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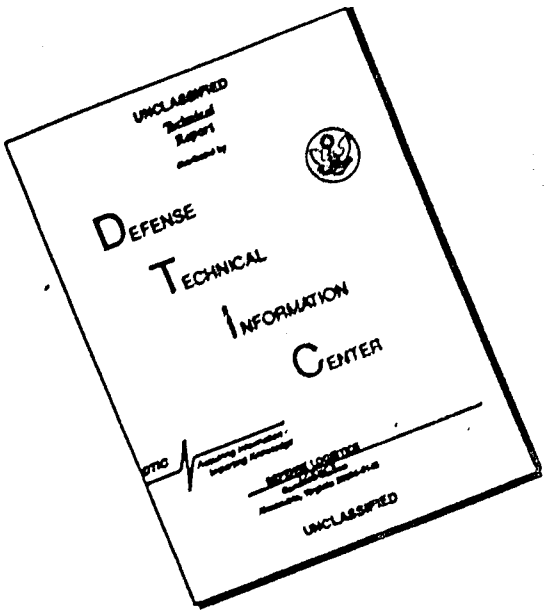

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WAR DEPARTMENT

Report 901

INTERIM REPORT ON DEVELOPMENT AND TESTING OF THE TWIN-SCREW UTILITY POWER BOAT

26 December 1944

FOR TECHNICAL INFORMATION ONLY

Does not represent recommendations or conclusions of the Office, Chief of Engineers

TECHNICAL STAFF
THE ENGINEER BOARD
Corps of Engineers, U. S. Army
Fort Belvoir, Virginia

[redacted]

ARMY SERVICE FORCES
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA

FILE NO.

Subject: Transmittal of Engineer Board Report 901, Interim Report on Development and Testing of the Twin-Screw Utility Power Boat

To: Chief of Engineers, U. S. Army
Attention: Equipment Development Branch
Engineering and Development Division

1. Transmitted herewith is Engineer Board "Report 901, Interim Report on Development and Testing of the Twin-Screw Utility Power Boat," dated 26 December 1944, which was prepared by the Technical Staff and has been considered by the members of the Board.

2. This report covers the development of a power boat of sufficient capacity to handle in fast currents rafts of 25-ton ponton, steel treadway, and Division-Army bridge equipage.

3. The Engineer Board concurs in the recommendations of the report, which are as follows:

a. That the Twin-Screw Utility Power Boat, as described in Corps of Engineers Tentative Specification EBP No. 441C, dated 29 June 1944, be accepted as a required type, development type, limited procurement type.

b. That investigation of methods of transporting the boat, as well as ways of reducing its weight, be continued.

For the Board:

John W. N. Schulz

John W. N. Schulz,
Brigadier General, U. S. Army,
President.

1 Incl. (in dup.)
Report as above

[redacted]

[redacted]

Report 901

INTERIM REPORT
ON
DEVELOPMENT AND TESTING OF THE TWIN-SCREW UTILITY POWER BOAT

Project - BR 290-A

26 December 1944

Submitted to

THE ENGINEER BOARD

Fort Belvoir, Virginia

and/or

The Chief of Engineers

U. S. Army

Washington, D. C.

FOR OFFICIAL ACTION

by

Carl H. Clement, Jr.,
Major, Corps of Engineers,
Technical Division IV.

and

Joseph H. Sonntag,
Captain, Corps of Engineers,
Acting Chief, Floating Equipage Branch.

[redacted]

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TABLE OF CONTENTS - cont.

[redacted]

SYLLABUS

This report covers the development of a power boat with sufficient capacity to handle rafts of 25-ton ponton, steel treadway, and Division-Army bridge equipage in fast currents.

The three boats tested were of similar design, the principal difference being in the size and type of power plant used. Each succeeding boat was constructed after engineering tests had been conducted on the preceding model. Modifications in the deck arrangement and equipment were made as a progressive development in the three boats. Some engineering tests were conducted at Fort Belvoir, Virginia, but the majority were conducted by the Engineer Board Yuma Test Branch on the Colorado River in the vicinity of Imperial Dam, Arizona.

The report finds that the Model T3 twin-screw utility power boat is the most satisfactory boat for the purpose intended, and that it substantially meets the military characteristics. However, an entirely satisfactory method of transporting the boat has not been found. Studies are being made of ways to reduce the weight of the boat.

The report recommends that:

a. The twin-screw utility power boat, as described in Corps of Engineers Tentative Specification EBP No. 441C, dated 29 June 1944 be adopted as a required type, development type, limited procurement type.

b. Investigation of methods of transporting the boat, as well as of ways of reducing its weight, be continued.

[redacted]

INTERIM REPORT ON DEVELOPMENT AND TESTING OF THE TWIN-SCREW UTILITY POWER BOAT

I. SCOPE OF REPORT

1. Scope. This report covers the development and testing of a power boat capable of propelling rafts constructed of standard ponton equipment and loaded with medium or heavy tanks at speeds of six miles per hour or more. The work was accomplished during the period 9 March 1943 to September 1944.

II. AUTHORITY

2. Authority. The authority for the engineering tests is contained in the following listed communications, copies of which are included in Appendix A.

a. 3rd indorsement dated 9 March 1943 from the Chief of Engineers to the Engineer Board. The military characteristics as approved in this indorsement cover the Twin-Screw Utility Power Boat. There were no approved characteristics for Sub-Project BR 290 A during the period when the present standard utility power boat was developed.

b. Letter dated 18 March 1943 from the Chief of Engineers to the Engineer Board, Subject: Power Boat.

c. Letter from the Chief of Engineers to the Engineer Board, dated 10 May 1943, Subject: "Reduction of Development Program."

d. Letter dated 4 October 1943 from the Chief of Engineers to the Engineer Board, Subject: Work Order No. DBR 3041, 150 HP Twin-Screw Utility Power Boat.

III. PREVIOUS INVESTIGATION

3. Studies at Fort Belvoir. Studies in the use of power boats with bridge equipment were started in October 1940 at Fort

Belvoir, Virginia. During the period from October 1940 to June 1941, a series of small boats were designed and tested for use with the 25-ton ponton equipage. These studies, covered in the Engineer Board Report 622, Use of Outboard Motors and Motor Boats with 23-Ton Ponton Bridge, dated 28 May 1941, resulted in the standardization of the utility power boat (Fig. 1) and in the issuance of this boat on the basis of one per bridge set to the Heavy Ponton Battalion and later to the Light Ponton Companies.

4. Raft Tests at Yuma. When it was found necessary to test bridges and rafts to determine their ultimate capacity in various currents, the standard utility power boat was also reinvestigated. During the period from November 1942 to June 1943, tests made on the Colorado River, in currents up to 6 mph indicated that the standard utility power boat lacked sufficient pushing and steering power to handle rafts loaded with the medium tank.

IV. PRESENT INVESTIGATION

5. Need for Higher-Powered Boat. Because the standard 52-hp utility power boat lacked sufficient power to push and handle rafts loaded with medium tanks and similar heavy loads, the Engineer Board was directed to develop a boat of 100 to 150 hp to handle the heavier loads.

6. Preliminary Studies.

a. Power Plants. Studies of possible power plants for the new boat were concentrated on two types: a single gasoline engine of approximately 100 to 150 hp coupled to two propellers, and two gasoline engines of lesser horsepower coupled to individual propellers and operating completely independent of each other. Each had favorable features, the principal ones being that single-engine operation would permit simpler operation of the boat and dual-engine operation would permit greater safety because, in the event of failure of one engine, the second could still operate the boat at reduced speed. Consideration of single-engine power plants for the power boat was eventually abandoned when it became apparent that time would not permit the necessary engineering and development work. A Lycoming Model O-435T tank engine had been considered in conjunction with a Ronning transmission to drive the two propellers for this installation. Data on foreign power boats, in particular the British Mk III and the German motor boat, were obtained and studied with regard to available power, thrust characteristics, and size of boat. These boats are described in more detail in paragraph 23.

b. Engines for Power Plants. The military characteristics for the power boat required the power plant to be a standard engine.

(1) The only standard army marine engines available in the 50- to 150-hp field at the time the investigation was initiated were:

(a) Chrysler Royal Marine Engine, 145 hp at 3200 rpm.

(b) Gray Model 4-52, 57 hp at 3000 rpm (the standard utility power boat engine).

(c) Chrysler Ace, 86 hp at 2800 rpm.

(2) In addition to the above, the following standard truck and stationary engines were also available in required power range:

(a) Chrysler T116, 91 hp at 3200 rpm (the standard 3/4-ton Dodge truck engine).

(b) Continental F226, 82 hp at 3200 rpm.

(c) Willys 1/4 ton truck engine, 41 hp at 2500 rpm.

(d) General Motors 2½-ton truck engine, 89 hp at 2400 rpm.

All of the above engines are water-cooled engines.

(3) Some consideration was also given to the following two air-cooled aircraft engines:

(a) Lycoming O-145-B3, 65 hp at 2550 rpm.

(b) Continental A65, 65 hp at 2300 rpm.

To convert either truck or aircraft engines to marine engines requires the installation of reversing gears with clutches. In addition, suitable water pumps or air-circulating fans are required. Actual installations in the test boats are described in paragraph 7.

7. Pilot Models. Three pilot model boats, T1, T2, and T3 (Fig. 2), were constructed in sequence by the C. V. Hill Company during the period September 1943 to April 1944.

a. Power Plants. Power plants were chosen for each installation on the basis of availability and maximum interchangeability of parts with standard engines. The models were modified progressively, with changes being based on weaknesses developed

during tests. Comparative details of the pilot models and their power plants are given in Table 1 (Fig. 3); Table 2 (Fig. 4); and Table 3 (Fig. 5). A column is also shown for the modified model T3 boat.

(1) Model T1. The power plant for this installation was two Chrysler M14 engines. The M14 is adapted from the standard 3/4-ton Dodge truck engine (model Chrysler T116) by the addition of a fluid coupling and marine reverse gear. This particular power plant was chosen because the available horsepower (91 hp at 3200 rpm) was satisfactory, and it appeared that the installation would provide the maximum interchangeability of parts.

(2) Model T2. The power plant in this installation was two non-standard Gray engines, Model 6-121. These were chosen because the engine contained seven main bearings and had a displacement of 330 cubic inches as compared to a maximum of four main bearings with 324 cubic inches displacement for the Chrysler Royal Marine engine, which was the only standard engine available at the same horsepower. The increase in power over the T1 installation was considerable, 124 hp as compared with 91 hp at 3200 rpm for each engine. This increase in power was incorporated into the T2 power plant to investigate possible advantages resulting from a higher-powered boat.

(3) Model T3. The experience gained from tests of the power plants in the T1 and T2 boats was utilized in the selection of the power plant for the T3 boat. This power plant, two Gray Model 6-77 engines, was the marine conversion of the standard Continental Model F226 engine, and developed 82 hp at 3200 rpm.

b. Hull. The hull design of all three models was basically the same. All were constructed of wood and plywood. The difference was largely in the arrangement of the deck.

8. Outline of Tests. The T1, T2, and T3 boats were tested at the Yuma Test Branch, and the T2 and T3 boats were also tested at the Engineer Board. Tests were made as follows:

a. Individual Boats.

(1) Towing power

(2) Torque for turning

(3) Maneuverability

FIG. 1. COMPARISON OF UTILITY POWER BOATS. Note difference in size and design of present standard utility power boat (left) and the new twin-screw utility power boat, T3, (right).

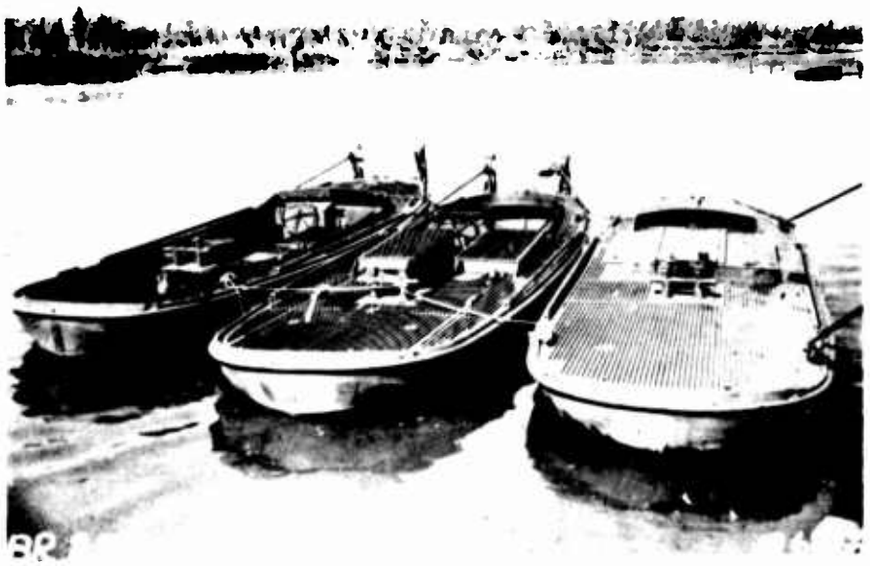

FIG. 2. COMPARISON OF DECK ARRANGEMENTS OF PILOT MODEL TWIN-SCREW UTILITY POWER BOATS. Left to right: T3, T2, and T1.

TWIN-SCREW UTILITY POWER BOAT
Comparison of Characteristics

Characteristic	Model T-1	Model T-2	Model T-3	Modified Model T-3
* Length Overall (Molded)	25 ft 0 in.	25 ft 0 in.	25 ft 0 in.	25 ft 1 3/8 in.
Length Overall with pushing knee	25 ft 10 3/4 in.	25 ft 10 3/4 in.	25 ft 10 3/4 in.	26 ft 1/8 in.
Length Load Waterline	23 ft 10 1/4 in.	23 ft 6 1/4 in.	25 ft 5 in.	23 ft 9 1/2 in.
** Beam Extreme	8 ft 5 in.	8 ft 5 in.	8 ft 5 in.	8 ft 8 in.
Beam Moulded	7 ft 11 1/2 in.	7 ft 11 1/2 in.	7 ft 11 1/2 in.	8 ft 1 3/4 in.
Depth Amidships	2 ft 6 1/8 in.	2 ft 6 1/8 in.	2 ft 6 1/8 in.	2 ft 9 3/4 in.
Depth Forward	3 ft 6 1/8 in.	3 ft 6 1/8 in.	3 ft 6 1/8 in.	4 ft 0 1/8 in.
Depth Aft	2 ft 9 1/4 in.	2 ft 9 1/4 in.	2 ft 9 1/4 in.	3 ft 1 1/2 in.
Draft Forward	12 in.	12 in.	11 in.	11 in.
Draft Aft	33 in.	33 in.	31 in.	31 in.
Total Horsepower	182	248	164	164
Propeller Data:				
1. Diameter	28 in.	28 in.	26 in.	26 in.
2. Pitch	24 in.	22 in.	17 in.	17 in.
Shaft Size (Diam)	1 3/8 in.	1 3/8 in.	1 3/8 in.	1 3/8 in.
Rudder Area	2.92 sq ft	2.92 sq ft	4.09 sq ft	4.09 sq ft
Displacement without accessories	6800 lb	6500 lb	5500 lb	5500 lb
Displacement Length Ratio	222	225	191	183
Fuel Capacity	100 gal	100 gal	100 gal	100 gal

** Maximum overall tolerance.
* Add 4½" for bumper rail and 5/8" for base of chock casting.
The pushing knee which is detachable adds 5 5/8" to base of chock casting.

FIG. 3. TABLE 1. COMPARISON OF CHARACTERISTICS, TWIN-SCREW POWER BOATS.

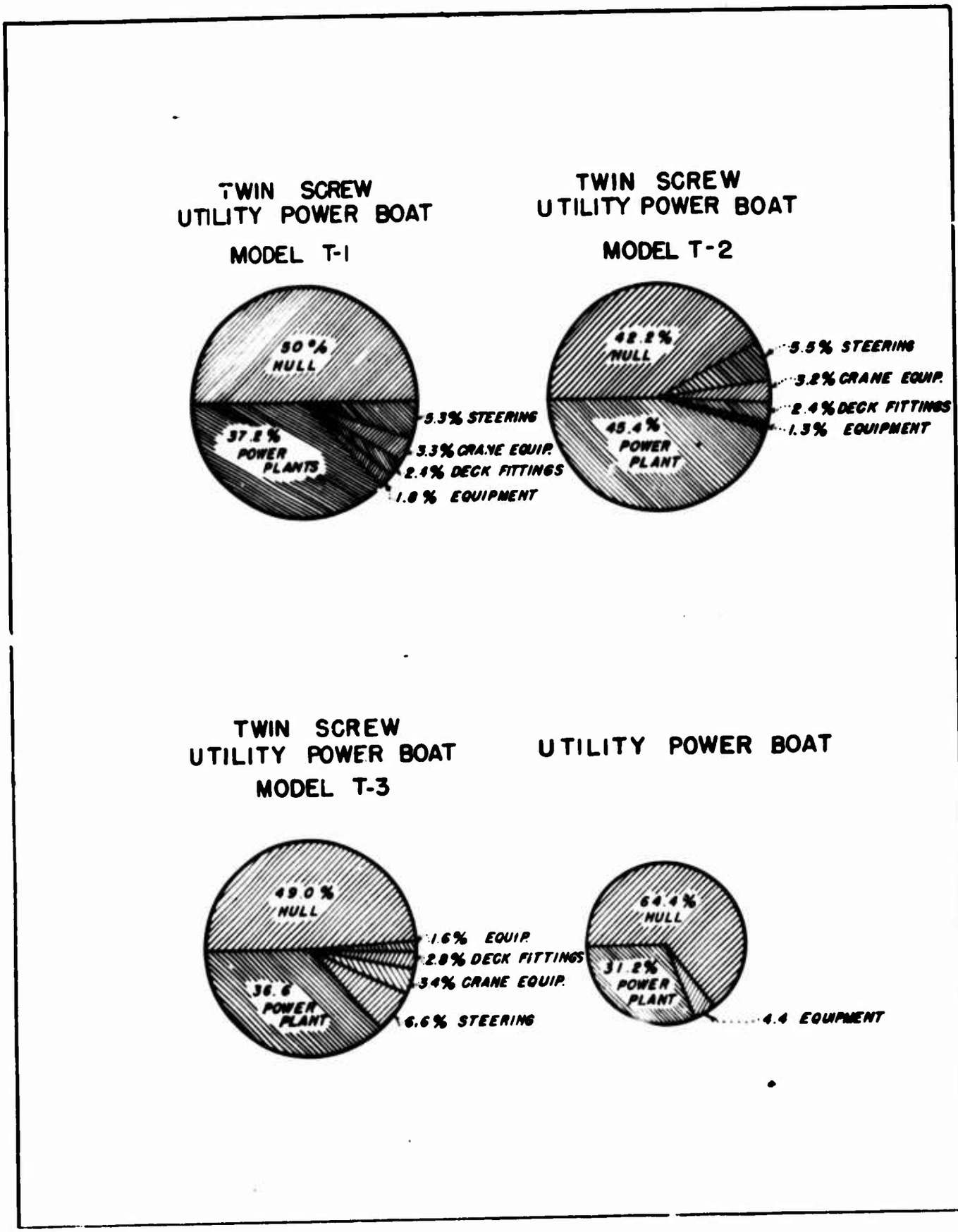

FIG. 4. TABLE 2. WEIGHT DISTRIBUTION DATA.

