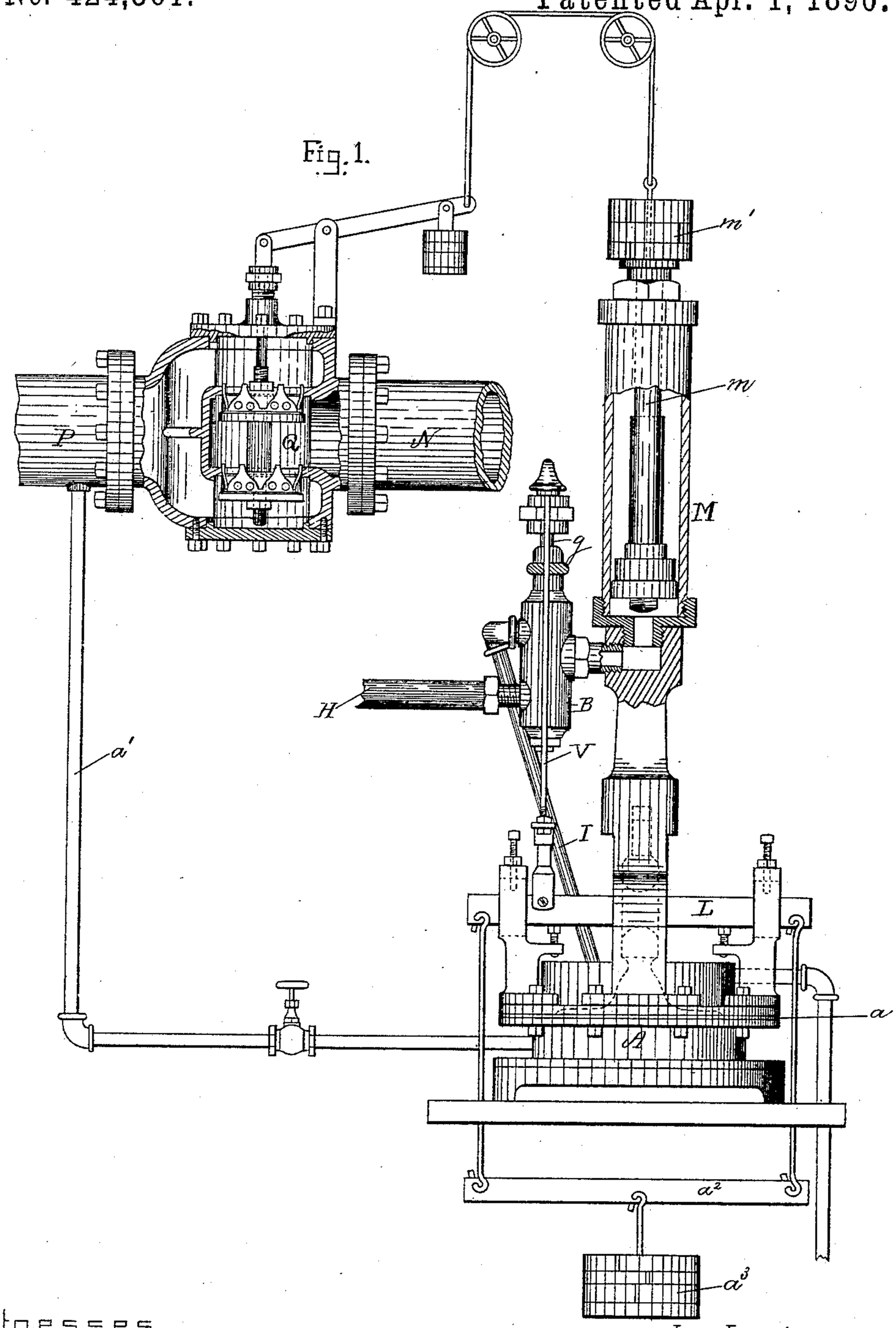
(No Model.) 2 Sheets—Sheet 1.

N. C. LOCKE.

PRESSURE REGULATING APPARATUS.

No. 424,561. Patented Apr. 1, 1890.

Fig. 1.



Witnesses.

Lauritz N. Møller.

John R. Snow.

Inventor

Nathaniel C. Locke

by his attorney

J. E. Maynadier

(No Model.) 2 Sheets—Sheet 2.

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PRESSURE REGULATING APPARATUS.

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Fig. 2.

