No. 824,681. PATENTED JUNE 26, 1906.

F. M. ASHLEY.

PRESSURE REGULATOR.

APPLICATION FILED FEB. 19, 1902.

3 SHEETS—SHEET 1.

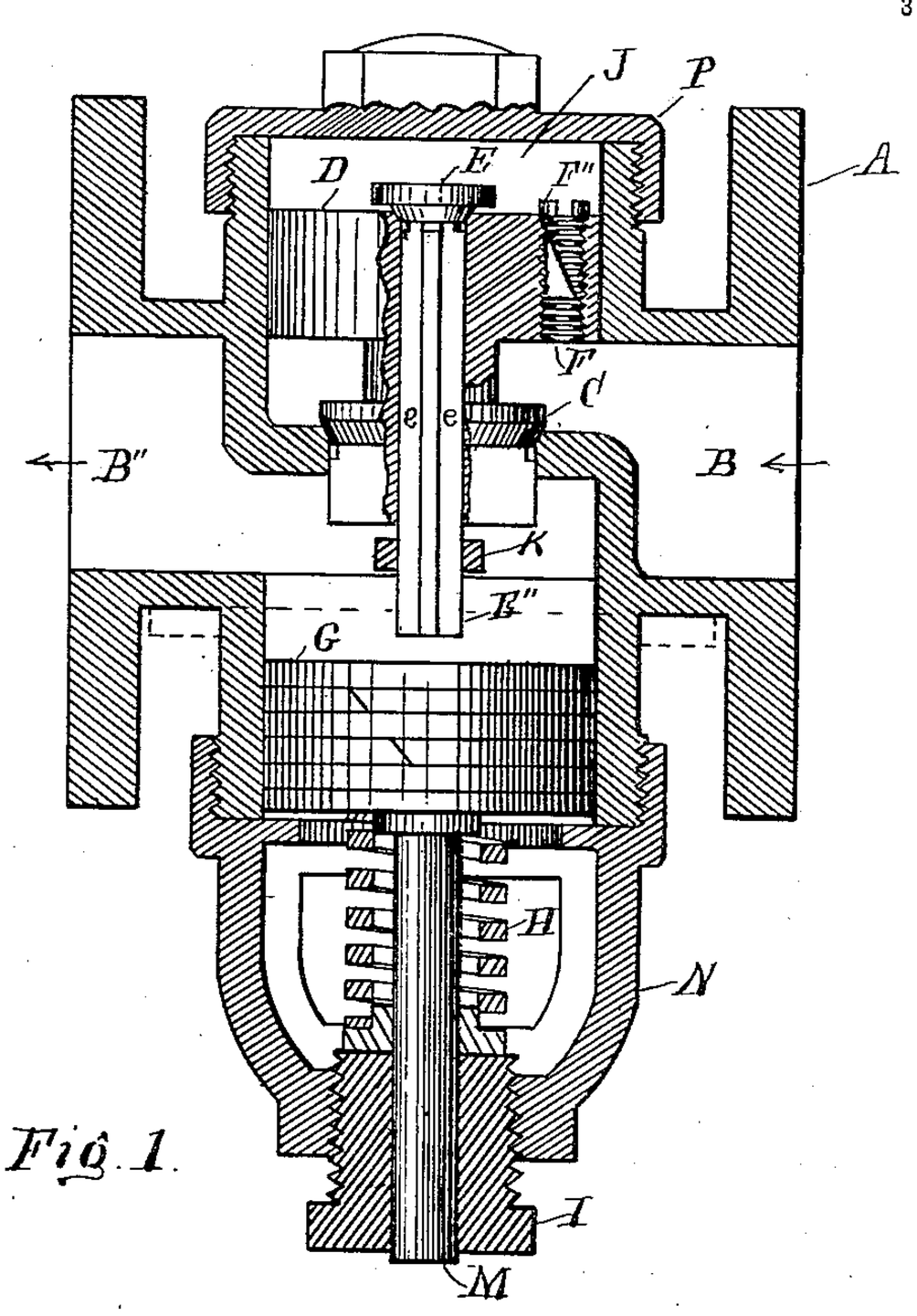

Fig. 1.

