No. 805,496. PATENTED NOV. 28, 1905.

L. Y. SPEAR.

BUOYANCY REGULATING APPARATUS FOR SUBMARINE BOATS.

APPLICATION FILED AUG. 10, 1904.

2 SHEETS—SHEET 1.

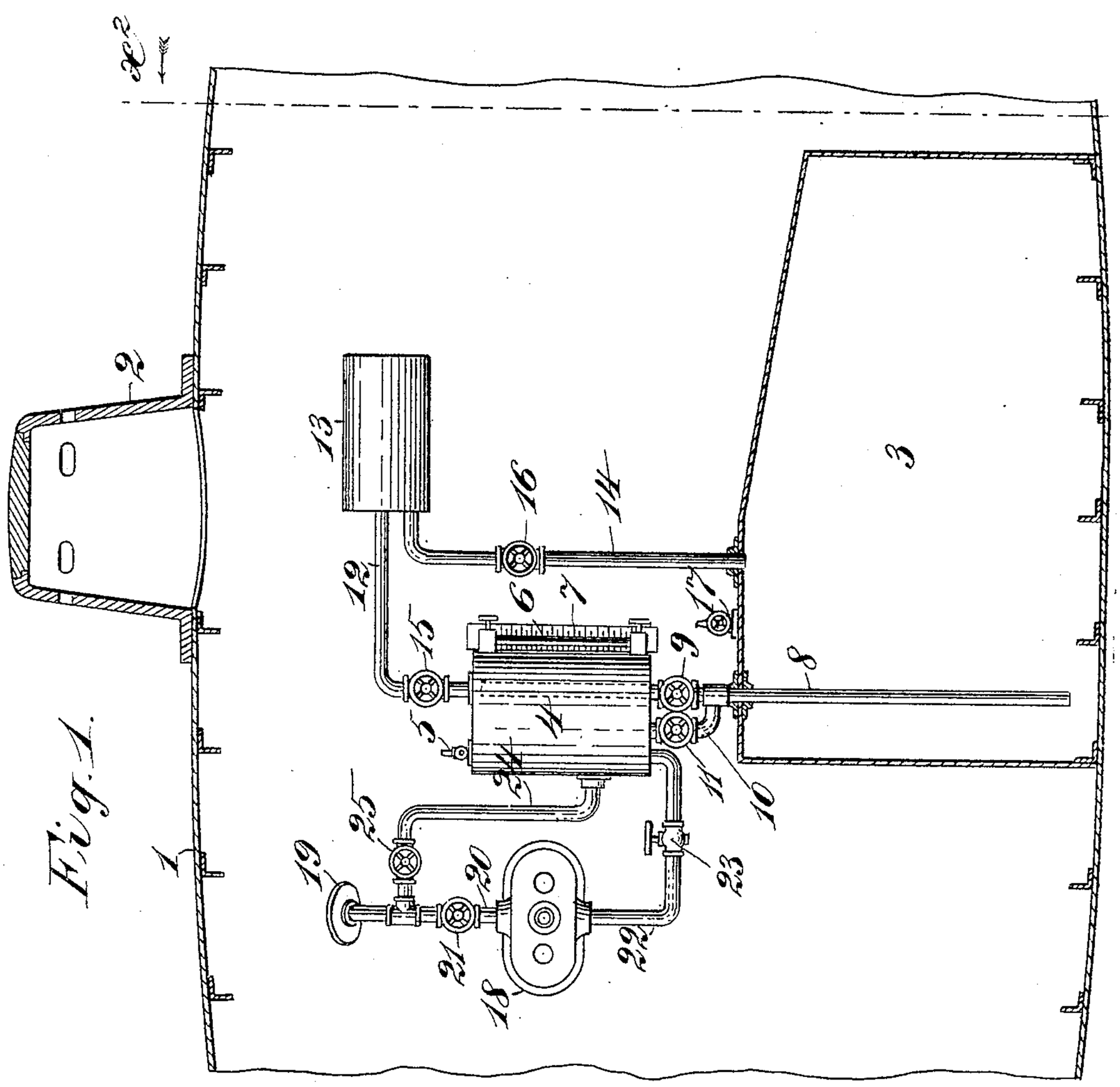

Fig. 1.

