2 Sheets—Sheet 1.

J. L. LAY.

Valves for Torpedo-Boats.

No. 217,120. Patented July 1, 1879.

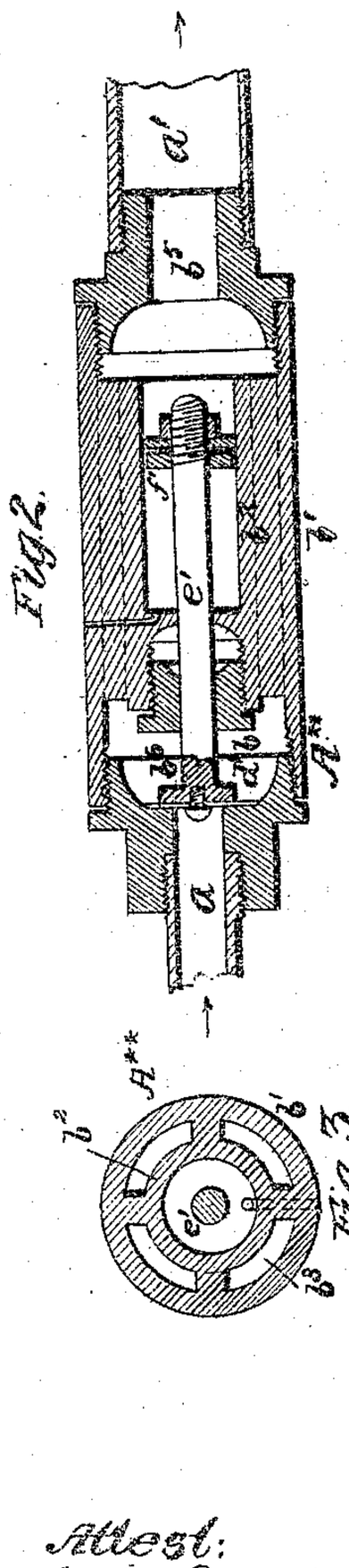

Fig. 2.

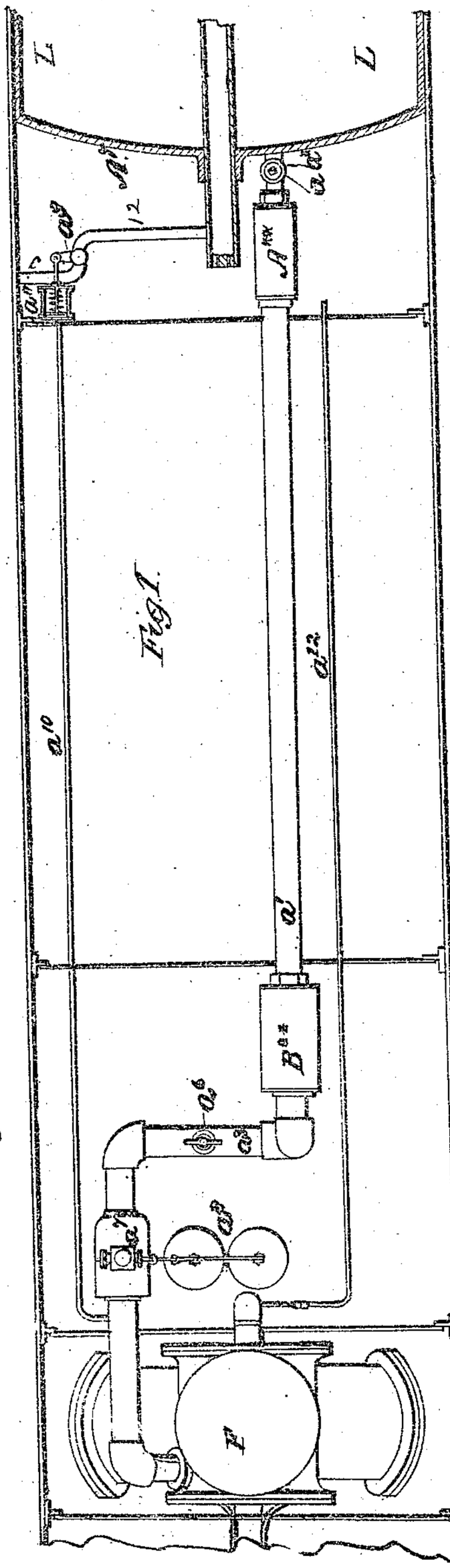

Fig. 1.

