No. 895,426. PATENTED AUG. 11, 1908.

F. T. CABLE.

PRESSURE REDUCING VALVE.

APPLICATION FILED NOV. 30, 1907.

3 SHEETS—SHEET 1.

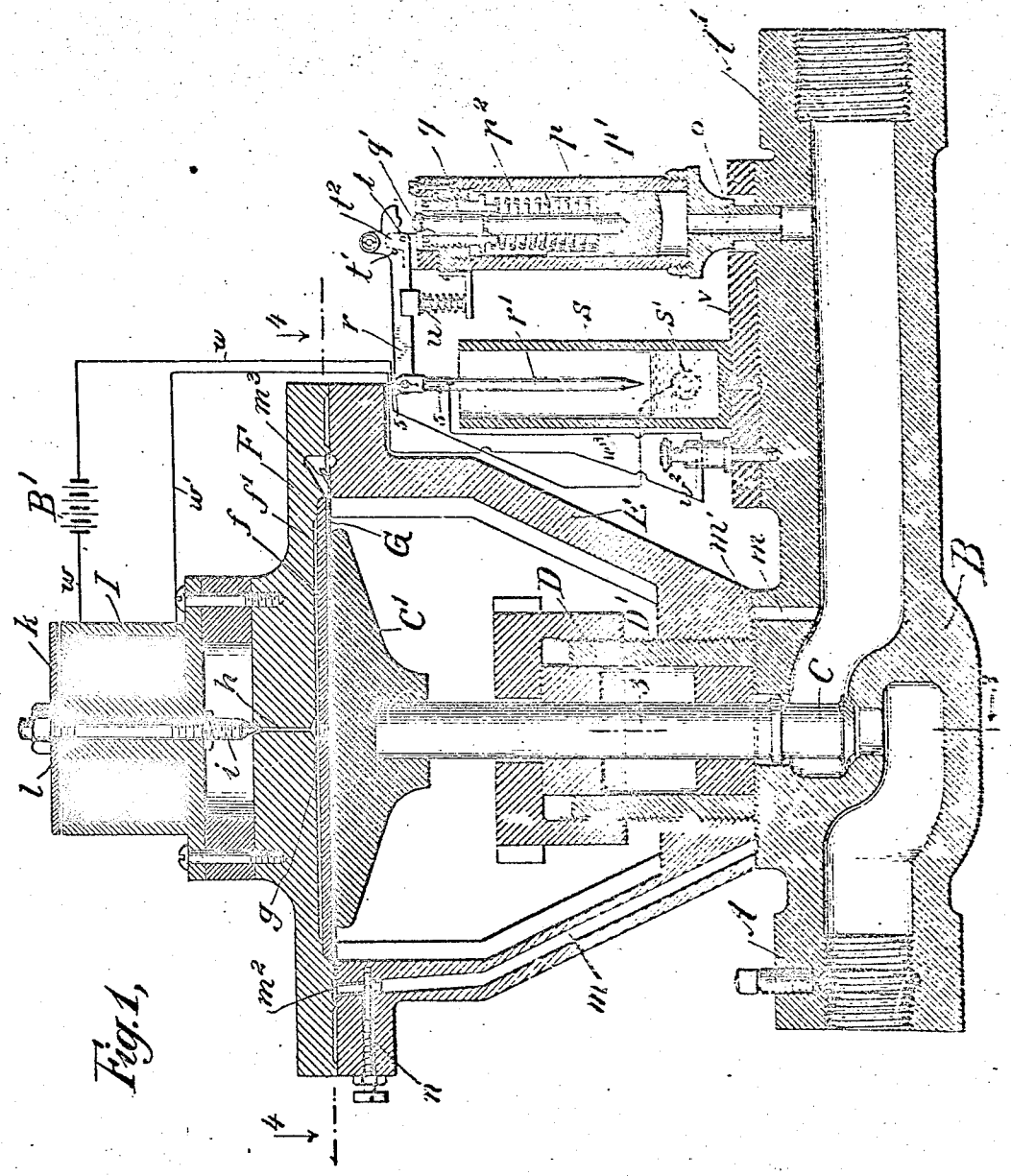

Fig. 1.

WITNESSES:

L. L. Jones.

INVENTOR

T. T. Cable.

BY

Lemmie & Goldsborough

ATTORNEYS

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3 SHEETS—SHEET 2.

Fig. 4.

