(No Model.)

G. POORE & W. C. STOREY.

SUBMARINE VESSEL.

No. 399,693. Patented Mar. 19, 1889.

Fig. 1.

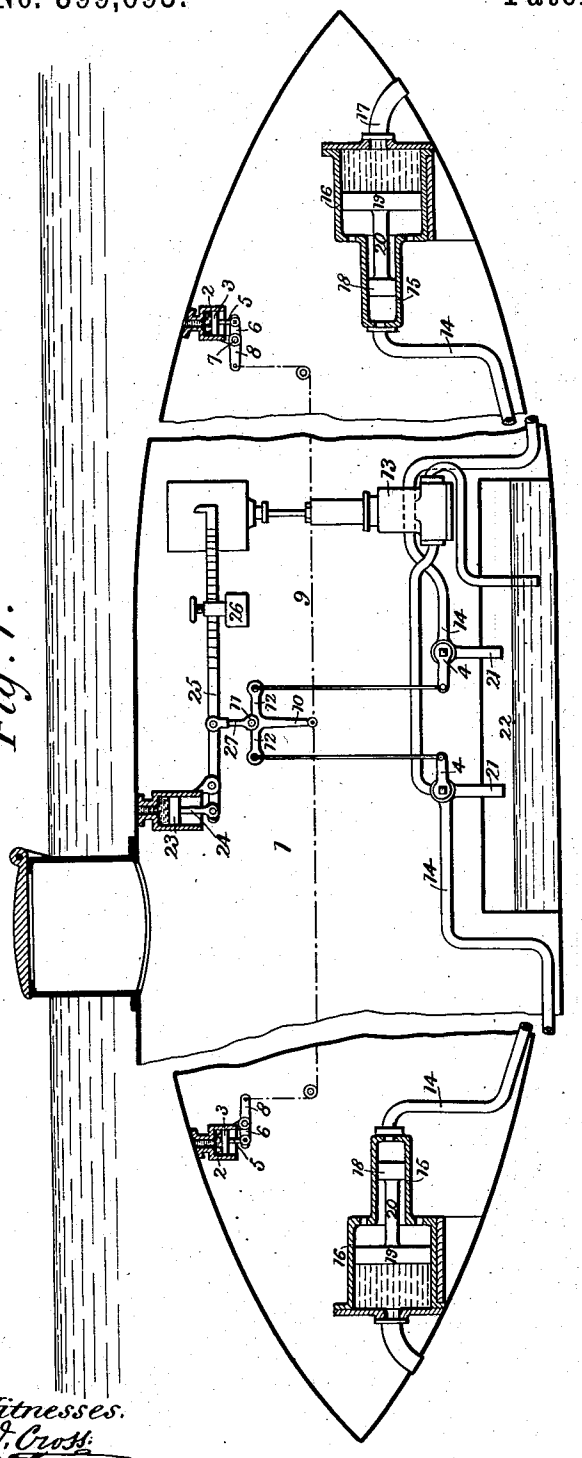
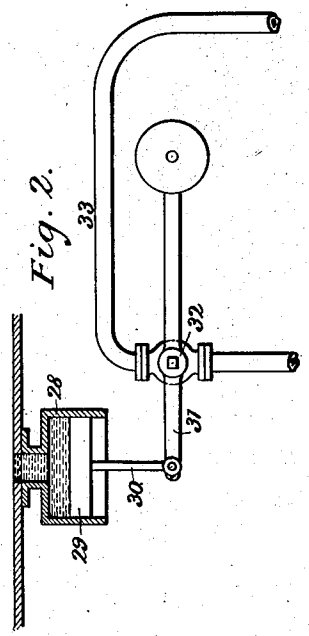


Fig. 2.



Witnesses.
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GRAYDON POORE AND WILLIAM CAMPER STOREY, OF LONDON, COUNTY OF MIDDLESEX, ENGLAND.

SUBMARINE VESSEL.

SPECIFICATION forming part of Letters Patent No. 399,693, dated March 19, 1889.

Application filed February 6, 1888. Serial No. 263,113. (No model.) Patented in England March 21, 1887, No. 4,227; in France January 23, 1888, No. 188,279; in Belgium January 24, 1888, No. 80,364; in Germany January 28, 1888, No. 44,088; in Italy March 31, 1888, XLV, 218; in Austria-Hungary May 27, 1888, No. 4,533, and in Spain June 7, 1888, No. 7,865.

