H. B. CADY.

VALVE FOR SUBMARINE BOATS.

APPLICATION FILED APR. 4, 1918.

1,285,931.

Patented Nov. 26, 1918.

2 SHEETS—SHEET 1.

Fig. 1.

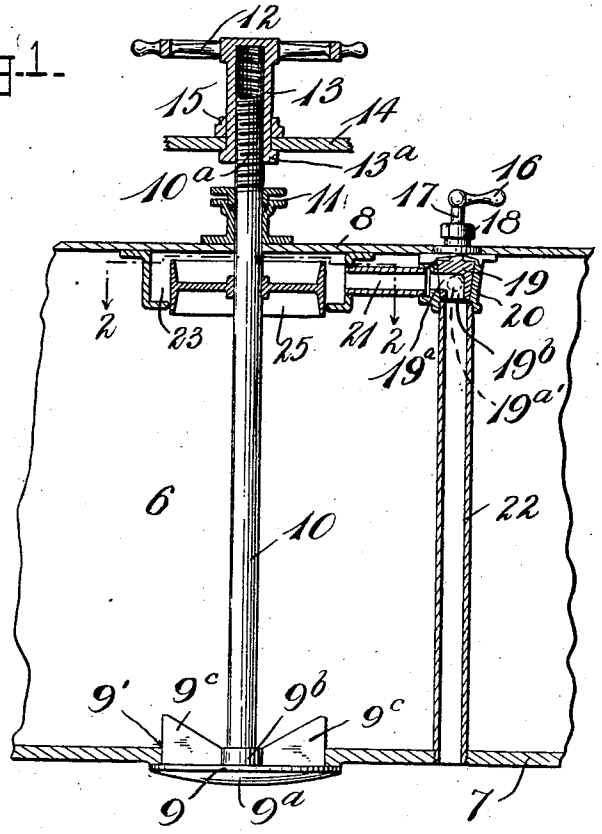
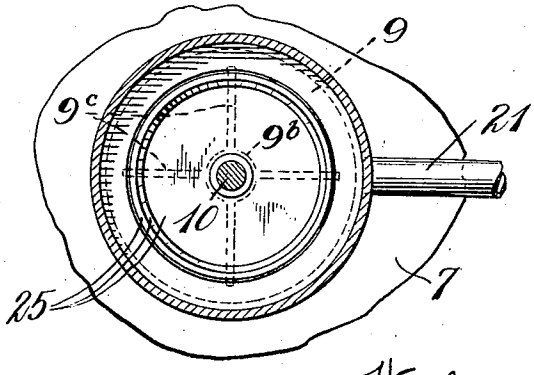


Fig. 2.