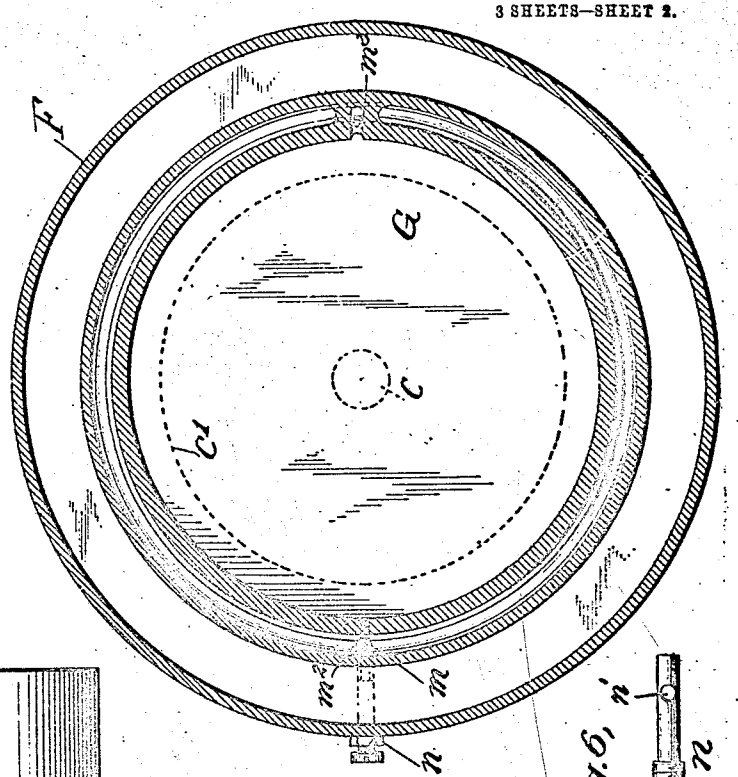


Fig. 2.

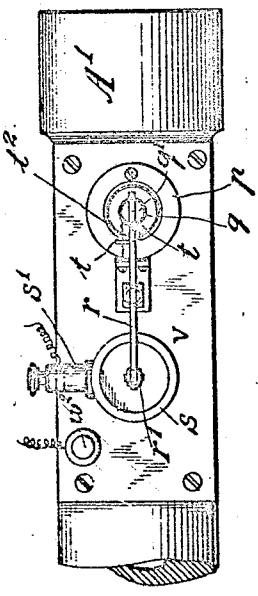


Fig. 3.

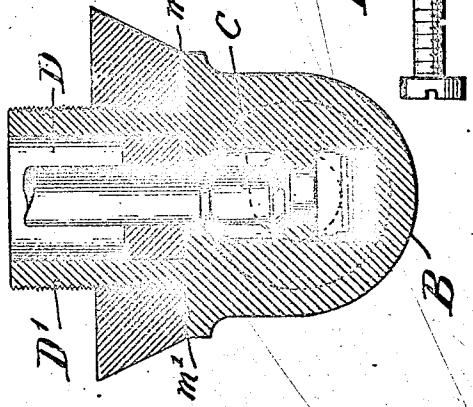
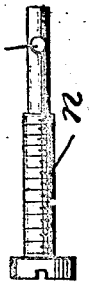


Fig. 6.



WITNESSES:

R. L. Jones.

INVENTOR

F. T. Cable,

BY

Lemmier Goldsborough

ATTORNEYS

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3 SHEETS—SHEET 3.

Fig. 5.

