relubricate pistons, rings and cylinder walls.

d. Apply heavy film of oil to all exposed metal parts.

Recommissioning After a Layup

Attention should particularly be given to the following:

a. Flush out all metal parts, clean, inspect and lubricate as required.

b. All rubber parts such as gaskets, rubber bearings, syntron seal, etc. will deteriorate. Therefore, it will probably be necessary to replace these throughout.

c. Inspect, clean and lubricate, as required, electrical parts.

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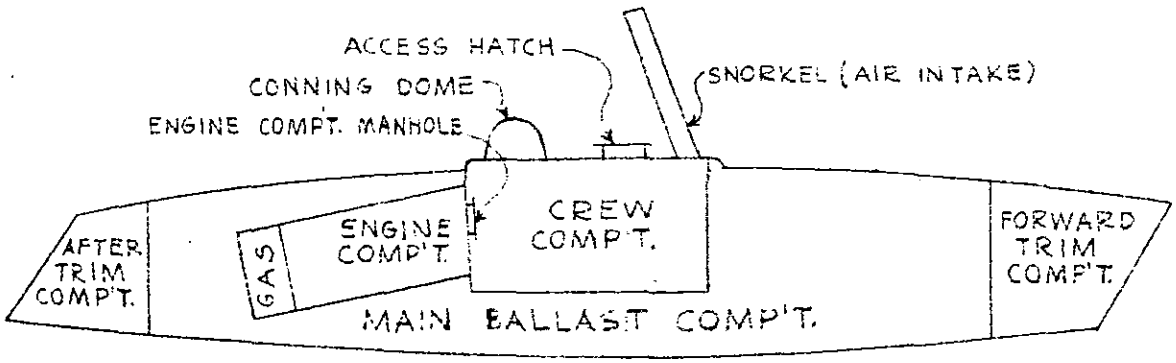
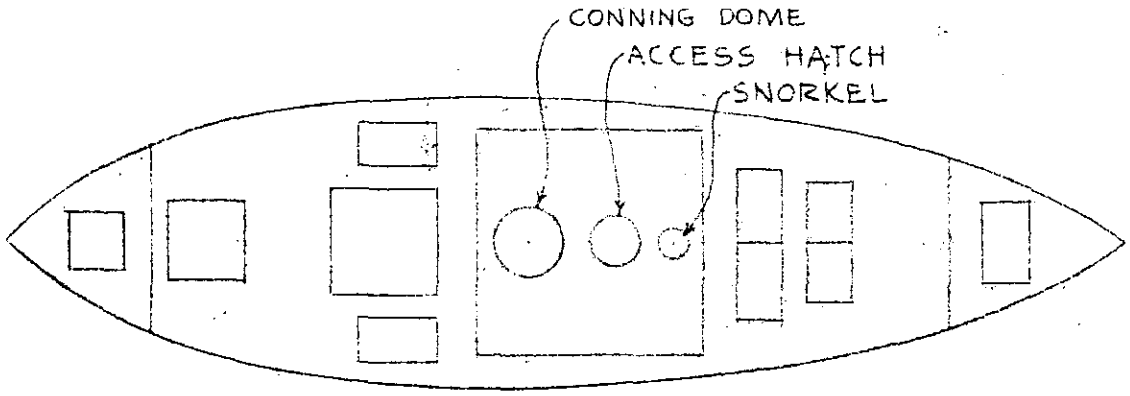
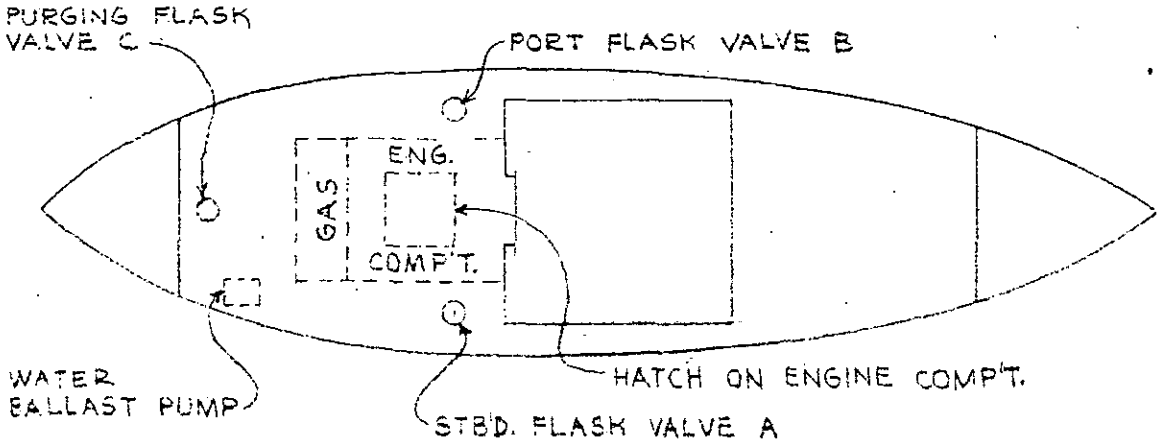


