No. 784,408. PATENTED MAR. 7, 1905.

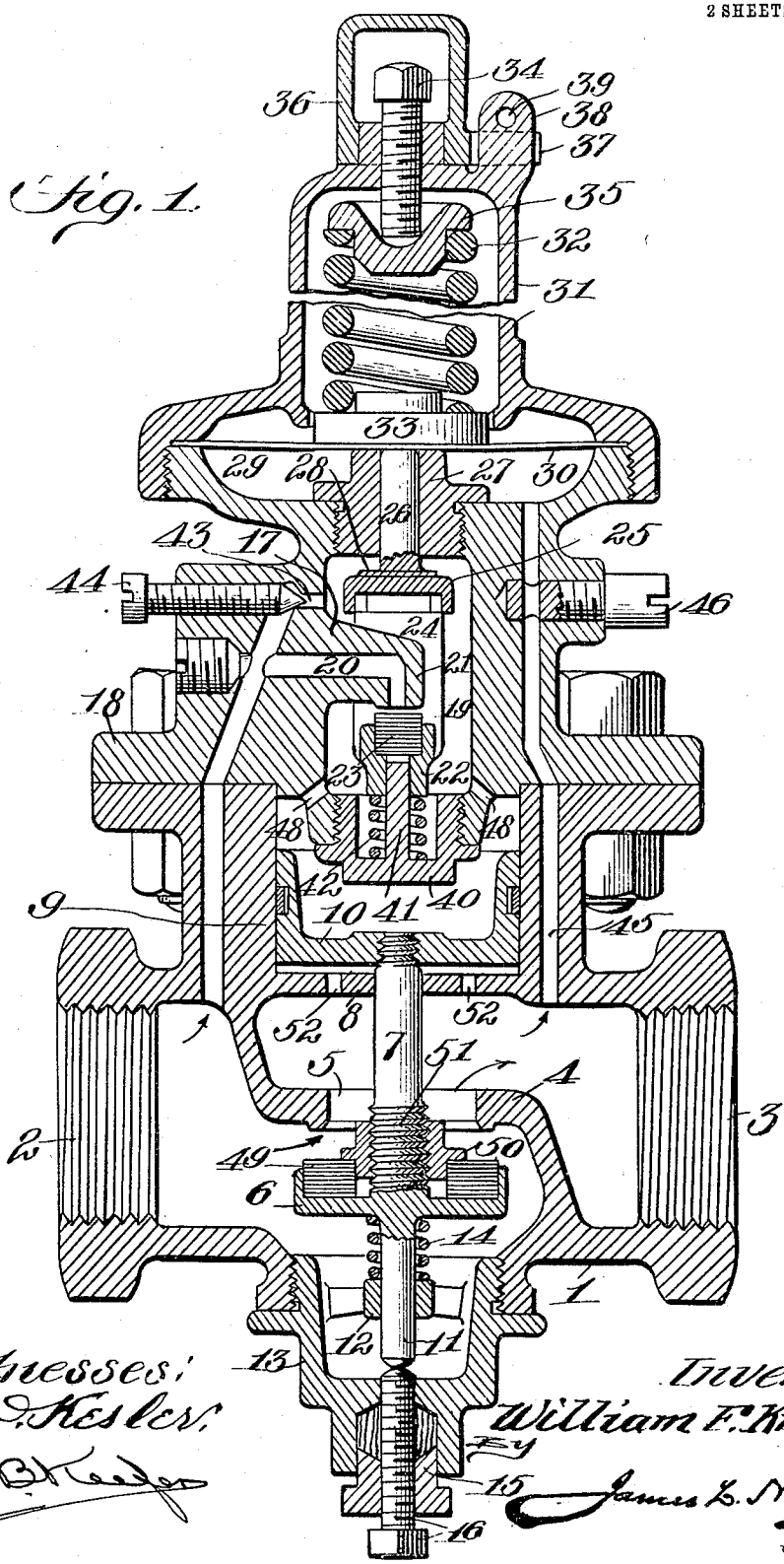
W. F. KRICHBAUM.