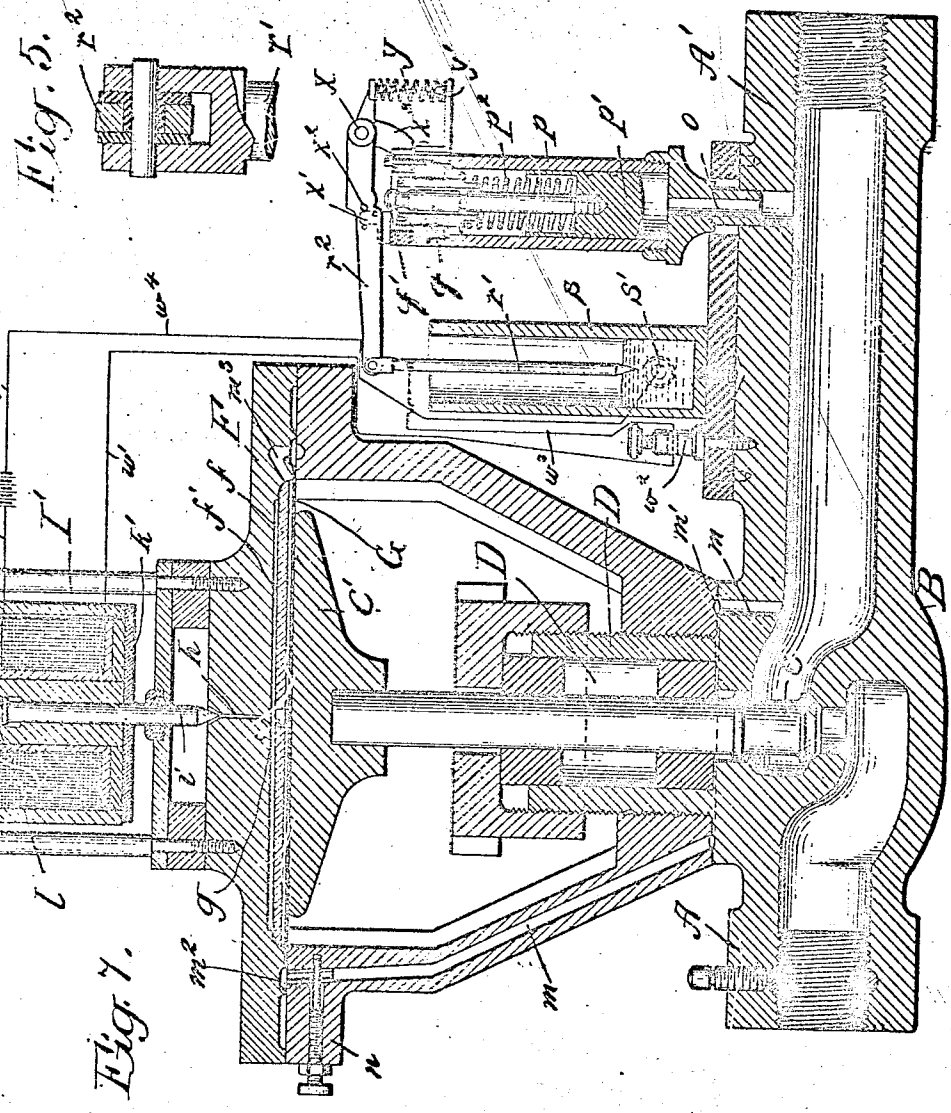

Fig. 7.

WITNESSES:

L. L. Jones

[illegible]

INVENTOR

F. T. Cable.

BY

Lemmer & Goldsborough

ATTORNEYS

UNITED STATES PATENT OFFICE.

FRANK TAYLOR CABLE, OF QUINCY, MASSACHUSETTS, ASSIGNOR TO ELECTRIC BOAT COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

PRESSURE-REDUCING VALVE.

No. 895,426. Specification of Letters Patent. Patented Aug. 11, 1908.

Application filed November 30, 1907. Serial No. 404,528.

To all whom it may concern:

Be it known that I, FRANK TAYLOR CABLE, a citizen of the United States, residing at Quincy, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Pressure-Reducing Valves; 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.

The object of my invention is to produce a pressure reducing valve capable of use on high pressure and which will give an accurate reduction and a constant flow on the low pressure side. The valve has been particularly designed for use on submarine boats and in similar places in which on account of the limited space, air is stored at a very high pressure, 2000 to 3000 pounds, and has to be reduced to a pressure of 10 to 200 pounds, and in which it is particularly necessary that the flow on the low pressure side should be constant and even.

The nature of my improvements will be understood from the following description and the accompanying drawings:

In the drawings, Figure 1 is a central section of the complete valve; Fig. 2 is a plan view of the circuit closing mechanism for the electric circuit which excites the magnet to actuate the valve; Fig. 3 is a section on the line 3—3 of Fig. 1 looking in the direction of the arrows; Fig. 4 is a section on the line 4—4 of Fig. 1, looking in the direction of the arrows, Fig. 5 is a section on the line 5—5 of Fig. 1; Fig. 6 is a detail view of the controlling valve N, and Fig. 7 is a view, similar to Fig. 1, of a modification.