PILOT MODEL POWER BOATS

ENGINE CHARACTERISTICS

Characteristic	Model T-1	Model T-2	Model T-3 and Modified Model T-3
Make and model	Chrysler M-14	Gray Model 6-121	Gray Model 6-77
Horsepower	91	124	82
RPM	3200	3200	3200
Weight, including reverse and reduction gear	990 lb	1140 lb	715 lb
Reduction ratio	3.46:1	3:1	3:1
Number of cylinders	6	6	6
Bore	3-3/8 in.	4 in.	3-5/16 in.
Stroke	4-3/8 in.	4-3/8 in.	4-3/8 in.
Piston displacement	230.2 cu in.	330 cu in.	226 cu in.
Total weight, propulsion machinery	2,100 lb	2,480 lb	1,530 lb
Thrust both engines, zero speed	3,600 lb	5,000 lb	4,000 lb

FIG. 5. TABLE 3. ENGINE CHARACTERISTICS.

(4) Fuel consumption

(5) Suitability of power plant

(6) Speed

(7) Beaching

(8) Transportability

(9) Accessory equipment

b. Rafting.

(1) Capacity and rafting speeds with various rafts

(2) Endurance test over continuous period (28 hours minimum) pushing loaded 5-boat raft

9. Test Data.

a. Towing Power, Speeds, and Raft Capacities. Comparative test data on towing power, speed, rafting capacities and rafting speeds of the three models and the standard 52-hp utility power boat are contained in Table 4 (Fig. 6). The 90-hp utility power boat, for which data is included in the chart, was an earlier attempt to use the Chrysler M14 engine in the single-screw utility power boat.

b. Maneuverability. All three boats maneuvered well, although the T2 boat with its extra power required more skillful handling. Results of the maneuverability tests are shown in Table 5, (Fig. 7).

c. Beaching. All boats were able to withstand both beaching and backing off a beach under their own power. (See Fig. 8)

d. Accessory Equipment. Much of the equipment, such as deck fittings, was designed specifically for use on this type boat. Most noteworthy of the deck fittings were the roller bow chock and haul tackles for the tightening of steering lines, located on the aft deck. A heavy towing bitt was provided at the aft end of the cockpit. A crane arrangement (Fig. 9) was also found of considerable value in the hoisting of anchors, raising of sterns of other boats for propeller maintenance, and as assistance for lifting in various salvage operations. Also included in the equipment are life preservers, tow lines, boat hooks, bilge pumps, and running lights. The boat is provided with adequate lifting eyes fore and aft for handling with a crane. These fittings are substantially anchored to the keel of the boat. The pushing knee, Fig. 19, also proved satisfactory as a means of propelling rafts.

e. Rafting Tests. Results of rafting tests are shown in Table 4 (Fig. 6). Various pictures of the rafting tests are shown in Figs. 10 to 13.

f. Endurance Test. An endurance test was made with the T3 power boat pushing four 25-ton pontons, in the form of two 2-boat rafts loaded to 43 tons displacement, up the Colorado River from Imperial Dam to the Palo Verde test site and return, a total distance of approximately 130 miles. The up-river trip required 33 hours 15 minutes operating time and the return trip required 7 hours 32 minutes. The maximum propelling speed was 6.1 mph. The average up-river speed was 2 mph against currents averaging 3 to 6 mph. One quart of oil was added and 387 gallons of gasoline were used on the trip. The T3 power boat, with the addition of some slight modifications found necessary as a result of the tests, was determined to be satisfactory for an operation as described above.

g. Transportation. Both the T2 and T3 boats were transported on the 2½-ton pole-type utility trailer (Fig. 14) towed by a 2½-ton 6 x 6 prime mover. Trailer capacity, however, was exceeded and there was a possibility of damaging axles in cross-country transportation. The high center of gravity of the load was also detrimental to cross-country travel. Because of the weight of the boat, a crane was required to load the boat on the trailer. An 8-ton flat bed, machinery-type trailer (Fig. 15) equipped with a shipping skid was also used to transport the boat. This method was satisfactory for on-road transportation but not satisfactory for cross-country operations.

10. Results of Tests. Tests of the three models of boats indicated that all three had sufficient pulling power to handle the standard rafts, up to and including the five-float 25-ton ponton raft with a 45-ton medium tank cargo, at speeds of 6 mph or more. Therefore, it became a matter of determining which of the three boats was best equipped for rafting operation and which had the most satisfactory power plant from the point of view of continued operation, fuel consumption and availability of spare parts for maintenance. Table 4 (Fig. 6) shows the results in chart form. In addition, the results are further summarized as follows:

a. Model T-1. The Model T-1 boat was found to have sufficient pulling power to handle the various rafts in currents up to five miles per hour. During the conduct of the tests with this boat, a number of mechanical deficiencies were uncovered. These included:

(1) Failure of the steering gear system, when heavily loaded and with both engines in reverse.

(2) Inconvenient location of the reverse gear levers.

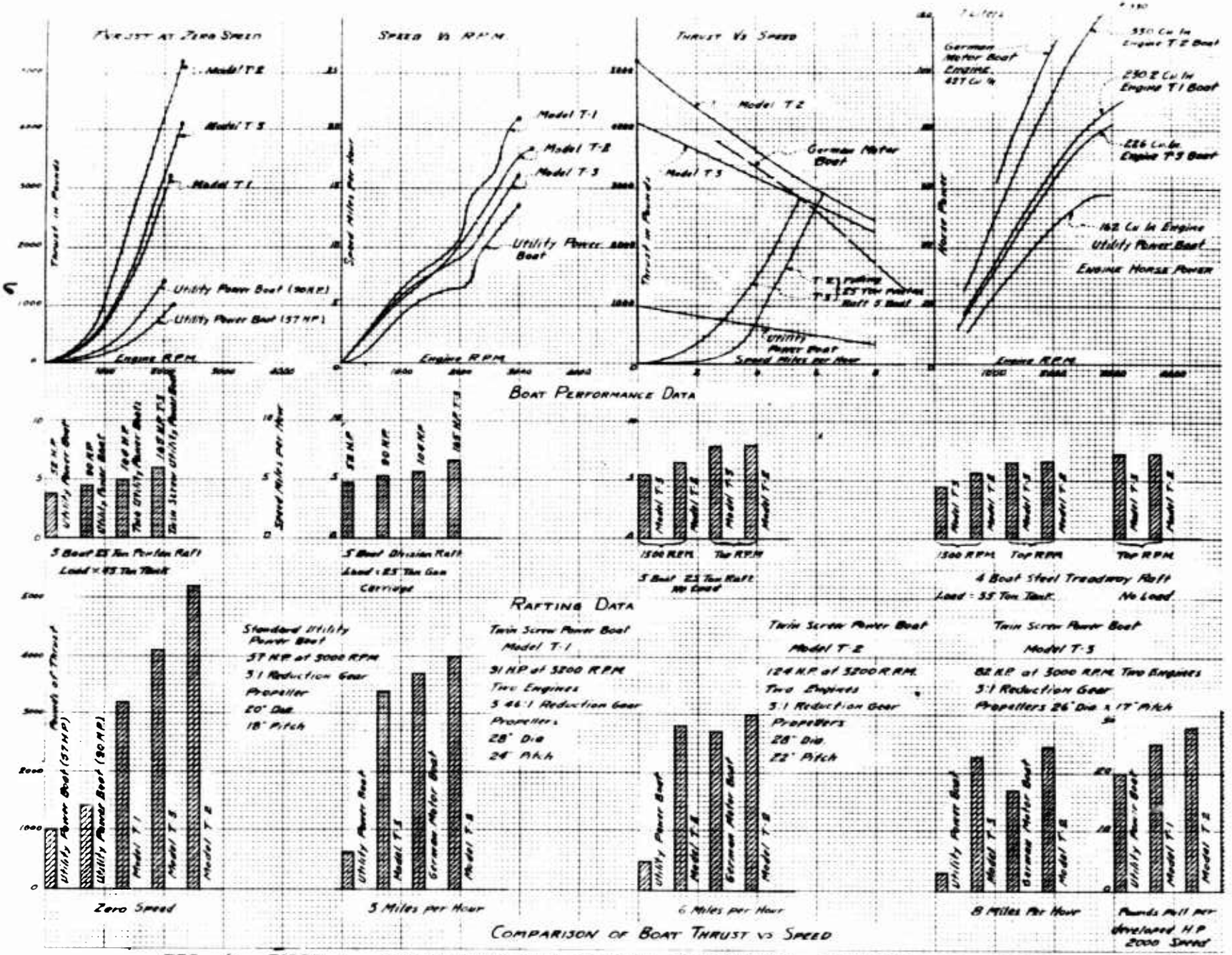

FIG. 6. TABLE 4. COMPARATIVE DATA ON BOAT PERFORMANCE, MODELS T1, T2, AND T3.

DATA ON MANEUVERABILITY OF
TWIN-SCREW UTILITY POWER BOATS

No.	Description of Test	T1	T2	T3
1	One engine full ahead, one full astern, rudders straight, minimum turning radius	20 ft	20 ft	18 ft
2	Same as 1, using rudders to aid turning, minimum turning radius		15 ft	15 ft
3	Both engines full ahead, rudder hard over, turning radius:			
	Starboard	65 ft	30 ft	25 ft
	Port	50 ft	30 ft	30 ft
4	Both engines full astern, rudders hard over, minimum turning radius,			
	Starboard		30 ft	25 ft
	Port		30 ft	25 ft
5	One engine full ahead, other stopped, minimum turning radius:			
	Rudders straight	100 ft	125 ft	80 ft
	Rudders hard over	35 ft	30 ft	25 ft
6	Starboard engine full astern, other stopped, minimum turning radius		15 ft	20 ft

FIG. 7. TABLE 5. MANEUVERABILITY OF TWIN-SCREW UTILITY POWER BOATS.

FIG. 8. BEACHING TWIN-SCREW UTILITY POWER BOATS IS NO PROBLEM. Ample protection is provided for propellers and rudder. The boat is easily retracted under its own power, as long as propellers are in the water.

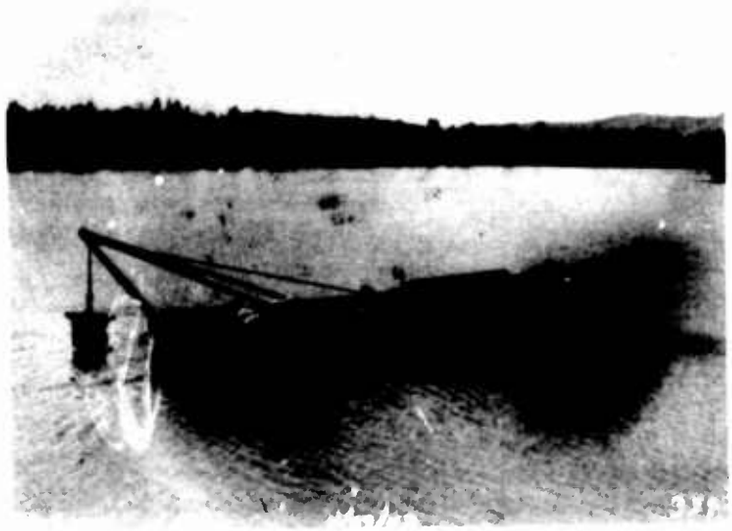

FIG. 9. CRANE EQUIPMENT FOR TWIN-SCREW UTILITY POWER BOATS. Rigged over the stern of the model T1 boat (above), the crane is lifting 1700 pounds. It can be used over either bow or stern.

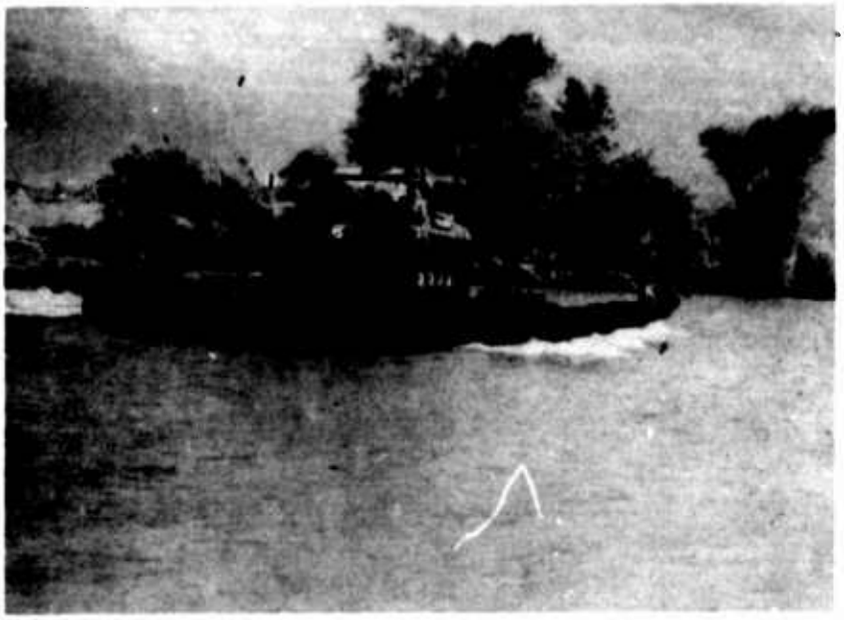

FIG. 10. TWIN-SCREW UTILITY POWER BOAT, T3, PROPELLING A 4-BOAT WHOLE PONTON DIVISION RAFT. Maximum speed of raft, loaded with model T~O motor gun carriage, is 6.5 miles per hour.

FIG. 11. TWIN-SCREW UTILITY POWER BOAT, T3, PUSHING A 4-BOAT WHOLE PONTON DIVISION RAFT. Speed of raft, loaded with an 18-ton light tank, is 6.5 miles per hour.

FIG. 12. THE TWIN-SCREW UTILITY POWER BOAT, T3, HAS POWER TO HANDLE THE 4-BOAT STEEL TREADWAY FERRY WITH A MEDIUM TANK LOAD AT A SPEED OF 6.1 MILES PER HOUR.

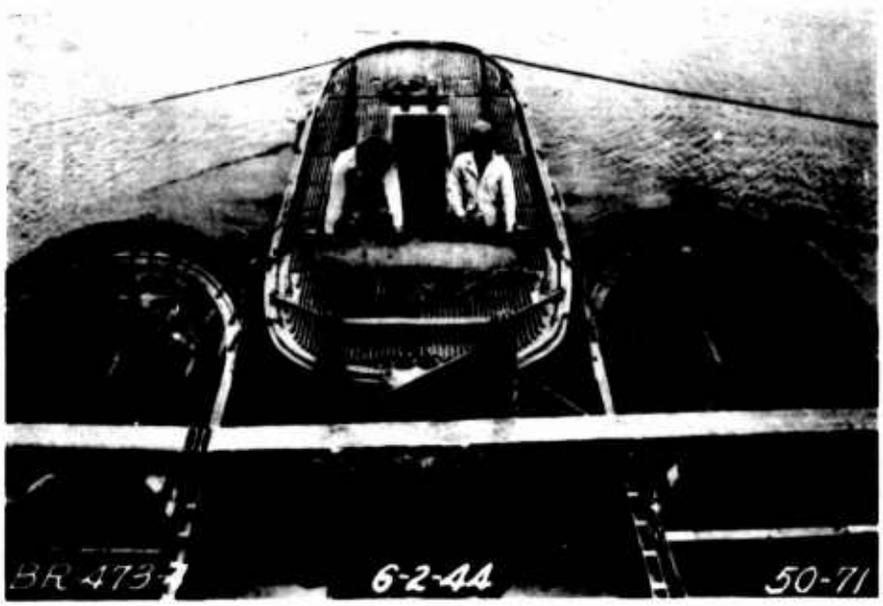

FIG. 13. TWIN-SCREW UTILITY POWER BOAT, T3, IN POSITION AT START OF RAFTING OPERATION WITH FORWARD PUSHING KNEES CONTACTING BALK OF NEW ARMY BRIDGE RAFT. Steering lines are tightened by haul tackles from the stern.

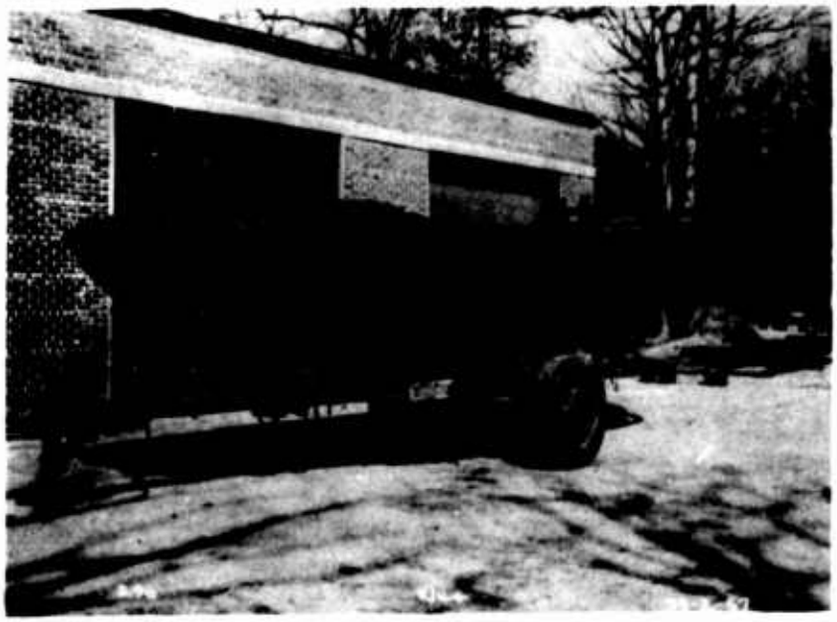

FIG. 14. 2½-TON POLE TYPE TRAILER USED IN TRANSPORTING TWIN-SCREW UTILITY POWER BOAT, T-3. Two bolsters at center provide primary support. Forward pad on pole prevents shifting of hull.

FIG. 15. 8-TON FLAT BED MACHINERY TRAILER USED TO TRANSPORT TWIN-SCREW UTILITY POWER BOAT, T-3. Wooden shipping skid supports the boat.

(3) Difficulty in proper adjustment of the reverse clutches.

(4) Inconvenient location of the instrument panels.

(5) Poor throttle control.

(6) Engine trouble in the form of sticking valves.