PRESSURE REGULATOR.

APPLICATION FILED AUG. 18, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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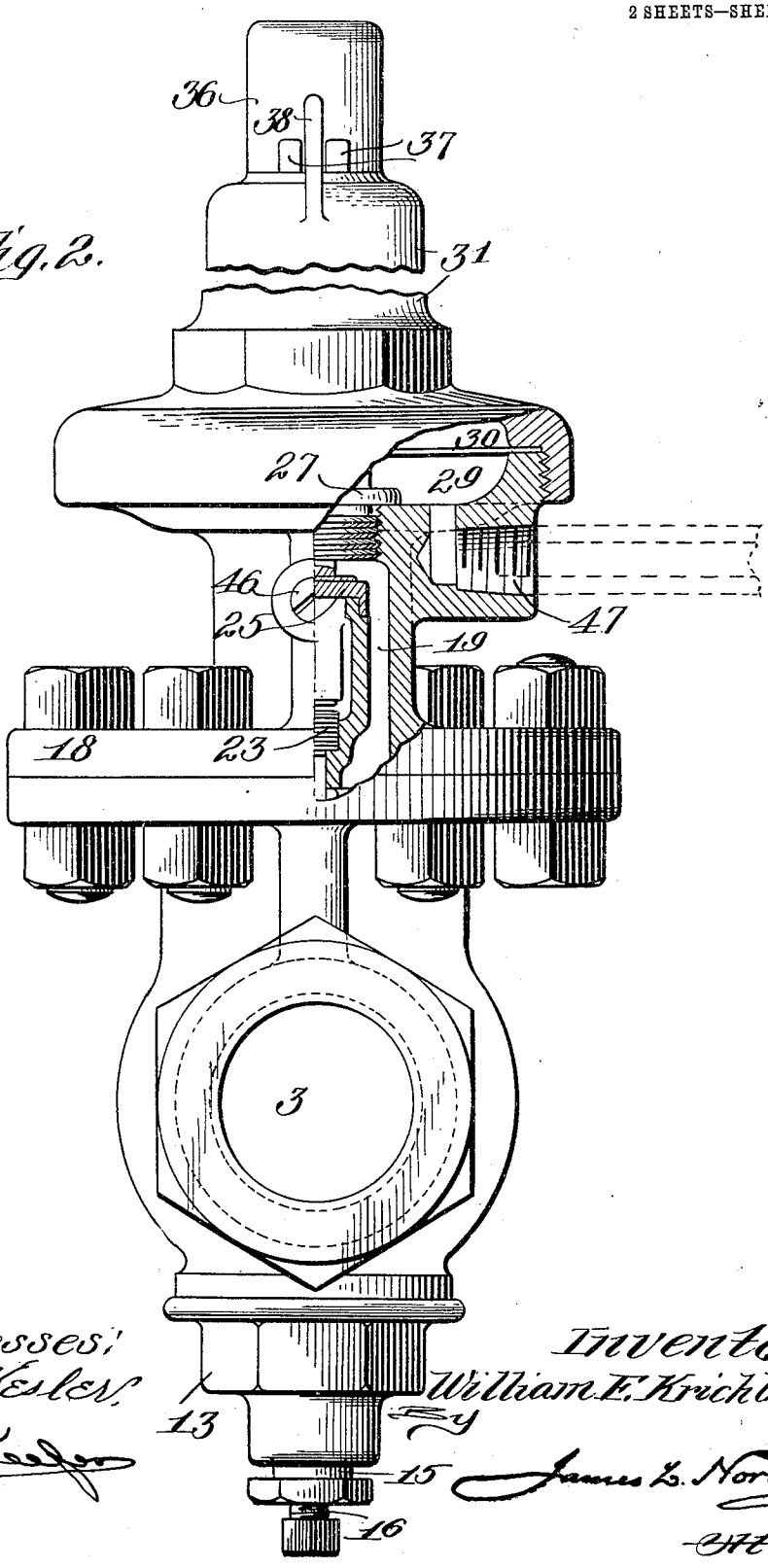
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

WILLIAM F. KRICHBAUM, OF NEWARK, NEW JERSEY, ASSIGNOR TO FOSTER ENGINEERING CO., OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 784,408, dated March 7, 1905.