Between the high pressure main A and the low pressure main A′ is a valve casing B containing the cone-seated valve C, the stem of which extends upwardly through the valve casing and through a stuffing box D in the frame E and tends to close the valve C by its own weight and the weight of its head C′. The frame E carries a cap F recessed on its under face to form the chamber *f* closed by the circular plate *f′* having a central port *g*. Between the cap *f* and the upper circular rim of the frame E is mounted the diaphragm G to which the head C′ of the valve stem is secured. Extending from the chamber *f* is a duct *h* having a port which exhausts to the atmosphere and is controlled by the cone-valve *i* operated by the magnet I. The stem of the valve *i* extends through the shell of the magnet centrally and carries at its upper end a disk armature *k* which is normally spring-pressed upward by the spring *l*. The frame E is screwed on to a tube D′ secured to the valve casing and forming part of the stuffing-box. From the low pressure pipe A′ a duct *m* leads to an annular groove *m′* between the valve casing and the frame E and from thence through one side of the frame to an annular groove m^2 in the lower face of the cover *f* and thence through the duct m^3 to the upper surface of the diaphragm. In this duct *m* where it passes through the frame is a controlling valve *n* having a port *n′* (see Fig. 6). These parts form a passage of limited capacity from the low pressure side of the system to the upper side of the diaphragm, and provided with the valve *n* for accurately controlling it.

Mounted on the low pressure pipe A′ and communicating with the interior thereof through a passage *o* is a casing *p* containing the plunger *p′* which is moved against the pressure in the pipe A′ by the spring p^2. This plunger carries a trigger *q* having an insulated head *q′* and adapted to engage the end of the lever *r* which carries the depending contact pin *r′* arranged to dip into a mercury cup *s*, to complete the circuit of the magnet I. The lever *r* which is pivoted at *t* is pressed upwardly by the spring *u* until the stop *t′* engages the lug t^2. The circuit of the magnet I is from battery B′ through wire *w*, magnet I, wire *w′*, binding-post w^2, wire w^3, pin *r*, mercury-cup *s*, binding-post *s′*, wire w^4, to battery. The depending contact pin *r′* is insulated from the lever *r* as shown in Fig. 5.

The operation of the valve is as follows: The pressure in the main A normally opens and holds up the valve C allowing a flow into the low pressure main A′. The pressure in that main is conducted through the passage *m*, *m′*, m^2 and m^3 to the upper surface of the diaphragm and through the port *g* to the chamber *f* and through the duct *h* and its exhaust port to the atmosphere. This conduit as controlled by the valve *n* has the effect to regulate the sensitiveness of the main valve and to dampen any slight variations in the pressure on the low-pressure main and thereby steady the movement of the main valve. As the pressure in the low pressure main rises it lifts the piston *p′* against the action of

the spring p^2 and when the pressure at which the device is set, say 50 pounds, is reached, this movement of the piston p' causes the trigger q to move the lever r and depressing the pin r' close the circuit of the magnet I, whereupon the armature of the magnet is drawn down against the action of the spring l and the valve i is closed. The pressure thereupon accumulates to the upper side of the diaphragm and positively closes the main valve against the pressure on the high pressure side of the system. By this means I secure a positively acting pressure reducing valve which will give a constant flow on the low pressure side after making a great reduction in pressure and in which a puffing discharge is avoided. When a valve of this type is used on a system in which the main valve is open the greater portion of the time as when the discharge on the low pressure side is substantially constant, then it is preferable to arrange the parts as in Fig. 1 so that the circuit of the magnet is closed by the excess of pressure on the low pressure side, but when the valve is used on a system in which the main valve is closed the greater portion of the time, as when the discharge on the low pressure is intermittent, then it is preferable to so arrange the parts that the magnetic circuit is broken by an excess of pressure on the low pressure side, the valve i being arranged to be closed by the spring, or its equivalent, and to be opened by the magnet.

Such an arrangement of parts is illustrated in Fig. 7, in which the parts are the same as in Fig. 1, excepting that the magnet I has an armature k' which, when the magnet is energized lifts the valve i' against the action of the spring l', and the lever r^2 is pivoted at x in a bracket x' extending from the other side of the cylinder p, and this lever r^2 is turned by the spring y mounted on bracket y' until stop x^2 engages lug x', thus holding the circuit closed until an excess of pressure in pipe A' lifts the plunger p' to open the circuit and allow valve i' to be closed by spring l'.

What I claim is:

1. In a pressure reducing valve mechanism, the combination with high and low pressure mains having a connecting passage, a normally open balanced valve controlling said passage, mechanism for destroying the balance to close the valve, and an electromagnet controlling said mechanism, of a switch in the energizing circuit of the magnet and mechanism acting upon said switch and actuated by an excess of pressure in the low pressure main to cause the magnet to actuate the unbalancing mechanism and close the valve, whereby upon an excess of pressure in the low pressure main the valve is closed and as the pressure falls the valve is automatically opened; substantially as described.