(7) Inaccessibility of the outboard side of both engines for adjustment and repair.

(8) Insufficient cockpit space to permit freedom of movement for operation by the crew.

(9) A total weight of 6800 pounds was found too great for convenient transportation, particularly with the 2½-ton trailer.

b. Model T2. The Model T2 boat was found to have abundant power under all conditions if properly handled.

If handled by an inexperienced operator, the tremendous power so readily available was found to be dangerous. Raft tests indicated that the boat had ample reserve power for any current up to 6 mph. This boat was found to have a greatly improved throttle control system, clutch control system, and instrument panel. The worm-type steering gear was found to be a considerable improvement over that on the T1 boat. No particular mechanical defects were encountered with the power plants, though proper adjustment and maintenance of the engine was still found to be difficult, due to the inaccessibility of the outboard side of the engines. The weight of this boat was 6400 pounds.

c. Model T3. The Model T3 boat was found to be the lightest (5500 pounds) and to have the best maneuverability of all three models tested. It was found to have ample power for currents up to five mph, to have a conveniently located control station (Fig. 16) and to be mechanically satisfactory in all tests conducted on it. The deck arrangement (Fig. 17) was found to be the most generally satisfactory of all three boats, when the boat was considered as a power plant for ponton raft operation and for the various utility jobs encountered in bridge construction. Even though lighter in weight, this boat was found to possess sufficient strength throughout to withstand beaching, transportation, and general conditions during its operation. No major weaknesses were found during any of the tests. However, the freeboard of the boat was found to be lower than desirable for all operations. During heavy tows, the stern of the boat was awash, and when the boat was used alone in rough water, considerable spray was taken over the bow.

V. DISCUSSION

11. General. As the test results indicate, the Model T3 boat was the best of the boats tested. The following discussion is centered on this boat, comparing it with the other two models tested and with the standard utility power boat, the British Mk-III and the German motor boat. As was noted in paragraph 5, no test models of a single engine, twin-screw boat, equipped with the Renning transmission, was built due to the time element involved in that type of construction.

12. Propelling Machinery. In considering the selection of a power plant for the boat, the Chrysler M14 marine engine installed on the T1 boat was an attempt to convert the 3/4-ton Dodge truck engine to a marine power plant by the addition of a fluid coupling and marine reverse gear. The use of the Dodge engine did not prove fully satisfactory, and the number of parts interchangeable with those of the truck engine was considerably less than had been anticipated. The resulting weight of the converted engine, 990 pounds, was also excessive. The Gray Medel 6-121 engines, used to power the Model T2 boat, were found to be fine power plants with great durability, smooth operation, and moderate fuel consumption. However, the extreme weight, 1140 pounds each, the excess of power, plus the high cost are factors against the adoption of the engines for these boats. The Gray 6-77 engine (Fig. 18) used to power the T3 boat was entirely satisfactory. The maximum power output of the twin engine installation is adequate to handle the heaviest loads under consideration at this time. In addition, its weight, 715 pounds, makes it the lightest engine of the three tested. It has good operating characteristics, and it provides a considerable degree of interchangeability with the Gray Model 4-52 engine of the present standard utility power boat.

13. Steering Machinery. The Model T1 boat was equipped with a flexible cable steering gear operated by a chain and sprocket. Tests proved that tension in the cable could not be maintained satisfactorily, and that the steering quadrants were not strong enough. Accordingly, the steering machinery of the Model T2 and T3 boats was completely redesigned, and a Ross-type worm gear steering mechanism with rigid push rod control was adopted. This type steering provided a more positive means of connection between the wheel and the rudders, and eliminated any play found in the cable type. Tests with the T3 boat indicated a lack of steering power on the first trial, but, by increasing the size of the rudder, ample steering power for reasonable maneuverability was obtained. The increase in rudder area did not appear detrimental to the steering gear.

14. Equipment. Each of the test boats was provided with the same type of equipment for pushing, for the efficient handling of

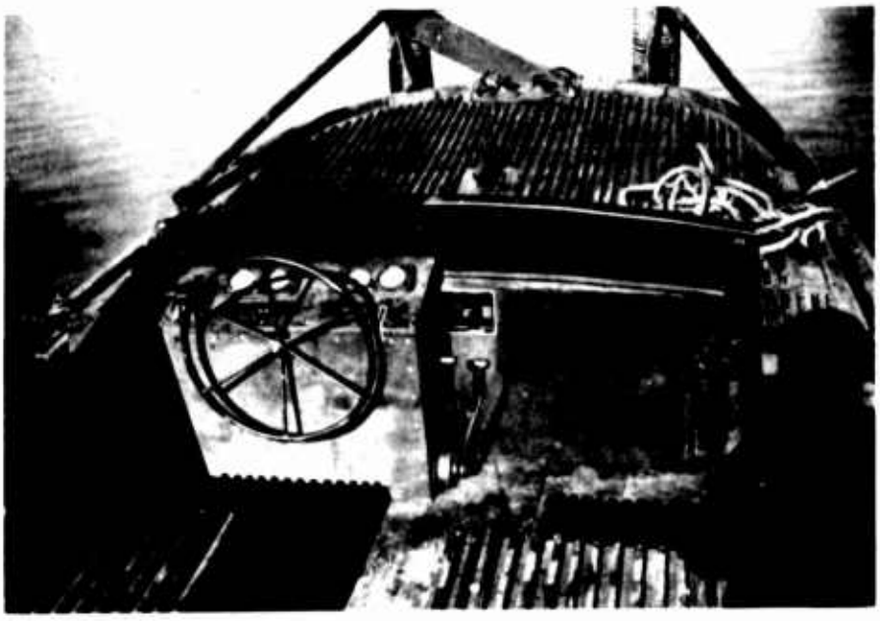

FIG. 16. CONTROL STATION OF TWIN-SCREW UTILITY POWER BOAT, T-3. It is conveniently located on the port side of the cockpit. All controls are within easy reach of the operator.

FIG. 17. DECK ARRANGEMENT OF TWIN-SCREW UTILITY POWER BOAT, T-3. Showing arrangement of cockpit, control station, equipment and large forward working deck.

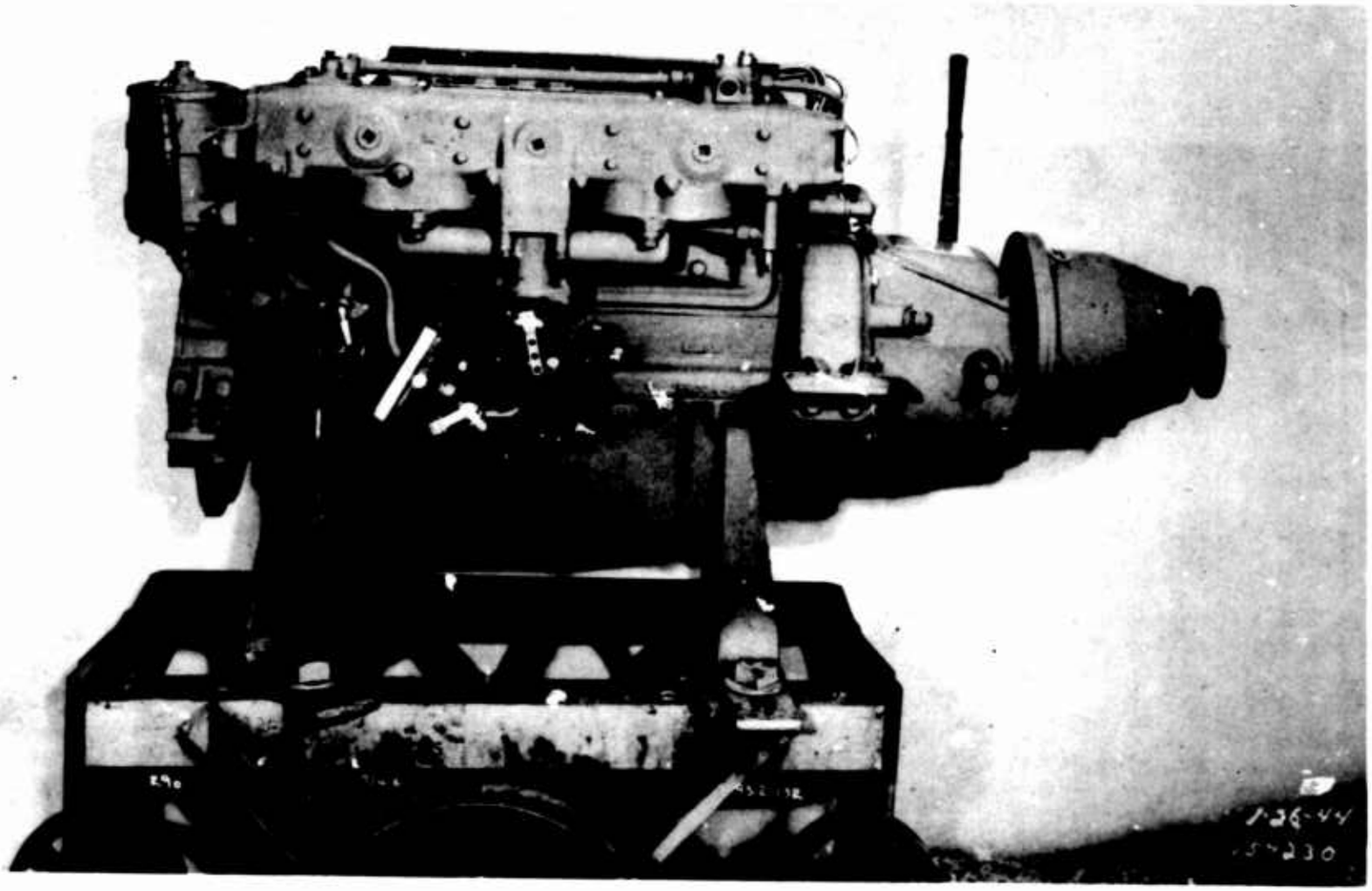

FIG. 18. GRAY MODEL 6-77 MARINE ENGINE. A 6-cylinder type developing 82 hp and weighing approximately 715 pounds. Two of these were used to power the model T-3 boat. This engine is recommended as a power plant for the Twin-Screw Utility Power Boat.

tow-lines for the raising of anchors, and with the same steering lines, lights, and ground tackle; these proved adequate. Part of this equipment is shown in Figs. 19 and 20. The original crane tested proved difficult to erect in the boat, as close tolerance fits were necessary in the various connections. It was redesigned to provide simpler erection and to eliminate the difficulties encountered in manufacture.

15. Operational Performance. The engineering tests indicate that the performance of the T3 boat towing 4-boat rafts, loaded with medium tanks and equivalent loads will exceed the 6 mph minimum requirement of the military characteristics. The top speed of the T3 boat is 16 mph, which, although less than the 18 mph top of the T1 and T2 boats, is nevertheless sufficient to make an efficient utility boat. Beaching of the boat for discharging passengers or cargo is quite possible on sand, mud, or gravel beaches, and, with caution, on rocky beaches. The boat has ample power for self-retraction after being beached. The service and endurance tests have shown that the boat is capable of continued operation for a considerable length of time without mechanical failure or exceptional maintenance problems. The tunnels for the 26-inch propellers (Fig. 22), permit a minimum draft of 32 inches. The tests, however, indicated that more freeboard was necessary, as the stern was awash and the fore part shipping spray when the boat was making a heavy tow in rough water. The following paragraph describes the steps taken to increase the freeboard.

16. Modified T3 Boat. An urgent lend-lease requirement for a twin-screw power boat had developed at the time engineering tests of the T3 boat were nearing completion. In order to make drawings and specifications available for this requirement as soon as possible and to permit utilization of patterns, forms, and molds already on hand, freeboard changes as follows were made to the existing T3 boat to increase its seaworthiness:

a. Depth amidships increased from 2 ft 6 1/8 in. to 2 ft 9 3/4 in.

b. Depth forward increased from 3 ft 6 1/8 in. to 4 ft 0 1/8 in.

c. Depth aft increased from 2 ft 9 1/4 in. to 3 ft 1 1/2 in.

The additional depths increased the overall length of the boat with bumper rail and chock casting base to 25 ft 6 1/2 in. and the width to 8 ft 8 in., due to the prolongation of the normal side and end battens of the boat. These dimensions were slightly in excess of the transportation requirements of the boat as set

up in the military characteristics, which required approximately 25 feet in length and 8 feet in width. However, the 8 inches of excessive width is at deck height on the boat and would not be a factor in curb-to-curb clearance on a roadway. The increase in the size of the boat did not increase its weight, as this was compensated for in the redesign of structural members. The scale weight of this model complete with accessory equipment is 6250 pounds.

17. Transportation. Tests indicated that both the 2-wheel utility pole-type trailer and the 8-ton flat-bed trailer when towed by a 2½-ton 6 x 6 truck could be used to transport the boat on highways, but neither is entirely satisfactory for off-road operations. The flat-bed trailer does not have sufficient clearance, and the pole-type trailer is overloaded. If a 4-ton truck, instead of a 2½-ton truck, is used as a prime mover, the pole-type trailer can be used in off-road operations. This is the type of transportation for the boat which has been included temporarily in the Floating Bridge, M4, equipage until a more satisfactoty solution is found. However, the tires of this combination must be kept in perfect condition at all times to maintain mobility. A special trailer in which the boat is carried in an underslung position is now being tested as a possible solution. The possibilities are being investigated of using a semi-trailer in which the boat is set into the frame of the trailer, thus allowing the center of gravity of the load to be as low as possible without reducing the road clearance of the trailer. Such a trailer would not embody any unusual features, but could use a 2½-ton 6 x 6 truck tractor as a prime mover. Another approach to the problem is the redesign of the boat in a lighter-weight material. The weight possibly could be reduced to 4000 pounds. The transportation weight of the modified T3 boat will vary from the stripped weight of 5500 pounds to approximately 7500 pounds, depending upon the number of accessories carried, the amount of gasoline in the tanks, the amount of bilge water and the amount of accumulated grease and paint.

18. Interchangeability of Parts. The maximum interchangeability of one engine with another was found with the Gray 6-77 power plant used in the T3 boat, in which 300 different items are completely interchangeable with the Gray Model 4-52 engine used in the present utility power boat. The basic engine from which the Gray 6-77 was converted is a Continental Model F226, which is a standard Corps of Engineers engine. The cylinder head, the intake and exhaust manifolding, and carburetor are different in these two engines. In addition to the engine parts which are interchangeable with the present utility power boat, other parts, such as the shaft log and stuffing box, are the same as in the standard utility power boat. Thus, it is believed that the maximum advantage of the interchangeability of parts with existing equipment has been taken into account.

FIG. 19. PUSHING KNEE IN PLACE ON TWIN-SCREW UTILITY POWER BOAT, T-3. The knee leaves ample room for working on deck. The knee and bases provide safety railing for the forward deck.

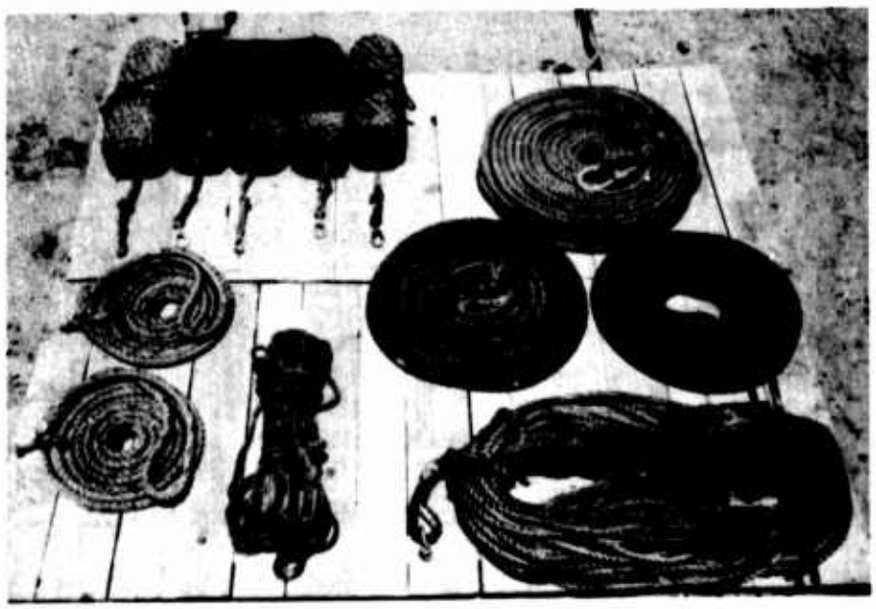

FIG. 20. MANILA ROPE EQUIPMENT FOR TWIN-SCREW UTILITY POWER BOAT. Equipment includes heavy tow hawser, steering lines, anchor line, triple block rope fall, dock lines, and bumpers.

FIG. 21. TWIN-SCREW UTILITY POWER BOAT, T-3. It has the best maneuverability at any speed. Making a hair-pin turn at full throttle.

FIG. 22. STERN VIEW OF TWIN-SCREW UTILITY POWER BOAT, T-3, ON POLE-TYPE TRAILER. Note extent of tunnels and location of 26-inch diameter propellers in tunnels, which assist greatly in maintaining a minimum draft of 32 inches.

19. Military Characteristics. The military characteristics outlined in the 1st indorsement of 26 February 1943 from the Chief of Engineers to the Commanding General, Services of Supply, (See Appendix A) have been substantially met, as noted in paragraphs 24 b and c.

20. Present Status of Modified T3 Boat. Limited service tests have recently been completed on one modified T3 power boat. Information received informally indicated that the boat was satisfactory, except for the need of minor modifications, principally to the steering machinery, which tended to bind during the tests. The necessary changes to the steering machinery have been included in the drawings for this boat. (See Appendix B.)

21. Capacity of Modified T3 Boat. The modified T3 boat, as recommended, has a net load capacity of approximately 3800 pounds at 19-inch draft to invert of engine exhaust pipe.

22. Report Film. A report film, RF No. 1233, Twin-Screw Utility Power Boat, which covers the testing of the power boats, was made during the course of the testing, and is now available.

23. Foreign Power Boats. Comparative data on foreign power boats follow:

a. The British Mk-III Power Boat. The largest and most powerful power boat furnished with British bridge equipment is the 20-foot MK-III power boat (Fig. 23). This boat is powered by an 80 to 90-hp Ford V-8 engine with marine reverse gear attached. The British boat is constructed of plywood throughout, and is provided with a tunnel which completely houses the single propeller. Since the propeller diameter is 15 inches, the pulling power is considerably less than the twin-screw utility power boat. While the boat has a flat bottom and a completely housed propeller, and is capable of operation in somewhat shallower water than the T-3 boat, this difference in draft is offset by the greater pulling power and higher maneuverability of the twin-screw utility power boat. The Mk-III boat requires the same type of transportation as the T 3 boat.

b. The German Power Boat. The German power boat (Fig. 24) might be considered as a compromise design between the twin-screw and the standard utility power boats. Compared to the British and American models, the German boat is unique in construction in that the hull is sheet steel. It has a draft of approximately two feet, and is provided with a tunnel of a design similar to both the American models, except that it is somewhat larger. The 29-inch-diameter propeller gives the boat reasonably good towing characteristics. From the information available, it is believed

that the model T-3 twin-screw utility power boat is a more suitable answer to the ponton powering problem than the German boat.

c. Comparative Data. Comparative data on the British, German and Model T3 (modified) boats are contained in Table 4 (Fig. 6) and Table 5 (Fig. 25).

