S. LAKE.

BALLAST CONTROLLING APPARATUS

APPLICATION FILED JUNE 2, 1914.

1,127,648.

Patented Feb. 9, 1915.

4 SHEETS—SHEET 1.

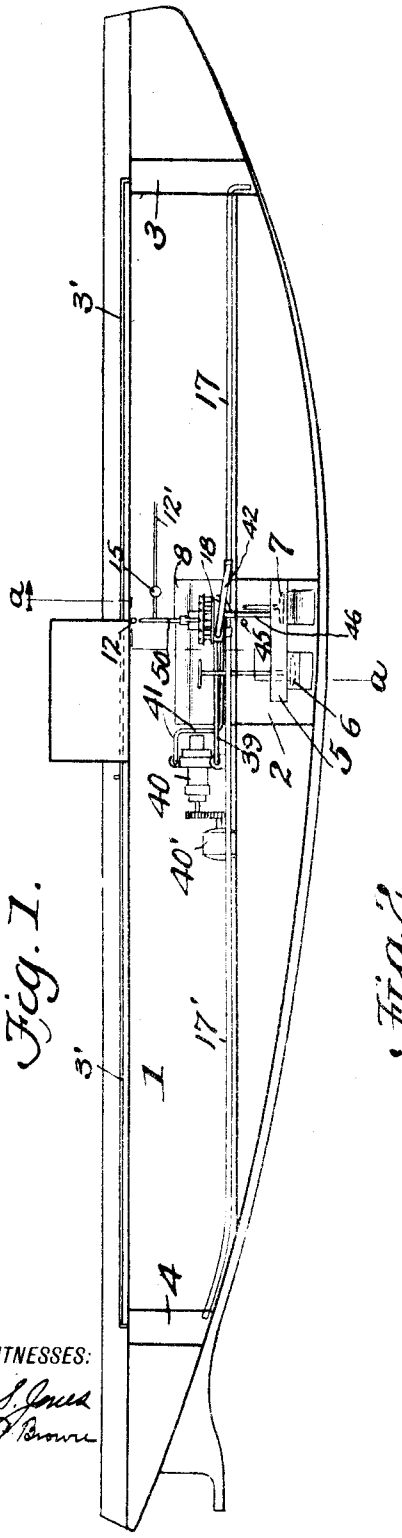


Fig. 1.

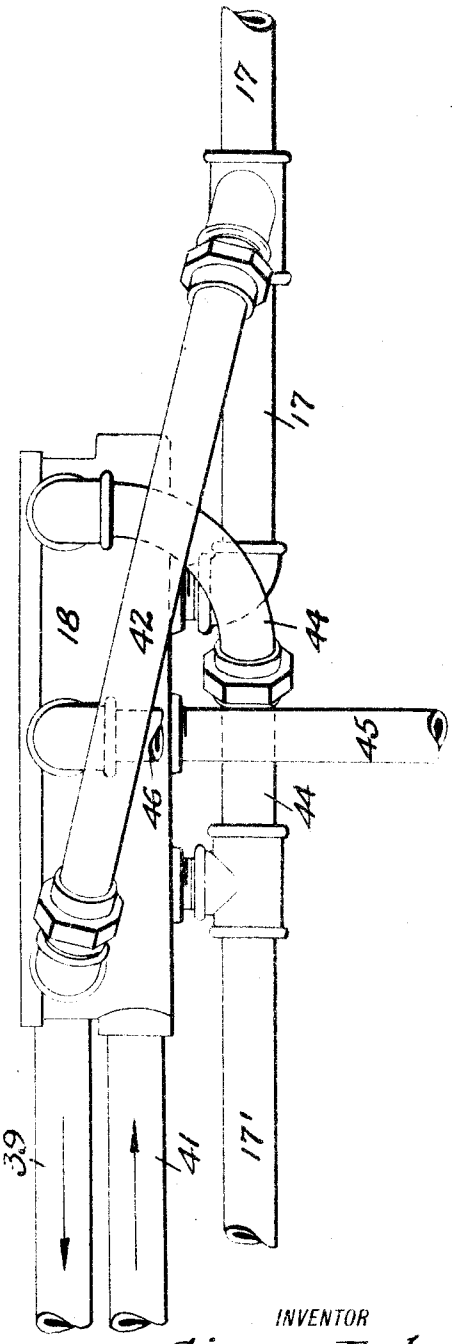


Fig. 2.

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4 SHEETS—SHEET 2

Fig. 4.