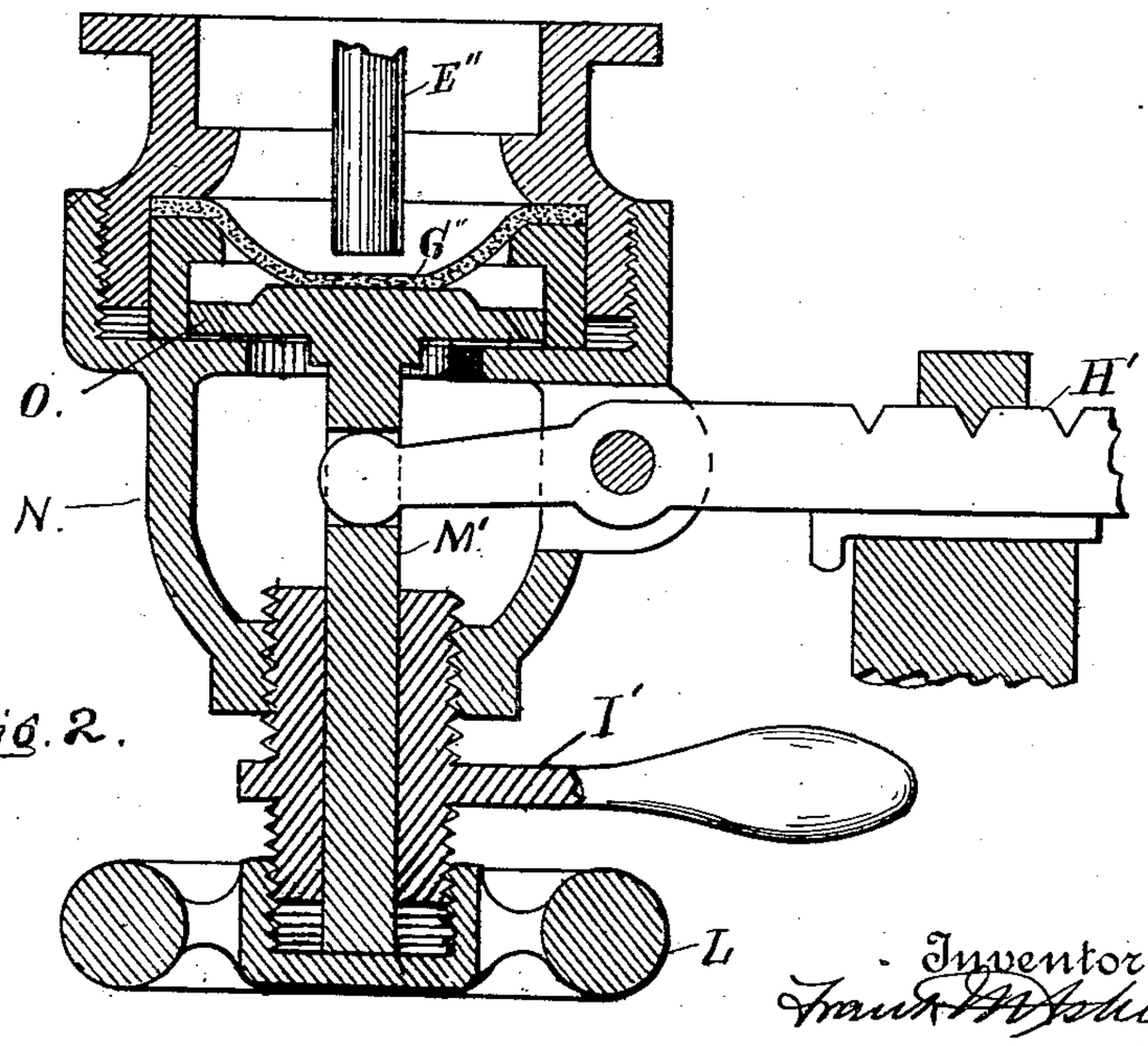

Fig. 2.