Comparative Data on British, German, and Model T3 (Modified) Boats

	British Mark III	German	T3 (Modified)
Length overall (molded)	20 ft 10 in.	23 ft 0 in.	25 ft 1 3/8 in.
Beam overall	5 ft 9½ in.	6 ft 7 in.	8 ft 8 in.
Depth maximum	2 ft 10 in. (without towing post)	4 ft 0 in. (amidship)	4 ft 0 1/8 in. (forward)
Draft	8½ in. (with 2 men)	2 ft 0 in. approx. (full load)	11 in. (no load)
Displacement (no load) without accessories	2240 lb	3600 lb approx.	6500 lb
Propeller	15 in. diam x 16 in. Pitch	29 in. diam x 26 in. Pitch	26 in. diam x 17 in. Pitch
Power	50 hp	100 hp (at 1800 rpm)	82 hp each engine (at 3200 rpm)
Thrust	1200 lb (at 0 mph)	2700 lb (at 6 mph)	2800 lb (at 6 mph)
Engines	1	1	2
Screws	1	1	2

FIG. 25. TABLE 5, COMPARATIVE DATA ON BRITISH, GERMAN, AND MODEL T3 (MODIFIED) BOATS

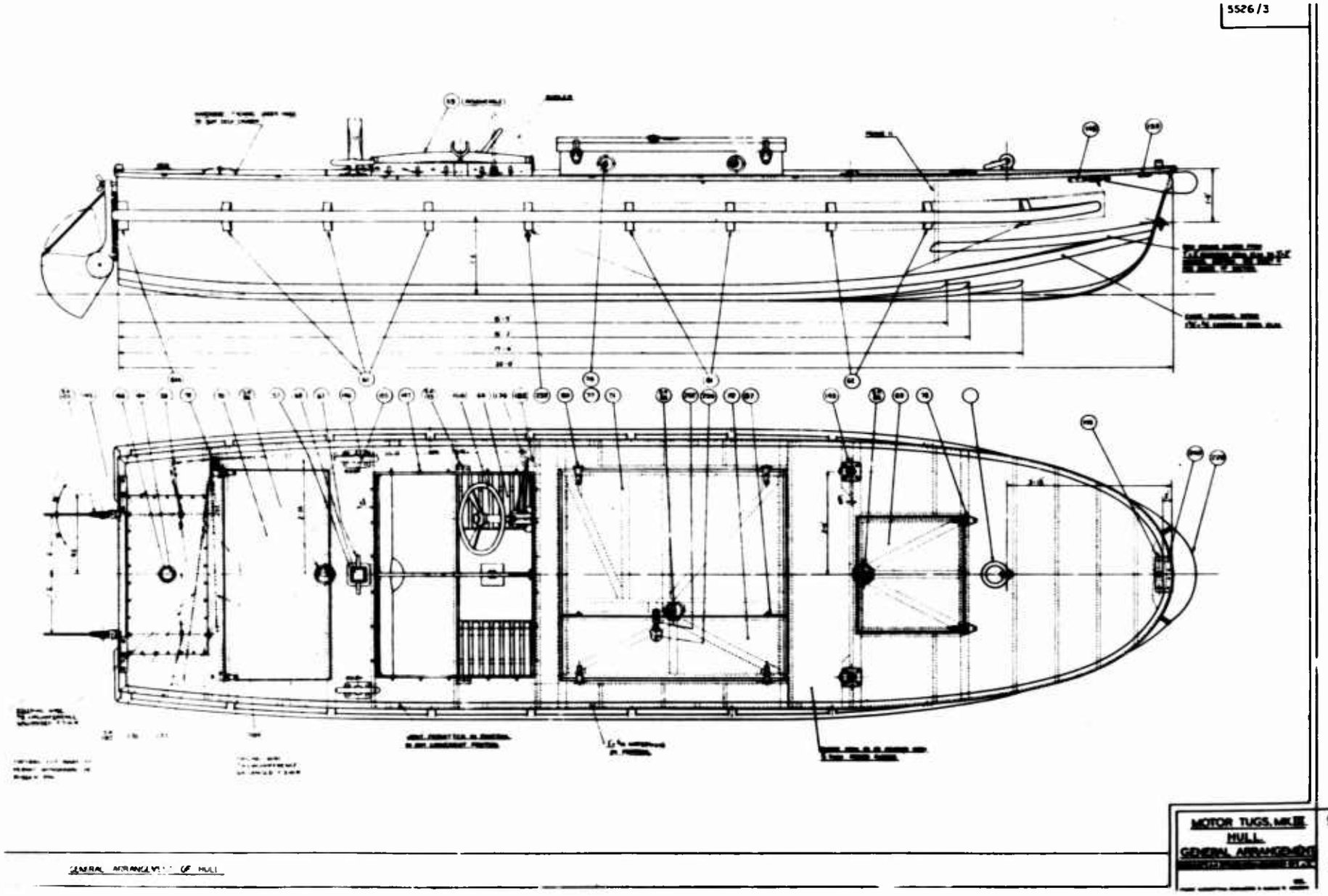

FIG. 23. BRITISH Mk-III POWER BOAT

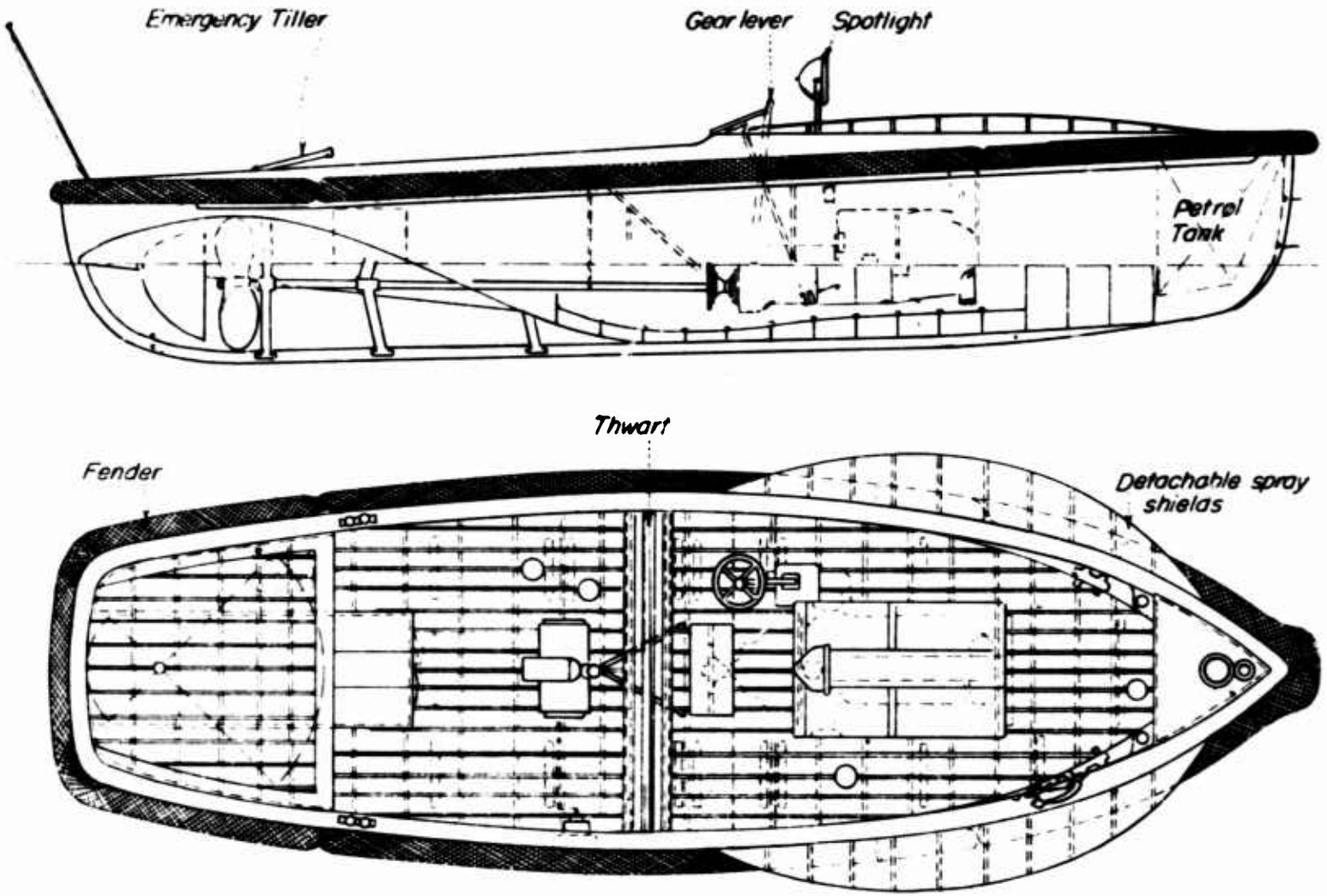

FIG. 24. GERMAN POWER BOAT.

VI. CONCLUSIONS

24. Conclusions. It is concluded that:

a. The modified Model T3 is a satisfactory twin-screw utility power boat.

b. The boat definitely meets the following military characteristics:

(1) The boat is capable of maneuvering 4-boat rafts of ponton equipage at minimum speeds of six mph in zero current.

(2) The boat has a minimum draft consistent with the size of the propeller.

(3) The boat has sufficient strength to withstand beaching and backing off th each under its own power.

(4) The boat is provided with necessary lifting rings so that it may be handled by a ship's crane.

c. The boat does not entirely fulfil the remainder of the military characteristics:

(1) The power plant is not a standard Army engine in its entirety, but a marine adaption of a standard Army truck engine. The majority of parts are therefore standard and readily available.

(2) The highway transportation requirements of approximately 25-foot length and 8-foot width for the boat have been slightly exceeded (25-foot 6½-inch length by 8-foot 8-inch width), but the additional 6½ inches in length and 8 inches in width are not considered excessive.

d. Transporting the modified T3 power boat on standard transportation, although possible, is not entirely satisfactory. Further study on methods of transporting the boat should continue.

e. Investigation of ways of reducing the weight of the boat and of developing better transportation should be continued.

VII. RECOMMENDATIONS

25. Recommendations. It is recommended that:

a. The twin-screw utility power boat, as described in Corps of Engineers Tentative Specification EBP No. 44LC, dated

29 June 44, be adopted as a required type, development type, limited procurement type.

b. Investigation of methods of transporting the boat, as well as of ways of reducing its weight, be continued.

Submitted by:

Carl H. Clement, Jr.,
Major, Corps of Engineers,
Technical Division IV.

Joseph H. Sonntag,
Captain, Corps of Engineers,
Acting Chief, Floating Equipage Branch.

Forwarded by:

Carl W. Meyer,
Colonel, Corps of Engineers,
Director, Technical Division IV.

APPENDIX A

AUTHORITY

ARMY SERVICE FORCES
THE ENGINEER BOARD
Corps of Engineers, U. S. Army
FORT BELVOIR, VIRGINIA

File No.
417 (BR 290 D)

Jan 23 1943

Subject: 100 to 150 H. P. Utility Power Boat.

To: THE CHIEF OF ENGINEERS, U. S. ARMY.

1. For some months the Engineer Board has been working on designs for a larger power boat to be used with ponton equipment and for special operations. Three methods of propulsion have been considered for this boat. They are as follows:

a. Single-screw installation using a single engine.

b. Twin-screw installation using a single engine.

c. Two-engine twin-screw installation.

2. The use of the single-screw requires considerable draft and reduces the maneuverability of the unit, and was therefore dropped early in the design. It is considered to have less rudder power than the twin-screw installation.

3. The single-engine twin-screw installation resolves itself to three types of mechanical transmissions of power. These are:

a. Use of the General Motors variable pitch propeller which embodies its own reverse gear because of the variable pitch feature. Each propeller shaft would be driven by a chain or gear drive from a central power plant. It would be advisable to incorporate an engine throw-out clutch between the engine and the propeller drive pinion. This makes it possible to use the standard type marine engine provided with its built-in reverse gear, or to use the standard type automotive engine (truck or airplane) fitted with a power take-off clutch, preferably of the disc type.

b. A second type of installation using one main power plant and twin-screws can be neatly arranged by the use of the Ronning Transmission. This transmission consists of a power input shaft imparting rotation to two independent shafts which are at right angles to the shaft. Each of the power take-off shafts may be rotated in either direction independently of the other, or maintained in a neutral position independent of the other shaft.

The entire operation of this transmission is controlled by a single lever. This transmission properly designed can be bolted directly to the motor flywheel housing, actually becoming a part of the motor. This permits a transmission suitable to marine operation to be applied to any automobile or truck engine, marine engine or any air craft engine adapted for installation in stationary positions, such as tanks or generator sets. To complete the installation of the Ronning Transmission it would be necessary to extend the two power take-off shafts transversely across the boat where each would be independently connected to its respective propeller shaft by means of bevel gears. The bevel gear case would also contain the thrust bearings to transmit the propeller thrust to the boat. The axis of the crank shaft of the driving engine would be parallel to the center line of the boat. The engine might be set in the center of the boat or to one side as might be desirable for the best internal arrangement of the boat.

4. The chief advantages of the Ronning type of transmission, as compared to other types of twin-screw installation, are:

a. Complete control of both propellers by the use of a single lever.

b. Complete control of the power plant by a single throttle.

c. The use of any engine of suitable size providing that a proper bell housing or adapter housing is designed to fit the transmission of the engine.

5. The engines which are available and considered to be of proper size for a single-engine twin-screw installation are listed below, giving their most important characteristics:

a. Gray Model - Super Six
145 H.P. at 3,200 RPM

Weight	990# complete with reverse gear
Length	49" complete with reverse gear
Width	28"
Height above engine bed	19-1/2"
Number cylinders	6 - 3-3/4" x 4-3/8"
Water cooled	

b. Chrysler Royal Marine Engine
143 H.P. at 3200 RPM

Weight	990# complete with reverse gear
Length	54-5/8" complete with reverse gear

Width	28"
Height above engine bed	19-1/2"
Number cylinders	8 - 3-1/4" x 4-7/8", 323.5 cu. in.
Water cooled	

c. Lycoming, Model O-435-T, Tank Engine
162 H.P. at 2,800 RPM

Weight	755#
Length	47"
Width	32.32"
Height above engine bed	15-3/4"
Number cylinders	6 - 3-7/8" x 3-7/8", 434 cu. in.

Air cooled - Forced Draft positive type

d. General Motors Corporation 2-1/2 Ton Cargo Truck Engine Approximately 100 H. P.

6. A two-engine twin-screw installation resolves the problem to a standard type of twin-screw marine installation requiring two engines of the same power provided with the same accessories and connected to its respective propeller shaft. To operate and installation of this type it requires two reverse gear and clutch control levers, one for each propeller, two throttle controls, two instrument panels, and two batteries. This requires that the operator become acquainted with the characteristics of dual control and the use of the instruments to synchronize the speeds of the two engines, since they are not mechanically connected. It is not absolutely necessary that both engines operate at exactly the same speed for efficient operation, but the variance in speed should not exceed 5 per cent.

7. Listed below are five engines, all of which are considered suitable for twin-screw installation. These engines would all be of the same rotation and would not be considered as right and left hand engines, as is frequently the case in commercial twin-screw installations. All parts in one engine would be completely interchangeable with those of the other.

a. Gray Model - 4-52
57 H.P. at 2600 RPM

Weight	580# complete with 3:1 reduction
Length	44-1/8"
Width	18-1/2"
Height above engine bed	16-3/4"

Number of cylinders	4 - 3-1/8" x 4-3/8" (134.2 cu. in.)
Water cooled	

b. Willys 1/4-Ton Truck Engine

45 H.P. at 3600 RPM	
Weight	No reverse or reduction
Length	
Width	
Height	
Number of cylinders	4 - 3-1/8" x 4-3/8" (134.2 cu. in.)
Water Cooled	

c. Lycoming, O-145-B3

65 H.P. at 2550 RPM	
Weight	160#, no reverse or reduction
Length	26"
Width	29-1/2"
Height above engine bed	13" (approximately)
Number of cylinders	4 - 3-5/8" x 3-1/2" (171 cu. in.)
Air cooled	

d. Continental, A-65

65 H.P. at 2300 RPM	
Weight	175#, No reverse or reduction
Length	28"
Width	31-11/16"
Height above engine bed	13" (approximately)
Number of cylinders	4 - 3-7/8" x 3-5/8" (171 cu. in.)
Air Cooled	

e. Chrysler Ace

78 H.P. at 3200 RPM	
Weight	770# with 2.56 reduction and reverse
Length	52-9/16"
Width	23"
Height above engine bed	17-3/4"
Number of cylinders	6 - 3-1/8" x 4-3/8" (201 cu. in.)
Water cooled	

8. The first water-cooled engine mentioned in paragraph 7, (Gray Model 452), is the engine now installed in the Utility Power Boat, with the same reduction gear and other accessories. It could be installed, without change, in the twin-screw installation utilizing the same size and type propeller, engines and stuffing boxes. This use would give the maximum interchangeability of parts with the present utility power boat.

9. The Willys 1/4-ton truck engine is approximately the same horsepower as the Gray Model 452. To adapt it for use as a marine engine would necessitate the installation of a marine type reverse gear with clutch and the addition of a suitable water pump.

10. Two aircraft engines are listed, since they are of suitable horsepower range and particularly because they are air-cooled engines, eliminating the difficulty of the external type water-cooling system as incorporated in previous designs. Both aircraft engines listed would require the adaptation of a marine type reverse gear and clutch before they could be suitably installed in a boat.

11. The weights involved in various propelling machinery installations may be condensed to the following figures:

a. Single-engine twin-screw installation using the engines as listed above - 1,000 pounds.

b. Total weight of twin-engine twin-screw installation, water-cooled engines - 1,200 to 1,500 pounds; air-cooled engine installations - 700 to 850 pounds.

The use of the Lycoming Model O-435-T tank engine with the Renning Transmission is believed to be a very desirable installation, since it would combine the advantages of the single clutch and single throttle control plus the cooling advantages of the air-cooled engine. It is believed that it would not require any more extensive engineering than the other installations. The installation using two Gray Model 452 engines would be more completely interchangeable with the present system than any other utility power boat. It would develop approximately 1,800 pounds thrust, whereas the single engine twin-screw installation could be expected to develop approximately 20-25 per cent more thrust.

