No. 821,595. PATENTED MAY 22, 1906.

E. NIEHOFF.

SUBMARINE BOAT.

APPLICATION FILED AUG. 11, 1905.

Fig. 1.

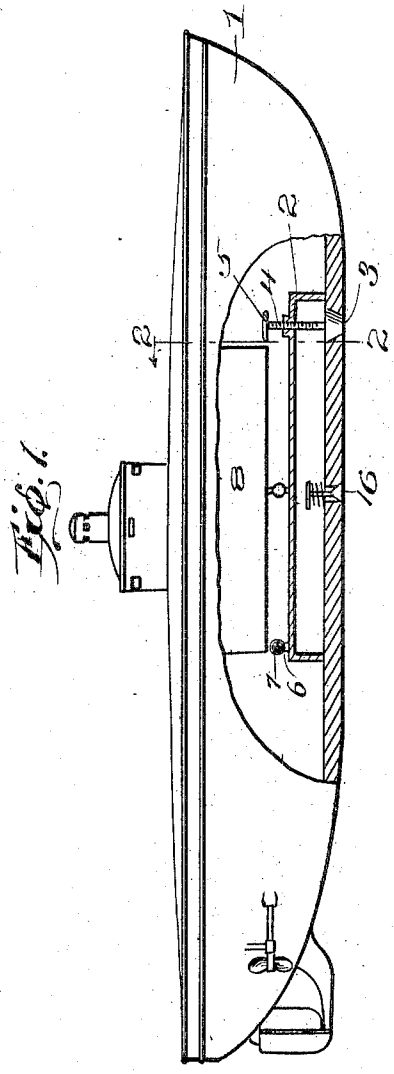



Fig. 3.

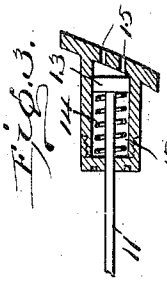



Fig. 5.

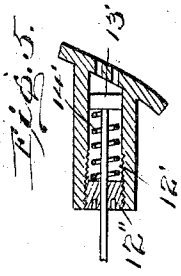



Fig. 4.

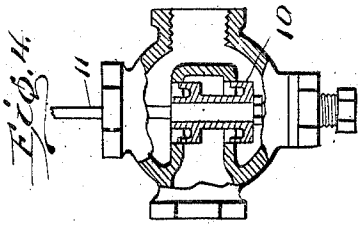
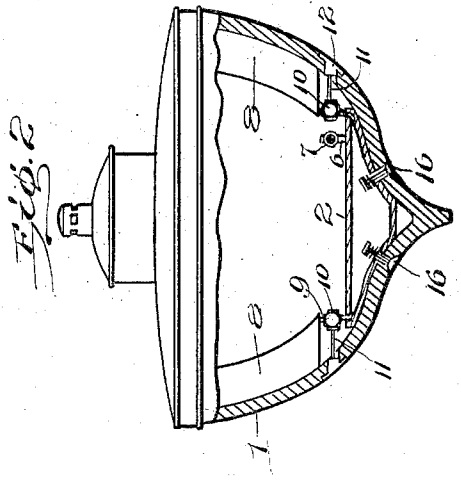



Fig. 2.




Witnesses

J. N. Fowler Jr.

Edgar M. Ritchin

Inventor

Ernest Niehoff,

By Mason, Fenwick & Lawrence

Attorneys

# UNITED STATES PATENT OFFICE.

ERNEST NIEHOFF, OF BROOKLYN, NEW YORK.

## SUBMARINE BOAT.

No. 821,595. Specification of Letters Patent. Patented May 22, 1906.

Application filed August 11, 1905. Serial No. 273,775.

*To all whom it may concern:*

Be it known that I, ERNEST NIEHOFF, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in 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 improvements in submarine boats, and more particularly to means for controlling the depth of the plunge and for maintaining a balanced condition of the boat.

The object in view is the provision of means for automatically governing the quantity of ballast carried by the submarine boat, whereby the depth of the plunge may be governed.

A further object is the arranging of the parts for maintaining an equal balance and at the same time for automatically governing the intake and discharge of the ballast.