Inventor:
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By his Attorneys
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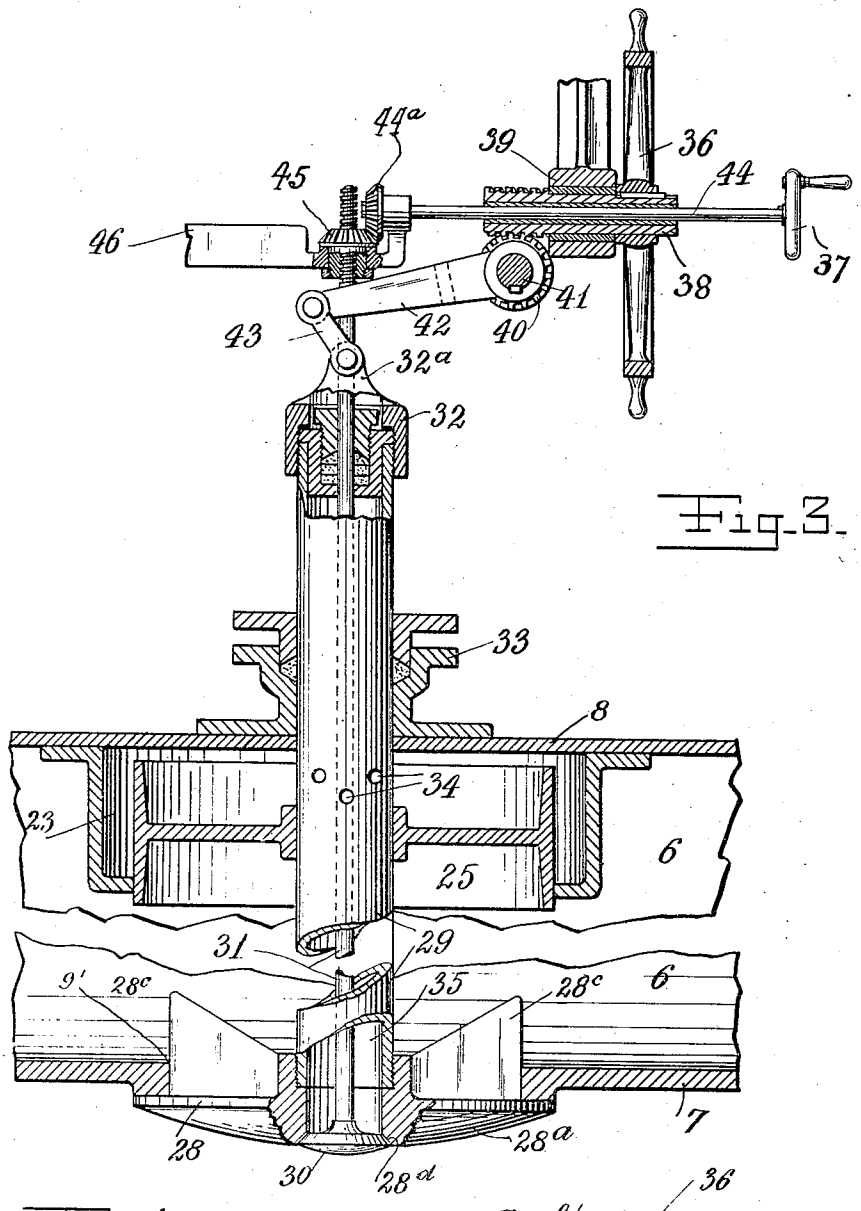
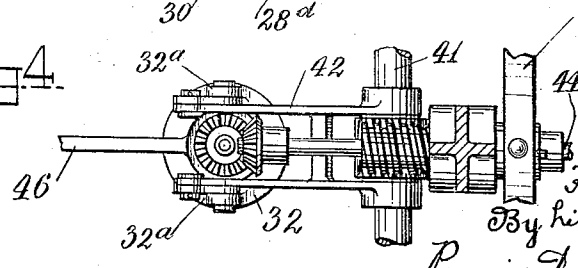


Fig. 3.

Fig. 4.



Inventor:
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UNITED STATES PATENT OFFICE.

HERBERT BARNEY CADY, OF GROTON, CONNECTICUT, ASSIGNOR TO ELECTRIC BOAT COMPANY, A CORPORATION OF NEW JERSEY.

VALVE FOR SUBMARINE BOATS.

1,285,931. Specification of Letters Patent. Patented Nov. 26, 1918.

Application filed April 4, 1918. Serial No. 226,739.

To all whom it may concern:

Be it known that I, HERBERT B. CADY, a citizen of the United States, residing at Groton, in the county of New London, State of Connecticut, have invented certain new and useful Improvements in Valves for Submarine Boats; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to submarine boats, and more particularly involves the provision of an improved ballast tank flooding valve installation.

In submarine boats, it is important to provide means for flooding the main ballast tanks quickly whenever desired, as when preparing to submerge, and for that purpose large Kingston or flooding valves are provided, the valves being arranged to open outwardly so that the sea pressure forcibly holds the valve closed. In the case of hand operated valves, much difficulty is often experienced in opening the valve against the sea pressure, especially where the valve must be opened quickly. Moreover, submarine boats are being constructed larger and larger, the ballast tanks are being enlarged in proportion, and the difficulties of handling the ordinary Kingston valve are correspondingly increased.

According to the present invention, the combination is provided of a water ballast tank, a valve operated from within the boat for putting the tank into and out of communication with the sea, and means operated from within the boat for admitting sea water to the interior of the boat so that this sea water may act on the valve member to facilitate opening of the valve against the sea pressure.

The preferred arrangement comprises two tanks, a major tank and a minor tank, the major tank being the well known main ballast tank having a wall formed by a part of the hull of the boat. An opening in the hull of the boat is provided for placing the interior of the ballast tank in communication with the sea, an outwardly opening Kingston valve serving normally to close this hull opening. The minor tank is provided with a piston-like member comprised by a movable wall secured to the stem of the Kingston valve, so that pressure in the minor tank will tend to move the valve. A conduit connects the interior of the minor tank directly with the sea. This conduit is normally closed by means of a valve so arranged that it may be manually operated from within the hull and independently of the Kingston valve, to control the admission of sea water through the conduit into the minor tank to act on the movable wall or piston.

The various features of the invention together with the advantages inherent therein will best be understood by reference to the following description when taken in connection with the accompanying drawings.