To all whom it may concern:

Be it known that we, GRAYDON POORE and WILLIAM CAMPER STOREY, subjects of the Queen of Great Britain and Ireland, residing, respectively, at Queen Victoria Street, in the city of London, and Regent Street, in the county of Middlesex, both in the Kingdom of Great Britain and Ireland, have invented Improvements in Submarine Vessels, (for which we have obtained Letters Patent in England, No. 4,227, dated March 21, 1887; in France, No. 188,279, dated January 23, 1888; in Germany, No. 44,088, dated January 28, 1888; in Austria-Hungary, No. 4,533, dated May 27, 1888; in Belgium, No. 80,364, dated January 24, 1888; in Spain, No. 7,865, dated June 7, 1888, and in Italy, No. 218, dated March 31, 1888, volume XLV,) of which the following is a specification.

This invention has for objects to enable a submarine vessel, torpedo-mine, or the like, hereinafter called a "submarine vessel," to automatically maintain a horizontal position or state of equilibrium when desired, whether it be at rest or in motion, notwithstanding displacement of weights within the vessel such as would otherwise interfere with the stability of the vessel, to enable such a vessel to be raised or lowered to any required depth on an even keel, (or with its axis horizontal,) and to enable it to automatically rise on reaching a greater depth than it is desirable she should maintain.

According to this invention we employ the pressure of the water in which the vessel is submerged, and which varies with the depth of submersion, to act through suitable apparatus for attaining the objects hereinbefore mentioned.

In order that the nature of this invention and the manner of performing it may be clearly understood, we proceed to explain the same by aid of the annexed sheet of illustrative drawings, in which—

Figure 1 shows in central longitudinal vertical section parts of a submarine vessel embodying features of this invention which are applicable to a submarine vessel, a torpedo-mine, or the like, hereinafter included in the expression "submarine vessel." Fig. 2 is a detail view showing apparatus for discharging water from the vessel, as hereinafter described.

For maintaining a submarine vessel, 1, in a horizontal position or state of equilibrium, we arrange at or near each end of the vessel a chamber, 2, containing a piston, 3, or a plunger or diaphragm one side of which is in free communication with the water in which the vessel is submerged. The pistons, plungers, or diaphragms are connected with each other and with valves 4 by any suitable means, mechanical, electrical, or other. In the example illustrated each piston 3 is connected by a rod, 5, to one arm, 6, of a lever pivoted at 7, and whose other arm, 8, is connected by a chain, 9, with the corresponding arm, 8, of the other lever, as also with one arm, 10, of a double bell-crank lever pivoted at 11. The two arms 12 of this lever are connected each to the lever of one of the valves 4, as shown.

The arrangement, as will be seen, is such that when one end of the vessel is submerged lower than the other, owing to displacement of internal weights or other cause, the difference of water-pressure on the said pistons 5, or on the plungers or diaphragms, when such are used in lieu of pistons, due to the difference in depth of their submersion, will automatically operate one or other of the said pistons, plungers, or diaphragms and the connected valves, and will cause fluid under pressure (from a pump, 13,) to pass toward one or other end of the vessel and restore it to a horizontal position or state of equilibrium. The fluid under pressure may act as movable ballast, and by its weight alter the trim of the vessel; or it may operate pistons or other suitable means arranged at opposite sides of the vessel's midship-section for varying the displacement of one or other end of the vessel, as desired, or for altering the position of the center of gravity of the vessel.

According to the arrangement illustrated in Fig. 1 of the drawings, the water under-pressure that flows past each valve is conveyed by a pipe, 14, to apparatus, as follows, (of which there is one near each end of the vessel.) A

cylinder of two diameters has its part of smaller diameter, 15, in communication with the pipe 14, and its part of larger diameter, 16, in communication by pipe 17 with the exterior of the vessel. The cylinder contains a smaller piston, 18, and a larger piston, 19, these being connected by a rod, 20. The valves 4 are three-way cocks, each having a connection by a pipe, 21, with a tank, 22, in the vessel 1.

When water under pressure flows past one of the valves 4 by one of the pipes 14 to one of the cylinders, the pistons of that cylinder move outward and force out of the vessel water from the larger part, 16, of such cylinder. At the same time, the pressure behind the smaller piston, 18, of the other cylinder being reduced, the pressure of water external to the vessel overcomes the resistance of the pistons in that cylinder, which accordingly recede and admit water from without the vessel into the larger part of such cylinder, and vice versa.

To enable the submarine vessel to be raised or lowered on an even keel, and to be caused to assume a given depth, we employ a piston, plunger, or diaphragm that is in free communication at one side with the external water.