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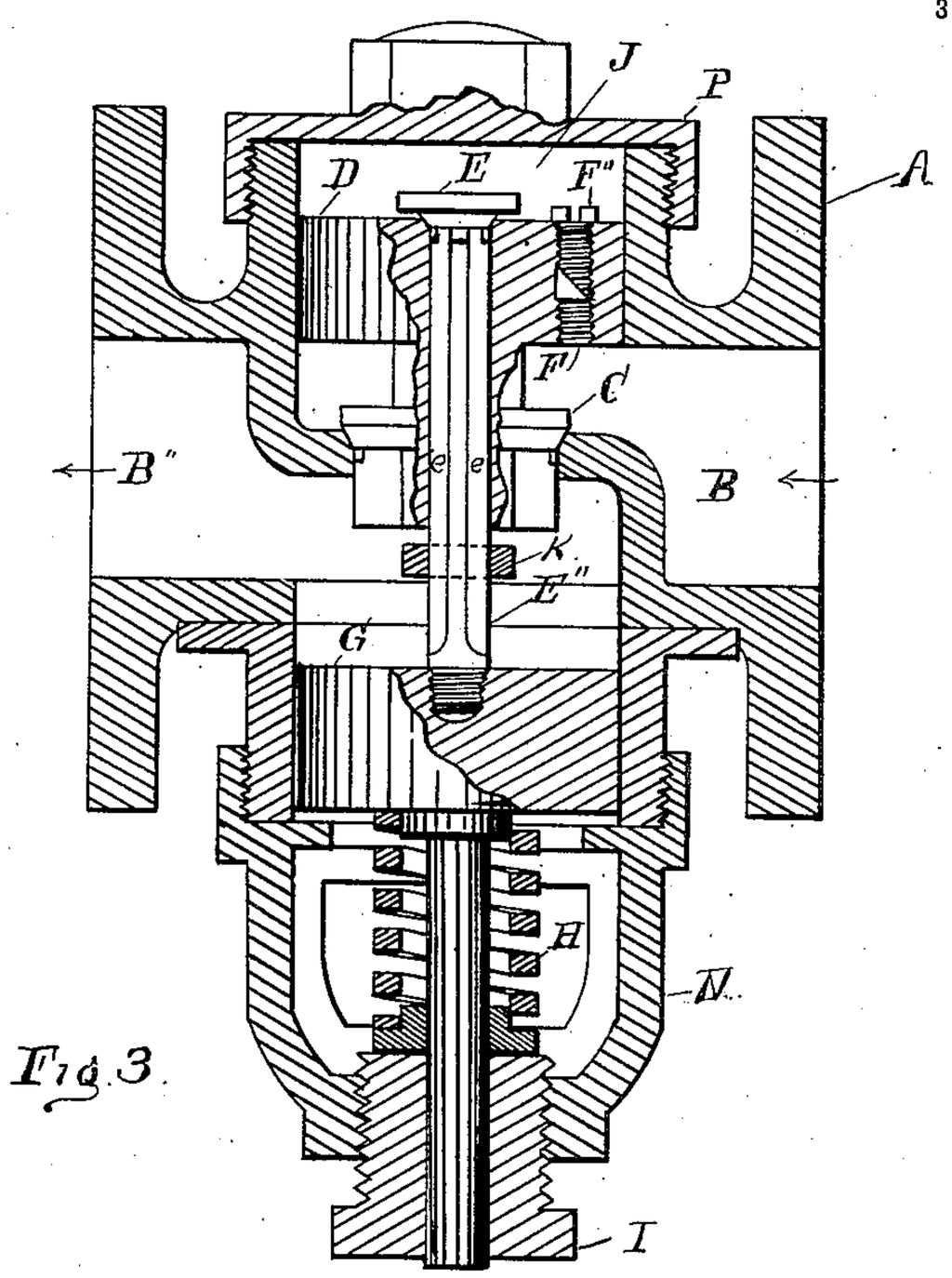

Fig. 3.

WITNESSES:

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Frank S. Ober.

INVENTOR

Frank M. Ashley.