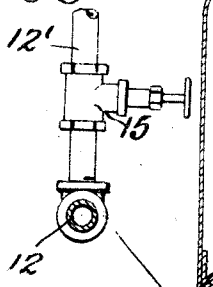


Fig. 3.

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4 SHEETS—SHEET 3.

Fig. 5.

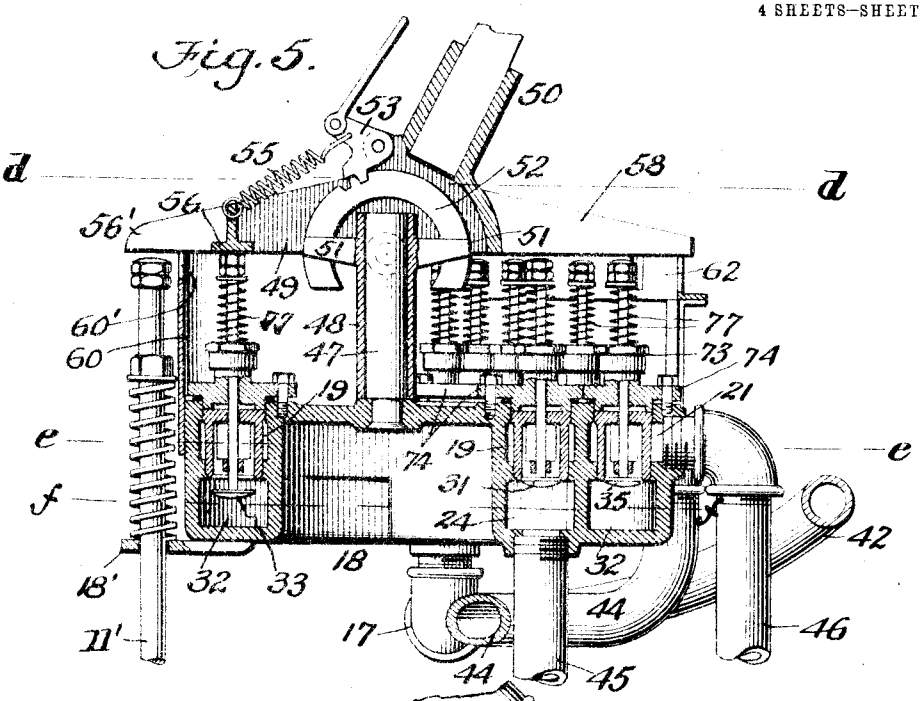
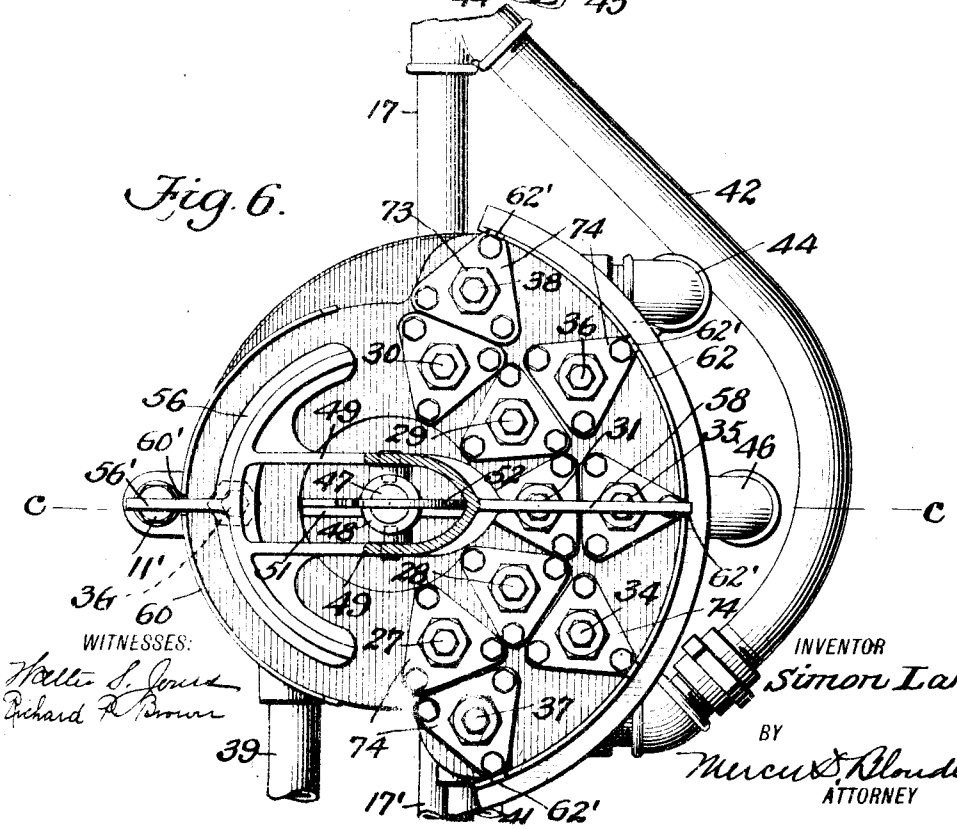