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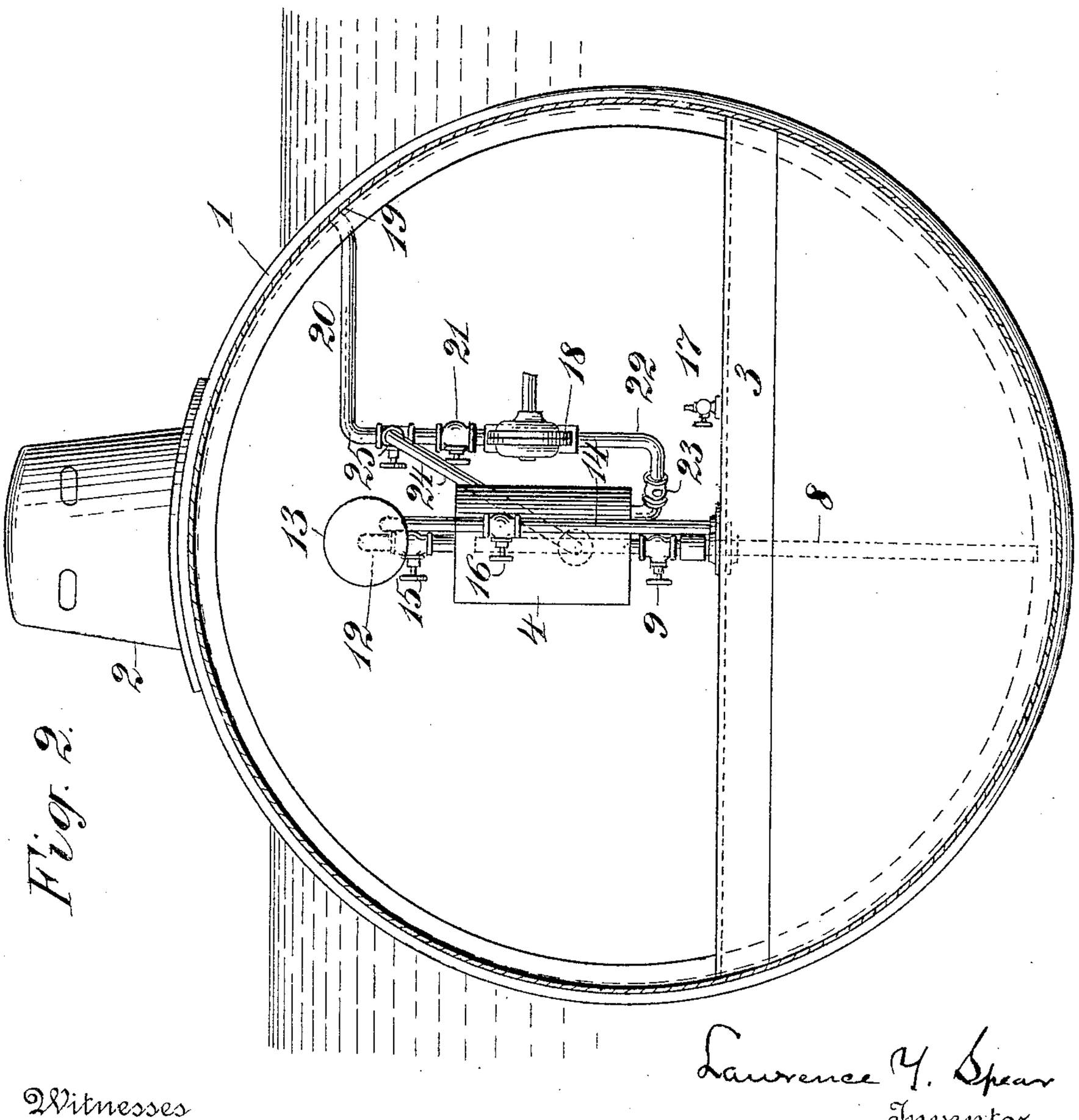

Fig. 2.

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UNITED STATES PATENT OFFICE.

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BUOYANCY-REGULATING APPARATUS FOR SUBMARINE BOATS.