12. The Engineer Board, in considering the various installations as outlined above, has been contacted by Mr. Hicks, representing the National Inventors Council, and Mr. Adelph Ronning, representing himself, regarding the use of the Renning Transmission for a twin-screw power boat using a single engine. The National Inventors Council has offered to construct a pilot model of this

transmission suitable for use with a boat as outlined above, and to be made in accordance with any specifications regarding this particular type installation as might be set down by the Engineer Board. A copy of an information sheet regarding the National Investors Council and its willingness to develop items considered of value by the armed forces is attached for further information.

13. In view of the foregoing, it is the opinion of the Engineer Board that a twin-screw power boat utilizing but a single engine coupled to each propeller, and utilizing the General Motors variable pitch propeller or the Ronning transmission, is the most desirable type of twin-screw power boat.

14. It is recommended that the Engineer Board be authorized to proceed with the development of the twin-screw power boat as outlined in paragraph 13. It is further recommended that the Engineer Board be authorized to contact the National Inventors Council in regard to the development of a suitable size and model of the Ronning Transmission for use in a twin-screw power boat.

15. In the event that the recommendations are approved, it is requested that the Engineer Board be authorized to expend funds in the amount of $10,000.00 for the development and construction of a 150 to 175 H. P. twin-screw power boat.

For the Board:

/s/
Peter P. Goerz,
Colonel, Corps of Engineers,
Executive Officer.

1 Incl.
"Information Regarding Construction of Trial Devices by the National Bureau of Standards for the National Investors Council"

INFORMATION REGARDING CONSTRUCTION OF TRIAL DEVICES BY THE NATIONAL BUREAU OF STANDARDS FOR THE NATIONAL INVENTORS COUNCIL

A fund of $150,000 has been made available to the National Inventors Council for expenditure through the agency of the National Bureau of Standards, for the construction of trial devices which the Army or the Navy or other appropriate government agencies might wish to have built and tested. A small part of this fund has already been expended. The principal purpose of this fund is to try out promising inventions, the performance of which can be determined only by trial, but the importance of which may not be sufficient to warrant the execution of a development contract by either the Army or the Navy. This information is made known to you because you may have such cases under consideration and may wish the Council to assist you in determining their value in the war effort.

The procedure for accomplishing the construction of such trial devices is substantially as follows: If the Council determines that such trial devices are of sufficient interest and if the Army or the Navy (through appropriate officers) approves such accomplishment, the National Bureau of Standards is so informed and then may construct such devices in its own shops, or it may execute a contract with outside agencies for such construction.

The trial of such devices can be made by the Bureau or by such outside agencies as the Army or the Navy may designate. The mutual interest of all concerned would naturally govern such trials.

The interested brances of the Army and bureaus of the Navy may know of such suggestions as come within the above described field and which they might wish to have tried out under the conditions described above. If so, they are requested to make this information known to the office of the National Inventors Council. The Council will then be glad to do what is possible in carrying out the wishes of the military services.

31-6997

Lawrence Langner
Secretary, National Inventors Coun.

417 (BR 290 D)-SPESD Subject: 100 to 150 H.P. Utility Power Boat

1st Ind.

Office, C. of E., Room 1403, Tempo Bldg. G, 23rd & C Sts., N. W.,
February 26, 1943.

To: The Commanding General, Services of Supply. Att: Chief,
Development Branch, Requirements Division.

1. It is recommended that the military characteristics for the subject power boat, as listed under sub-project BR 290 A, be deleted and the following substituted:

a. The boat shall be capable of maneuvering four-boat rafts of 25-ton ponton equipage, ponton girder equipage, or floating Bailey equipage at a speed of 6 to 8 miles an hour in zero current.

b. The power plant shall be one or more gasoline engines of a present Army standard type.

c. The combination of the boat on its highway transportation shall approximate 25 feet in length or 8 feet in width.

d. The boat shall have a minimum draft consistent with the size of the propeller.

e. The boat shall have sufficient strength to withstand beaching under its own power and to back off the beach under its own power.

f. The boat shall be provided with necessary lifting rings so that it may be handled by a ship's crane.

2. The approval of the Services of Supply is requested.

For the Chief of Engineers:

/s/
F. C. Kendall,
Major, Corps of Engineers,
Executive Officer.
Engineering and Development Branch,
Supply Division.

1 Incl.
n/c

Newton/mee
Ext. 76271

SUBJECT: 100 to 150 H. P. Utility Power Boat.

SPRMD 417 (1-23-43) 2nd Indorsement WJN/bfl 6047

Headquarters, Services of Supply, Washington, D. C. MAR 5 1943

To: Chief of Engineers.
Attn: Development Branch, Supply Division.

1. The recommendation contained in the 1st Indorsement is approved.

For the Commanding General:

W. A. WOOD, JR.,
Brigadier General, General Staff Corps,
Director, Requirements Division.

1 Incl.
n/c

/s/
R. M. OSBORNE
Colonel, Field Artillery
Deputy Chief, Development Branch

417 (BR 290 D) SPESD Subject: 100 to 150 H.P. Utility Power Boat.

3rd Ind.

Office, C. of E., Room 1416, Tempo Bldg. G, 23rd & C Sts., N. W., March 9, 1943.

To: The President, The Engineer Board, Fort Belvoir, Virginia.

1. Forwarded, inviting attention to the 1st and 2nd Indorsements.

2. The Engineer Board is authorized to contact the National Inventors Council relative to the development of a suitable size and model of the Ronning Transmission for use in a twin-screw power boat. Further, the Engineer Board is authorized to expend funds in the amount of $10,000.00 for the development and construction of a 150 to 175 H. P. twin-screw power boat.

3. The Engineer Board will submit informally plans of the power boat for approval prior to construction.

By order of the Chief of Engineers:

Signed: F. C. Kendall

F. C. Kendall,
Major, Corps of Engineers,
Executive Officer,
Engineering and Development Branch,
Supply Division.

1 Incl.
n/c

Kinker/mee
Ext. 79493

WAR DEPARTMENT
Office of the Chief of Engineers
WASHINGTON

Room 1416 Temp Bldg. G.

March 18, 1943.

SUBJECT: Power Boat.

TO: The President,
The Engineer Board,
Fort Belvoir, Virginia.

1. In a 3rd Indorsement, dated March 9, 1943, subject "100 to 150 H.P. Utility Power Boat" to an Engineer Board communication, dated January 23, 1943, same subject, this office authorized the Board to contact the National Inventors Council relative to the development of a Ronning Transmission. When making this investigation the Board will also investigate other means of transmitting power from the motor to the propellers.

2. During the course of development the Engineer Board will also investigate utilizing various types of prime movers for powering the boat other than air cooled motors. It is imperative that a motor be selected for which there are ample facilities for its manufacture.

3. Should more than one pilot boat be required to carry on this investigation, the Board is authorized to build one or two additional models.

By order of the Chief of Engineers:

/s/
E. L. Knutson,
Captain, Corps of Engineers,
Assistant; Engineering and Development Branch,
Supply Division.

Kinker/mee
Ext. 79493

CE SPESD
EB 417 (BR 390 A)

Subject: Power Boat.

1st Ind.

The Engineer Board, Fort Belvoir, Virginia. APR 17 1943

To: THE CHIEF OF ENGINEERS, U. S. ARMY.

1. The contents of the basic communication have been noted. Reference is made to 1st Indorsement from the Engineer Board to Office, Chief of Engineers, dated April 1, 1943, Subject: Reduction in Development Program; Confidential File 320. In regard to reconsideration of active development projects, it is understood that there is some question as to whether or not BR 290 A, Development of 100 to 150 HP Power Boat, should be continued.

2. Some preliminary design work has been done on this boat, but no steps have been taken for procurement of pilot models of the designs. Further action is delayed pending decision by the Office, Chief of Engineers, on the recent recommendation of the Engineer Board that the project remain open.

For the Board:

/s/
W. J. MATTESON,
Colonel, Corps of Engineers,
Assistant Executive Officer.

SPESD Subject: Power Boat.

2nd Ind.

Office, C. of E., Room 1416 Tempo Bldg. G, 23rd and C Streets, N. W., April 24, 1943.

To: The President, The Engineer Board, FORT BELVOIR, VIRGINIA.

In a 2nd Indorsement, dated April 17, 1943, subject "Reduction in Development Program", this office advised the Board that authority would be requested from Headquarters, Army Service Forces, to continue Projects MP 321A, BR 290A and DM 382A. In the meantime the Board was authorized to continue work on these projects until Army Service Forces rendered a decision on the above projects.

By order of the Chief of Engineers:

E. L. Knutson,
Captain, Corps of Engineers,
Assistant; Engineering & Development Branch,
Supply Division.

WAR DEPARTMENT
OCE
WASHINGTON

SPESD 400.112 (Engr. Bd.)
EB 400.11 (Projects)

May 10, 1943.

SUBJECT: Reduction of Development Program

TO: The President,
The Engr. Bd.,
Ft. Belvoir, Va.

The Commanding General, Army Service Forces has granted authority for the continuance of projects MP 321 A (Military Theodolite) and BR 290A (150 HP Twin-Screw Power Boats, and for the discontinuance of MP 379 (Distance Finder) and MR 261 V (Drums, Asphalt).

By order of the C. of E.:

s/ D. A. Hipkins,
1st Lt., C.E.,
Asst; Engrg & Dev. Br.,
Sup. Div.

REC'D EB 1943 May 11 AM 9:53

BR 290A

WAR DEPARTMENT
Office of the Chief of Engineers
WASHINGTON

File No. CE SPENC

4 October 1943

SUBJECT: Work Order No. DBR 3041, 150 HP Twin Screw Power Boat.

TO: The President,
The Engineer Board,
FORT BELVOIR, VIRGINIA.

Confirming Major Clements telephone conversation with Mr. Kinker it is requested that the Engineer Board procure a total of three (3) 150 HP Twin Screw Power Boats. The Engineer Board will retain one of the boats to determine the adequacy of design and engineering features. The second boat will be shipped to the Special Bridge Test Section, Yuma, Arizona for service tests and the third boat will be shipped to an Armored Battalion as determined by higher authority.

By order of the Chief of Engineers:

Signed: William J. New

WILLIAM J. NEW,
Major, Corps of Engineers,
Executive Officer, Equipment Development Branch,
Engineering Division.

APPENDIX B

SPECIFICATIONS AND DRAWINGS

CORPS OF ENGINEERS
(ENGINEER BOARD)
TENTATIVE SPECIFICATION

EBP No. 441C
29 June 1944
Superseding EBP No. 441B
Dated 6 May 1944

BOAT, UTILITY, POWER, TWIN SCREW, M1

A. APPLICABLE SPECIFICATIONS AND DRAWINGS.

A-1. Specifications. - The following specifications of the issue in effect on date of invitation for bids, unless otherwise indicated, form a part of this specification, except that in case of conflict, the requirements of this specification shall govern.

A-1a. Federal Specifications:

O-F-351 - Fire Extinguishers, Chemical, Hand; Carbon Tetrachloride Type.

T-R-601 - Rope; Manila.

T-R-631 - Rope; Sisal.

FF-S-111 - Screws; Wood.

QQ-A-601 - Aluminum-Base-Alloys; Sand-Castings.

QQ-B-726 - Bronze, Manganese; Castings (Including Manganese-Aluminum Bronze).

QQ-I-666 - Iron, Malleable; Castings.

QQ-I-716 - Iron and Steel; Sheet, Zinc-Coated (Galvanized).

QQ-S-636 - Steel; Carbon (Low-Carbon), Sheets and Strips.

QQ-S-671 - Steel, Carbon and Alloy, Bars.

QQ-S-741 - Steel, Structural (Including Welding) and Rivet; (for) Bridges and Buildings.

QQ-S-763 - Steel, Corrosion-Resisting; Bars and Forgings (Except for Reforgings).

RR-C-271 - Chain and Attachments; Standard, Miscellaneous.

WW-P-403 - Pipe; Steel and Ferrous-Alloy, Welded and Seamless (Iron-Pipe-Size).

WW-P-441 - Pipe; Wrought Iron, Welded, Black and Zinc-Coated.

WW-T-799 - Tubing; Copper, Seamless (For use with Soldered or Flared Fittings).

A-1b. Army-Navy Aeronautical Specification:

AN-G-20 - Glue; Application of Cold-Setting Urea-Formaldehyde Resin.

A-1c. U. S. Army Specifications, Nos.:

2-103 - Motor Fuel (All Purpose).

47-19 - Hook, Boat, Ball Point, 10 Feet, for Pontons.

57-180 - Tubing, Round, Mechanical and Structural; Steel, Carbon and Alloy, Seamless, Welded and Brazed.

82-17 - Plywood; Flat Panel.

A-1d. Corps of Engineers Tentative Specifications, Nos.:

T-1184 - General Specification for Finishing, Treating and Painting.

T-1483 - Maintenance Manuals and Spare Parts Catalogs for Engineer Equipment.

T-1739 - Standard Requirements for Marking Corps of Engineer Shipments.

A-2. Drawings. - The following drawings of the issue in effect on the date of invitation for bids form a part of this specification.

A-2a. Corps of Engineers Drawings, Nos.:

D 3871-1 to 54 inclusive - Boat, Utility, Power, Twin Screw, Model M1.

B. TYPE.

B-1. This specification covers only one type of 25 foot, twin screw power boat.

C. MATERIAL AND WORKMANSHIP.

C-1. Material. - The material used in the construction of the boat shall be as specified herein and as shown on the applicable drawings. Material not definitely specified shall be of the best quality normally used in good commercial practice for this type of work. Material shall be free from all defects and imperfections that might affect the serviceability of the finished product.

C-1a. Plywood. - Shall conform to U. S. Army Specification No. 82-17, Marine plywood, grade A or B. The wood species shall be as specified herein or shown on the drawings.

C-1b. Wood. - Each wood part shall be free of characteristics which would render the assembled boat unsuitable for the use intended. Decay,

steep cross grain, split, warp, and moisture content less than 10 or more than 16 percent are not permitted. Burls, medium surface check, pin holes, slight shake, medium stain, barkless medium wane, and knots not exceeding one-fourth the width of the piece in which they appear, are permitted. The species of wood shall be as shown on the drawings.

C-1c. Steel Pipe. - Shall conform to Federal Specification WW-P-403, type I, class A, except that no hydrostatic tests will be required. Wrought iron pipe shall conform to Federal Specification WW-P-441, class A.

C-1d. Bar Steel. - Shall conform to Federal Specification QQ-S-671, as-rolled (hot-rolled or forged) condition and with chemical composition conforming to FS No. 1015 to 1035, unless otherwise specified herein or on the drawings.

C-1e. Manganese Bronze Castings. - Shall conform to Federal Specification QQ-B-726, class A.

C-1f. Sheet Steel. - Shall conform to Federal Specification QQ-S-636, hot-rolled and in the annealed condition, unless otherwise specified or shown on the drawings.

C-1g. Rope. - Shall be manila, conforming to Federal Specification T-R-601, or sisal, conforming to Federal Specification T-R-631.

C-1h. Steel Plates and Shapes. - Shall conform to Federal Specification QQ-S-741, type II, grade A.

C-1i. Aluminum Castings. - Shall conform to Federal Specification QQ-A-601, class 5, or class 4 if mechanical properties of this alloy are required.

C-1j. Malleable Iron Castings. - Shall conform to Federal Specification QQ-I-666, type B.

C-1k. Galvanized Iron Sheet. - Shall conform to Federal Specification QQ-I-716, flat sheet, class C.

C-1l. Copper Tubing. - Shall conform to Federal Specification WW-T-799, type N.

C-1m. Stainless Steel. - Shall conform to Federal Specification QQ-S-763, class 9, type C.

C-1n. Chain. - Shall conform to Federal Specification RR-C-271, type B, class 6.

C-1o. Steel Tubing. - Shall conform to U. S. Army Specification No. 57-180, type I, as-hot-rolled, class A, W.D.1020 and type IV, as-welded, class A, W.D. 1020 as shown on the drawings.

C-2. Workmanship. - Shall be of the highest grade throughout.

D. GENERAL REQUIREMENTS.

D-1. See Section E.

E. DETAIL REQUIREMENTS.

E-1. Construction. - The power boat shall be constructed as shown on the drawings and as specified herein. All details of construction, where they are not specifically mentioned herein or shown on the drawings, shall be fully carried out in the manner best suited to the purpose in accordance with good commercial boat building practice.

E-1a. Hull. - The hull shall be of wood and plywood construction, glued and screw fastened during fabrication. Gluing shall conform to Army-Navy Aeronautical Specification AN-G-20 and screws shall conform to Federal Specification FF-S-111, brass, flat head. The sides, bottom, deck, bulkheads and framing of the hull shall be of plywood made up of veneers of wood of the Group I species as listed in U. S. Army Specification 82-17. The tunnels shall be of molded laminations of cotton duck, impregnated with an urea formaldehyde or phenolic resin adhesive of the thermo-setting waterproof type, havin sufficient water resistance, rigidity and strength to withstand rough military usage.

E-1b. Steering Gear. - The power boat shall be equipped with a twin rudder steering gear. Rudder bearings shall be cast manganese bronze and have bronze washers and packing nuts. A worm gear steerer shall be used. The wheel shall be a 22 inch diameter plain wheel as shown on the drawing. Steering arm and bell crank lever shall be of cast aluminum.

E-1c. Lifting Attachments. - The power boat shall be equipped with lifting devices consisting of a lifting cleat and lifting shackle. The cleat shall be of manganese bronze and shall be mounted with an under deck cleat reinforcing plate. The lifting shackle shall be fabricated of steel shapes and mounted firmly to the lifting shackle blocks, keel and keelson. The anchor shackle shall be of drop forged steel.

E-1d. Roller Bow Chock. - The roller bow chock shall be of manganese bronze with cold rolled steel spindle and bronze or bronze lined rollers.

E-1e. Struts, Cleats, Skeg Shoes and Chocks. - Lifting struts shall be of steel bars with steel fittings and shackle bolts. Strut deck fittings, cleats and skeg shoes and chocks shall be of manganese bronze.

E-1f. Bitts. - The bitts shall be of wrought iron pipe with steel deck plates, washers and collars.

E-2. Driving Unit. - The driving unit of the power boat shall consist of two engines, propeller shafts and propellers with all necessary accessories and fittings, all of which shall be mounted in the boat in a manner to insure optimum performance.