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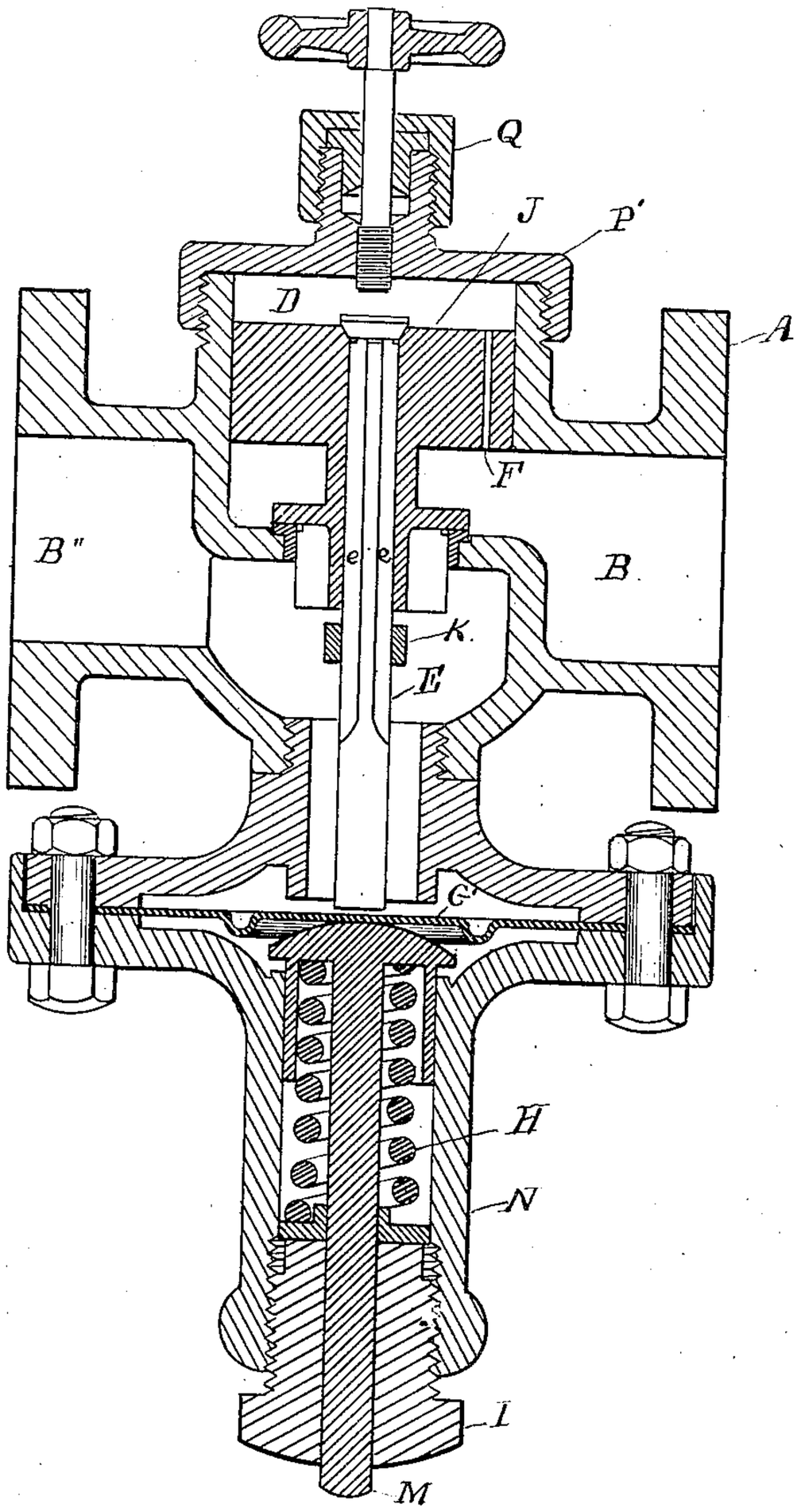

Fig 4.

Witnesses
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UNITED STATES PATENT OFFICE.

FRANK M. ASHLEY, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO ALBERT T. SCHARPS, OF NEW YORK, N. Y.

PRESSURE-REGULATOR.

No. 824,681. Specification of Letters Patent. Patented June 26, 1906.

Application filed February 19, 1902. Serial No. 94,727.

To all whom it may concern:

Be it known that I, FRANK M. ASHLEY, a citizen of the United States, residing at the city of New York, in the borough of Brooklyn and State of New York, have invented certain new and useful Improvements in Pressure-Regulators, commonly known as "Reducing-Valves," and particularly to that class wherein the main valve is operated directly by the steam or fluid through the medium of a piston, of which the following is a specification.