In Fig. 1 a piston, 23, is shown. The other side of this piston is connected by suitable means—such as a rod, 24—to a graduated lever, 25, provided with an adjustable balance-weight, 26, or with a spring, and also by other means—such as a bar or link, 27—pivoted to the said lever 25 to a valve or valves that controls or control the passage of motive fluid to apparatus for altering the specific weight or the total displacement of the vessel, as well as the relative displacement of its two end portions or the locality of its center of gravity. In the arrangement illustrated the piston 23 is connected to the valves 4 through the double bell-crank lever 10 12, hereinbefore mentioned. As a modification, one arm of the bell-crank-lever 10 12 might be connected to a weighted pendulum-rod or equivalent, employed for determining the horizontality of the vessel, instead of being connected to and operated by the pistons 3, the other arm or arms of the said lever being connected with the valves just mentioned. By adjusting the weight on the graduated lever, or by altering the tension of the spring, where a spring is used, the vessel may be set to fall or rise to any desired depth. The bar or lever may be caused at all times to remain in the same position with reference to a horizontal or vertical plane, notwithstanding changes in the position of the vessel or departure from horizontality, by reason of its connection with the weighted pendulum-rod, and will in consequence suitably distribute the motive fluid to the apparatus hereinbefore mentioned to actuate the pistons thereof, for the purposes mentioned.

For the purpose of preventing descent of the vessel beyond a safe depth, we employ a piston or equivalent in free communication at one side with the external water, and connected at its other side with an adjustable counterbalanced lever or equivalent, and with means such that when the vessel has reached the lowest depth to which it may safely be allowed to descend a volume of water or other weight or ballast is suddenly released or the displacement of the vessel increased, and the vessel thus caused to rapidly rise to the surface or to a safe depth.

Referring to Fig. 2 of the annexed drawings, 28 is a cylinder in which is a piston, 29, whose rod 30 is connected to one arm, 31, of the weighted lever of a valve, 32, which controls a pipe, 33, through which, when the valve opens, water under pressure may pass from a steam-boiler to the exterior of the vessel. The inner end of cylinder 28 is open to the atmosphere. Thus it will be understood that the position of the piston 29 in its cylinder 28 will vary with the pressure of water behind the piston, which will depend upon the depth of submersion of the vessel.

What we claim is—

1. In a submarine vessel, the combination of pistons or their equivalent, subject on one side to the pressure of the water in which the vessel is placed and arranged to be capable of moving under the differential action of the water-pressure thereon, chambers arranged at each side of the vessel's midship-section to contain liquid, a fluid-pressure generator adapted to supply fluid under pressure, pipes connecting said generator with said chambers, and a valve or valves to control the passage of fluid under pressure from said generator to one of said chambers and the escape of fluid from the other of said chambers, said valve or valves being arranged to be operated by movement of said pistons or equivalent due to difference of pressure thereon, for the purpose specified.

2. In a submarine vessel, the combination of pistons or their equivalent, subject on one side to the pressure of water in which the vessel is placed, and so connected and arranged as to be operated by the difference in water-pressure upon them, a fluid-pressure generator adapted to supply fluid under pressure, chambers arranged at each side of the vessel's midship-section, and each in communication at one end with a liquid-supply and at the other end with said fluid-pressure generator, pistons arranged to travel in said chambers, and a valve or valves adapted to control the passage of fluid from said generator to each of said chambers, and also the escape of such fluid therefrom, said valve or valves being in connection with said pistons or their equivalent, and arranged to be operated thereby, substantially as described.

3. In a submarine vessel, the combination of a piston or equivalent, subject on one side to pressure of the external water, a loaded lever connected at one end to said piston or equivalent, a fluid-pressure generator adapted to supply fluid under pressure, chambers ar-

ranged at each side of the vessel's midship-section to contain liquid and in communication with said generator, and a valve or valves to control the passage of fluid under pressure from said generator to said chambers, and the escape of fluid therefrom, said valve or valves being connected to said loaded lever, substantially as described, for the purpose specified.

4. In a submarine vessel, the combination, with pistons or their equivalent, connected to move together and arranged at opposite sides of the vessel's midship-section and subject on one side to the pressure of the water in which the vessel is placed, a loaded lever, a piston or equivalent, also subject on one side to the pressure of the external water and connected to one arm of said lever, a fluid-pressure generator, chambers arranged at opposite sides of the vessel's midship-section to contain liquid, and each in communication at one end with said fluid-pressure generator, and at the opposite end with a liquid-supply, and a valve or valves adapted to control the passage of fluid under pressure from said generator to one of said chambers, and the escape of fluid from the other of said chambers, said valve or valves being connected with said loaded lever and with the connected pistons, substantially as described, for the purpose specified.

5. In a submarine vessel, the combination of chambers 2, arranged at opposite sides of the vessel's midship-section and in free communication at one end with the external water, pistons 3, or their equivalent, adapted to move in said chambers, a pump, 13, adapted to supply fluid under pressure, pipes 14, in communication with said pump and adapted to conduct said fluid from one part of the vessel to another, valves 4, adapted to control the passage of said fluid through said pipes 14, and means for connecting said pistons 3 with said valves 4, substantially as herein described, for the purpose set forth.