No. 805,496. Specification of Letters Patent. Patented Nov. 28, 1905.

Application filed August 10, 1904. Serial No. 220,222.

To all whom it may concern:

Be it known that I, LAWRENCE Y. SPEAR, a citizen of the United States, residing at Greenport, in the county of Suffolk and State of New York, have invented certain new and useful Improvements in Buoyancy-Regulating Apparatus for Submarine Boats, of which the following is a specification.

This invention relates to buoyancy-regulating devices applicable for all classes of submarine and submergible boats, but especially to such types of these boats as have normally when navigating below the surface of the water a certain amount of reserve or surplus buoyancy residing wholly or in part in the conning-tower or sighting-hood of the boat, which projects above the hull of the latter.

The present invention is an improvement on the device or apparatus for regulating the buoyancy of such boats, illustrated and described in my United States Patent No. 772,970, dated October 25, 1904, and relates only to that part of such an apparatus whereby the reserve buoyancy of the boat may be varied at will and to the means for effecting the proper initial regulation of the reserve buoyancy in any state or condition of wind and weather and for maintaining such reserve despite changes in the specific gravity of the water of flotation. The apparatus also enables all the water ballast in the boat or vessel to be blown out at a great depth without subjecting the ballast-tanks to excessive pressure.

The special features of the invention will be hereinafter fully described, and their novel characteristics carefully defined in the claims.

In the accompanying drawings, which serve to illustrate an embodiment of the invention, Figure 1 is a vertical longitudinal section of the middle portion of a submarine boat provided with the invention, and Fig. 2 is a transverse scction taken at the line x^2 in Fig. 1.

1 designates the hull or body of the submarine boat, and 2 the conning-tower thereof. Within the boat 3 is an auxiliary ballast-tank of limited capacity located at the center of buoyancy of the boat and usually connected by pipe-lines with the other ballast-tanks of the boat. There is nothing novel in this tank *per se*.

4 is an intermediate ballast-tank made, by preference, of cylindrical form and having strength to resist great internal pressure. This tank will be located at the point where the reserve buoyancy is required, which will usually be a little abaft the conning-tower. This tank 4 is provided with a vent 5, opening into the interior of the boat, a glass gage 6, and a scale 7 behind said gage. This gage will be graduated from the bottom up and from the top down, the graduations showing in connection with the gage the weight of the water that may be at any time in the tank. From near the top of the tank 4 a pipe 8 extends down to near the bottom of the tank 3 and is provided with a controlling-valve 9, and a by-pass 10, controlled by valve 11, connects the bottom of the tank 4 with the pipe 8 below the valve 9. The top of the tank 4 is connected by a pipe 12 with a tank 13 for compressed air, and this air-tank is connected by a pipe 14 with the ballast-tank 3. The pipes 12 and 14 are controlled, respectively, by valves 15 and 16. The tank 3 has an air-vent 17.

A reversible pump 18 is connected at its top with the sea at 19 by a pipe 20, controlled by a valve 21, and at its bottom by a pipe 22 with the bottom of the tank 4. This pipe 22 is controlled by a valve 23. There is a pipe 24 forming a by-pass about the pump and connecting the pipe 20 with the tank 4. This by-pass connects the tank 4 with the sea, and it is controlled by a valve 25. The pump 18 is somewhat diagrammatically illustrated. It may be any desired kind or type of reversible pump adapted to be operated by hand, by power, or by both.

The capacity of the tank 4 is not strictly limited, but by preference it will be about twenty per cent. greater than the maximum reserve buoyancy of the boat.

The operation will be as follows:

First. To effect the initial regulation for buoyancy: All the other connections being closed, the valves 9 and 25 are opened and the tanks freed from air at the air-vents, which latter will be afterward closed. The tank 3 will thus be filled through sea connection 19, pipes 20 and 24, tank 4, and pipe 8, the tank 4 being filled before water flows to the tank 3. When the buoyancy of the boat or vessel is wholly destroyed by the ballast, it will begin to sink. This will be noted by a gage. (Not shown herein.) When this begins, the valve 9 must be closed and the valve 15 opened. This admits compressed air to the tank 4 to blow out the water through port 19 until the initial reserve buoyancy is shown on the gage.