Fig. 6.



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4 SHEETS—SHEET 4.

Fig. 7

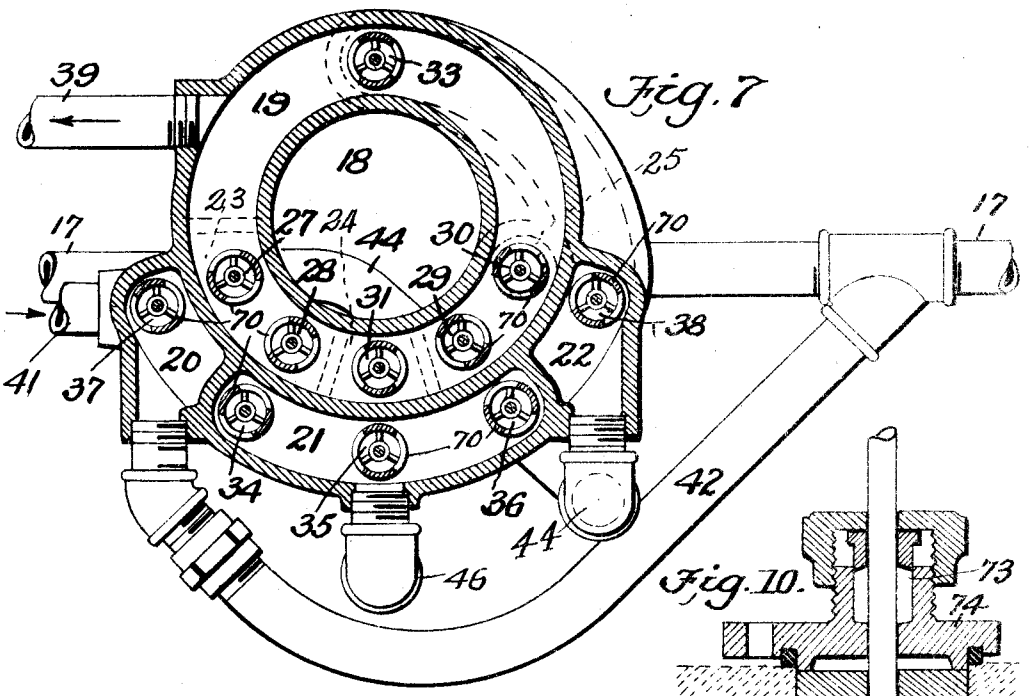


Fig. 10.

Fig. 8.

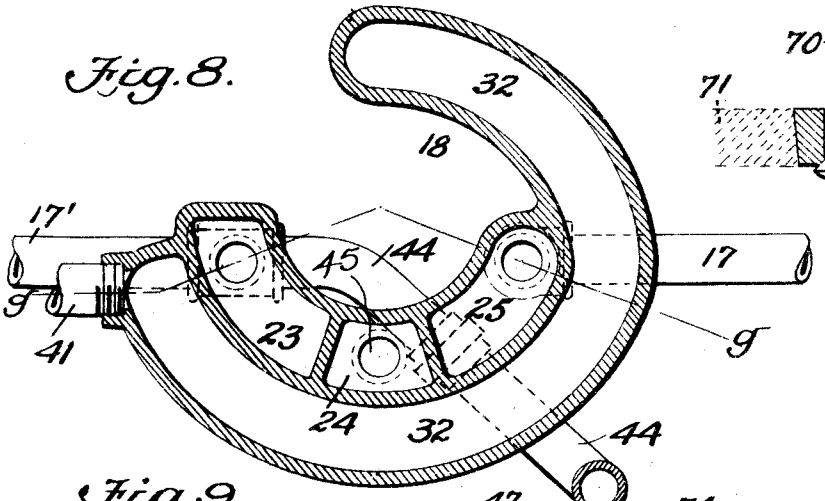
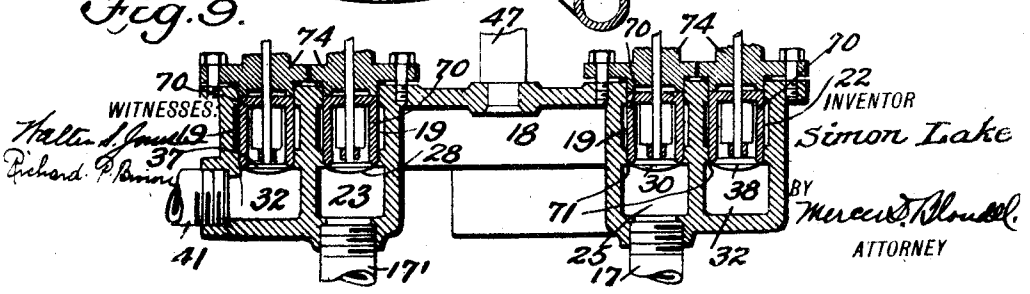


