No. 706,721. Patented Aug. 12, 1902.

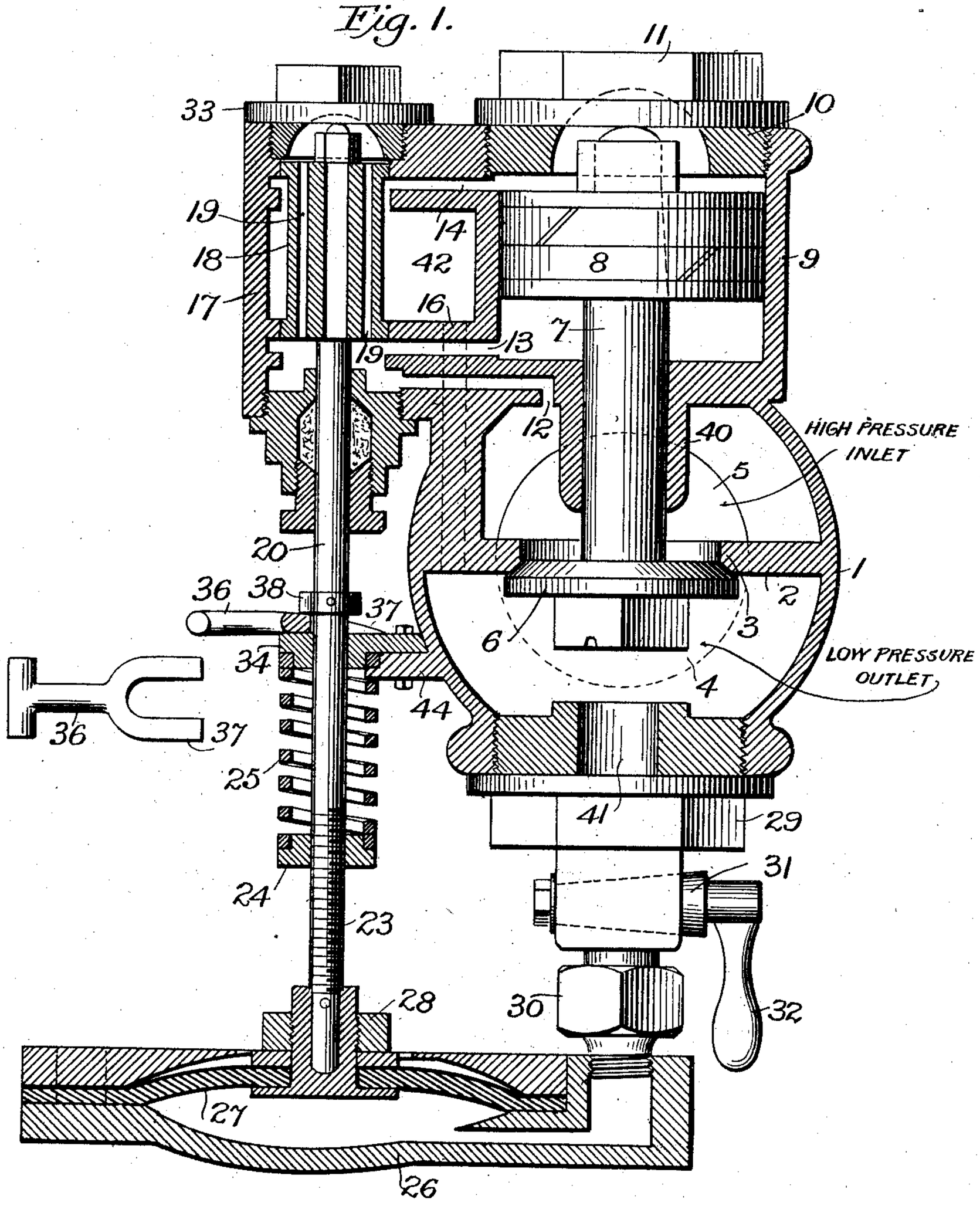
C. H. BUCKELEW.