This invention relates to pressure-regulators, commonly known as "reducing-valves," and particularly to that class of regulators wherein the main valve is operated directly by the steam or fluid through the medium of a piston; and its object is to provide a simple and reliable construction which will operate entirely without the use of springs, if desired, and particularly without the use of springs in the steam-spaces, one that will be less costly to manufacture than those now on the market, and one wherein a moderate amount of leakage around the auxiliary valve will not affect the operation of the main valve.

A further object is to provide means whereby the main valve can be opened or closed manually whenever required.

The invention will be more particularly described with reference to the accompanying drawings, in which—

Figure 1 represents a central vertical section of a regulator constructed according to my invention. Fig. 2 represents a central vertical section of a modified form with low-pressure operating means. Fig. 3 is a central vertical section showing a modified form of regulator adapted to be used when high pressures are being reduced, and Fig. 4 shows a further modified form for use with gases when a diaphragm is used and illustrates means for manually closing the main valve.

Referring more particularly to the drawings, A represents the casing in which the pistons are fitted and through which the fluids pass; B, the inlet end of the conduit, and B″ the outlet end of the conduit on the low-pressure side of the regulator. C is the main valve, controlling said conduit; D, the main piston; E, the vent-valve, and E″ the valve-stem.

F is the equalizing-port; F″, the means used for changing the area thereof; G, the low-pressure piston, which is carried on the stem M. The stem M works through an adjustable nut I, which is threaded into the housing N, which is in turn threaded onto the body portion A.

P is a detachable cap for the chamber J. This chamber receives fluid under pressure through the vent F″ and stores it until the valve E is opened, permitting the fluid to be discharged directly into chamber B″. When the fluid under pressure in chamber J discharges faster than it can enter through port F″, the unbalanced pressure raises the piston D and opens the main valve.

H is a spring which bears at one end on the piston G and at the other on the adjusting-nut I, by which the tension of the spring, and thereby the difference in pressure between the passages B and B″, is regulated. In the modification illustrated in Fig. 2 the spring H is substituted by the adaptation of a weighted lever H′, and in this illustration the diaphragm G″ is substituted for the piston G, as will be more fully explained.

The operation of the device is as follows: In Fig. 1 and all the other figures shown it is assumed that the regulator is in its normal working position—that is, pressure is on—and is reduced on the low-pressure side at B″ to, say, fifty pounds pressure per square inch, while on the other side at B the high pressure is at one hundred pounds. Therefore the low-pressure piston G is depressed and balances the pressure on the tension device H, which is here shown as a spring; or if the modification Fig. 2 is applied as a substitute for the low-pressure valve G of Fig. 1 the weighted lever H″ will be the tension device. This allows the vent-valve E to seat with the main valve C, which is also closed, as shown. The fluid under pressure enters the regulator through the conduit B and passes through the equalizing-port F and control-valve F″ and fills the chamber J to one hundred pounds pressure. When the pressure falls at B″ through any cause to, say, forty-eight pounds, the tension device H or H′ forces piston G, or in the modification illustrated in Fig. 2 the substituted diaphragm G″, upward until it lifts valve-stem E″ and vent-valve E from its seat, and as vent-valve E has a much larger area than the

equalizing-passage F and control-valve F″ the fluid exhausts through vent-valve E and the longitudinal passages *e e* in the stem of the valve E, which stem and passages extend into the low-pressure side of the main valve C, and thus leave but forty-eight pounds above piston D, with one hundred pounds under piston D, which is therefore forced upward, opening main valve C and allowing the fluid to flow directly into conduit B″ until it is again under fifty pounds pressure, when piston G or diaphragm G″ is again depressed. The instant piston D is raised the vent-valve E will be closed, and the high-pressure fluid will flow through the port F from conduit B until the pressure in chamber J is sufficient to force piston D down, carrying the main valve C, until it is closed, unless in the meantime the pressure has again lowered on the low-pressure side B″, in which case the vent-valve would be again opened, as piston G would be raised, due to the lowered pressure, and the stem E″ would again open vent-valve E and the action of piston D would be again repeated.

The quickness of the action of piston D depends on the relative size of the vent-valve E and control-port F or control-valve F″.

Control-valve F″ consists of a simple screw fitted in the passage F and having one side of the screw filed off, so that the higher the screw stands in the passage the larger the area through the port becomes, and vice versa, and its object is to time the movement of the piston D according to the duty the regulator is to perform. Where the conditions are known, I prefer to use a port of a given area and dispense with the control-valve F″.