Fig. 9.



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SIMON LAKE, OF MILFORD, CONNECTICUT. ASSIGNOR TO LAKE TORPEDO BOAT COMPANY OF MAINE, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF MAINE.

BALLAST-CONTROLLING APPARATUS.

1,127,648. Specification of Letters Patent. Patented Feb. 9, 1915.

Application filed June 8, 1914. Serial No. 843,802.

To all whom it may concern:

Be it known that I, SIMON LAKE, a citizen of the United States, residing at Milford, in the county of New Haven and State of Connecticut, have invented certain new and useful Ballast-Controlling Apparatus, of which the following is a specification.

The object of the invention is to provide a simple apparatus for controlling the final submergence and trim of submarine boats by which one man only is required for controlling the admission and expulsion of water-ballast to and from the trimming and the final adjusting tanks of the boat, and by which the valves and connections to the individual tanks and the services of a number of men for operating them is dispensed with, thus not only simplifying the operation, but putting the control of the final adjustment and trim of the boat under one person, the operation and arrangement of the apparatus being such that the admission and expulsion of the water to and from the several tanks, or the transferring of water from one tank to the other, may be accomplished in less time than when attended to by several operators.

The invention consists in providing a single valve casing having a series of passages which are piped to the several tanks of the boat, the passage of water through the pipes being controlled by valves arranged in the valve casing and operated by a single lever adjustably mounted on the valve casing.

These and other features germane thereto, constitute the invention, as will be hereinafter fully described and then pointed out in the claims.

In the drawings illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a diagrammatic longitudinal section of a submarine torpedo boat embodying my invention. Fig. 2 is a front view of the multiple valve casing, the valves and operating lever being omitted. Fig. 3 is a diagrammatic transverse section of the boat drawn on a larger scale on the irregular line *a—a* of Fig. 1. Fig. 4 is a detail section drawn on a larger scale on the line *b—b* of Fig. 3. Fig. 5 is a vertical transverse section drawn through the multiple valve casing on the line *c—c* of Fig. 6, the upper end of the operating lever being broken away. Fig. 6 is a horizontal section drawn on the line *d—d* of Fig. 5. Fig. 7 is a horizontal section drawn on the line *e—e* of Fig. 5. Fig. 8 is a horizontal section drawn on the line *f—f* of Fig. 5. Fig. 9 is a vertical section drawn on the irregular line *g—g* of Fig. 8, the upper ends of the valve stems and their stuffing boxes being broken away. Fig. 10 is a detail section drawn through one of the valves of the valve casing.

1 designates the hull of a submarine torpedo boat having at amidships the usual center or main ballast tank 2 and in its ends the usual fore and aft trimming tanks 3 and 4, respectively. Water ballast is admitted to the main ballast tank 2 through a manifold 5, the admission of water to the manifold being controlled by an outwardly opening sea valve 6, and from the manifold to the said tank 2 through an opening controlled by an inwardly opening valve 7, the stems of the valves being extended into the working compartment of the boat in the usual manner. Water ballast is admitted to the trimming tanks through sea-valves (not shown) in the usual manner. Built upon the top of the main ballast tank and at the sides of the boat are ballast tanks 8, of substantially the same length as the main ballast tank, and into which water is let to effect the final reserve of buoyancy of the boat when submerging and which I shall hereafter refer to as final adjusting tanks. The tanks 8 are connected by a pipe 9 arranged in and extending transversely of the main ballast tank and having its ends extended upwardly and opening through the top of the main ballast tank 2. The pipe 9 is provided with a union to which is connected a supply pipe 10 extending from the manifold 5. The passage through the pipe 10 is controlled by a valve 11, the stem 11′ of which extends upwardly through the top of the main ballast tank and has its upper end arranged for engagement by an operating lever as will be hereinafter described. The tops of the tanks 8 are connected by a pipe 12 having a vent pipe 13 extending therefrom which is provided with a valve 14 which is also arranged for engagement by the operating lever to vent the said tanks 8 when water ballast is admitted to them. The pipe 12 is connected to a compressed air supply pipe 12′ extending from a suitable source of compressed air supply (not shown) for blowing water from the tanks

