No. 815,350. PATENTED MAR. 20, 1906.

J. P. HOLLAND.

SUBMARINE BOAT.

APPLICATION FILED SEPT. 24, 1904.

2 SHEETS—SHEET 1.

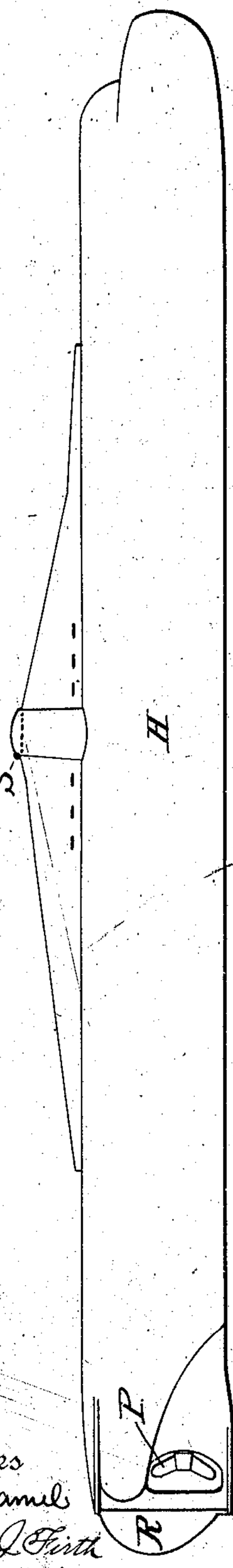

Fig. 1.

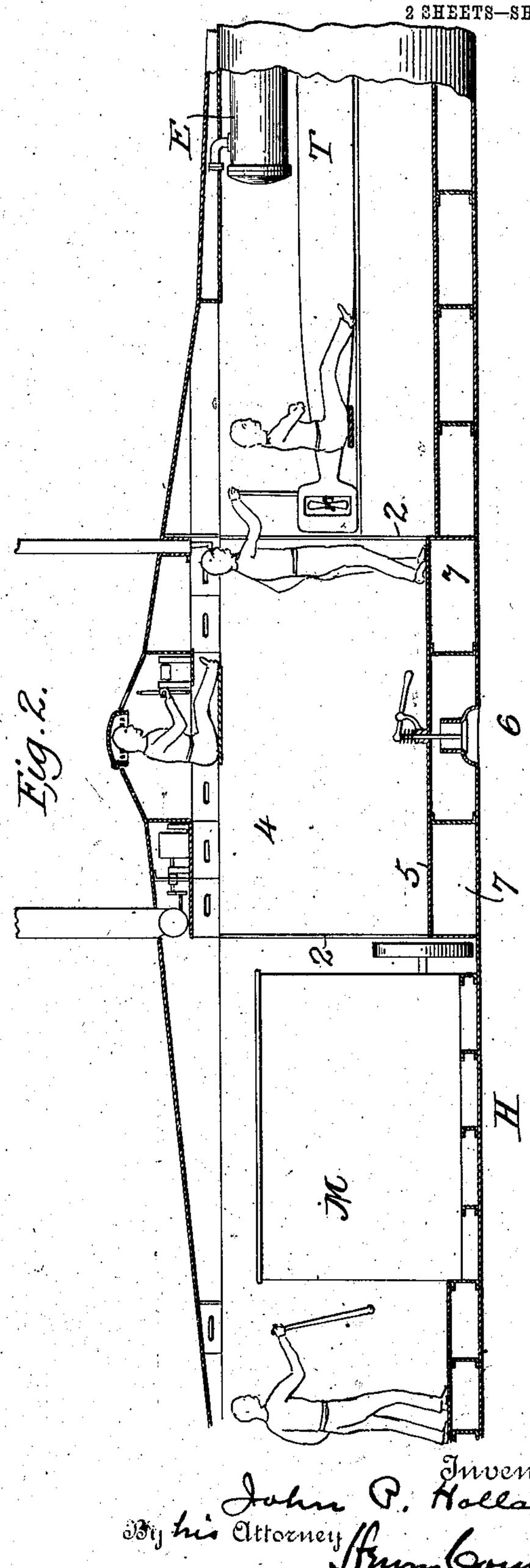

Fig. 2.