In these drawings Figure 1 shows, in section, a tank equipped with one type of valve; Fig. 2 is an enlarged detail view taken on the line 2—2 of Fig. 1; Fig. 3 is a view similar to Fig. 1, but showing the tank equipped with another type of valve; and Fig. 4 is a top plan view of certain of the parts shown in Fig. 3.

Referring to Figs. 1 and 2, there is illustrated at 6 one of the ballast tanks of a submarine, the skin of the hull being shown at 7 and forming a wall of the tank opposite the tank's roof 8.

The skin 7 is provided with a Kingston or flooding valve 9 for closing an opening 9′ to the sea. The valve 9 has a mushroom head 9^a, a hub 9^b, and radially-arranged guiding ribs 9^c. The valve is secured to the lower end of a valve-stem 10, the upper end of the stem passing through tank 6, its roof 8, and a suitable stuffing box 11. The valve stem is moved axially to open and close the valve 9, by means of hand-wheel 12, the hand-wheel carrying a sleeve 13, which is interiorly threaded to coact with a threaded portion 10^a of the valve-stem. The sleeve 13 is journaled in a fixed bearing 14, the bearing being interposed between collars 13^a and 15 carried by the sleeve. The sleeve is thus permitted to rotate but is prevented from axial movement, and accordingly the hand-wheel 12 may be rotated in one direction or the other to open or close the Kingston valve. Other suitable mechanism for axially moving the valve stem may be used.

A minor tank 23 is located within the ballast tank 6 and is provided with a movable wall or piston 25 which is secured to the stem 10 of the Kingston valve. Pipes 21 and 22 form a conduit or passageway com-

municating at its inner end with the interior of the minor tank 23, the outboard end of the pipe 22 being open to the sea.

At the junction of pipes 21 and 22 is located a valve casing 20 for a plug-valve 19. The spindle 17 of the plug-valve is journaled in a suitable bearing 18 and is provided with a cock 16 exterior to the tank 6. The plug-valve is provided with passages 19^a and 19^b, the passage 19^a being ordinarily arranged as shown in broken lines at $19^{a'}$.

When, however, the cock 16 is moved to turn the plug-valve 19 so that the passages 19^a and 19^b are arranged as shown in full lines, sea-water passes from pipe 22 to and through pipe 21 and into the minor tank 23. The pressure of the sea-water, acting on the wall or piston 25, may be made to balance, wholly or in part, or to overbalance, the pressure of the sea-water on the mushroom head 9^a of the Kingston valve which offers resistance to the opening of the valve; the balancing action being dependent upon the relative areas of the wall 25 and valve 9 and upon the difference in hydrostatic head at the two points. The pipes 21 and 22, and the passages 19^a and 19^b in the plug valve, should be large enough to permit a free flow of water to and from the minor-tank 23 as the wall 25 moves.

The operation is as follows:

Let us assume that the submarine is in surface or light condition, and it is desired to flood the ballast tanks preparatory to submergence. The cock 16 is opened wide to admit sea-water to the minor tank 23. by this means a pressure on the movable wall or piston 25 may be opposed to the submergence pressure which is holding the Kingston valve on its seat, thereby substantially reducing the resistance of the Kingston valve to opening movement. After the opening of the plug valve 19, the hand wheel 12 may with little effort be revolved a sufficient number of times to open the Kingston valve.

Referring now to Figs. 3 and 4, there is illustrated a water ballast tank 6 having the walls 7 and 8 and an opening 9′ to the sea, and a minor tank 23 having a movable wall or piston 25, all substantially as shown in Figs. 1 and 2. The ballast tank 6 is provided with a Kingston valve 28 for closing the opening 9′, the stem of the Kingston valve having the movable wall of the minor tank 23 secured thereto. The mushroom head valve member 28 is generally similar to the mushroom head valve member 9 of Figs. 1 and 2 as will be noted. The hub of the Kingston valve 28, however, is bored, the upper end of this bore being threaded on the lower end of a tubular valve stem 29. The lower end of the bore through the hub of the Kingston valve is shaped to form a conical valve seat 28^d. This valve seat 28^d co-acts with an outwardly opening valve 30 secured to the lower end of a solid valve stem 31 which extends through the hub's bore and through the tubular valve stem 29. The solid valve stem 31 passes through the entire length of the tubular valve stem 29 and projects above the top of the tubular valve stem and above the top of a stuffing-box 32, mounted on the upper end of the tubular valve stem and forming a leak-tight slide bearing for the solid valve stem. A similar bearing for the tubular valve stem is provided in the tank roof 8 as indicated at 33. The tubular valve stem 29 is equipped with a plurality of apertures 34 which serve to keep annular conduit 35 formed between the two valve stems in communication at all times with the interior of the minor tank 23.