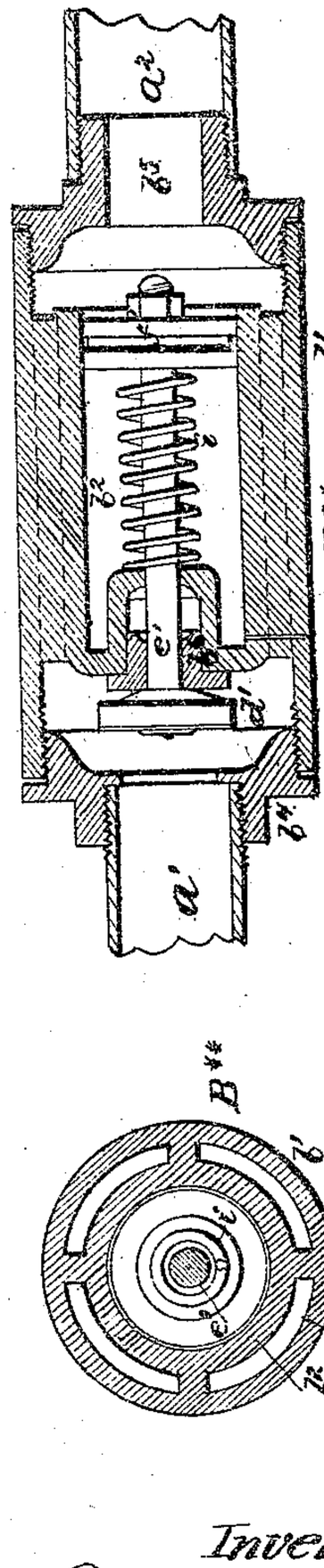

Fig. 4.

Fig. 3.

Fig. 5.

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2 Sheets—Sheet 2.

J. L. LAY.

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Fig. 8.

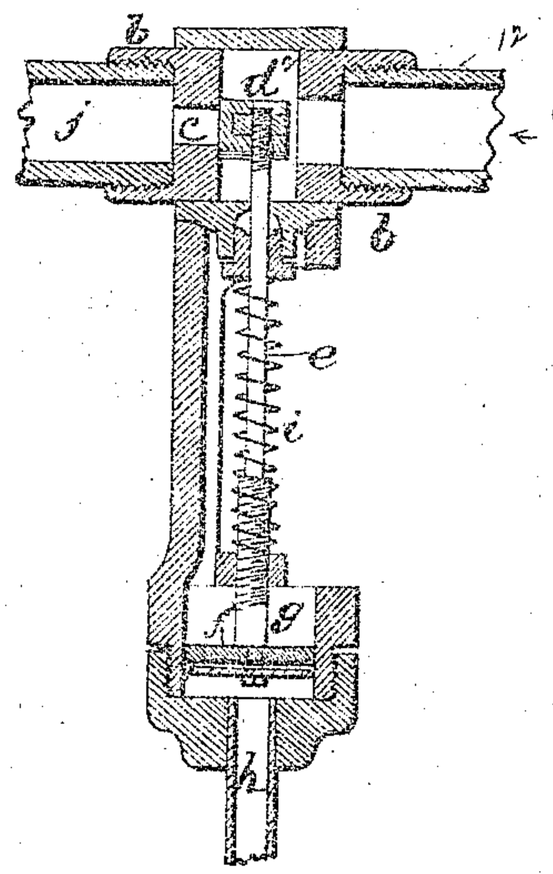


Fig. 7.