With these and further objects in view the invention comprises certain novel constructions, combinations, and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 represents a view in side elevation of a submarine boat, parts being broken away for disclosing the interior structure. Fig. 2 represents a transverse section taken on the plane of line 2 2 of Fig. 1 and looking in the direction indicated by the arrow, parts being shown in elevation. Fig. 3 represents a detail vertical section taken through one of the cylinders, illustrating the valve-actuating piston in elevation. Fig. 4 represents an enlarged detail view, partly in section and partly in elevation, of one of the balance-valves. Fig. 5 represents a view similar to Fig. 3 of a slightly-modified form of cylinder.

Referring to the drawings by numerals, 1 indicates a submarine boat of any ordinary type as far as construction of the shell and arrangement of parts for propulsion and guidance is concerned. It is common in submarine vessels to provide a compartment or series of compartments adapted to be filled with water for causing the vessel to sink and designed to have the water ejected therefrom for causing the vessel to rise. I provide such a compartment or chamber, as indicated at 2, which compartment or chamber may be of any required size and is preferably disposed immediately above the keel of the vessel 1. The chamber 2 may be divided up into as many cells or small compartments as may be found desirable, and the said chamber may be made of as great length and size as required for accomplishing the results desired. At a suitable point in the wall of the vessel 1 is arranged a valve-opening communicating between the outside of said vessel and the interior of the chamber or compartment 2, said valve-opening being closed by the valve 3, provided with a stem 4 and a suitable operating wheel or handle 5, adapted to be actuated for elevating the valve for permitting the entrance of water ballast to the chamber 2 when desired. A pipe 6 extends from the top of the chamber 2 and is closed by the valve 7, said valve being designed to be opened manually for permitting the discharge of air from the chamber 2 when the valve 3 is opened for admitting water. After the desired quantity of water has been admitted the valve 3 is designed to be closed and the valve 7 is also designed to be closed.

At each side of the vessel 1 is arranged a compressed-air reservoir 8, each of which is preferably constructed relatively narrow and conforming to the contour of the side wall of the vessel, whereby only a minimum amount of space is occupied by the said reservoir. A pipe 9 leads from each of the reservoirs 8 and extends into the chamber 2. A valve 10 is interposed in the length of each of the pipes 9, said valve being seen in detail in Fig. 4 and being of any ordinary balanced-valve type. A stem 11 projects from the valve 10 and extends into the casing or cylinder 12, (seen best in Fig. 3,) arranged in the side wall of the vessel 1. The cylinder 12 incloses a piston 13, to which the stem 11 is connected, and a coil or other suitable spring 14 surrounds the stem 11 and is disposed between the piston 3 and the inner head of the cylinder 12, so as to retain the piston 3 normally in its outer position, in which position the valve 10 is held closed. The outer end of the cylinder 12 is formed with apertures 15 15 for admitting water from the exterior of the vessel 1, the spring 14 being capable of resisting the pressure of the exterior water up to a certain point, which may be predetermined by the strength of the spring 14 being employed. The inner head of the cylinder 12 is preferably removably connected to the cylinder, as

indicated in Fig. 3, so that in practice when it is desired to vary the resistance of the piston 13 to the exterior pressure it is only necessary to remove the inner head of cylinder 12, remove the particular spring 14, and introduce a different spring of greater or less resiliency, as desired.

In operation the valve 3 is opened and the valve 7 opened, whereupon the vessel 1 begins to sink and will continue the plunge until the chamber 2 is filled, whereupon the valves 7 and 3 will be closed. The vessel will probably not cease its downward travel when the chamber 2 is filled, but may continue the plunge to an undesirable degree, except for the provision of the mechanism above described. Assuming the spring 14 to be set at a limit above that to which vessel 1 would ordinarily plunge when the chamber 2 is filled, as soon as the vessel has descended to that extent required for causing the pressure of the water on the exterior of the boat to overcome the resistance of the spring 14 the piston 13 will be caused by such pressure to travel inwardly, and thereby each of the valves 10 will be opened, both of the pistons 13 being of course operated at the same time. As soon as the valves 10 are opened air under pressure from the reservoir 8 will enter the chamber 2 and will eject therefrom a certain portion of the water contained therein through the check-valves 16 16. The air will continue to enter the chamber 2 until a sufficient quantity of water has been ejected to permit the boat to rise to that level at which the spring 14 is able to overcome the resistance of the water surrounding the vessel 1. As soon as the boat has arrived at its level the piston 13 moves outwardly and draws the valve 10 to a closed condition, whereupon the supply of air is cut off and the boat is in condition for traveling at the particular level at which the valve-closing operation occurs. It is to be observed that by the provision of the valves 10 and the piston 13, for automatically governing the operation thereof, the level to which the vessel will plunge, or, in other words, the depth of the plunge, may be positively predetermined. When it is desired to raise the boat again to the surface, air-pressure from any suitable source may be admitted by any preferred means (not illustrated) to the chamber 2 for ejecting all of the water therefrom.