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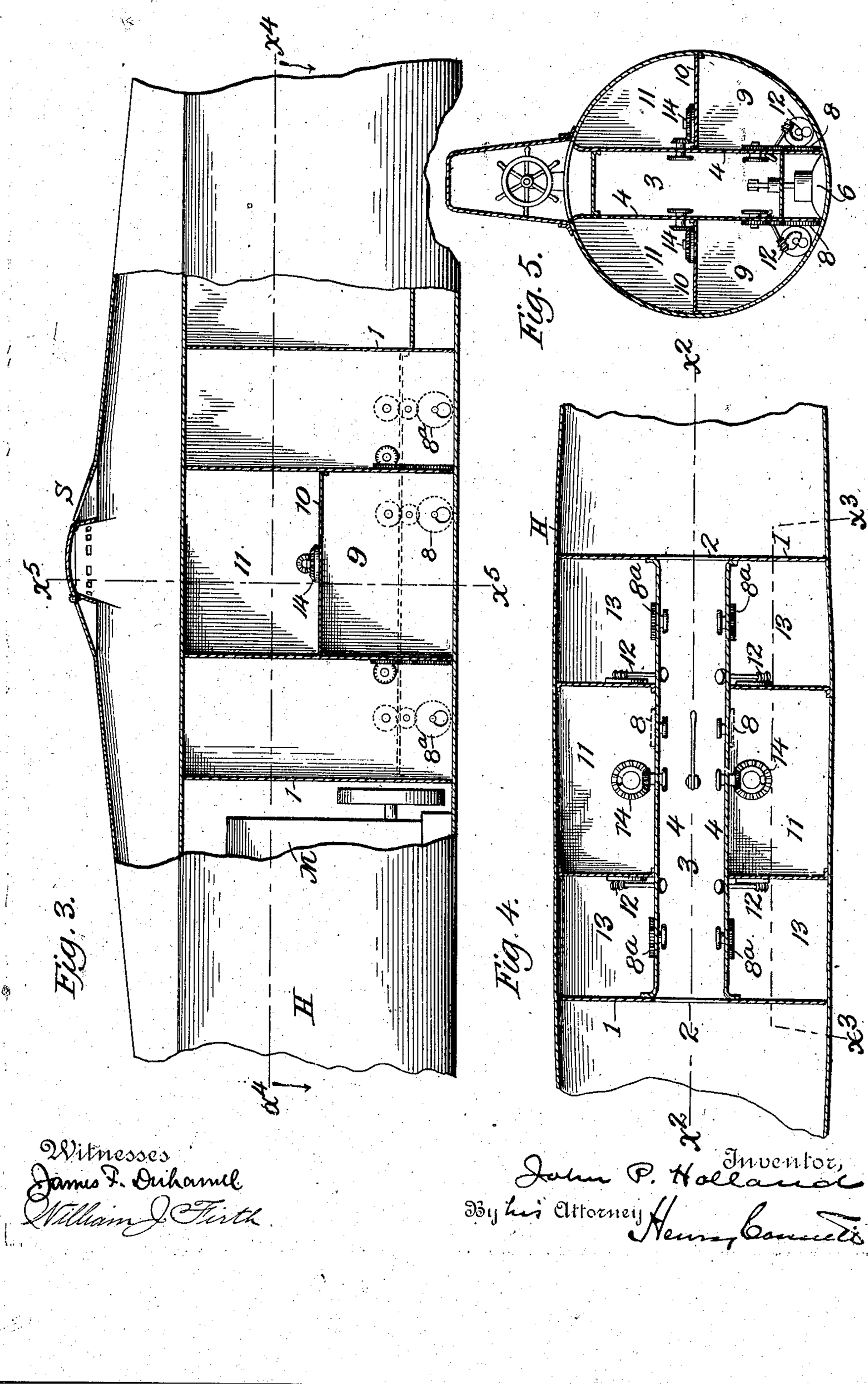

Fig. 3.

Fig. 4.

Fig. 5.

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UNITED STATES PATENT OFFICE.

JOHN P. HOLLAND, OF NEWARK, NEW JERSEY.

SUBMARINE BOAT.

No. 815,350. Specification of Letters Patent. Patented March 20, 1906.

Application filed September 24, 1904. Serial No. 225,805.

To all whom it may concern:

Be it known that I, JOHN PHILIP HOLLAND, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Submarine Boats, of which the following is a specification.

This invention relates to the class of submarine and submergible boats in which water is employed for ballast.