SIDE VIEW SHOWING PRINCIPAL COMPARTMENTS



PLAN VIEW SHOWING DECK PLATE ENTRIES INTO BALLAST TANKS



PLAN VIEW SHOWING AIR FLASKS, WATER BALLAST PUMP AND HATCH ON ENGINE COMP'T.

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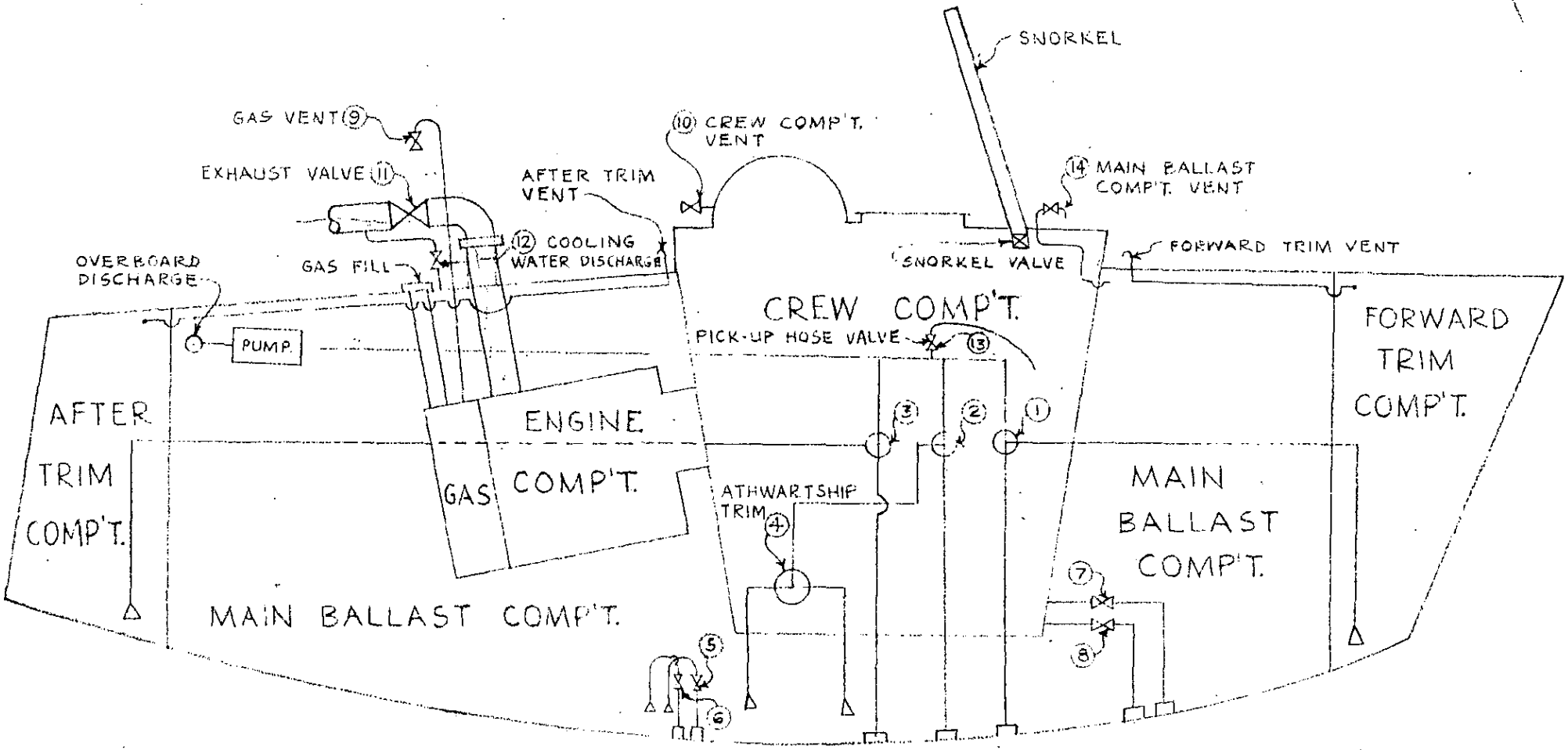
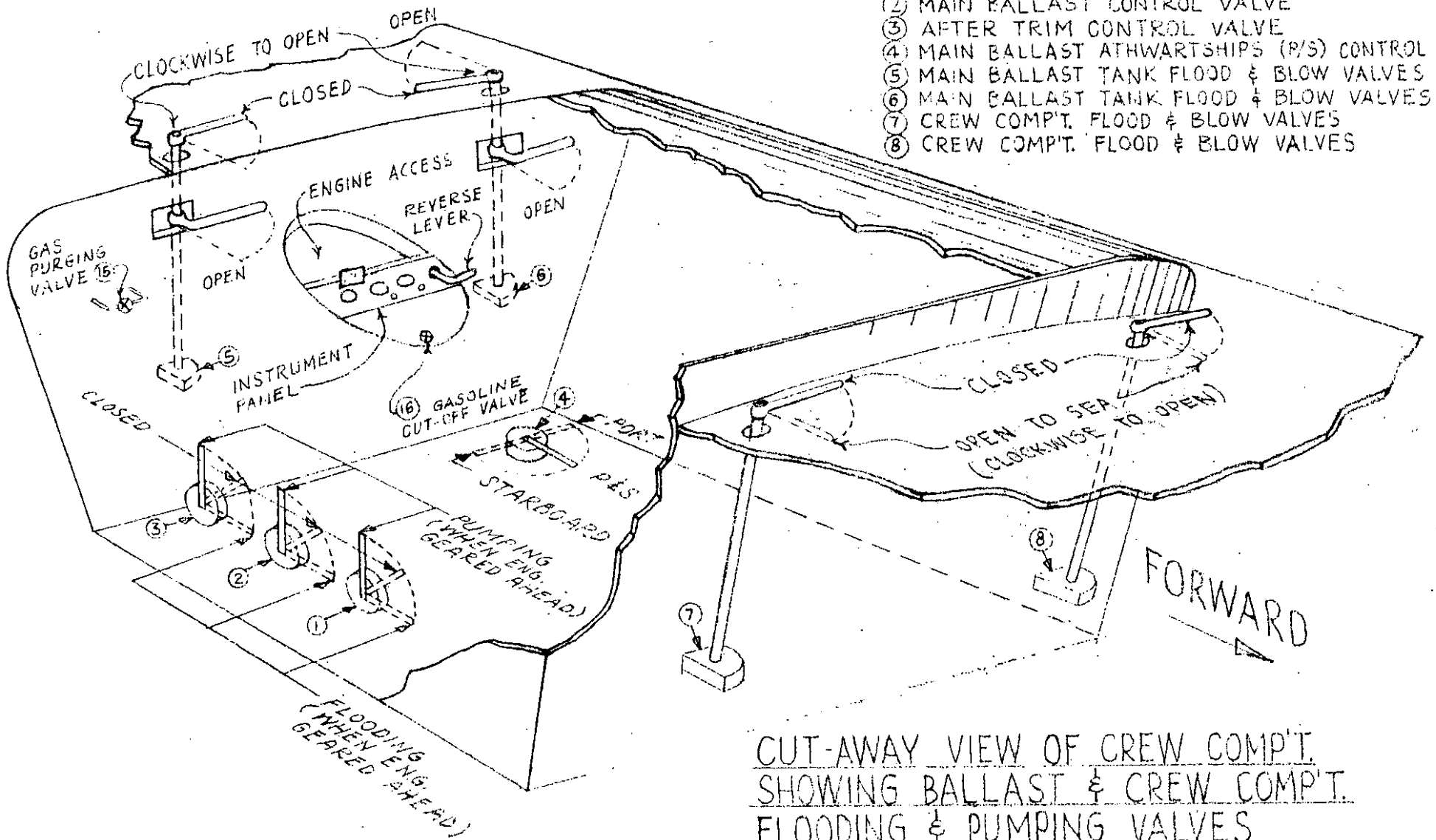
FIG. 1