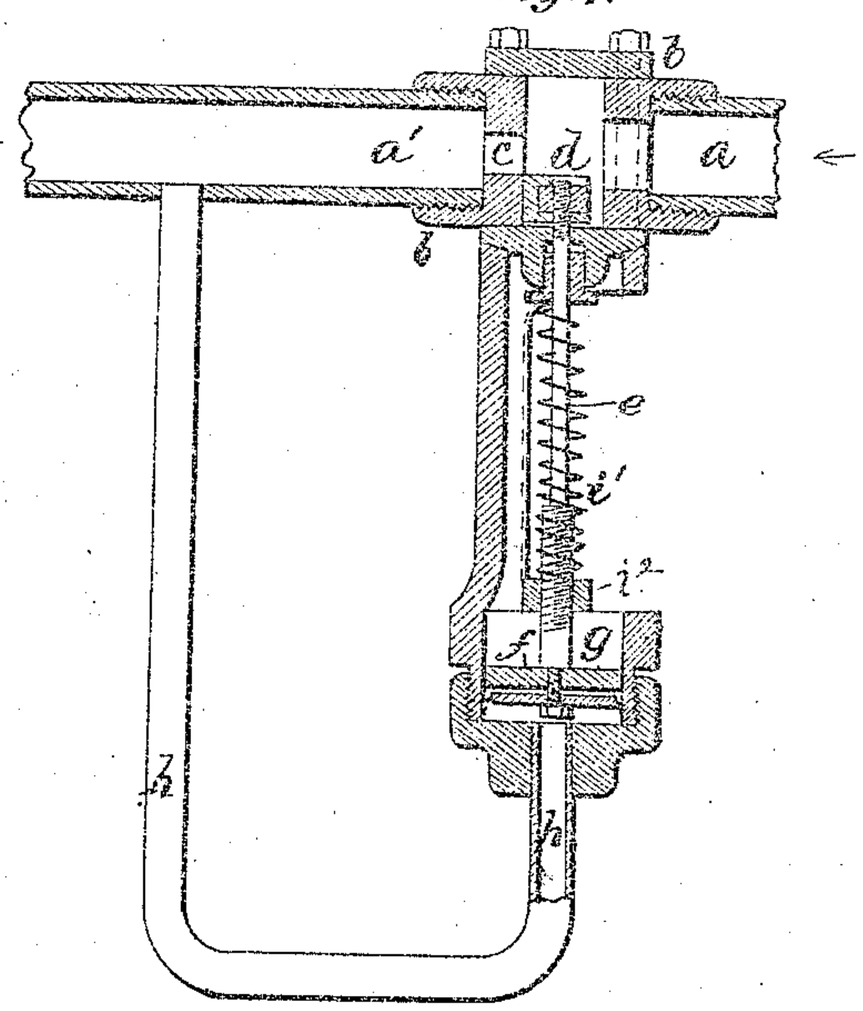
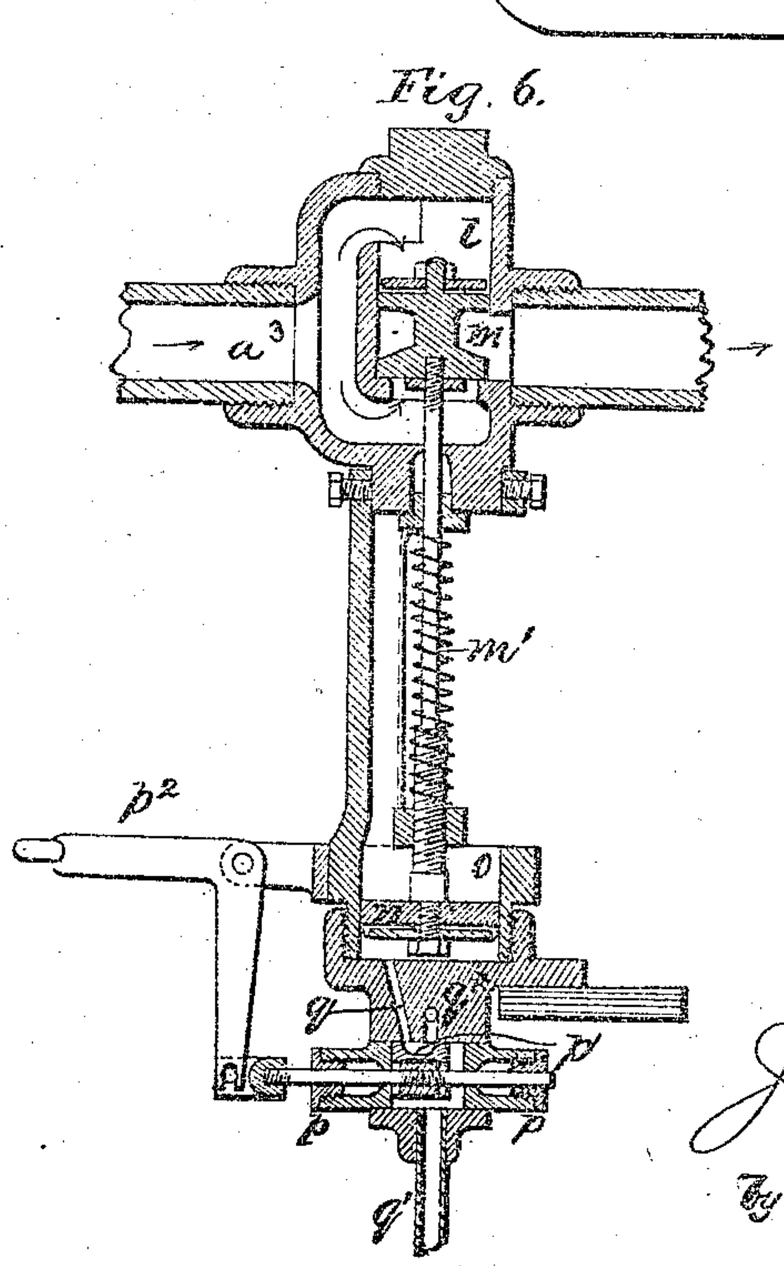