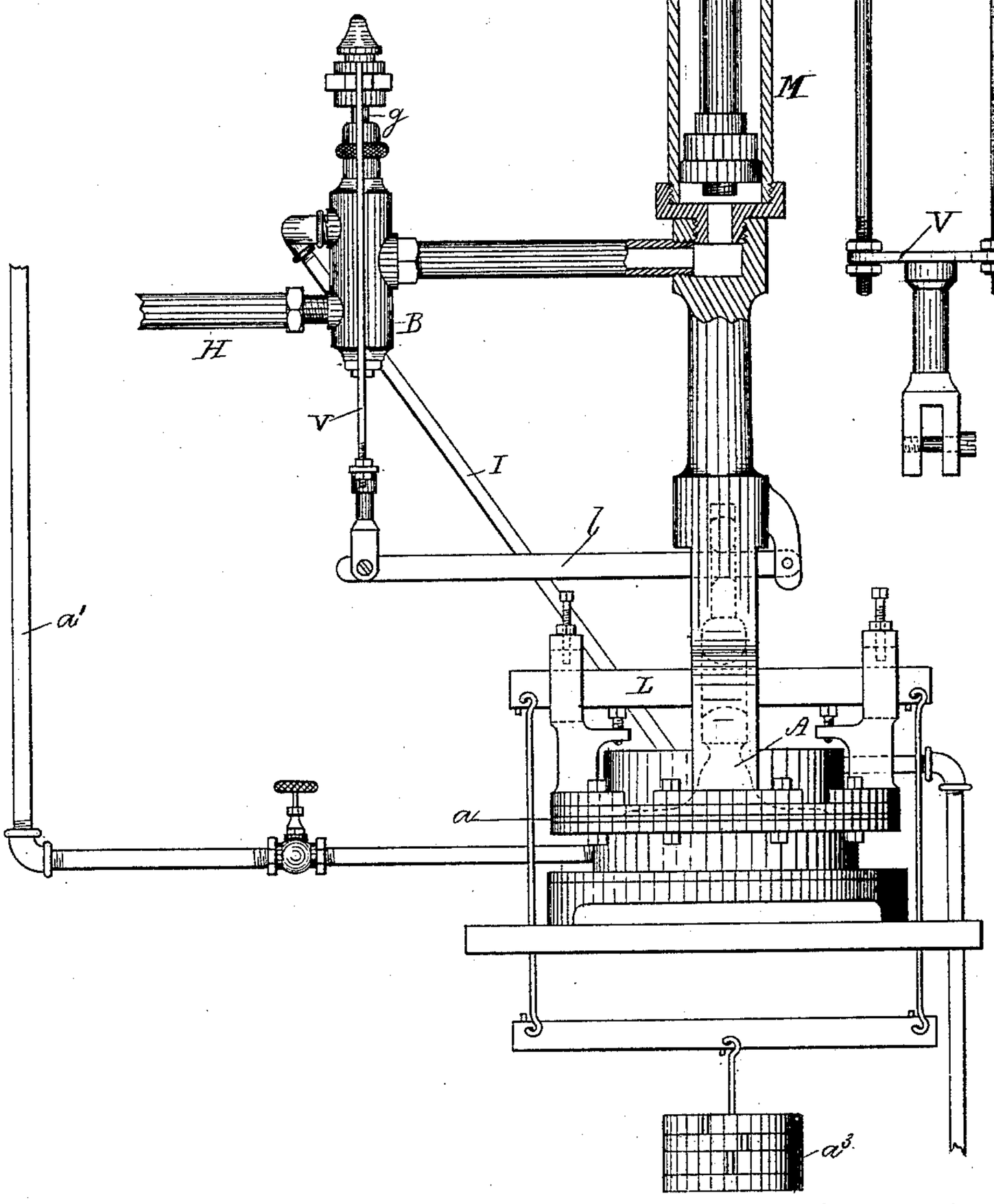

Fig. 3.

Witnesses.

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UNITED STATES PATENT OFFICE.

NATHANIEL C. LOCKE, OF SALEM, MASSACHUSETTS.

PRESSURE-REGULATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 424,561, dated April 1, 1890.

Application filed January 14, 1889. Serial No. 296,333. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL C. LOCKE, of Salem, in the county of Essex and State of Massachusetts, have invented new and useful Pressure-Regulating Apparatus, of which the following is a specification, reference being had to the accompanying drawings explained below.

My invention relates to that class of pressure-regulating apparatus which is composed of a pressure-motor and an auxiliary motor, the former operated by variations in the pressure to be regulated and the latter operating to prevent such variations. Apparatus of this class has long been known; but the results heretofore obtained have been far inferior to those which are now practically obtained in my improved apparatus.

In Figure 1 of the drawings I show that form of my apparatus intended for use where the pressure to be regulated is low—for example, where the boiler-pressure is to be reduced by controlling a valve which separates a high-pressure chamber. In Fig. 2 I show that form of my apparatus adapted for use where the low pressure is to be regulated with great nicety and accuracy. Fig. 3 shows a partial side view of the yoke which connects the valve to the pressure-motor by which the valve is controlled.

The main feature of my invention relates to the construction and operation of the valve which controls the auxiliary motor; but before explaining further it is necessary to make it clear that the inlet and outlet ports of this valve are opened or closed by variations in the pressure which operates the pressure-motor, and therefore if slight variations of pressure are to be utilized for this purpose the valve must be delicately balanced and as frictionless as possible.

In the drawings, B represents the valve casing or shell, and *g* the valve-spindle, (best constructed as shown in my patent, No. 393,164, dated November 20, 1888,) and operating to allow water to flow when the spindle *g* is in one position through pipe H into motor M, and when spindle *g* is in its other position to allow water to escape from motor M into waste-pipe I, the pipe H communicating with a water-supply, the water being under sufficient pressure to operate the motor, as will be clear without further description. The valve-spindle *g* is connected with cross-piece L by a yoke V in Fig. 1, Fig. 3 being a detail illustrating the yoke V. In Fig. 2 the yoke V is connected to the cross-piece L by means of lever *l* and the stem of the piston of the pressure-motor (shown in dotted lines in Fig. 2) for a purpose which is explained below.