Application filed August 18, 1904. Serial No. 221,273.

To all whom it may concern:

Be it known that I, WILLIAM F. KRICHBAUM, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Pressure-Regulators, of which the following is a specification.

This invention relates to certain new and useful improvements in pressure-regulators of the class operated by means of the high pressure acting upon a piston actuating the main valve to open the same, which high pressure is controlled by an auxiliary valve, which in turn is controlled by the delivery-pressure acting on a diaphragm against the action of an opposing pressure, such as a spring or weight.

The main objects of the invention are in a novel manner to control the action of the main valve by the aid of the auxiliary valve closing against the high-pressure fluid and to provide means for renewing the diaphragm when broken without stopping the passage of the fluid through the valve and at the same time prevent the full initial fluid-pressure from entering the line.

In addition to the above-stated objects other minor objects of the invention relate to details of construction and to combinations and operations of parts, all of which will be more clearly described in the specification to follow.

In order that the invention may be clearly understood, I have illustrated the same in the accompanying drawings, in which—

Figure 1 is a central vertical sectional view of a pressure-regulator constructed according to my invention, and Fig. 2 is a vertical elevation and part section taken at right angles to Fig. 1.

Referring now to the drawings, 1 indicates the main portion or body of the regulator and is provided with an inlet 2 and an outlet 3. Interposed between said inlet and outlet is a horizontally-disposed partition 4, having a valve-opening 5 affording communication between the inlet and outlet.

6 indicates the main valve, controlling the opening 5 and provided on its upper side with a stem 7, extending through and working in an opening in the bottom 8 of a cylinder 9. Said stem has screw-threaded engagement, as shown, with a piston 10, working in said cylinder and having a free or loose fit therein.

11 indicates a stem depending from the lower side of the valve 6, which extends through and works in a guide 12, cast into a plug 13, which plug is screwed into the under side of the body 1.

14 indicates a spring interposed between the valve 6 and the guide 12, said spring being of sufficient strength to support the combined weight of piston 10 and valve 6, with its stems.

Screwed into the bottom of the plug 13 in line with the lower stem 11 of the valve and surrounded by a stuffing-box 15 is a limit-screw 16, which is adapted to be engaged by the stem 11 to limit the downward movement of the valve 6, and thus determine the maximum amount of high-pressure fluid which may pass through the valve-opening 5.

17 indicates a projecting neck formed integral with the top casting 18 of the regulator and extending into the auxiliary-valve chamber 19. Said neck is drilled to form a continuation of the supply-port 20, leading from the inlet or high-pressure side of the regulator. The neck 17 has a downwardly-projecting portion 21, which affords a face-bearing for the auxiliary valve 22.

Great inconvenience arises in the use of pressure-regulators and similar devices from what is known as "wire-drawing" of the seats. I provide for this contingency in the present case by mounting a removable disk 23 in the auxiliary valve to seat against the face-bearing of the neck 17. When this disk becomes worn, it can be readily removed and its place supplied with a fresh disk. The provision of the removable disk is particularly desirable when regulating air and water pressures, and in the case of the auxiliary valve it enables the diameter of the opening to be restricted, which I have found necessary in some cases. The auxiliary valve 22 is carried by a yoke 24, which in turn is mounted in a cap 25,

having a stem 26 on its upper side, said stem working freely or loosely in a guide-sleeve 27, screwed into the upper end of the top casting 18. The upper side of the cap 25 is provided with a ground shoulder 28, adapted to bear against the bottom of the guide-sleeve 27 for a purpose hereinafter explained.

29 indicates the pressure-chamber, having located therein a diaphragm 30, held between the top casting 18 and the spring-chamber casting 31, which is screwed onto said top casting and secures the flexible diaphragm in a well-known manner.