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN L. LAY, OF BUFFALO, NEW YORK.

IMPROVEMENT IN VALVES FOR TORPEDO-BOATS.

Specification forming part of Letters Patent No. **217,120**, dated July 1, 1879; application filed June 5, 1879.

To all whom it may concern:

Be it known that I, JOHN L. LAY, of Buffalo, New York, temporarily residing at St. Petersburgh, Russia, have invented certain new and useful Improvements in Valves for Torpedo-Boats and other Purposes, of which the following is a specification.

My present invention relates to certain improvements in the internal mechanism of submarine torpedo-boats, of the class that are guided and controlled by an operator outside the boat through the medium of electric wires or cables, but are propelled by an engine on board by means of condensed gas stored in a suitable reservoir. Such vessels are shown and described, in whole or in part, in two patents granted to me in December, 1877, and in three patents granted January 14, 1879, and in other pending applications in the Patent Office, to which reference is made, to show the general construction of such a vessel as I design my present improvement to be applied to.

The specific devices for which I desire to secure protection in the present application are the valves and valve-connections, which enable me to use carbonic-acid gas, ammoniacal gas, condensed air under high pressure, or similar expansive gases, for the propulsion of a submarine vessel.

It is well known that the rapid expansion of gases under pressure has a tendency to produce such a degree of cold (or absorption of heat) as to congeal any moisture in its neighborhood, and even to congeal the gas itself, when it is compressed into liquid form. It is in part to overcome this tendency to freezing, and in part to reduce the high pressure in the reservoir to such a degree as will economize it, and work the engine only at a moderate pressure, that I have devised the present system of valves, which I will now proceed to describe.

The features which I believe to be new with me are hereinafter pointed out in the claims.

Figure 1 is a section of a portion of a torpedo-boat, showing the arrangement of pipes and valves between the reservoir and the engine. Fig. 2 is a longitudinal, and Fig. 3 a cross, section of a valve which may be used at A**, Fig. 1. Figs. 4 and 5 are similar sections of a valve which may be at B**. Fig. 6 is the throttle-valve, as at a^7. Fig. 7 is a valve which I sometimes use at A** in lieu of the one shown in Fig. 2. Fig. 8 is a water-inlet valve, as at a^9, Fig. 1.

Similar letters in the drawings indicate corresponding parts.

L is a gas-reservoir, in which gas is stored under great pressure. A tube passes through this reservoir to connect the water-tight compartments at each end thereof, and to permit the passage of wires, &c., for the transmission of electric currents. It will be understood that sea-water has free passage through this tube when once admitted to the compartment A^7.