and is provided with a valve 15 for controlling the admission of air to the tanks. The forward and aft trimming tanks are connected by a vent pipe 3' which is arranged in the superstructure in the usual manner.

The forward and after trimming tanks are connected by pipes 17 and 17', respectively which have their inner ends connected to my improved multiple valve 18 which controls the admission to and withdrawal of water from the said tanks, and the transferring of water from one tank to the other, and also controls the contents of the final adjusting tanks. The valve 18 comprises a casing having an annular passage 19, and a series of compartments 20, 21 and 22 which partly surround the periphery of the annular passage, and directly below the annular passage the casing is formed with compartments or passages 23, 24 and 25. The passages 23 and 25 communicate with the annular passage 19 through openings controlled by valves 27 and 28, and 29 and 30, respectively, and the passage 24 communicates with the said passage 19 through an opening controlled by a valve 31. Below the passages 20, 21 and 22, the casing is formed with a passage 32 which is extended around to the rear side of the casing and communicates with the annular passage 19 through an opening controlled by a valve 33 the latter opening and its valve being arranged diametrically opposite the valve 31. The passage 32 also communicates with the passage 21 through openings controlled by valves 34, 35 and 36, and with the passages 20 and 22 through openings which are controlled by valves 37 and 38, respectively. As shown, the valves 31, 33 and 35, are arranged in transverse alinement, and the valves 27 and 37; 28 and 34; 29 and 36, and 30 and 38, respectively, are arranged in radial alinement and are designed to be operated together as will be hereinafter described.

The annular passage 19 is connected by a pipe 39 with the intake of a suction pump 40, and from the discharge of the pump extends a pipe 41 which is connected to the passage 32. When submerging the boat, and during the time of adjustment of trim and buoyancy, the pump is continuously operated, and for the purpose of illustration I show it geared to a motor 40', shown in Fig. 1. The pipe 17 extending from the forward trimming tank 3 is connected to the passage 25 of the valve casing and is provided with a branch pipe 42 which extends to the passage 20, while the pipe 17' extending from the after trimming tank 4 opens into the passage 23 and is provided with an extension 44 which opens into the passage 22. From the passage 24 extends a pipe 45 Figs. 2, 3 and 5, which passes through the top of the main ballast tank and has its lower end connected to the pipe 9 connecting the final adjusting tasks 8, and from the passage 21 extends a pipe 46 which also passes downwardly through the top of the main ballast tank and has its lower end connected to the supply pipe 10 leading from the manifold 5.

Extending upwardly from the center of the valve casing, that is to say, from the axial center of the annular passage 19 thereof, is a cylindrical pivotal post 47 upon which is rotatably mounted a sleeve 48 having diametrically disposed lugs adjacent to its upper end to which are pivotally connected the parallel horizontally disposed arms 49 of an operating lever 50 by which the several valves of the casing are operated. The handle of the lever is extended upwardly and at an obtuse angle from the horizontal arms 49 and is provided with a lug 49' which is designed for engagement with the stem of the valve 14 whereby to open the valve to vent the tanks 8 when the lever is operated to admit water to the tanks. The sleeve 48 is formed with diametrically disposed ears 51 to which are connected the opposite ends of a segmental bar 52 having peripheral recesses or notches to receive the tooth of a locking pawl 53 pivoted in lugs extending from the parallel arms of the lever, and to which is connected the lower end of a connecting rod extending from an operating handle 54 pivoted to the handle end of the operating lever 50. A spring 55, Fig. 5, serves to hold the pawl into engagement with the recesses of the bar 52.