E-2a. Engine. - Each engine shall be of the 4 stroke cycle type, having 6 cylinders and weighing not more than 725 pounds. Each engine shall develop not less than 80 horsepower at 3000 rpm using gasoline conforming to U. S. Army Specification 2-103, type A. Water jackets shall allow full lengthwise and circumferential contact of cooling water with cylinders. The engines shall be capable of continuous operation at speeds of from 2200 to 2600 rpm and a maximum speed of 3200 rpm. The cylinder blocks shall be made of nickel

iron. The engines shall be capable of operating at an angle of 20° from the horizontal. The engines shall be equipped with 5 replaceable main bearings. Crankshafts shall be statically and dynamically balanced (dynamic balance being construed as requiring a fully counterbalanced crankshaft) to prevent objectionable torsional vibration within the entire range of operating speeds. Pistons shall have not less than 4 rings. Forced feed lubrication shall be provided for all crankshaft and connecting rod bearings (and to reverse gear). The engine shall be provided with an external oil filter of the replaceable element or cartridge type. An oil cooler shall be provided to maintain crankcase oil at temperatures not to exceed 210 degrees F. in ambient temperatures up to 120 degrees F. The carburetor shall be provided with an approved marine type flame arrester. The exhaust manifold shall be water jacketed. A raw water cooling system shall be provided and shall be capable of maintaining water jacket temperature at not more than 200 degrees F., with engine operating continuously at maximum throttle opening in an ambient temperature of 120 degrees F. with water supply temperature at 80 degrees F. The water pump shall be of the gear type having pumping gears of neoprene independent of driving gears. The engine shall be equipped with a 6-volt battery ignition system complete with generator and distributor. The generator shall be of the non-ventilated, shunt-wound, constant voltage type rated at 6 volts and 20 amperes at 1650 rpm. A 6-volt electric motor shall be provided for starting the engine and actuated by a switch or button on the control panel. Each engine shall have a separate control panel containing the following engine instruments:

Oil Temperature Gage
Oil Pressure Gage
Water Temperature Gage
Tachometer
Ammeter

The control panel shall have shielded lights mounted upon it.

Distance between foundation bolt centers shall be 20 inches. A 3:1 reduction gear and an integral reversing mechanism shall be provided. The reversing mechanism shall be provided with control levers as shown on the drawings. Each bidder will be required to submit with his bid a completed copy of the Questionnaire attached hereto. The information supplied in the Questionnaire shall be descriptive of the power plant the bidder proposes to furnish.

E-2b. Propeller Shafts. - The propeller shafts shall be 1-3/8 inch diameter stainless steel.

E-2c. Propellers. - The propellers shall be three blade of cast bronze and shall be not more than 26 inches in diameter. Pitch shall be 17 inches and bore shall be 1-3/8 inches.

E-3. Equipment. - The following equipment shall be provided with each boat. Detailed information on equipment shall be supplied as indicated in the Questionnaire. Equipment shall be properly mounted, attached or stowed in compartments depending on its use on the boat:

Running lights, mounted on each side of cockpit coaming.

Mast head light.

Towing lights, not less than two.

One quart fire extinguishers, 2, conforming to Federal Specification O-F-351, mounted on after bulkhead in cockpit.

35 pound Danforth type anchor.

Rope, towing hawser, 1-1/2 inches, 200 feet long.

Rope, 3/4 inch, one-100 foot length, for anchor.

Rope, steering lines, 1 inch, 50 feet long.

Rope, mooring lines, 3/4 inch, two 50 foot lengths.

Life preservers, approved vest type, 4.

Fog horn, 15 inch.

Ball point boat hook, conforming to U. S. Army Specification 47-19.

Wrench, special, for water pump packing gland.

Wrench, special, for clutch adjustment.

Wrench, special, spanner, for propeller shaft stuffing box.

Wrench, special, spanner, for rudder shaft stuffing box.

E-4. Finish and Painting. - The entire boat shall be finished and painted in accordance with Corps of Engineers Tentative Specification T-1184, type II. Wood shall not be given the preservative treatment.

E-5. Maintenance Manuals and Spare Parts Catalogs. - The contractor shall furnish maintenance manuals and spare parts catalogs covering the description, operation, adjustment, maintenance, lubrication and spare parts lists for all equipment furnished. The contents of these manuals shall be as set forth under "detailed specifications" outlined in paragraph 6 of Specification T-1483. The cover of each manual shall state the machine name and model, manufacturer's name, date of approval of the manual, title of the manual and machine serial numbers to which the spare parts catalog applies. (The machine name shall be as furnished by the Contracting Officer, in accordance with standard nomenclature). A preliminary dummy manuscript made up of typewritten sheets, clippings, photographs, sketches and other suitable material will be forwarded to the Contracting Officer for approval. After preliminary approval, proof sample copies, in duplicate, of the Maintenance Manuals and Parts Catalog, will be forwarded to the Contracting Officer, for final approval. After final approval, two copies of the Maintenance Manuals and Parts Catalogs will be furnished with each machine, and two additional copies per machine plus manuals to the total required by the contract or invitation to bid, which will be determined by the spare parts lists for the machine, will be shipped to the Engineer Supply Officer, Columbus Quartermaster Depot, marked: "Attention: Spare Parts Branch". When specifically called for in the invitation to bid or the contract, these manuals shall conform to Corps of Engineers Tentative Specification T-1483.

F. METHODS OF INSPECTION AND TESTS.

F-1. Inspection. - Equipment furnished under this specification shall be subject to inspection, during and after the process of manufacture, by authorized Government Inspectors, who shall be afforded proper facilities for determining compliance with the specification.

F-2. Tests. - Equipment furnished under this specification shall be given such tests as may be necessary to determine compliance with the specification requirements. When tests are to be made at the site of manufacture, the contractor shall provide all necessary facilities and supplies required for the testing procedure.

F-2a. Test Run. - Each boat shall be given a test run of at least two hours prior to acceptance. The test shall be comprised mostly of slow speed runs, to check water circulation, proper installation of the motor and motor controls, and alignment of propeller shaft with motor. During the test, a full throttle run of five minutes shall be made for rechecking the above items.

G. PACKING AND MARKING FOR SHIPMENT.

G-1. Packing. - Packing shall be in accordance with the instructions furnished by the Contracting Officer.

G-2. Marking. - Marking for shipment shall be in accordance with Corps of Engineers Tentative Specification T-1739, except as may be modified by the Contracting Officer.

H. NOTES.

H-1. Copies of this specification and Corps of Engineers drawings may be obtained from the Specifications Section, The Engineer Board, Fort Belvoir, Virginia, except that requests by offices of the Corps of Engineers should be addressed to the Procurement Division, Office, Chief of Engineers. Other specifications listed herein may be obtained from the following applicable addresses

Federal Specifications - Superintendent of Documents,
Washington, D. C.

U. S. Army Specifications - Office, Chief of Engineers,
Washington 25, D. C.

Army-Navy Aeronautical Specifications - Army Air Forces,
Materiel Command, Wright Field, Dayton, Ohio.

H-2. Definitions and terms used to specify the wood are governed by Department of Commerce Simplified Practice Recommendation R-16-39.

H-3. The contract should contain all information supplied by the bidder in the attached Questionnaire plus any additional information necessary to completely identify and describe the equipment contracted for.

H-4. Engineer Board Tentative Specifications are ad interim specifications which may be converted to Corps of Engineers Tentative Specifications. They are used for the procurement of engineer equipment during development, and for the purpose of making recommendations t the Office, Chief of Engineers. They should not be accepted as indorsed by the Corps of Engineers or the Engineer

Board for quantity procurement, unless accompanied by specific instructions as to their use.

NOTICE. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

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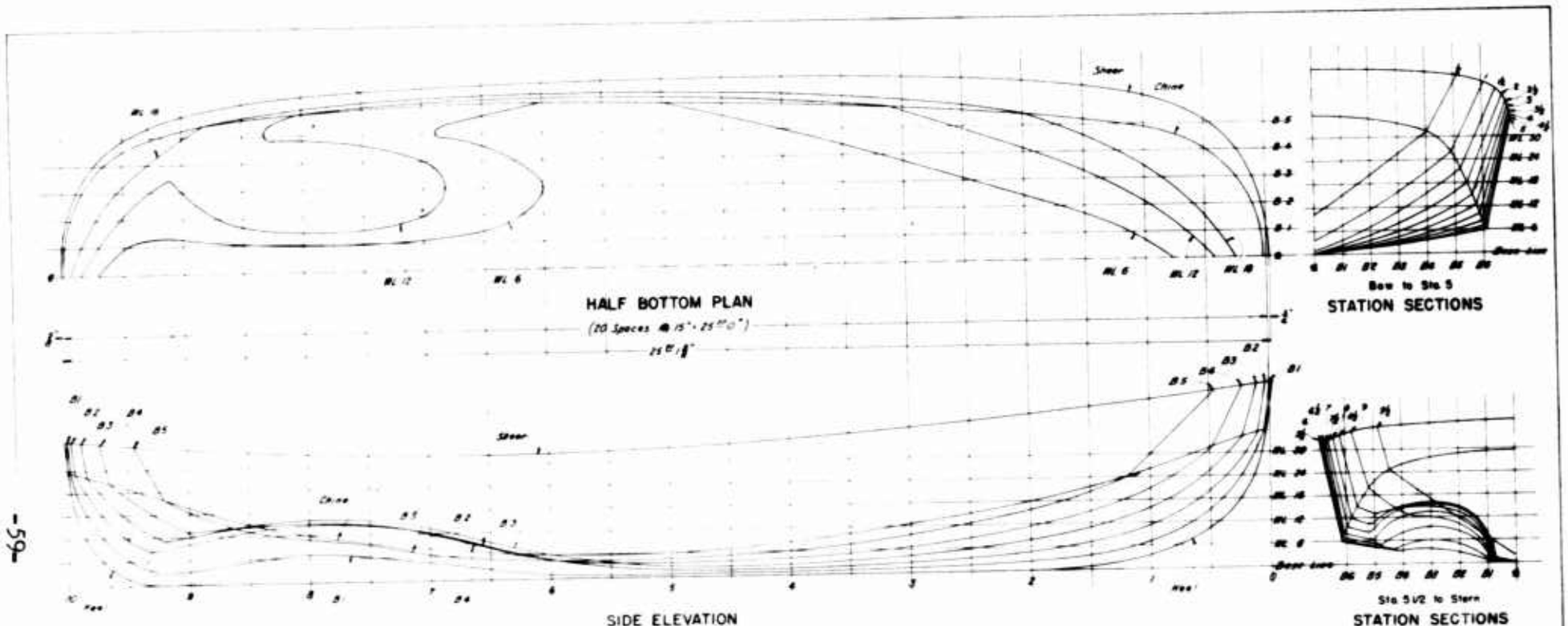


TABLE OF HALF BREADTHS, FEET, INCHES & EIGHTHS

TABLE OF HEIGHTS ABOVE BASE LINE, FEET, INCHES & EIGHTHS

FIG. 26.

BOAT UTILITY, POWER, TWIN SCREW
MODEL M1
HULL LINES & OFFSET TABLES
SCALE 1 INCH=2 1 FOOT
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA
D 3871-1

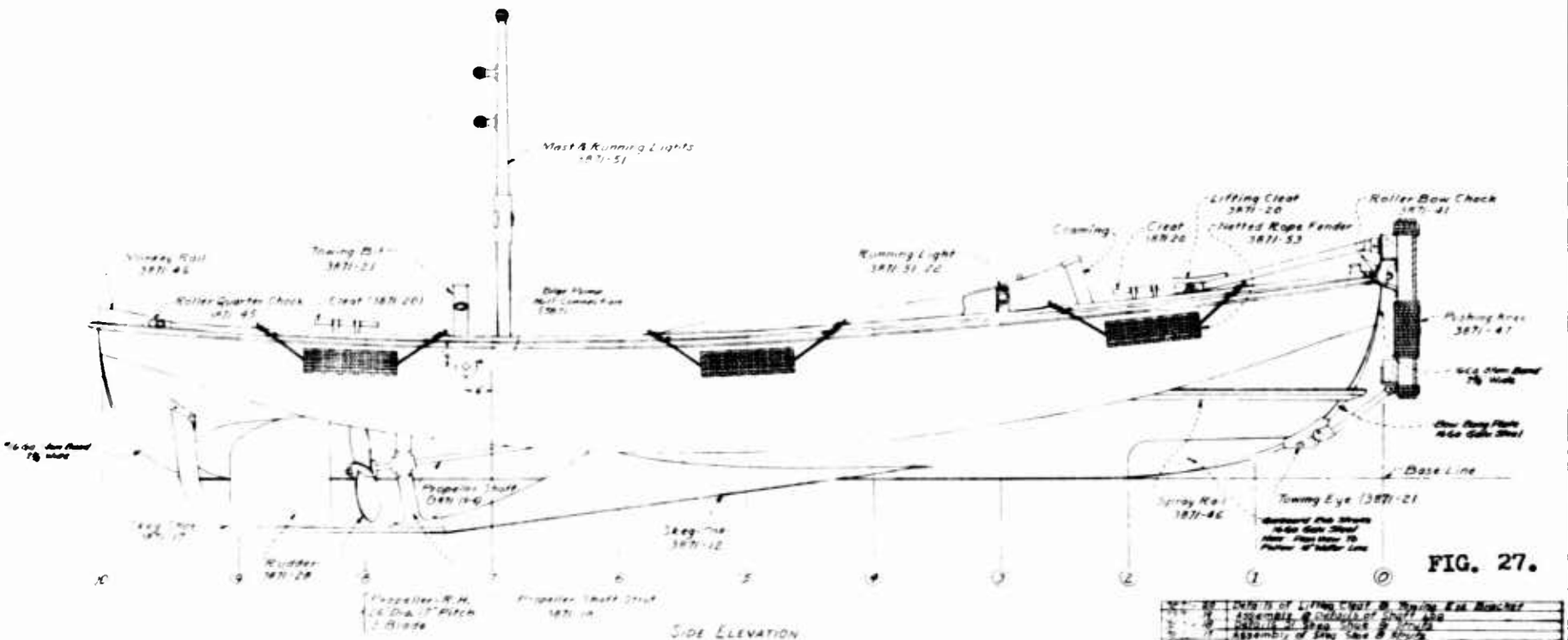
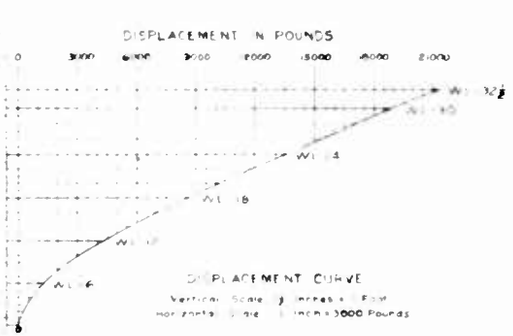
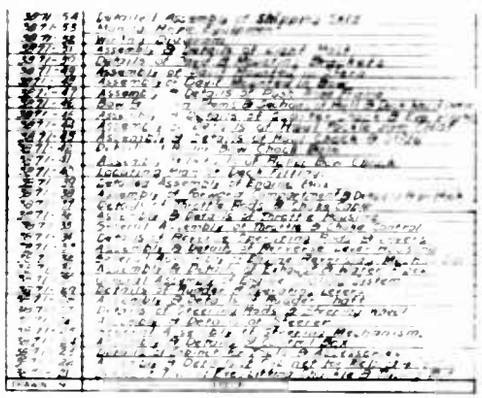


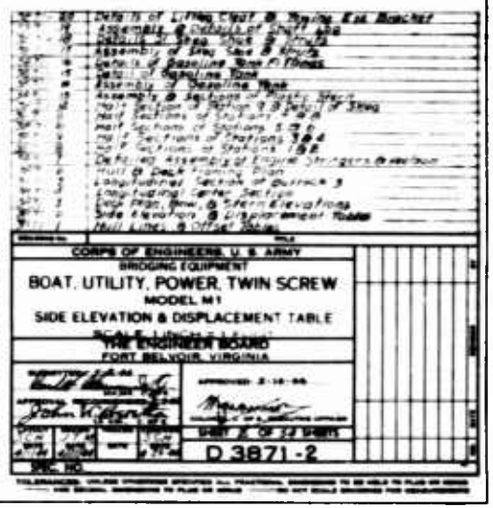
FIG. 27.

APPROXIMATE DISPLACEMENT FOR EACH 2 INCHES OF DRAFT

FREEBOARD IN INCHES AT MAIN DECK	DISPLACEMENT IN POUNDS	DRAFT IN INCHES
0	21222	32½
2	18755	30
4	16985	28
6	15068	26
8	13605	24
10	12040	22
12	10580	20
14	9081	18
16	7720	16
18	6430	14
20	5187	12
22	3958	10
24	2868	8
26	1977	6
28	1218	4
30	620	2
32½	0	0







CORPS OF ENGINEERS, U. S. ARMY
BRIDGING EQUIPMENT
BOAT, UTILITY, POWER, TWIN SCREW
MODEL M1
SIDE ELEVATION & DISPLACEMENT TABLE
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA
SHEET 8 OF 22 SHEETS
D 3871-2