The gas-pipe *a* leads from the reservoir L toward the engine. When the stop-cock *a** is opened, as it will be before starting the boat, the gas passes through *a* to A**, where its pressure is reduced. It then passes through a^1 to B**, where the pressure is still further reduced. The gas then passes still farther toward the engine through pipe a^3, past a safety-valve at a^6, to the throttle-valve a^7, and on to the engine F in due course.

When the throttle-valve is open to permit gas to enter the engine, it also has access to the pipe a^{10}, and by its pressure on the spring a^{11} opens the valve a^9, which permits the sea-water to enter the vessel through pipe 12, to restore the equilibrium which would otherwise be lost by the escape of spent gas from the engine.

It may be remarked that the gas from the engine is allowed to escape through a suitable exhaust-pipe, or is absorbed for reuse, according to the nature of the gas, and in manner described in my other specifications hereinbefore referred to, or in other suitable manner.

I will now proceed to describe the construction of valves I have found it necessary to use in order to produce the best results with my reservoir, engine, and connections.

The valve *a***, which I call a "reducing-valve," and which I prefer to locate as shown in the diagram, Fig. 1, is made as follows: *a* represents the pipe leading from the reservoir or generator to the engines. A cylinder or box, b^1, contains an internal cylinder, b^2, and spaces or passages b^3 exist between these cylinders. The outer cylinder or box, b^1, is con-

nected at its ends with the pipe a a^1 by suitable couplings, as by the screws b^5 b^6. d^1 is a valve which is fitted to a seat in the ends or coupling b^6, whose stem or spindle e' extends into the inner cylinder, b^2, through a packing-box. The end of the stem inside this inner cylinder has a piston, f^1, fitted to work tight but freely therein.

It will be seen that the area of this piston is greater than that of the valve d^1. The end of the said cylinder b^2 is open into pipe a^1, as shown, so that the pressure inside the outer cylinder and pipe a^1 will act to force the piston f^1 inward and to keep the valve d^1 up to its seat; but when the pressure in the pipe a, acting on the said valve, overcomes the pressure on the piston f^1, the said valve is forced open and the gas fills the cylinder b^1 and pipe a^1. When a certain amount of gas has passed through the valves, determined by the relative size of the valve d^1 and the piston f^1, the greater area of the piston then gives to the pressure exerted thereon a preponderance over that acting on the valve, so that the latter is immediately closed until the pressure on the valve again preponderates.

It will thus be seen that the action of this valve is automatic; that the pressure on the side farthest from the reservoir will be as much less (on the average) as the size of the piston f^1 exceeds that of the valve d^1.

The valve B**, Fig. 4, is similar in construction to that just described, and has, in addition, a spring, i, which surrounds the piston-rod e'. This spring can be set to a regulated tension by a screw and nut.

An escape-passage through the side of the cylinder or box b^1 may be made, to permit the escape of air from behind the piston f^1, though this is not always necessary.

In practice I prefer to employ both valves A** and B** The former reduces the gas from the very high pressure it is under in the reservoir, the latter still further reducing it before it reaches the throttle-valve. This gradual reduction of pressure tends to prevent an excess of cold at any one point.

Instead of the valve A** or B**, I may use the valve shown in Fig. 7 as a reducing-valve.

In this case I interpose in the pipe leading from the reservoir a box or chest, b, which has an aperture at c, controlled by a small slide-valve, d, so that when this slide is in the position shown in the drawings there will be a free passage for the fluid through the said pipe; but when the valve d slides over and closes the aperture c, such passage for the fluid will be stopped. This slide-valve d is attached to a rod, e, which extends through the stuffing-box, to a piston, f, fitted in a small cylinder, g. Below the said piston the cylinder g has a pipe, h, which extends to the feed-pipe a^1, and communicates with the same at some point between the aperture c and the engine.