SIDE VIEW OF BALLAST FLOODING AND PUMPING AND VENT SYSTEM

FIG. 2



CUT-AWAY VIEW OF CREW COMP'T. SHOWING BALLAST & CREW COMP'T. FLOODING & PUMPING VALVES

FIG. 3

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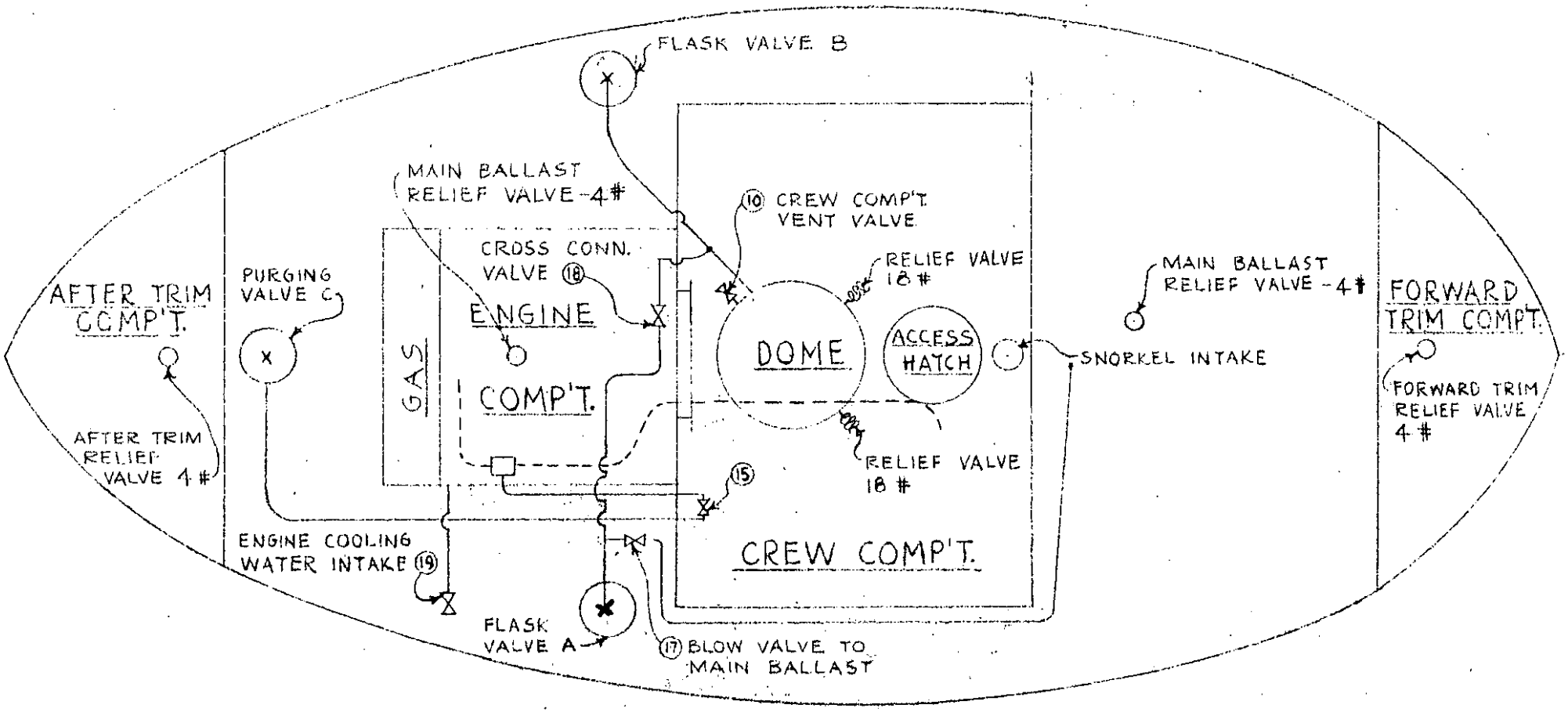