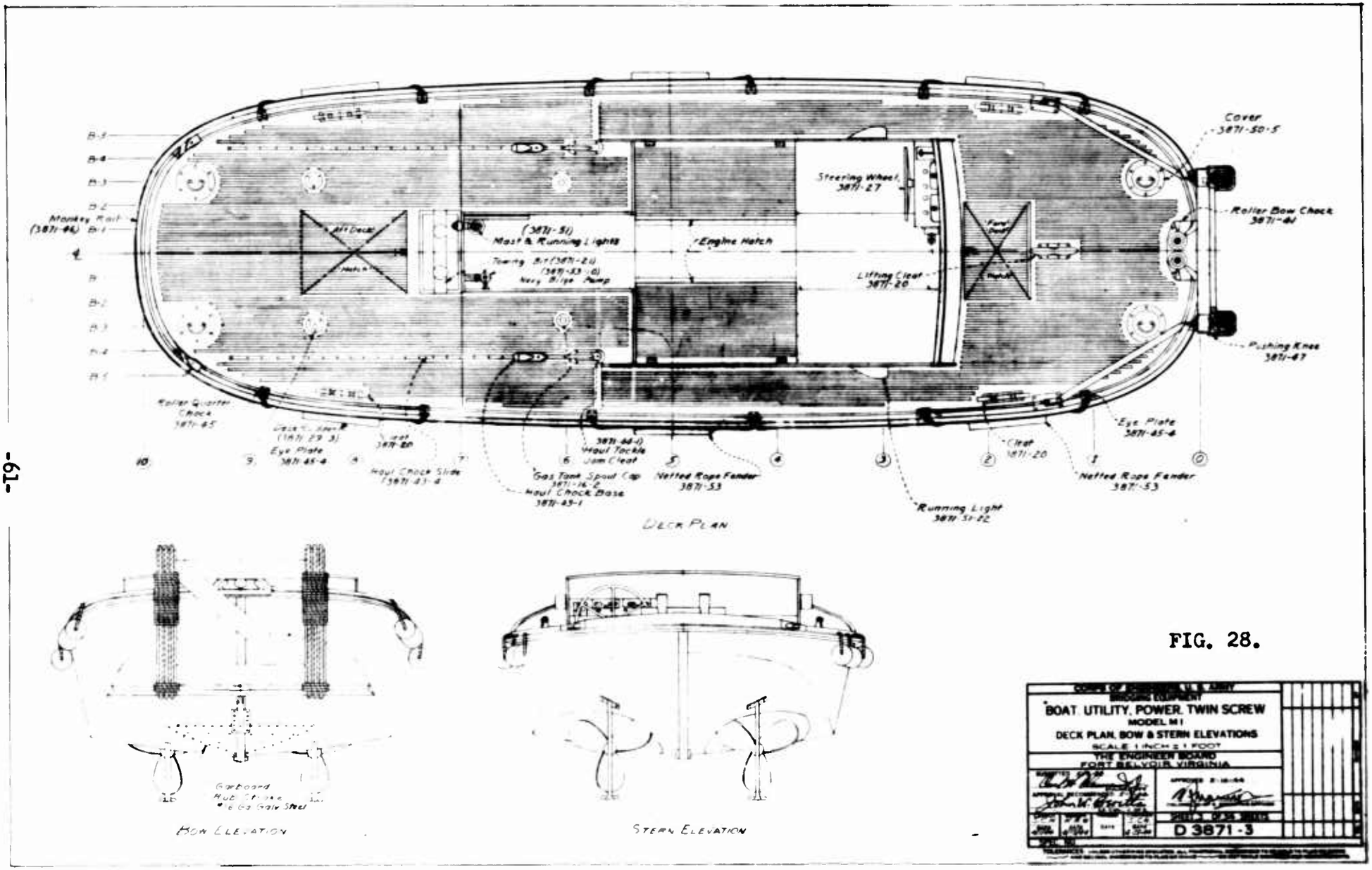
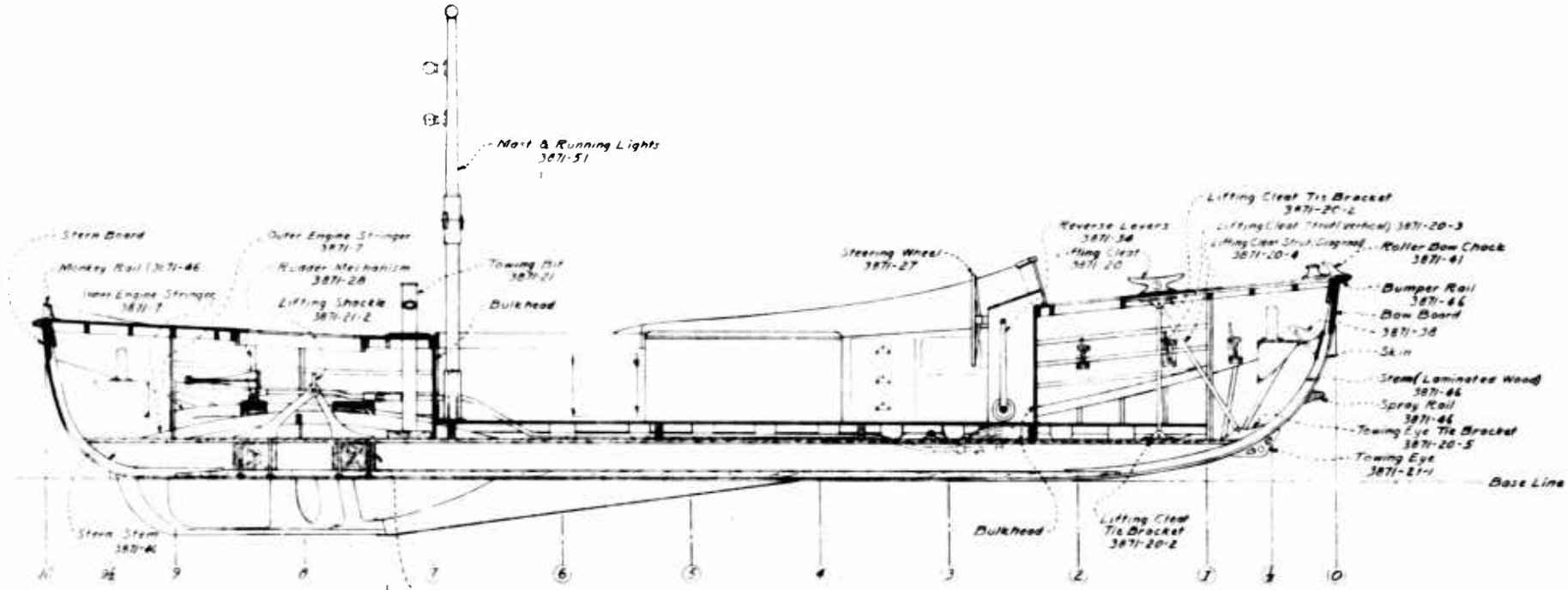


FIG. 28.

BOAT, UTILITY, POWER, TWIN SCREW	
MODEL M1	
DECK PLAN, BOW & STERN ELEVATIONS	
SCALE 1 INCH = 1 FOOT	
THE ENGINEER BOARD	
FORT BELVOIR, VIRGINIA	
	D 3871-3



HALF SECTION STATION 6½

Starboard side looking aft

Scale ½" = 1 Foot

FIG. 29.

CORPS OF ENGINEERS, U.S. ARMY	
BRIDGING EQUIPMENT	
BOAT, UTILITY, POWER, TWIN SCREW	
MODEL M1	
LONGITUDINAL CENTER SECTION	
SCALE 1 INCH = 1 FOOT	
THE ENGINEER BOARD	
FORT BELVOIR, VIRGINIA	
SUBMITTED	APPROVED 2-10-66
SHEET 4 OF 14 SHEETS	D 3871-4

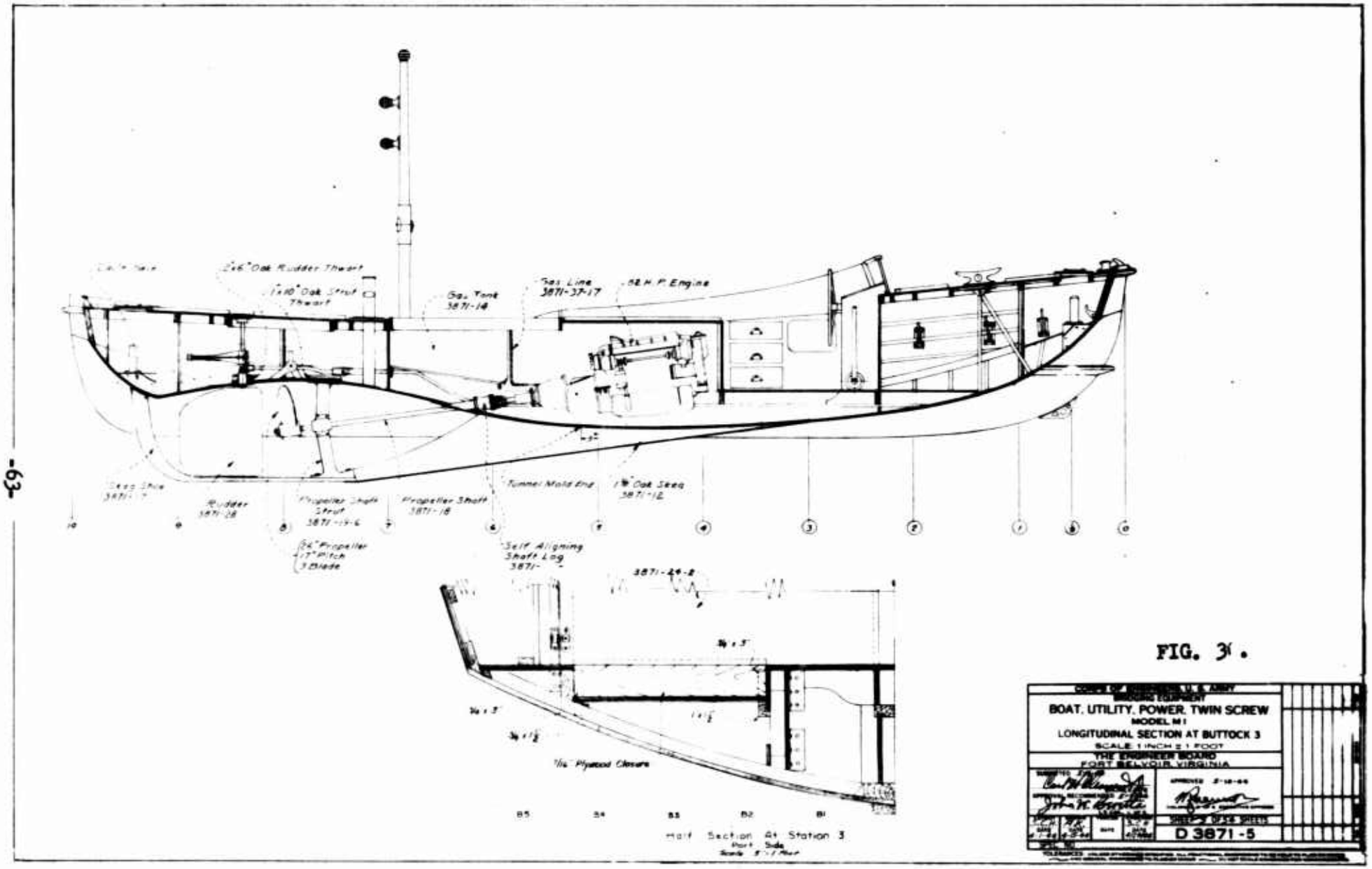

2x6" Oak Rudder Thwart
1x10" Oak Strut Thwart
Gas. Tank 3871-14
Fuel Line 3871-37-17
58 H.P. Engine
Rudder 3871-28
Propeller Shaft Strut 3871-19-6
Propeller Shaft 3871-18
Tunnel Mold End
1" Oak Skeg 3871-12
34" Propeller 17" Pitch 3 Blade
Self Aligning Shaft Log 3871-
3871-29-2
1/4" Plywood Closure
Half Section At Station 3
Port Side
BOAT, UTILITY, POWER, TWIN SCREW
MODEL M1
LONGITUDINAL SECTION AT BUTTOCK 3
SCALE 1 INCH = 1 FOOT
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA
D 3871-5

FIG. 3.

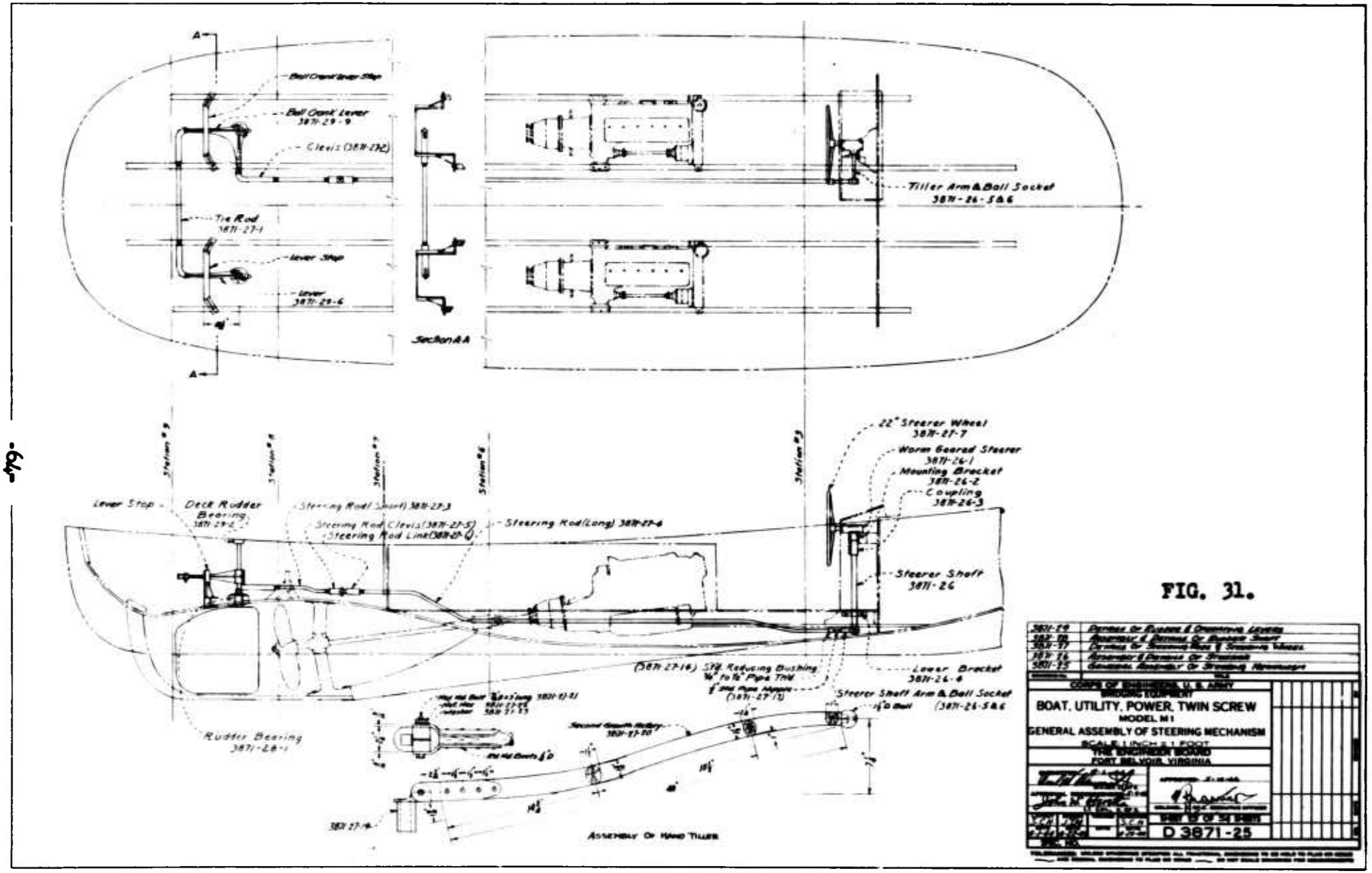


FIG. 31.

3871-29	Details Of Rudder & Operating Levers
3871-28	Assembly & Details Of Rudder Shaft
3871-27	Details Of Steering Rod & Steering Wheel
3871-26	Assembly & Details Of Steerer
3871-25	General Assembly Of Steering Mechanism

COMPANY NO.1
CORPS OF ENGINEERS, U. S. ARMY
BROOKE LOCKWOOD

BOAT, UTILITY, POWER, TWIN SCREW
MODEL M1
GENERAL ASSEMBLY OF STEERING MECHANISM
SCALE 1 INCH = 1 FOOT
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA

SHEET 18 OF 34 SHEETS
D 3871-25

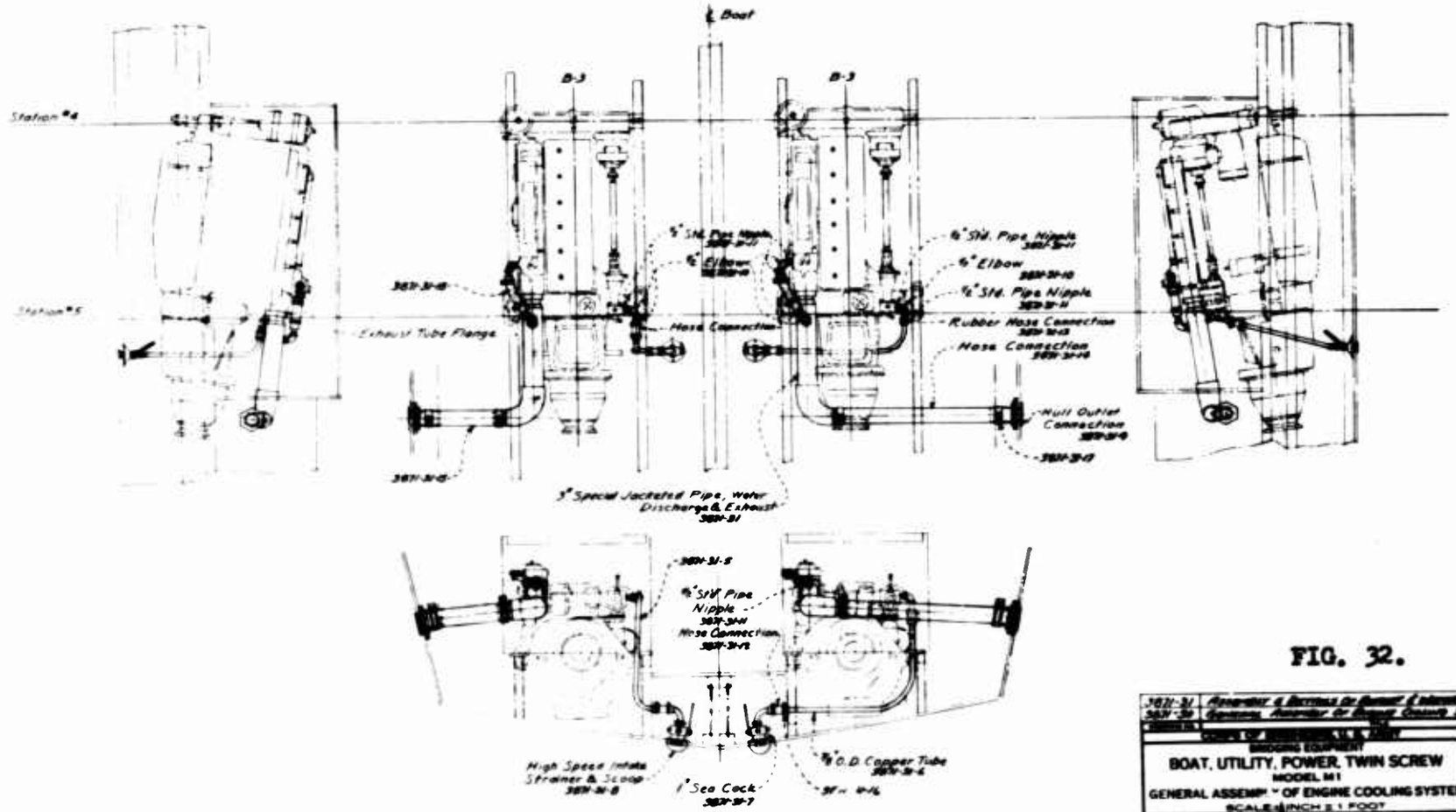

Station #4
Station #5
B-3
B-3
Exhaust Tube Flange
Hose Connection
Rubber Hose Connection
Hose Connection
Hull Outlet Connection
3" Special Jacketed Pipe, Water Discharge & Exhaust
High Speed Intake Strainer & Scoop
1" Sea Cock
BOAT, UTILITY, POWER, TWIN SCREW
MODEL M1
GENERAL ASSEMBLY OF ENGINE COOLING SYSTEM
SCALE 1 INCH = 1 FOOT
THE ERICSSON BOARD
FORT BELVOIR, VIRGINIA
D 3871-30

FIG. 32.