In Fig. 1, N represents a conduit by which a high-pressure chamber, commonly the boiler, is connected with a low-pressure chamber through conduit P by means of a valve Q, which valve is controlled by motor M, that motor being controlled by valve B *g*, and that valve being controlled by the pressure-motor A, whose diaphragm *a* is under pressure from the low-pressure chamber, fed by conduit P. In practice, pipe *a'*, which connects the low-pressure chamber with the pressure-motor A, will be placed sufficiently far from valve Q to make it certain that the pressure under diaphragm *a* of motor A is always the same as the pressure in the low-pressure chamber fed through conduit P. Neither the high-pressure chamber nor the low-pressure chamber is shown in the drawings, for the reason that they will be well understood without further description by all skilled in the art. Moreover, it has been common heretofore to control the valve in all substantial respects the equivalent of valve Q directly by a steam-pressure motor whose diaphragm was under pressure from the low-pressure chamber.

Reducing-valve Q is a double puppet-valve and stands open when the parts are in the position shown in Fig. 1; but when steam from the boiler is admitted through pipe N it flows freely past the reducing-valve Q and through pipe P into the low-pressure chamber until the pressure in that chamber reaches the desired point; but as pipe *a'* connects the low-pressure chamber with the chamber of the diaphragm *a* the pressure under diaphragm *a* is always the same as that in the low-pressure chamber, and when the pressure in the low-pressure chamber has risen to the desired point the cross-bar L' of the pressure-motor A is lifted against its counter-weight, and the valve-spindle *g* moved thereby to open the inlet-port, which allows water under pressure to flow past the valve-spindle *g* into the cylinder of motor M, thereby raising the piston-

rod *m* and closing valve Q. As steam is drawn from the low-pressure chamber, the pressure falls in that chamber, and as the pressure falls the counter-weight depresses the cross-bar L, and with it the valve-spindle *g*, opening the outlet-port of valve B *g*, and the piston-rod *m* is moved downward by the counter-weight *m'* and valve Q is opened sufficiently to allow more steam to pass and preserve the desired pressure in the low-pressure chamber.

It will be seen that the counter-weight a^3 of the pressure-motor is hung to the cross-rod a^2, and cross-rod a^2 is hung to cross-rod L.

Heretofore it has been customary to counterbalance the upward pressure under diaphram *a* by means of a weight and lever; but I have discovered that it is practically impossible to make a diaphragm pressure-motor sufficiently sensitive to be operated by slight variations of pressure when a counter-weight and lever are used; and one feature of my invention is based upon this discovery and consists in a pressure-motor whose counter-weight is hung below the diaphragm-chamber by means of a frame which is balanced upon the piston of the diaphragm. This gives a freedom of motion and consequent sensitiveness under low pressures which I have been unable to obtain in any other way, and is a matter of very great value and importance in all pressure-motors designed for low pressures.

In Fig. 2 a lever *l* is introduced between cross-head L and valve-spindle *g*, the purpose being to reduce the motion of diaphragm *a* below that requisite in the apparatus shown in Fig. 1.

In practice I prefer to make this lever *l* light and without any counter-weight, although a portion of the counter-weight a^3 may of course be applied through lever *l*; but the use of any counter-weight on the lever *l* tends to diminish the sensitiveness of the pressure-motor A to variations in the pressure under the diaphragm *a*.

It will be obvious that when my improved apparatus is used as a damper-regulator the pipe *a'* will be in connection with the boiler, and the piston-rod *m* of motor M in connection with the damper; but my present form of apparatus, whose main novelty consists in a direct application of the counter-weight a^3 by means of a frame which brings the stress of the counter-weight on the axis of the piston of the pressure-motor A, will be found of especial advantage in any case where variations in pressure are to be reduced to the minimum.

What I claim as my invention is—

1. In combination, a diaphragm pressure-motor provided with a direct-acting weight hung centrally below the diaphragm-chamber, an auxiliary water-motor, and a valve which is controlled by the diaphragm pressure-motor and controls the auxiliary water-motor, all substantially as and for the purpose specified.

2. In combination, a diaphragm pressure-motor provided with a direct-acting weight hung centrally below the diaphragm-chamber, an auxiliary motor, its valve, the conduit N from the high-pressure chamber and the conduit P to the low-pressure chamber, and the reducing-valve Q between them, the pressure-motor being connected with and operated by variations of pressure in the low-pressure chamber, the reducing-valve Q being connected and operated by the auxiliary motor M, and the valve of motor M being operated by the pressure-motor A and controlling the inflow and outflow of water into and out of the cylinder of the auxiliary motor, all the parts being arranged and operating substantially as described.

NATHANIEL C. LOCKE.

Witnesses:
EDWARD S. BEACH,
JOHN R. SNOW.