2. In a pressure-reducing-valve mechanism, the combination with high and low pressure mains having a connecting passage, of a valve controlling said passage, a stem for said valve, a diaphragm connected to said stem, a casing forming a chamber about the diaphragm in which an increase of pressure tends to close said valve, said chamber being connected with the low pressure main through a restricted passage and having an exhaust port, a valve controlling said exhaust port, and a magnet actuated by variations in pressure in the low-pressure main controlling said exhaust-port valve; substantially as described.

3. In a pressure-reducing-valve mechanism, the combination with high and low pressure mains having a connecting passage, of a valve controlling said passage and normally opened by the pressure in the high-pressure main, a stem for said valve, a diaphragm connected to said stem, a casing forming a chamber about the diaphragm in which an increase of pressure tends to close the valve, said chamber being connected with the low pressure main through a restricted passage and having a normally open exhaust port, a valve controlling said exhaust port, a magnet controlling said valve, and mechanism acting upon the energizing circuit of the magnet and actuated by an excess of pressure in the low-pressure main to close the exhaust port, substantially as described.

4. In a pressure-reducing-valve mechanism, the combination with high and low pressure mains separated by a horizontal partition having a vertically opening connecting passage, of a cone-seated valve controlling said passage and having a weighted stem which is normally lifted by the pressure in the high-pressure main, a stuffing-box through which the stem extends into the valve casing, a frame about said stem, a diaphragm supported on said frame and connected to the valve stem, a cap secured to the frame and forming a diaphragm chamber above the diaphragm, said chamber being connected with the low-pressure main by a restricted passage extending through the frame to the low pressure main and said cap containing an exhaust port for the diaphragm chamber, a magnet mounted on the cap, an armature for said magnet, a valve controlling the exhaust port from the diaphragm chamber and connected to the armature, a spring tending to seat said valve, the armature and spring being so arranged that when the magnet is energized the attraction exerted between the magnet and armature overcomes the force of the spring to lift the valve, a casing secured to and communicating with the low-pressure main, a plunger in said casing, and a switch in the energizing circuit of the magnet which is actuated by

said plunger upon an excess of pressure in the low-pressure main to open said circuit; substantially as described.

5. In a pressure-reducing-valve mechanism, the combination with high and low pressure mains having a connecting passage, a valve controlling said passage, a stem for said valve, a diaphragm connected to said stem, a casing forming a chamber about the diaphragm in which an increase of pressure tends to close said valve, said chamber being connected with the low pressure main through a restricted passage and having an exhaust port, a valve controlling said exhaust port, and a magnet controlling said exhaust-port valve, of a switch in the energizing circuit of the magnet, a plunger arranged to actuate said switch and a casing surrounding the plunger and communicating with the low-pressure main; substantially as described.

6. In a pressure-reducing valve mechanism, the combination with high and low pressure mains having a connecting passage, of a valve controlling said passage and normally lifted by the pressure in the high pressure main, a weighted stem for said valve, a diaphragm connected to said stem, a casing forming a chamber about the diaphragm in which an increase of pressure tends to close said valve, said chamber being connected with a source of fluid supply and having an exhaust port, a valve controlling said exhaust port, and a magnet actuated by an increase in pressure in the low pressure main for closing said exhaust-port valve; substantially as described.

7. In a pressure-reducing valve mechanism, the combination with high and low pressure mains having a connecting passage, of a valve controlling said passage, a stem for said valve, a diaphragm connected to said stem, a casing forming a chamber about the diaphragm in which an increase of pressure tends to close said valve, said chamber being connected with the low pressure main through a restricted passage and having an exhaust port, a regulating valve in said restricted passage, a valve controlling said exhaust port, and a magnet actuated by an increase in pressure in the low pressure main to close said exhaust-port valve; substantially as described.

8. In a pressure reducing valve mechanism, the combination with high and low pressure mains having a connecting passage, a valve controlling said passage, mechanism for closing said valve, and an electro-magnet controlling said mechanism, of means for controlling the circuit of said magnet comprising a casing secured to and communicating with the low pressure main, a piston in said casing, a plunger carried by said piston, a lever pivoted in the path of movement of said plunger, a contact pin depending from said lever and a mercury cup beneath the contact pin, whereby on an increase of pressure in the low pressure main the piston moves the plunger to actuate the lever and contact pin and thereby control the circuit of the electro-magnet; substantially as described.

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

FRANK TAYLOR CABLE.

Witnesses:
F. L. BRAKE,
W. D. FESLER.