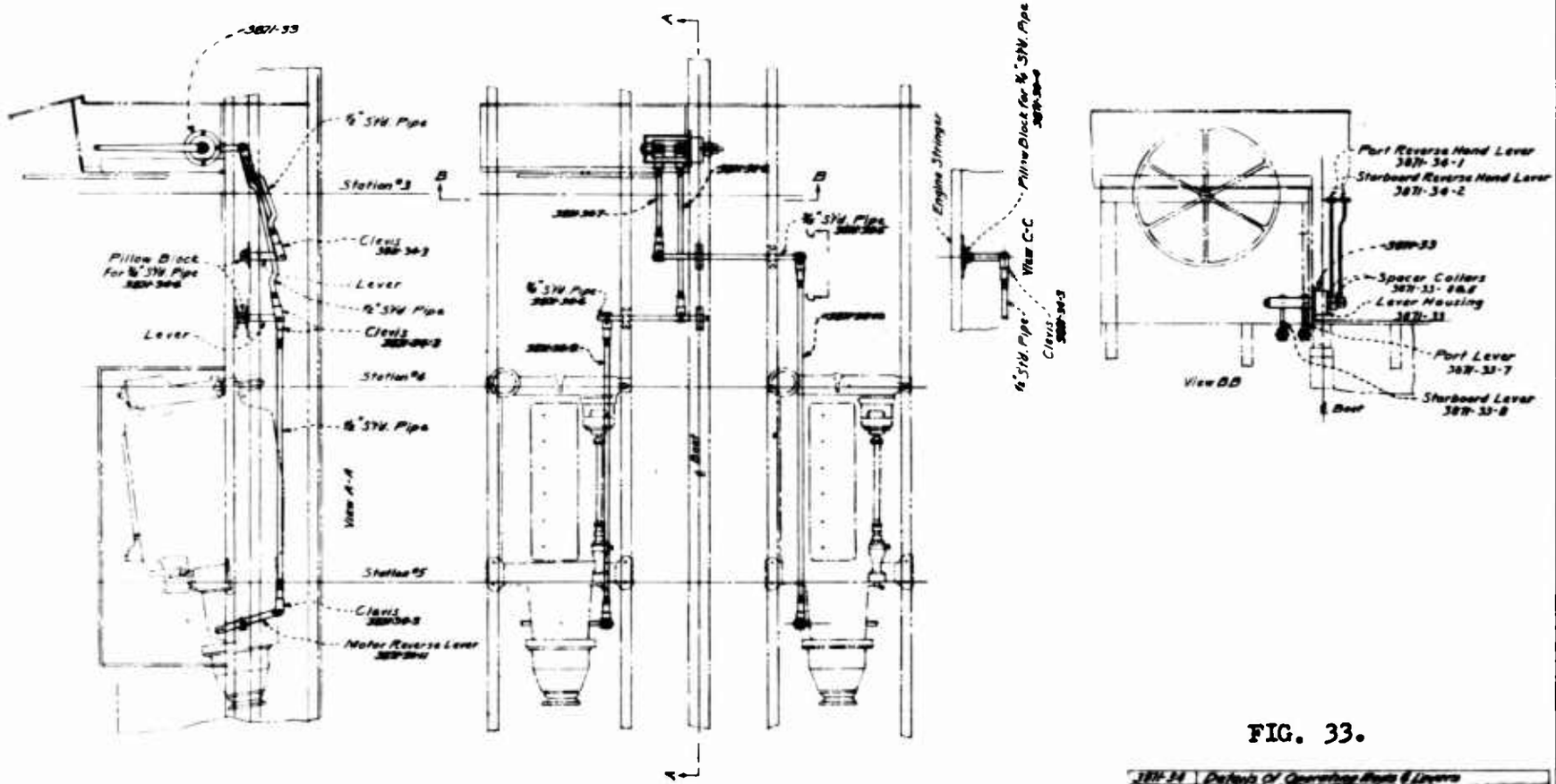


FIG. 33.

3871-34	Details Of Operating Rods & Levers
3871-33	Assembly & Details Of Reverse Lever Housing
3871-32	General Assembly & Engine Reversing Mechanism

CORPS OF ENGINEERS, U. S. ARMY
ENGINEERING EQUIPMENT
BOAT, UTILITY, POWER, TWIN SCREW
MODEL M1
GENERAL ASSEMBLY OF ENGINE REVERSING MECHANISM
FOR 36 FOOT
FORT BELVOIR, VIRGINIA

D 3871-32

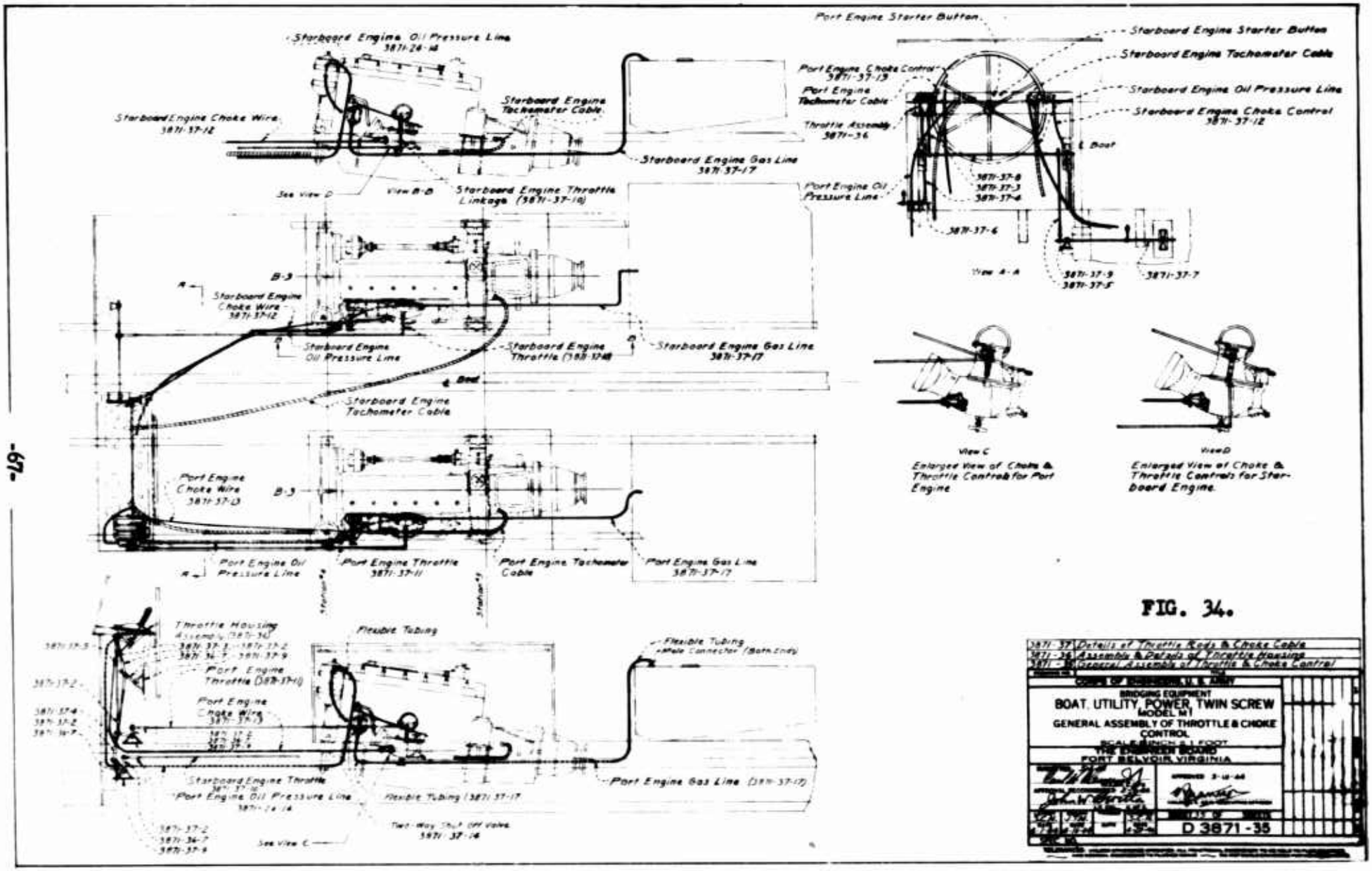


FIG. 34.

3871-37 Details of Throttle Rods & Choke Cable
3871-35 Assembly & Details of Throttle Housings
3871- Universal Assembly of Throttle & Choke Control

CORPS OF ENGINEERS, U. S. ARMY
BRIDGING EQUIPMENT
BOAT, UTILITY, POWER, TWIN SCREW
MODEL M1
GENERAL ASSEMBLY OF THROTTLE & CHOKE CONTROL
SCALE 1 INCH = 1 FOOT
THE ENGINEER BOARD
FORT BELVOIR, VIRGINIA
APPROVED 3-18-44
D 3871-35

APPENDIX C

INFORMATION REQUIRED FOR STANDARDIZATION OF EQUIPMENT

INFORMATION REQUIRED FOR STANDARDIZATION OF EQUIPMENT

1. Approved military characteristics of the Twin Screw Utility Power Boat.

a. The boat shall be capable of maneuvering four-boat rafts of 25-ton ponton equipage, ponton girder equipage, or floating Bailey equipage at a speed of 6 to 8 miles an hour in zero current.

b. The power plant shall be one or more gasoline engines of a present Army standard type.

c. The combination of the boat on its highway transportation shall approximate 25 feet in length or 8 feet in width.

d. The boat shall have a minimum draft consistent with the size of the propeller.

e. The boat shall have sufficient strength to withstand beaching under its own power and to back off the beach under its own power.

f. The boat shall be provided with necessary lifting rings so that it may be handled by a ship's crane.

2. Dimensions and Weight of Modified T3 Boat.

a. Length Overall 25'6½"

Beam Overall 8'8"

Height Overall 5'6"

b. Weight 5500 pounds (without accessories)

3. Photographs.

a. Side View in water, Fig. 35

b. Deck View in water, Fig. 36

c. Side View on Trailer, Fig. 37

4. Drawings. Applicable drawings of the Twin-Screw Utility Power Boat are listed in specification EBP No. 441C, a copy of which is contained in Appendix B of this report. Only general assembly drawings are shown in Appendix B.

5. Estimated unit cost - $7,600.00.

6. Estimated cost in quantity production - same.

7. Approximate date production can begin and estimated rate of production.

a. C. V. Hill and Company, Trenton, New Jersey.

(1) Start delivery approximately 60 days after receipt of order.

(2) Rate of Production: Approximately ten per month.

8. The item is satisfactory from a development point of view for use overseas.

9. Classification of Type of Equipment as recommended in this report:

a. Required Type.

(1) Development Type.

(a) Limited Procurement Type.

10. This is a new item of equipment. The power plant is partially interchangeable with that in the utility power boat which utilizes a Gray model 4-52 gasoline motor. The main interchangeable parts are the reverse and reduction gear.

11. The tests conducted to date have shown the equipment to operate satisfactorily under all conditions for which it was tested.

FIG. 35. TWIN-SCREW UTILITY POWER BOAT

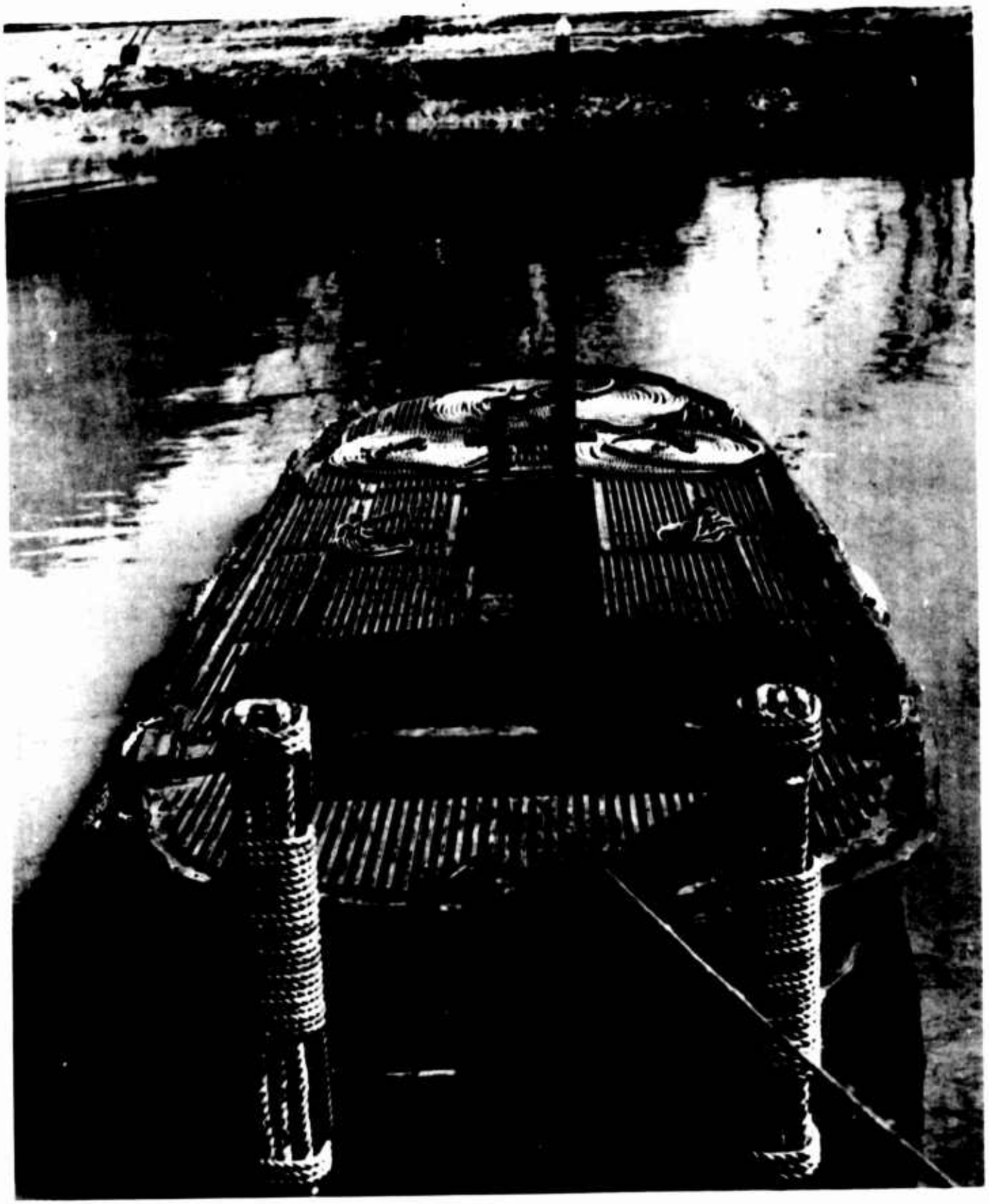


FIG. 36. TWIN-SCREW UTILITY POWER BOAT. Deck view.

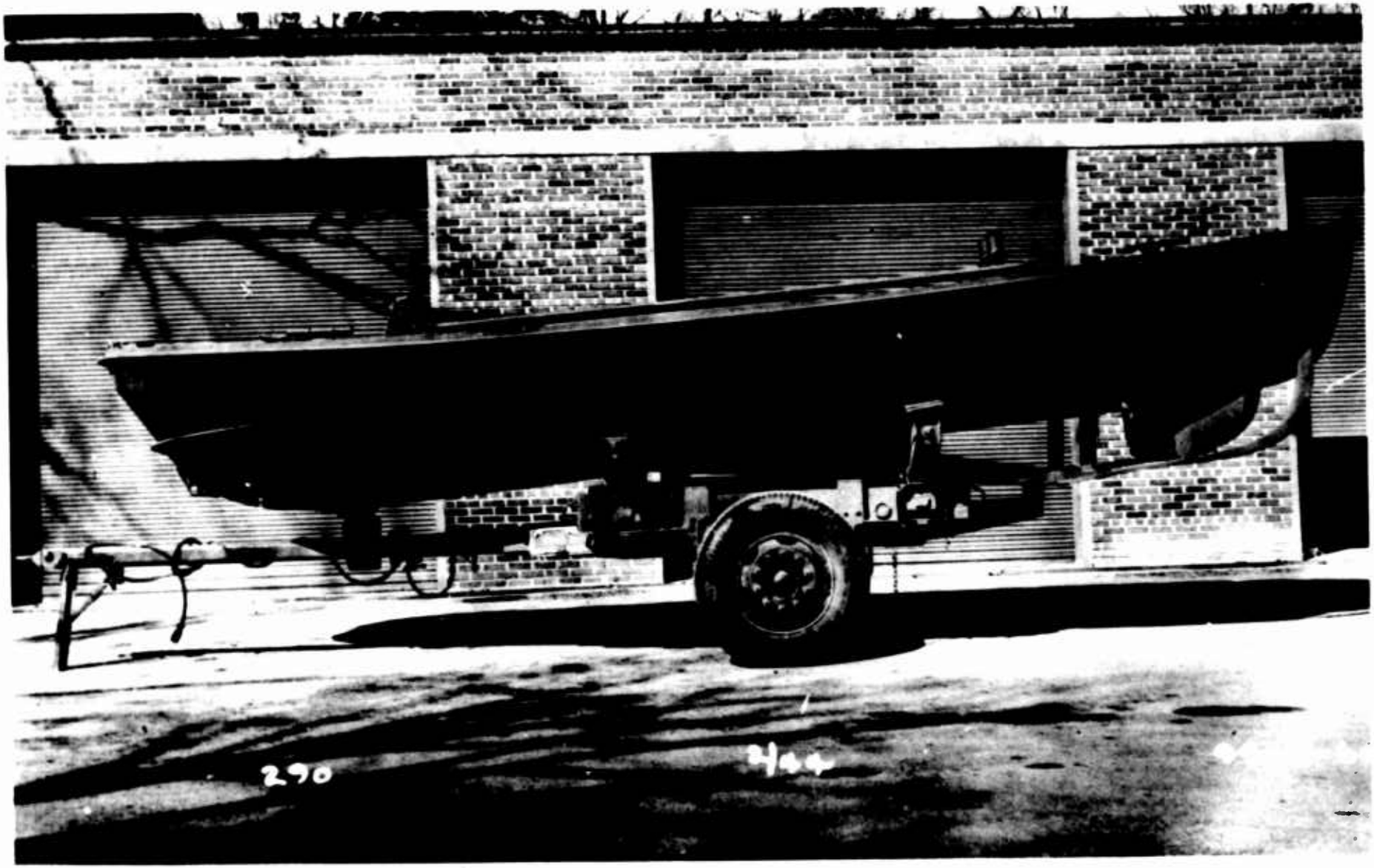


FIG. 37. TWIN-SCREW UTILITY POWER BOAT. On two-wheel, utility, pole-type trailer.