COMPRESSED AIR SYSTEM

FIG. 4

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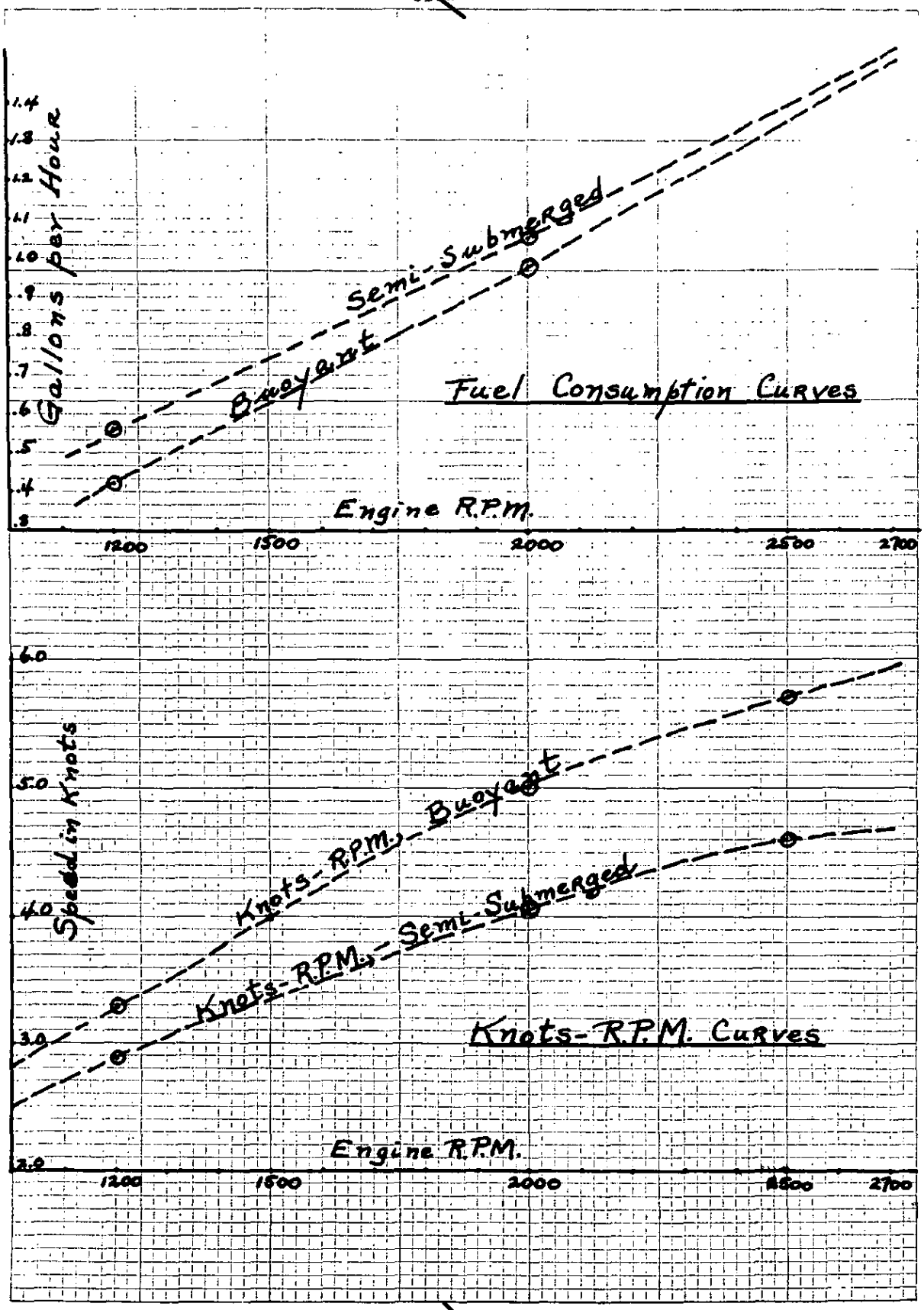
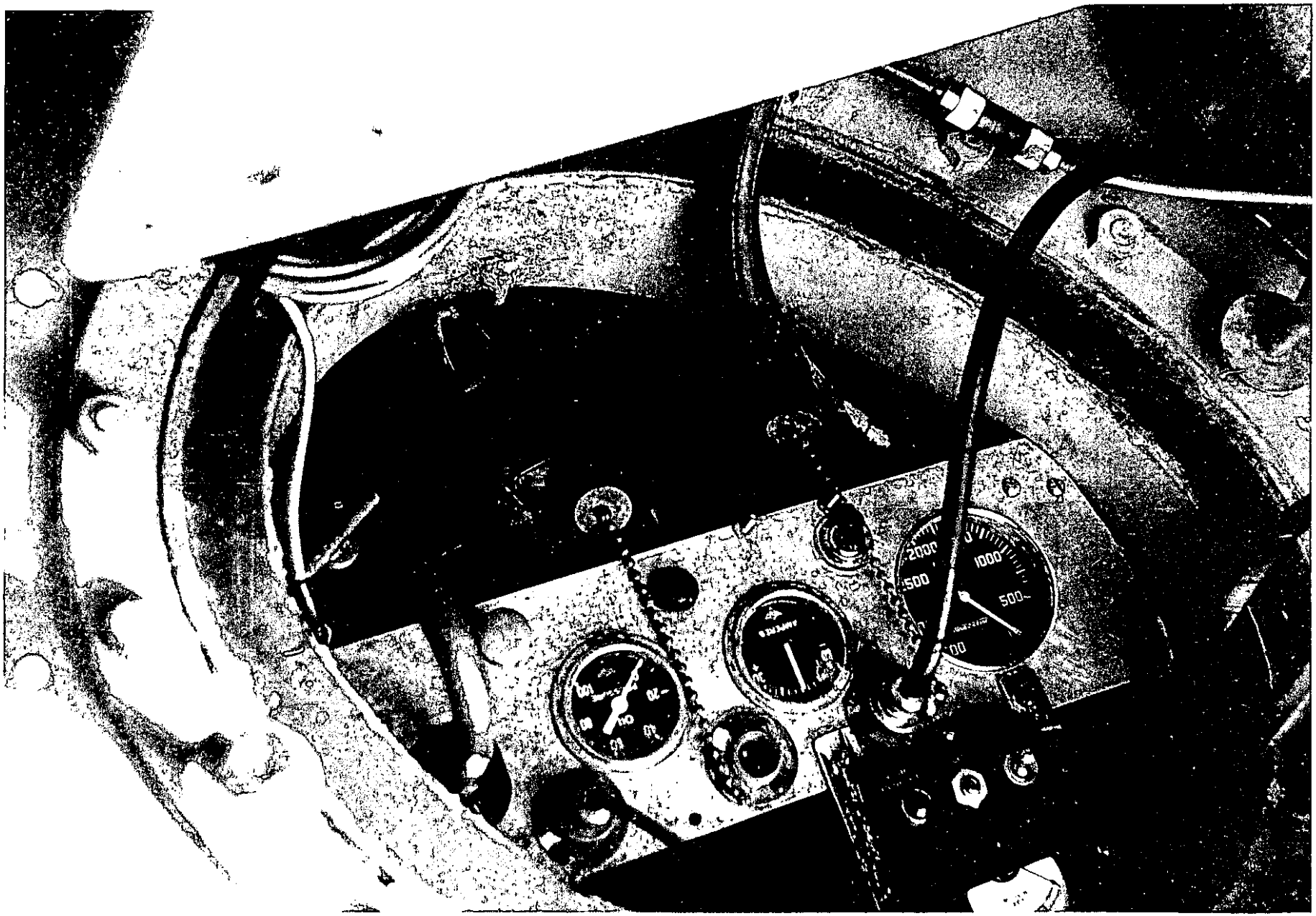

Gallons per Hour
1.4
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
Semi-Submerged
Buoyant
Fuel Consumption Curves
Engine R.P.M.
1200
1500
2000
2500
2700
Speed in Knots
6.0
5.0
4.0
3.0
2.0
Knots-R.P.M.-Buoyant
Knots-R.P.M.-Semi-Submerged
Knots-R.P.M. Curves
Engine R.P.M.
1200
1500
2000
2500
2700

FIG. 5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