This class of boats are ordinarily so constructed that they may be at will so ballasted as to have considerable freeboard and be able to navigate on the surface or be so ballasted that they are "awashed" or in diving condition, when they may be made to dive and navigate submerged. In such boats as at present constructed the ballast-tanks are disposed at the bottom of the boat and extend fore and aft nearly the entire length of the boat, and the consequence is that owing to the fluid character of the ballast and the distance of the greater part of the ballast mass from the center of gravity of the boat any slight roll or pitch of the boat will produce a shift of the ballast toward the lowest point, and thus so seriously disturb the center of gravity of the mass as to render liable the total destruction of the boat if it be running submerged, or if on the surface should there be any opening in the boat above the surface the sudden pitch or roll of the boat will cause it to take water at such opening and be foundered and sunk. Even if the opening be closed before enough water enters to sink the boat the water may find its way to the storage batteries and by the generation of chlorin or other gases suffocate the crew. Such accidents have actually occurred. To obviate the liability of such dangerous conditions arising is the object of the present invention, which consists in grouping all of the ballast-tanks and also the tank or tanks for containing liquid fuel at the center of the boat where they extend from near the bottom of the boat up to the top plates thereof. The tanks are grouped symmetrically about the center of buoyancy of the boat, and, being so near the latter, any slight flow or disturbance due to a slight heeling or pitching of the boat will have no appreciable effect on the stability of the boat. Such boats have also tanks to contain liquid fuel for use in internal combustion engines for driving the boat when navigating on the surface, the consumption of the liquid fuel being compensated by water ballast. These tanks are also disposed symmetrically about the center of the boat, as will be hereinafter explained.

Obviously in carrying out the invention the tanks, the are-material of which they are constructed, and the valves controlling admission of water to the tanks may be of the usual or any satisfactory kind. It is the disposition of the tanks and valves for accomplishing the object sought that forms the distinctive feature of the invention.

In the accompanying drawings, which serve to illustrate the invention, Figure 1 is a side elevation of the boat on a relatively small scale. Fig. 2 is a vertical longitudinal axial section of the middle portion of the boat on a much larger scale than Fig. 1. Fig. 3 is a vertical longitudinal section of the middle portion of the boat, taken at one side of the axis, as indicated by line x^3 in Fig. 4. Fig. 4 is a horizontal section taken at line x^4 in Fig. 3. Fig. 5 is a transverse section taken at line x^5 in Fig. 3.

H designates the main hull or shell of the boat; S, the sighting-hood; P, the propeller; R, the rudder; M, the motor for driving; E, the expulsion-tube, and T a spare torpedo. These and some of the other ordinary appurtenances of a submarine torpedo-boat are herein indicated somewhat diagrammatically. Their construction will be readily understood by those skilled in the art.

A space equal to about one-seventh of the boat's length and having its center coincident with the boat's center of buoyancy is set apart for the ballast and fuel tanks. This portion is separated from the end portions of the boat by transverse bulkheads 1 1, having in them door-apertures 2 2, corresponding to the ends of a gangway 3, formed by longitudinal bulkheads 4 4. These several bulkheads extend to the shell of the boat all around—above, below, and at the sides. The gangway 3 has a floor 5 raised above the bottom of the boat a distance or height sufficient to provide space for a sea-valve 6 to admit water of flotation. This may be a Kingston valve of known construction, and it may be operated from above the floor 5 to admit water to a tank or chamber 7 under the floor 5 and communicating laterally, by valve-controlled inlets or gates 8, with lower ballast-tanks 9 at the respective sides of the gangway. These lower tanks 9 are separated by horizontal partitions 10 from upper ballast-tanks 11. At their fore-and-aft ends the lower

tanks 9 connect, by valve-controlled inlets or gates 12, with ballast-tanks 13, which extend from the bottom to the top of the boat. These tanks 13 connect below, by valve-controlled inlets 8^a, with the receiving-tank 7, and the lower tanks 9 connect, respectively, with the upper tanks 11, by means of valve-controlled inlets 14. Thus it will be seen that the middle space between the bulkheads 1 is divided up into the gangway 3, the receiving-tank 7, which is a ballast-tank, and four tanks on each side. Preferably each of the tanks 13, plus one-fourth of the tank 7, will have a capacity equal to about .0239 per cent. of the boat's total displacement. Thus these four tanks 13, plus the tank 7, will have a total capacity of about .0955 per cent. of the total displacement of the boat.

One of the tanks 9 and 11 at each side of the boat is designed to contain liquid fuel. Either the upper or lower of the two superposed tanks may be used for this purpose, as found most convenient. If the fuel is to be supplied to the engine by a pump, the lower tank 9 may be utilized; but if it is to be supplied by gravity the upper tank 11 may be utilized. When it is determined whether it is the upper or lower tanks that are to be used for liquid fuel, the remaining part of the central ballast-space can be properly proportioned. The portion of the ballast-space occupied by the superposed tanks 9 and 11 should have a capacity (exclusive of the fuel-space) equal to about .03 of the boat's total displacement.

The central water-ballast space taken as a whole—that is, all of the tanks 7, 9, 11, and 13—will have a capacity such that when completely filled with sea-water, they will suffice to neutralize entirely the buoyancy of the boat and cause complete submergence.