32 indicates the main or actuating spring, which is mounted in the casting 31 and bears against a spring-plate 33, which in turn bears upon the diaphragm 30. Said spring is designed to have its tension or pressure regulated by means of a screw 34, having a bearing in a spring-washer 35, mounted in the upper end of the spring 32.

36 indicates a hollow casting adapted to be fitted on the upper end of the casting 31 and to receive the upper end of the adjusting-screw 34. The casting 36 is provided with a slotted lug 37, through which projects a tongue 38, having an aperture 39 for receiving a lock, whereby the adjustment may be sealed against improper manipulation.

40 indicates a spring-chamber which is screwed into the lower side of the top casting 18 and has a central upwardly-projecting stem 41, which projects into the under side and guides the auxiliary valve 22. Surrounding this stem and supported on the bottom of the chamber 40 is a spring 42, which bears upward against the auxiliary valve and supports the same against opposing fluid-pressure in port 20. The high-pressure port 20 is continued upward through the top casting 18 beyond the neck 17 and communicates with the auxiliary-valve chamber 19 by means of a port 43, which is controlled by a needle-valve 44. The purpose of this construction will presently appear.

45 indicates a port leading from the low-pressure or outlet side 3 of the regulator to the pressure-chamber 29. Said port may be closed at will for a purpose hereinafter explained by means of a screw 46.

47 indicates a tapped connection with the pressure-chamber 29, to which may be attached a pipe leading from some distant point or from the discharge of a pump, whereby in the latter case to control the steam or other pressure used to drive the pump. When used in this connection or when the pressure in the diaphragm-chamber is to be controlled from a distant point through the connection 47, the port 45 is closed by means of the screw 46. When the pressure in the chamber 29 is determined by the fluid passing from the outlet side of the regulator, the port 45 is opened and the tapped connection 47 closed.

48 indicates ports affording communication between the auxiliary chamber 19 and the cylinder 9.

Referring now to the main valve 6, 49 indicates a removable disk mounted in said valve and held in place by means of a collar 50, having engagement with a screw-threaded portion 51 of the upper valve-stem 7. In operation the steam or other fluid at high pressure passes into the regulator at the inlet 2 and through the valve-opening 5 and out through the outlet 3 to the line or system, and at the same time said fluid passes up through the port 45 into the pressure-chamber 29, raising the diaphragm 30 to a greater or less extent. At the same time high-pressure fluid passes through the port 20 into the auxiliary chamber 19 and out through the ports 48 into the cylinder 9 and exerting its pressure upon the piston 10 depresses the valve 6 and moves the same against the resistance of the spring 14 a greater or less distance from the valve-opening 5. According to the pressure of the fluid at the outlet the diaphragm 30 will be raised against resistance of the spring 32 to bring the auxiliary valve into greater or less proximity to its valve-seat, thereby regulating the amount of high-pressure fluid passing to the piston 10, and thereby regulating the distance of the main valve 6 from its seat. By means of the screw 34 the spring 32 can be adjusted to any required delivery-pressure.

52 indicates ports in the lower wall of the cylinder 9 to enable pressure to be exerted upon the under side of the piston 10 in establishing an equilibrium between the parts of the regulator.

In operation the device establishes an equilibrium at the pressure set and passes an uninterrupted flow of fluid at a reduced pressure. Should the pressure at the outlet exceed that required, the back pressure will operate to raise the diaphragm 30 and permit the spring 42 to raise the auxiliary valve 22 and close the port 20, thus preventing the admission of high-pressure fluid to the cylinder 9. This will permit the pressure in said cylinder by escape of fluid around the piston 10 and stem 26 to equalize with that at the outlet 3 of the regulator, and the high-pressure fluid entering at 2, aided by the spring 14, will close the main valve 6 against its seat and prevent the further passage of fluid to the line. As soon as the pressure is reduced at the outlet 3 below the required amount the spring 32 will again depress the diaphragm 30, thereby through the stem 36 lowering the auxiliary valve and permitting high-pressure fluid to flow again into the cylinder 9 and depress the piston 10 and valve 6 until an equilibrium is established and fluid at the required pressure can pass through the regulator. The limit-screw 16 is adjusted to clear the stem 11 and acts as a restriction to any further opening of the main valve than is required for maximum conditions.