The operation of the valve shown in Fig. 3 is as follows:

The solid valve-stem 31 is moved downward relatively to the tubular valve-stem 29 to unseat the valve 30, and then sea water enters the annular conduit 35, passes upwardly through the conduit, flows through the apertures 34, floods the tank 23 and acts on the Kingston valve 28 to oppose the submergence pressure. Then the tubular valve stem 29 is moved downward to open the thus balanced Kingston valve.

It will be noted that the arrangement of Fig. 3 shows a valve installation constructed and operating according to the present invention, but having the two valves and their connections very compactly arranged inside the tank 6, the two valve-stems being concentric and hence conveniently located relative to a single controlling mechanism which may be provided for operating the two valves.

In order that the valves 28 and 30 may be operated conveniently and in proper order from a single station, hand-wheels 36 and 37 may be provided and mechanism associated therewith as indicated. The hand-wheel 36 is secured to one end of a hollow worm shaft 38 journaled in a suitable bearing 39. The worm meshes with a worm gear 40 fixed on a rock-shaft 41 carrying an offset H-shaped rocker-arm 42. The swinging ends of the rocker-arm are pivoted to the upper ends of a pair of links 43, the lower ends of these links being pivoted to ears 32^a formed on stuffing box 32. The hand wheel 37 is secured on a solid shaft 44 which extends through and works within the hollow worm shaft 38, the shaft 44 having fixed thereon a bevel gear 44^a meshing with a similar gear 45 which has a threaded bore and which is journaled in a suitable bearing 46. The threads within the bore of gear 45 coact with threads on the upper end of the solid valve stem 31. When the hand wheel 37 is rotated in one direction or the other, the valve 30 is opened or closed independ-

ently of an opening or closing of the Kingston valve; and when the hand wheel 36 is rotated in one direction or the other, the Kingston valve is opened or closed or both hand wheels may be rotated together to open or close the Kingston valve while maintaining the valve 30 opened or closed.

From the foregoing it will be seen that in the above described constructions, when valve 30 and the Kingston valve are closed, the Kingston valve is very much unbalanced in favor of a retention of its closed position, at any time when the pressure inside the major tank is less than the sea pressure. When thus unbalanced, the stout skin of the hull receives all the strains of the valve-closing fluid-pressure, and there is no possibility that the Kingston valve may be inadvertently opened. In other words, the Kingston valve may be substantially balanced and hence easily opened, when, and only when the auxiliary valve is deliberately opened first and as a preliminary to opening the Kingston valve.

While the invention has been illustrated in connection with the Kingston valve of the ballast tank 6, it will of course be understood that the invention may with equal advantage be applied to the vent-valve equipment of a ballast tank, as will be readily apparent to those skilled in the art.

I claim:

1. In a submarine boat, the combination of a water ballast tank having an opening below the water line of the boat for admitting sea water thereinto; a valve for controlling said opening normally held forcibly in closed position by the pressure exerted against it by the sea; a piston connected to said valve; a cylinder wherein said piston is arranged to work; a conduit opening into the sea and leading therefrom into said cylinder, for admitting sea water back of said piston to act thereagainst, so as to balance the pressure exerted by the sea against said valve and permit the valve to be readily opened thereafter; and a device for opening said valve operative after the pressures have been balanced.

2. In a submarine boat, the combination of major and minor water tanks, the major tank having an opening below the water line of the boat for admitting sea water thereinto, and the minor tank having a movable wall; an outwardly-opening valve normally held forcibly in closed position in said opening by the pressure exerted against it by the sea, said valve having said movable wall connected to it; a conduit in the boat for establishing communication between the minor tank and the sea, so as to admit sea water to said minor tank and thereby impose pressure upon said movable wall, to balance the pressure exerted by the sea against said valve and permit the valve to be readily opened; and valve means for controlling the passage of sea water through said conduit.

3. In a submarine boat, the combination of a main water ballast tank having an opening below the water line of the boat for admitting sea water thereinto; an auxiliary water tank within the main tank having a movable wall in line with said opening; a valve for controlling said opening normally held forcibly in closed position by the pressure exerted against it by the sea, a stem to which said valve is secured extending through the auxiliary tank and having said movable wall fastened to it; a conduit for establishing communication between the auxiliary tank and the sea, so as to admit sea water to said auxiliary tank and thereby impose pressure upon said movable wall, to balance the pressure exerted by the sea against said valve; a valve for controlling the passage of water through said conduit; a device for opening the last-named valve; and a separate device for opening the first-named valve after the pressures have been so balanced.

In testimony whereof I affix my signature.

HERBERT BARNEY CADY.