The rear ends of the parallel arms 49 are connected by a segmental bar 56 which operates over the upper end of the stem of the valve 33, and from the segmental bar 56 extends a finger 56' which is designed to engage the upper end of the stem 11' of the valve 11. As shown in Figs. 3 and 5, the upper end of the valve stem 11' is held in a guide 18' extending from the valve casing 18 and between which and a nut threaded on the stem 11' is interposed a spring for holding the valve 11 normally to its seat. The forward ends of the parallel arms 49 converge and terminate in a single arm 58 which extends therefrom in longitudinal alinement with the finger 56'. The finger 56' operates over a segmental guide plate 60 which is formed with a notch 60', Figs. 5 and 6, arranged adjacent to the stem 11' of the valve 11, and which permits the operation of the lever to admit water to the final adjusting tanks only when the lower end of the lever is arranged transversely of the valve casing as will be clearly understood from the general description of the operation of the invention. The forward end of the arm 58 operates over a segmental guide

bar 62 which is arranged around the front of the valve casing and is provided in its upper end with notches 62′ disposed in radial alinement with the stems of the several pairs of co-acting valves of the casing 18.

As the valves of the casing 18 are each constructed alike the description of one will suffice for all. Each valve (Fig. 10), has its stem held in a valve cage 70, having its lower end slightly tapered to snugly fit a tapered opening formed in the partition 71 of the valve casing which separates the upper and lower passages in the latter and has its lower end ground to provide a valve seat against which the valve operates. The stem of the valve passes upwardly through the top of the cage and through a stuffing box 73 formed on a plate 74 secured to the top of the valve casing. The lower face of the plate is formed with a circular flange which snugly fits the opening in the top of the valve casing, through which the valve is inserted in the casing, and is seated against the top of the valve cage to thus securely hold the valve cage in position. The lower side of the plate is formed with a circular recess which surrounds the flange and in which is held a washer of suitable material to provide a sealed joint around the opening in the top of the valve casing. As shown, the valves are held to their seats by coiled springs 77 which surround the upper ends of the valve stems and bear against the tops of the stuffing boxes 73 and against nuts screwed on the upper ends of the said stems.

The operation of the invention is as follows: It may first be stated that it is the general practice in submerging all submarine boats to first admit sufficient water to the main ballast tank and the auxiliary and trimming tanks to reduce the buoyancy of the boat to within about one thousand pounds of its total displacement, after which additional quantities of water are let into the final adjusting tank to further reduce the buoyancy to about five hundred pounds of total displacement, under which condition the boat is operated submerged, it being understood that it is forced under the water by the horizontal rudders and hydroplanes as it is propelled through the water. We will assume therefore, that sufficient water ballast has been admitted to the several tanks to put the boat in the "awash" condition, with a reserve of buoyancy of about one thousand pounds and it is desired to further reduce the buoyance to put it in submerging trim. It will be understood, that when the boat is in the "awash" condition the valve casing passages and the pipes extending therefrom are full of water and that when the lower end of the operating lever is in horizontal position the valve 33 is held open so that when the pump 40 is set in motion the water will be drawn into the pump from the passage 19 through the suction pipe 39, and thence forced through the pipe 41 into the passage 32 from which it escapes through the valve 33 back into the passage 19. Now, should the command be given to submerge to five hundred pounds buoyancy, the operator pushes the operating handle of the lever over to cause the finger 56′ to push the valve stem 11′ downwardly to open the valve 11 and at the same time to cause the lug 49′ to engage the stem of and open the vent valve 14 thus permitting the water of flotation to flow into the final adjusting tanks, the amount, of course, being indicated by the gages (not shown) in the usual manner. When the required amount of water has been admitted to the said tanks the operator then draws the handle of the lever toward him which permits the valve 11 to be automatically seated to thus cut off the admission of water to the tanks. Should the boat be trimmed by the stern and the command be given to "submerge to five hundred pounds buoyancy and trim one degree by the head", the operator after first admitting water-ballast to the adjusting tanks, as previously described, throws the operating lever around until the arm 58 is adjusted over the upper ends of the stems of the valves 27 and 37, and then pulls the handle end of the lever over to cause the arm 58 to engage the stems of and open said valves, which movement simultaneously lifts the segmental bar 56 from engagement with the stem of the valve 33 to permit the latter to be automatically seated by its spring, thus cutting off the communication between the passages 19 and 32 through the said valve, and establishing communication between the after trimming tank 4 and the passage 19 through the valve 27 so that the water from said tank 4 will be drawn through the pipe 17′, the valve 27, the passage 19, and the pipe 39 into the pump 40, and from the pump it will be forced through the discharge pipe 41 into the passage 32, through the said passage up through the valve 37, and thence through the pipes 42 and 17 into the forward trimming tank 3.