If while in use the diaphragm 30 becomes broken, it may be replaced without stopping the flow of fluid by turning needle-valve 44 one turn to the left and closing port 46, thus opening the passage leading from the high-pressure side of the regulator, closing admission of low pressure to diaphragm-chamber, and throwing the full fluid-pressure into cylinder 9 to hold the piston 10 in its depressed position, which operates to force the stem 11 downward against the limit-screw 16, so that the valve will be held at the maximum distance from the opening 5. This insures a reduction of the high pressure and prevents the full initial fluid-pressure from being admitted to the line so long as the amount the valve passes is being used. The ground shoulder 28 provides a seal preventing the escape of high-pressure fluid about the stem 26 while the diaphragm is being repaired or a new diaphragm being placed in position. The lip of cap 25 extends downward a sufficient distance to prevent the yoke 24 becoming disengaged from said cap. The limit-screw 16 may be adjusted to pass any constant reduced pressure until repairs can be made.

I have shown the edge of the valve-opening 5 beveled, so that an ordinary beveled-edge metal valve may be used, if desired, in place of the removable disk valve shown in the drawings.

It will be noted in this invention that after the main and auxiliary valves are closed there are no pistons or stems interposed between the high and low pressure sides of the regulator whereby leakage may occur.

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

1. In a pressure-regulator, in combination with a casing having an inlet and outlet communicating through a valve-opening, a main valve controlling said opening, a cylinder, a piston in said cylinder controlling said main valve, an auxiliary-valve chamber communicating with said cylinder, a port leading from the inlet or high-pressure side of the regulator and communicating with said auxiliary chamber, an auxiliary valve controlling said port and closing against the high pressure therein, a pressure-chamber containing a spring-pressed diaphragm coöperating with said auxiliary valve and tending normally to press the same from its seat, and means for controlling said auxiliary valve to regulate the admission of high-pressure fluid to said cylinder comprising a spring tending normally to raise said auxiliary valve, and a port leading from the outlet or low-pressure side of the regulator and communicating with said pressure-chamber below the diaphragm thereof.

2. In a pressure-regulator, in combination with a casing having an inlet and outlet communicating through a valve-opening, a main valve controlling said opening and actuated by the high-pressure fluid from the inlet side of the regulator, a port for the high-pressure fluid, an auxiliary valve controlling said port, means for automatically regulating the movements of said auxiliary valve, a second port leading from the inlet side of the regulator and adapted, when open, to admit high-pressure fluid to operate the main valve, and a valve for controlling the opening of said second port.

3. In a pressure-regulator, in combination with a casing having an inlet and outlet communicating through a valve-opening, a valve for controlling said opening, a cylinder, a piston in said cylinder operating said valve, an auxiliary-valve chamber communicating with said cylinder, a high-pressure-fluid port communicating with said chamber, an auxiliary valve controlling said port, means for automatically controlling said auxiliary valve, a second port affording communication between said chamber and said high-pressure port, and located above the port controlled by the auxiliary valve, and a needle-valve for controlling said second port.

4. In a pressure-regulator, in combination with a casing having an inlet and outlet communicating through a valve-opening, a valve for controlling said opening, a cylinder, a piston in said cylinder operating said valve, an auxiliary-valve chamber communicating with said cylinder, a high-pressure-fluid port communicating with said chamber, an auxiliary valve controlling said port, means for automatically controlling said auxiliary valve, a second port affording communication between said chamber and said high-pressure port, and located above the port controlled by the auxiliary valve, a needle-valve for controlling said second port, and a limit-screw for determining the distance at which the main valve shall be moved from its seat.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

WILLIAM F. KRICHBAUM.

Witnesses:
C. S. GEORTNER,
A. C. ELLIS.