The valves controlling the ports connecting the tanks with the receiving-tank 7 and with each other will be under the control of the diver.

As herein shown, the upper tanks 11 are designed as liquid-fuel tanks, and they are connected by valve-controlled ports with the lower tanks in order that the lower tanks also may be utilized for fuel-storage when the boat is to make a long voyage on the surface. This connection also facilitates cleaning out the fuel-tanks by making it possible to discharge their contents through the sea-valve 6. One important advantage of this arrangement of the ballast-tanks is that it eliminates wholly the necessity for trimming the boat preparatory to diving. The trim is never disturbed, and the regulation of the quantity of water admitted to the ballast-tanks can be effected almost instantly and with great exactness. Premising that the boat will be provided with the usual appliances—such as a hydrometer, depth-gages, and means for blowing out water from the tanks with compressed air—it may be explained that in preparing to dive the sea-valve is opened, and the four tanks 13 may be filled full in less than one minute. When the gages show that the tanks 9 are filled to the required depth, the valves are closed. The tanks 13 will now be completely filled and the only free liquid-surfaces in the boat will be those tanks (9 and 11 in the present case) which are nearest the center of the boat, and the movement of the liquid in these cannot cause any inconvenience, partly on account of the limited space in which movement is possible and partly to their proximity to the center of the boat's buoyancy.

As the total weight of the boat and its contents may vary several hundred pounds without notably affecting its performance, when such change of weight occurs at the boat's center it will not be necessary to provide special automatic means for compensating the expenditure of liquid fuel, as that can be done by hand at long intervals.

Fig. 2 shows the positions of the steersman, the diver, the gunner, and the engineer.

It will be seen from the above that the leading object of the invention is to group the entire ballast-space of the boat at its center, so that they occupy the entire middle section of the boat with the exception of the gangway which connects the after and forward sections of the boat. Thus all the water ballast and liquid fuel will be grouped closely about the center of buoyancy of the boat in tanks extending practically from bottom to top of the boat. Thus when the ballast-tank shall be only partially filled, as when the boat is operating in brackish or slightly-saline water or when the fuel-tanks are only partly full, the shift of the liquid cannot be very great, as the construction shown provides the minimum radii of gyration of the center of gravity when the boat rolls or pitches, and the disturbance of the center of gravity will thus be reduced to a minimum.

Having thus described my invention, I claim—

1. A submarine boat, having all of its water-ballast tanks and liquid-fuel tanks grouped symmetrically about the center of buoyancy of the boat, such tank-space extending from top to bottom and from side to side of the hull of the boat, and having a fore-and-aft gangway extending through said tank-space.

2. A submarine boat, having all of its water-ballast and fuel-tank space included between two parallel transverse, vertical bulkheads in the boat and extending to the hull thereof above, below and at both sides, and said bulkheads, disposed respectively at equal distances forward and after the boat's center of buoyancy, and having fore-and-aft bulkheads between the transverse bulkheads and extending from top to bottom of the hull, said fore-and-aft bulkheads forming the sides

of a fore-and-aft gangway through the tank-space.

3. A submarine boat, having two transverse bulkheads 1, 1, disposed at equal distances, respectively forward of and aft the boat's center of buoyance and extending to the top, bottom and sides of the hull of the boat, two parallel, upright, fore-and-aft bulkheads 4, 4, extending from one of said transverse bulkheads to the other, forming thus a gangway 3 opening out at 2 through the transverse bulkheads, and the space inclosed between said transverse bulkheads partitioned to form all the water-ballast and liquid-fuel tanks of the boat, such tank-space occupying about one-sixth of the boat's entire length.

4. A submarine boat, having grouped symmetrically about its center of buoyancy a receiving-tank 7, four ballast-tanks 13 which extend from the bottom to the top of the boat, and tanks 9 and 11, the tanks 11 being superposed on the respective tanks 9, each pair of such tanks being disposed between two of the tanks 13 at that side and extending from top to bottom of the boat.

5. A submarine boat, having about one-seventh of the entire length of the boat at the middle of the latter inclosed to form a tank-space, said space being divided into a gangway 3, a tank 7 under the floor of the gangway, two lower middle tanks 9, two upper middle tanks 11, four tanks 13, all grouped symmetrically about the center of buoyancy of the boat, and means for controlling the flow of liquid to and between the tanks.

In witness whereof I have hereunto signed my name, this 18th day of August, 1904, in the presence of two subscribing witnesses.

JOHN P. HOLLAND.

Witnesses:

HENRY CONNETT,

BENJAMIN H. HOLT.