The valve-rod e is also provided with a spring, i', which tends always to draw the valve down and open the aperture c. This spring is regulated to the desired pressure in the engine-cylinders by means of the screw-nut i^2, and when the pressure in these cylinders and the portion of pipe adjacent thereto does not exceed the desired limit, the said valve will not completely close the aperture c; but when the pressure exceeds this limit the piston f will be forced upward, and will overcome the resistance of the spring i^2, so that the slide-valve d will close the aperture c.

It will be seen that the operation of the reducing-valves depends in a measure upon the rapidity with which the gas in the pipes on the side toward the engine is exhausted.

I will now proceed to describe the construction of the throttle-valve, premising with the statement that I do not claim the electric connections in this application, the same being shown and claimed in another pending application. This valve is shown in section in Fig. 6. a^3 is the pipe which feeds the engine with the gas or other fluid. l is a valve-box connected with the said pipe, and containing a valve, m, which controls the passage of the fluid through the same. m' is a valve-rod passing through the stuffing-box, and connected with a piston, n, in a cylinder, o. The said rod is provided with a spring, which tends always to keep the valve in a position to close the passage from said pipe a^3. Below the cylinder o is a box or casing, p, containing a slide, p^1, and there is a passage, q, forming a communication between the said casing and the space in the cylinder below the piston n. The rod or spring of the slide p^1 is connected with the bell-crank lever p^2, which is connected with magnets and operated by an electric current passed through the same. q' is an orifice that admits gas to the casing p.

When the current passes in one direction it will move this slide to admit gas through the orifice q' and passage q to the under side of the piston, thereby raising the same and the valve m, which then admits gas to the propelling-engine.

By reversing the electric current the port or passage q is closed and the exhaust-port q^* is opened, the supply of gas being cut off and engine stopped.

As it is intended to retain the vessel as nearly as possible of the same specific gravity as the water in which it is operated, it becomes necessary to restore the equilibrium by introducing some substance into the vessel in lieu of the compressed gas used in propelling the engine. For this purpose I attach the pipe a^{10} between the throttle-valve and the engine. As soon as the throttle-valve is opened the gas-pressure, through intermediate mechanism in a^{10}, opens the valve a^9, and admits water from outside the boat to the compartment A^7 through pipe 12, as before stated. The air in compartment A^7 is permitted to escape through pipe a^{12} into the exhaust.

The engine-compartment is open to the sea, so that it will always be full of water.

The slide-valve d^3, Fig. 8, closes the pipe 12

at *j*, so that no water can flow through the same, except when the slide d^2 is raised by pressure on the piston f^2, which pressure comes from the gas in pipe a^{10}, so that water is admitted to the boat whenever the throttle-valve is open. The opening of the valve which admits it is regulated by the pressure of gas between the throttle-valve and engine.

In this application I have not shown the wires by means of which electric connection between the shore and the various operative mechanisms are maintained, as that is clearly shown in another application now pending.

What I claim is—

1. The combination, with a reservoir and engine of a carbonic-acid or ammoniacal gas motor, of a series of pressure-reducing valves, so that the expansion of gas in the supply-pipes is effected gradually to prevent freezing, substantially as described.

2. The reducing-valve described, consisting, essentially, of an external and an internal cylinder, having passages between them, and a piston working within the internal cylinder, which piston closes the controlling-valve by back-pressure, substantially as shown.

3. The combination, in a reducing-valve, of an external and an internal cylinder, having passages between the two, a piston working in the inside cylinder to close the controlling-valve, and a spring governing the piston, so that the valve shall only be closed by a pressure sufficient to overcome the spring, as set forth.

4. The combination, in a reducing-valve, of cylinders b^1 and b^2, having passages between them, the piston f^1, having its rod passing through a stuffing-box, the spring *i*, and the valve d^1, all as shown and described.

5. The combination of a gas-reservoir, an automatic reducing-valve, as A**, a second automatic valve controlled by a spring to reduce the gas to a determinate pressure, as B**, and a throttle-valve, as shown and described.

6. In combination with the engine of a torpedo-boat, the series of pipes and suitable valves, substantially as shown, for supplying gas or other fluid from the reservoir, holder, or generator to the engine, and for exhausting the gas and admitting water to the boat, all arranged and operated as set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

JOHN L. LAY.

Witnesses:
GEORGE E. HAIGHT,
H. D. WINSOR.