When the required quantity of water has been transferred to the forward tank the lever is again adjusted to permit the valves 27 and 37 to be seated and to cause the segmental bar 56 to engage the stem of and open the valve 33 to thus cut off communication between the said tanks and to reëstablish communication between the passages 19 and 32 through the pump as previously described. To transfer water from the forward trimming tank to the after trimming tank the lever is swung around on its support so that the arm 58 will be adjusted over

the upper ends of the stems of the valves 30 and 38, then, when the valves are opened, water will be drawn from the tank 4 through the pipe 17, into the passage 25, thence through the valve 30 into the passage 19 and through the pipe 39 into the pump 40, from which it is forced through the pipe 41, into the passage 32, thence through the valve 38 into the passage 22 and through the pipes 44 and 17' into the after tank 4. To pump water overboard from the forward and after trimming tanks in order to regulate the trim or to compensate for the discharge of torpedoes, I proceed as follows:—Assuming that water is to be pumped overboard from the forward trimming tank 3, the lever is rotated on its support to position the arm 58 over the stems of the valves 29 and 36, and when the lever is operated to open said valves the valve 33 will be allowed to automatically seat, and the water from the tank 3 will then be drawn through the pipe 17 into the passage 25, through the valve 29 into the annular passage 19, thence through the pipe 39, into the pump 40, from which it is forced through the pipe 41 into the passage 32, thence through the valve 36 into the passage 21, thence through the pipe 46 into the manifold 5, and out through the opening controlled by the valve 6, it being understood, of course, that as in all submarine boats the sea valve 6 is open during the entire time the boat is submerged. To pump water overboard from the after tank 4, the operating lever is rotated so as to position its arm 58 over the upper ends of the stems of the valves 28 and 34, and when the said valves are open the water will be withdrawn from the said tank through the pipe 17' into the chamber 23, thence through the valve 27 into the annular chamber or passage 19, through the pipe 39 into the pump 40, from which it is forced through the pipe 41 into the passage 32, thence through the valve 34 into the passage 21, and then through the pipe 46 into and through the manifold 5.

As will be noted, the description of the operation of the apparatus so far given refers to the admission of water to the final adjusting tanks and to the control of the contents of the forward and after trimming tanks. In order to increase the buoyancy of the boat and to maintain a uniform amount of reserve buoyancy without disturbing the contents of the main or auxiliary tanks, I proceed as follows:—Assuming that through the submerging operations the boat has its reserve buoyancy reduced to say, four hundred pounds, and it is desired to give it one hundred pounds additional buoyancy, the operating lever is adjusted to the position shown in Fig. 6, in which the arm 58 will be adjusted over the upper ends of the stems of the valves 31 and 35, so that when the lever is drawn forwardly to open the said valves, water will be drawn from the final adjusting tanks 8 through the pipes 9 and 45, into the passage 24, thence through the valve 31 into the annular passage 19 and through the pipe 39 into the pump 40, from which it will be forced out through the pipe 41, into the passage 32, thence up through the valve 35, through the pipe 46, and into and through the manifold 5. Water may also be forced from the final adjusting tanks 8 by compressed air which is led into the tops of the tanks through the pipe 12' as shown. It will thus be seen that the operation is exceedingly simple and requires the services of but one man to control the admission and pumping of water to and from the final adjusting tanks whereby to control the buoyancy of the boat and to control the contents of the forward and aft trimming tanks and to transfer water from one tank to the other whereby to control the forward and aft trim of the boat. It will also be seen that by the use of my apparatus it is necessary to connect each tank by a single pipe only through which the water is pumped into and out of the tanks, thus dispensing with the inlet and outlet pipes now employed for this purpose.

While I have shown and described the boat constructed with two final adjusting tanks I do not want to be understood as limiting myself to this construction as it will be apparent that the apparatus may be used to equal advantage in boats employing only one final adjusting tank in connection with the other auxiliary tanks if desired.

In Fig. 6, I have applied the reference characters of the valve to their stem in order to avoid multiplicity of reference numerals on the drawings.

What I claim is:—

1. The combination with a submarine boat having forward and aft trimming tanks piped together and to the water of flotation, of a multiple valve interposed in said pipes and having a plurality of passages to which the said pipes are connected, and a common means for operating said valves.