It will be noted that by making the piston D a loose fit port F could be dispensed with, as the fluid could pass around piston D; but I prefer the use of the ports and the advantages of their regulation, so that I can use either water or steam in the same regulator when the conditions of their use are not known previous to their manufacture. The plain open port is illustrated in Fig. 4.

The ring K on the valve-stem E″ allows the main valve C to be raised manually in case it should stick by reason of foreign matter getting between the piston D and casing A.

In Fig. 2 I show a modified construction in which a weight is used instead of a spring and a diaphragm instead of the piston G. H′ is the weight, which can be moved in and out on a pivoted lever connected with the stem M′ in any convenient manner. The diaphragm G″ rises and falls with variations in pressure in the low-pressure chamber B″. The diaphragm G″ is pushed up by the weight when the pressure falls and raises the stem E″ to open the valve in the piston. O is a plate attached to the stem M′ and prevents the main valve from being opened in case the diaphragm breaks, as the area of the plate or piston *o* is as large as that of the diaphragm, and thus keeps the tension device, whether spring or weight, balanced until a new diaphragm can be supplied. If the area was less than that of the diaphragm, the balancing device would raise the piston and open the main valve and cause great damage to the low-pressure system.

It will be seen that the piston G and diaphragm G″ are equivalents, and in practice one or the other is used, according to the conditions to be met.

By referring to Fig. 2 the means for manually opening valve C is illustrated as that of a hand-wheel L, screwing on the nut I and engaging the rod M′, so that said rod can be forced up and the movement transmitted to the valve-stem E″, which in turn by means of the ring K (shown in Fig. 1) is raised in contact with the bottom of valve C and forces it from its seat.

Referring to Fig. 3, the only difference between this drawing and Fig. 1 is that the valve-stem E″ is connected to the piston G. This is often found to be an advantage, as it insures a prompt seating of the main valve C, even though the piston D might otherwise return more slowly to its normal position, and insures closer regulation when water is used.

Referring to Fig. 4, the regulator works as already described in Figs. 1 and 2, except that I use a metal diaphragm G″ in place of a piston, and the said diaphragm is limited in its vertical movements, so that a very little movement is necessary to operate the main valve, and the liability of the diaphragm cracking is greatly reduced. In this instance Q is a cap attached to cap P′, with a screw passing through it and cap P′, threaded in cap P′, and adapted to engage and close valves C and E when screwed down. This is a decided advantage, and as the caps P and P′ are interchangeable on a given-size valve either kind may be used.

Should it be necessary to use the regulator in an inverted position from that shown in the drawings, I prefer to use the form where the pistons D and G are connected, as shown in Fig. 3, as otherwise it is necessary to use a spring to support the weight of the vent-valve E, and I prefer to dispense with springs as far as possible, especially where they are to be used in the steam-chambers.

It will be noticed that there are no complicated parts or difficult coring or packing-rings necessary in the construction of this regulator, and that by removing cap P the piston and main valves can be easily removed, and that any leakage of the vent-valve will not affect the main valve unless it leaks faster than the port F can supply, which is very improbable. It will also be noted that by reason of the fluid-pressure being at all times on both sides of the piston D the said

piston is cushioned and there will be no chatter or pounding, but instead a positive and easy movement, both in opening and closing of the main valve.

Having thus described my invention, I declare that what I claim as new, and desire to secure by Letters Patent, is—

1. A pressure-regulator of the character described comprising a casing presenting a cap-closed piston-chamber, a conduit formed in said casing and passing therethrough, a valve contained within the said casing and adapted to control said conduit, a piston disposed within the piston-chamber and adapted to control said valve, said piston being freely removable from said chamber when the casing-cap is detached; a second valve carried by said piston, and means coacting with the casing, piston and said second valve for opening the said conduit-valve when the pressure on the low-pressure side of said latter valve falls below the normal of that at which said regulator is set; substantially as set forth.

2. A pressure-regulator comprising a casing having a conduit for the fluid, a valve controlling said conduit, a piston having a passage controlling said valve, means for closing said passage and means for opening said passage when the pressure on the low-pressure side of said valve falls below the normal pressure at which the regulator is set, substantially as described.