In case the compressed air is exhausted or for any reason it is not desired to use it the valves 15 and 25 may be left closed, the valves 21 and 23 be opened, and the water pumped from the tank 4 by the pump 18.

Second. To effect a fine regulation of the buoyancy in any condition of the boat or vessel: In this case, all connections being supposed closed, the valves 21 and 23 and the vent 5 are opened and the pump set in motion in the proper direction to pump water into the tank 4 or from it, as may be required, the rise and fall and weight of water in said tank 4 being always indicated on the scale 7. Should it be desired to take in water in quantity greater than the tank 4 will contain, the valve 11 is opened and the surplus passes through the pipe 10 into the tank 3. The pipe 8 may be employed in lieu of the pipe 10 except when it is desired to maintain a nearly-constant weight of water in the tank 4. When it is desired to pass out a larger quantity of water than is contained in the tank 4, this tank is refilled from the tank 3 through the pipes 8 or 10 by opening the cock 16 and admitting compressed air from tank 13 to tank 3 through pipe 14.

Third. To empty the tank 3 and all the tanks that may be connected with it when the boat is submerged to a great depth: In this case the intermediate tank 4 is rapidly filled from the auxiliary tank 3 by the means described and the tank 4 then emptied to the sea at 19 either with compressed air or by the pump, the former being preferred. This may be repeated until the ballast-tanks are empty. On account of its restricted dimensions and the cylindrical form of the tank 4 it may be constructed of great strength, so that it will sustain the high pressure necessary to force the water to the sea at such a great depth, and this permits the ballast-tanks to be emptied in an emergency at a very great depth of submersion, the latter being limited only by the strength of the tank 4 and not by that of the main ballast-tanks.

Obviously the pipes 10 and 24, although shown for convenience as by-pass connections, might be direct—that is to say, the pipe 10 is shown as connecting with the pipe 8; but it might as well connect directly with the tank 3, and the pipe 24 might as well connect directly with the sea instead of with the pipe 20. These features require no illustration, as they will be obvious to any skilled mechanic.

Having thus described my invention, I claim—

1. A submarine boat having means for regulating its buoyancy, comprising a ballast-tank, a strong intermediate tank of relatively small capacity, a valve-controlled pipe connecting said tanks, a valve-controlled pipe connecting the stronger intermediate tank with the sea, and means for forcing water from the ballast-tank to said intermediate tank and from said intermediate tank to the sea, substantially as and for the purpose set forth.

2. A submarine boat having means for regulating its buoyancy, comprising an auxiliary ballast-tank 3, an intermediate cylindrical tank 4, a valve-controlled pipe connecting the tank 3 with the tank 4, a gage and scale on the tank 4, a container or tank 13 for compressed air, a valve-controlled pipe connecting said tank 13 with the tank 3, a valve-controlled pipe connecting the tank 4 with the sea, and means for forcing water from the tank 4 to the sea through said pipe.

3. A submarine boat having means for regulating its buoyancy, comprising an auxiliary ballast-tank 3, an intermediate cylindrical tank 4, a valve-controlled pipe connecting said tanks, a gage and scale on the tank 4, an air-tank 13, valve-controlled pipes connecting the air-tank with the tanks 3 and 4, respectively, a valve-controlled pipe 24 connecting the tank 4 with the sea, a reversible pump, a valve-controlled pipe connecting said pump with the tank 4, and a valve-controlled pipe connecting the pump with the sea.

4. A submarine boat having means for regulating its buoyancy, comprising an auxiliary ballast-tank 3, an intermediate and relatively small tank 4, a valve-controlled pipe 8 connecting the upper part of the tank 4 with the lower part of the tank 3, a valve-controlled pipe 10, connecting the lower part of the tank 4 with the tank 3, a valve-controlled pipe 24 connecting the tank 4 with the sea, a tank for compressed air, and valve-controlled pipes connecting said air-tank with the respective tanks 3 and 4.

In witness whereof I have hereunto signed my name, this 4th day of August, 1904, in the presence of two subscribing witnesses.

LAWRENCE Y. SPEAR.

Witnesses:
HOWARD G. TUTHILL,
FRANK L. BRAKE.