6. In a submarine vessel, the combination of chambers 2, each in communication at one end with the external water, pistons 3, or equivalent, arranged to move in said chambers, levers 6 8, and chain 9, or equivalent, connecting said pistons, a double bell-crank lever, 10 12, pivoted at 11 and connected with said chain 9, a pump, 13, adapted to supply fluid under pressure, pipes 14, in communication with the delivery side of said pump and capable of conducting said fluid from one part of said vessel to another, a tank, 22, containing fluid and placed in communication with the suction side of said pump, and valves 4, connected with said double bell-crank lever 10 12 and adapted to control the passage of fluid through said pipes 14, all substantially as herein described.

7. In a submarine vessel, the combination of chambers 2, each in free communication at one end with the external water, pistons 3, or equivalent, arranged to move in said chambers, a pump, 13, adapted to supply fluid under pressure, pipes 14, in communication at one end with said pump, valves 4, adapted to control the passage of said fluid through said pipes 14, means for connecting said pistons with said valves 4, cylinders 15 16, located at each side of the vessel's midship-section, and each in communication at one end with one of said pipes 14, and at the other end with the external water, connected pistons 18 19, adapted to move in said cylinders 15 and 16, respectively, a tank, 22, in communication with the exhaust side of said pump, and pipes 21, adapted to place said pipes 14 in communication with said tank, substantially as herein described, for the purposes set forth.

8. In a submarine vessel, the combination of chambers 2, each in free communication at one end with the external water, pistons 3, or equivalent, arranged to move in said chambers, a pump, 13, adapted to supply fluid under pressure, pipes 14, in communication at one end with said pump, valves 4, adapted to control the passage of said fluid through said pipes, a double bell-crank lever, 10 12, pivoted at 11 and connected with said pistons 3 and with said valves 4, a piston, 23, acted upon by pressure of external water, a lever, 25, connected to said piston 23, and provided with an adjustable balance-weight, 26, or a spring, a link, 27, whereby said double bell-crank lever 10 12 is suspended to said lever 25, cylinders 15 and 16, located at each side of the vessel's midship-section, and each in communication at one end with one of said pipes 14, and at the other end with the external water, connected pistons 18 19, adapted to move in said cylinders 15 and 16, respectively, a tank, 22, in communication with the suction side of said pump, and pipes 21, adapted to place said pipes 14 in communication with said tanks, substantially as herein described, for the purposes set forth.

9. In a submarine vessel, a cylinder, 28, in free communication at one end with the water in which said vessel is placed, a piston, 29, or equivalent, arranged to move in said cylinder, a loaded lever, one arm, 31, of which is in connection with said piston, or equivalent, a vessel containing liquid under pressure, a pipe, 33, in communication with said vessel containing liquid under pressure and with the water external to said submarine vessel, and a valve, 32, connected to said lever and arranged to control the passage of liquid under pressure through said pipe 33, substantially as herein described, for the purpose set forth.

10. In a submarine vessel, the combination of chambers 2, each in free communication at one end with the external water, pistons 3, or equivalent, arranged to move in said chambers, a pump, 13, adapted to supply fluid under pressure, pipes 14, each in communication at one end with said pump, a double bell-crank lever, 10 12, pivoted at 11, means for connecting said pistons 3 with said bell-crank lever, valves 4, connected with said double

bell-crank lever and arranged to control the passage of fluid through said pipes 14, a piston, 23, acted upon by pressure of external water, a lever, 25, connected to said piston 23, and provided with an adjustable weight, 26, or a spring, a link, 27, whereby said double bell-crank lever 10 12 is suspended to said lever 25, cylinders 15 and 16, located at each side of the vessel's midship-section, and each in communication at one end with one of said pipes 14, and at the other end with the external water, connected pistons 18 19, adapted to move in said cylinders 15 and 16, respectively, a tank, 22, in communication with the suction side of said pump, and pipes 21, adapted to place said pipes 14 in communication with said tanks, a cylinder, 28, in free communication at one end with the water in which said vessel is placed, a piston, 29, or equivalent, arranged to move in said cylinder, a loaded lever, one arm, 31, of which is in connection with said piston, or equivalent, a vessel containing liquid under pressure, a pipe, 33, in communication with said vessel containing liquid under pressure and with the water external to said submarine vessel, and a valve, 32, connected to said lever and arranged to control the passage of liquid under pressure through said pipe 33, substantially as herein described, for the purpose set forth.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GRAYDON POORE.
WILLIAM CAMPER STOREY.

Witnesses:
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Both of 46 *Lincoln's Inn Fields, London.*