3. A pressure-regulator of the character described comprising a casing, a fluid-conveying conduit formed therein and passing therethrough, a valve contained within the said casing for controlling said conduit, a movable element and means carried thereby at one side thereof for controlling the rapidity of the movement of the said element, and devices below said valve coacting with said means for operating the element upon a fall of fluid-pressure.

4. A pressure-regulator comprising a casing having a conduit for the fluid, a valve controlling said conduit, a piston located in the upper end of said casing which controls said valve, a vent-valve through which fluid may be released from the high-pressure side of the valve to the low-pressure side and means located at the lower end of the regulator for operating said vent-valve.

5. In a pressure-regulator, a casing having a conduit for fluid, said conduit being divided into a low-pressure side and a high-pressure side, a valve controlling said conduit, a piston fitted in the upper end of said casing, a cap closing the top of said casing above said piston forming thereby a closed chamber having a communicating passage between said low-pressure side and said high-pressure side for the fluid, a valve controlling said passage from said chamber to the low-pressure side of said casing, and means whereby said valve is opened when the reduced pressure falls below the normal pressure which the regulator is set to maintain.

6. In a pressure-regulator, a casing having a conduit for fluid, a main valve controlling said conduit, a piston controlling said valve said piston having a passage from the upper to the under side thereof, means for regulating the operative area of said passage, a chamber formed above said piston, a vent-valve located in said piston and controlling a passage leading directly from said chamber to the under side of the main valve and normally closing said passage, and means for opening said passage when the pressure falls below the normal pressure which the regulator is set to maintain.

7. In a fluid-pressure regulator of the character described, the combination with the casing having a fluid-conduit therein, of a main valve adapted to control the said conduit, a piston adapted to control the said valve, a passage for fluid located in said piston and extending from the high-pressure side to the low-pressure side of the said valve, a vent-valve controlling said passage for fluid, and a lower-pressure element adapted to be actuated by a fluid-pressure on one side thereof and having a reacting tension device, on the opposite side thereof, said element being adapted to open said vent-valve and said main valve when said element is subjected to a lower pressure on the fluid side than that exerted by the said device on the opposite of said element.

8. In a pressure-regulator, a casing having a conduit for the fluid, a main valve controlling said conduit, a piston in the upper end of said casing and a second piston in the lower end of said casing, a valve seated in the first-named piston and having a stem extending through same to said second-named piston, and means whereby when the reduced pressure falls below the pressure the regulator is set to maintain, the pistons will act to open the main valve and when the reduced pressure again rises to the normal pressure the said pistons will act to close said main valve.

9. In a pressure-regulating valve of the character described, the combination with a cap-closed casing and fluid-conduit therein, of a valve adapted to control the said conduit, and a ported piston for controlling the said valve, devices for controlling the movement of the said piston upon pressure differentiation, and of instrumentalities for varying the effective area of said port the construction being such that upon the detachment of the casing-cap the piston and all the valves can be freely removed from said casing; substantially as described.

10. A reducing-valve comprising a casing with a conduit leading therethrough, a main valve controlling said conduit, said valve being controlled by a movable element located

in the upper end of said casing and dividing said casing so that a closed chamber or recess is formed above said element, a passage for fluid leading from the high-pressure side of said conduit to said chamber and communicating therewith, a vent-valve controlling a passage leading from said chamber to the low-pressure side of said conduit, and means located below said main valve for operating said valve and said vent-valve.

11. A pressure-regulator comprising a casing having a conduit for fluid, a main valve controlling said conduit, a movable element located in the upper end of said casing for controlling said valve, a vent-valve, means for operating said vent-valve located in the lower end of said casing, said means being adapted to open the said main valve directly in case of failure of the said valve to open when the pressure falls below that at which the regulator is set to maintain.

12. In a pressure-regulator, the combination of a casing having a conduit for the fluid, a main valve controlling said conduit, a movable element located in the upper end of said casing which controls said valve, a vent-valve, means located in the lower end of said casing for operating said vent-valve, said means comprising a diaphragm and a piston located below said diaphragm, whereby, should the diaphragm break, the piston would hold the steam or fluid pressure from escaping and also prevent the tension device which operates said piston, from opening the vent or main valves; substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 18th day of February, 1902.

FRANK M. ASHLEY.

Witnesses:

FRANK S. OBER,

JOHN H. DALE.