2. The combination with a submarine boat having forward and aft trimming tanks in the bow and stern respectively and water pipes connected to said tanks, of a pump, a valve casing having a plurality of passages to which said pipes are connected, a passage piped to the water of flotation and two normally communicating passages piped to said pump, valves controlling the flow of water through said passages, and a common means for operating said valves for the purposes specified.

3. The combination with a submarine boat having forward and aft trimming tanks in the bow and stern respectively and water pipes connecting said tanks, of a pump, a valve casing having a plurality of passages to which said pipes are connected, a pas-

sage piped to the water of flotation and communicating passages piped to said pump, a normally open valve controlling the communication between the passages piped to the pump, normally closed valves controlling the flow of water through the said passages piped to said tanks, and a lever for operating said valves as specified.

4. The combination with a submarine boat having forward and aft trimming tanks in the bow and stern respectively, and a final adjusting tank, of a pump, a valve casing having communicating passages piped to said pump, a plurality of passages piped to the said tanks, and a passage piped to the water of flotation, valves controlling the flow of water through the said passages, the pump, and the tank pipes, a valve controlled pipe connecting the water of flotation with the final adjusting tank, and a common lever for operating all of the said valves, as specified.

5. The combination with a submarine boat having forward and aft trimming tanks in the bow and stern respectively, and a final adjusting tank having a valve controlled vent, of a pump, a valve casing having an annular passage 19 piped to the inlet of the pump and a passage 32 piped to the outlet of the pump and communicating with said annular passage 19, a normally open valve controlling the communication between said passages 19 and 32, said casing also having passages 23 and 25 communicating with said annular passages and which are piped to the said trimming tanks, a passage 24 connected to the final adjusting tank pipe, two passages 20 and 22 communicating with the passage 32 and which are connected with the said trimming tank pipes, and a passage 21 communicating with the passage 32 and which is piped to the water of flotation, valves controlling the communications between said passages, and a common lever for operating the valves.

6. The combination with a submarine boat having forward and aft trimming tanks piped to each other, of a pump, a valve casing interposed in said pipe and having communicating water passages connected with said pump and a water passage piped to the water of flotation, a normally open valve controlling the communication between the passages connected with the pump, valves controlling the passage of water through said tank pipes and through the pipe extending to the water of flotation, and a common lever for operating all of said valves for the purposes specified.

7. The combination with a submarine boat having forward and aft trimming tanks in the bow and stern respectively, and final adjusting tanks at the amidships section of the boat and a valve controlled pipe connecting said final adjusting tanks with the water of flotation, of a pump, a valve casing having communicating passages piped to said pump and a plurality of passages piped to said trimming tanks, and a passage connected to the pipe leading to said final adjusting tanks, valves controlling the flow of water through said passages communicating with the several tanks and the pump, a valve controlled vent for the said final adjusting tanks, and a common means for operating all of the said valves, substantially as specified.

8. The combination with a submarine boat having forward and aft trimming tanks in the bow and stern respectively, and final adjusting tanks at the amidships section of the boat, and a valve controlled pipe connecting said final adjusting tanks with the water of flotation, of a pump, a valve casing having a plurality of communicating passages piped to said trimming tanks and said final adjusting tanks, communicating passages piped to said pump, and a passage piped to the water of flotation, a normally open valve controlling the communication between the passages leading to the pump, and normally closed valves controlling the communications between the several passages communicating with the said tank pipes, a valve controlled vent for the said trimming tanks, a rotatable control lever pivotally mounted on said valve casing and having a horizontal member adapted for engagement with the stems of all of said valves, said lever being also adapted to operate said vent valve, substantially as and for the purpose specified.

9. Apparatus for controlling the contents of the forward and aft trimming tanks and the final adjusting tank of submarine boats, comprising a pump, a valve casing having a plurality of valve controlled passages piped to said tanks, to said pump and to the water of flotation, and a common means for operating all of said valves as specified.

10. Apparatus for controlling the contents of the forward and aft trimming tanks and the final adjusting tank or tanks of submarine boats, comprising a pump, a valve casing having a plurality of valve controlled passages piped to said tanks, a valve controlled pipe connecting the said final adjusting tank or tanks with the water of flotation, and a common means for operating all of the said valves.

In testimony whereof I have hereunto set my hand this 4th day of June, A. D. 1914.

SIMON LAKE.

Witnesses:
JAMES A. PEASE,
WALTER S. JONES.