The above-described valve-operating device is of value and may be utilized to advantage. Still I find that the provision of means for facilitating alteration in the tension of the spring pressing the valve-actuating piston advantageous, as such alteration in the tension obviates the necessity for changing the spring and at the same time makes possible the altering of the condition of the parts after the boat has found one level in order to permit the same to find another level. A concrete example is seen in Fig. 5, wherein is shown a cylinder 12', having its inner head 12'' threaded in position and adapted to be rotated for traveling longitudinally of the cylinder 12', whereupon the spring 14' may have its tension increased or decreased, so that the piston 13' will resist a greater or less pressure, whereby various levels may be attained by the vessel 1.

What I claim is—

1. In a submarine boat, a ballast-chamber provided with a plurality of apertures communicating with the exterior of the boat, an outwardly-opening spring-actuated valve closing one of the apertures, an inwardly-opening valve disposed to close the other aperture and having a stem piercing the wall of the chamber and extending within the interior of the boat, means carried by the stem for manipulating the valve, means to admit air under tension to the ballast-chamber, a valve disposed to control the flow of air, a cylinder opening externally of the body, a piston slidably mounted in the cylinder, a stem connecting the piston, an air-controlling valve, and means to exert variable stress upon the piston.

2. In a submarine boat, a ballast-chamber disposed in the bottom of the boat, and provided with a plurality of apertures through the bottom communicating with the exterior of the boat, an outwardly-opening spring-actuated valve closing one of the apertures, an inwardly-opening valve disposed to close the other aperture and having a stem piercing the wall of the chamber and extending within the interior of the boat, means carried by the stem for manipulating the valve, means to admit air under tension to the ballast-chamber, of a valve disposed to control the flow of air, a cylinder opening externally of the boat, a piston slidably mounted in the cylinder, a stem connecting the piston and air-controlling valve, and means to exert variable stress upon the piston.

3. In a submarine boat, a ballast-chamber, provided with a plurality of apertures communicating with the exterior of the boat, an outwardly-opening spring-actuated valve closing one of the apertures, an inwardly-opening valve disposed to close the other aperture and having a stem piercing the wall of the chamber and extending within the interior of the boat, means carried by the stem for manipulating the valve, air-reservoirs secured to and conforming with the sides of the boat above the ballast-chamber, and adapted to receive and store air under tension, means to admit air from the reservoirs to the ballast-chamber, a valve disposed to control the flow of air, a cylinder opening externally of the boat, a piston slidably mounted in the cylinder, a stem connecting the piston and air-controlling valve, and

means to exert variable stress upon the piston.

4. In a submarine boat, a ballast-chamber disposed in and extending along the bottom of the boat and provided with a plurality of apertures through the bottom and communicating with the exterior of the boat, an outwardly-opening check-valve closing one of the apertures, an inwardly-opening valve disposed to close the other aperture and having a stem piercing the wall of the chamber and extending within the interior of the boat, means carried by the stem for manipulating the valve, air-tanks secured to and conforming with the sides of the boat, and disposed above the ballast-chamber and adapted to receive and store air under tension, means to admit air from the reservoir to the ballast-chamber, a valve disposed to control the flow of air, a cylinder opening externally of the boat, a piston slidably mounted in the cylinder, a stem connecting the piston and air-controlling valve, and means to exert variable stress upon the piston.

In testimony whereof I affix my signature in presence of two witnesses.

ERNEST NIEHOFF.

Witnesses:
JOHN L. FLETCHER,
EDGAR M. KITCHIN.