PRESSURE REDUCING VALVE

(Application filed Oct. 30, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



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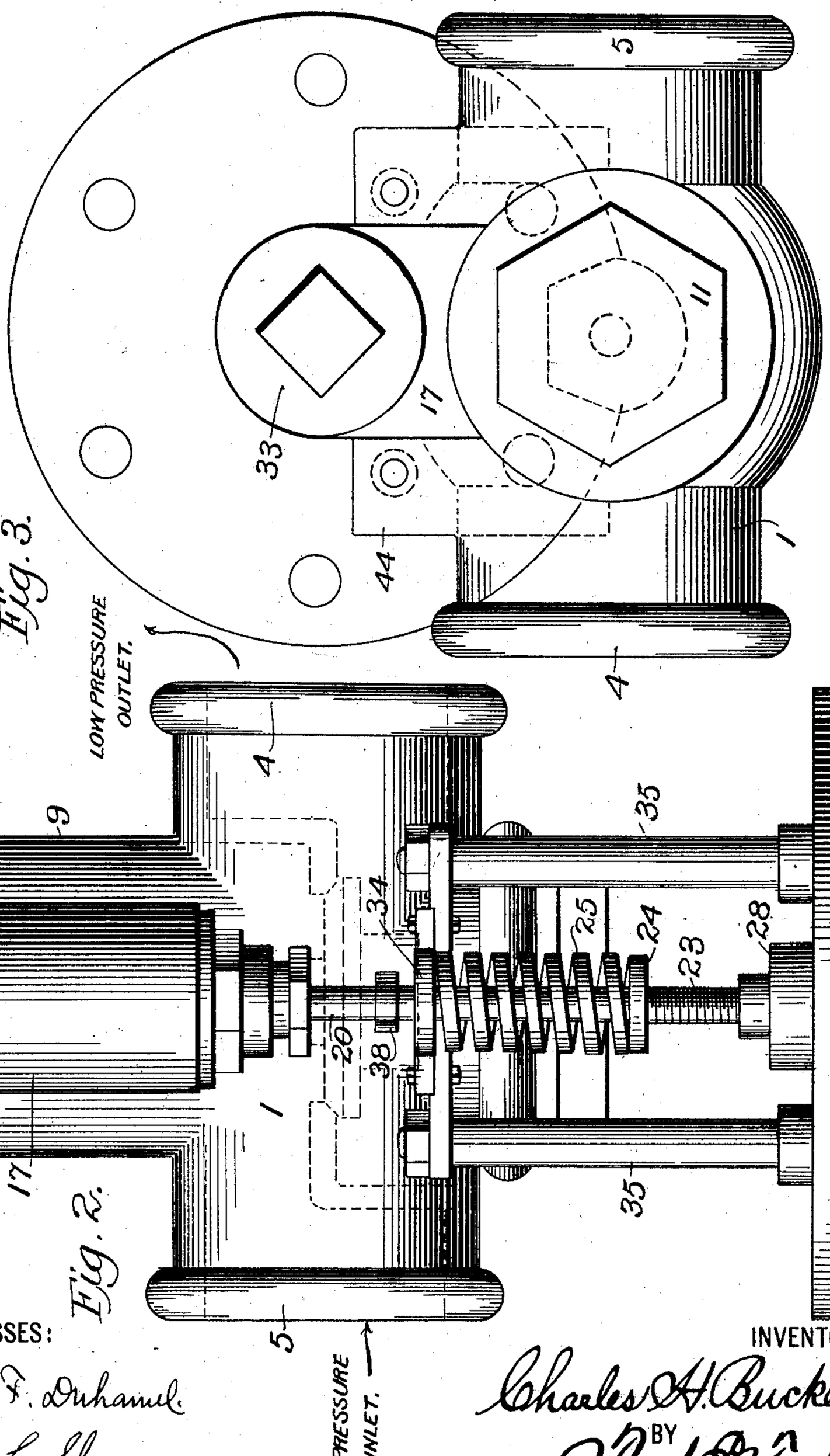

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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PRESSURE-REDUCING VALVE.

SPECIFICATION forming part of Letters Patent No. 706,721, dated August 12, 1902.

Application filed October 30, 1901. Serial No. 80,503. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. BUCKELEW, a citizen of the United States of America, and a resident of the city of Plainfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Pressure-Reducing Valves, of which the following is a specification.

My present invention has reference to a pressure-reducing valve for use in connection with steam or other fluid to enable high-pressure steam to be taken direct from the boiler or generator and supplied to the engine at any desired reduced pressure.

Among various objects which I desire to attain is the provision of a valve in which there shall be no leakage and by the use of which I may prevent the accumulation of pressure on the low-pressure side of the valve while the low-pressure system is not being drawn upon, and it is my expectation that the valve hereinafter described may be made perfectly tight against any pressure and may be easily and accurately controlled by a variation of pressure on the low-pressure side.

The invention consists, essentially, in the construction, arrangement, and combination of the parts, substantially as will be hereinafter described and then more particularly pointed out in the claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a vertical sectional view of my improved pressure-reducing valve. Fig. 2 is a side elevation of the same. Fig. 3 is a top plan view.

Similar characters of reference designate corresponding parts throughout the different figures of the drawings.

1 denotes the main-valve chest, formed with a high-pressure steam-inlet chamber 5 and a low-pressure steam-outlet chamber 4 and an intermediate seating partition or division 2, having an opening to provide the seating 3, in conjunction with which the main regulating-valve 6 is arranged.

Integral with the main-valve chest 1 is formed a cylinder 9, closed at one end by a screw-cap 10 having a nut-shaped face 11. Within cylinder 9 is a reciprocatory piston 8 of larger area than valve 6 and having a piston-rod 7, which connects with and serves also as a valve-stem for the main regulating-valve 6, said stem passing through a bearing 40, formed in the casting between the cylinder 9 and the high-pressure steam-inlet chamber 5, all as clearly delineated in Fig. 1. Cylinder 9 has an upper port 14 and a lower port 13, and the high-pressure steam-inlet chamber 5 has an outlet-port 12, located in the wall thereof near the end of cylinder 9, and consequently not far distant from the cylinder-port 13.

One side of the main-valve casing 1 has an opening therein into which screws a cap 29, through which runs a passage 41, that leads away from the low-pressure steam-outlet chamber 4 and connects with a nut-provided pipe 30, that screws into the diaphragm-chamber 26, there being in this way a passage provided between said diaphragm-chamber 26 and the low-pressure chamber 4, in the length of which passage is a shut-off cock 31, having a handle 32.

In the diaphragm-chamber 26 is a diaphragm 27, of rubber or other suitable flexible material, one side of which is exposed to the low-pressure fluid, which reaches the diaphragm-chamber through the passage 41 already spoken of. This low-pressure fluid exerts its force against one side of the diaphragm 27. The other side of the diaphragm is acted on by a spring located in such a position as to actuate at certain times the valve-rod belonging to the auxiliary valve, and thereby influence the position of the valve in a manner which I shall now more fully explain.

On the side of the cylinder 9 is the valve-chamber 17, containing the slide-valve 18, which I term an "auxiliary" valve, as the function thereof is to control the movements of the piston 8. Through this valve 18 are several passages 19, that run from end to end of the valve and allow pressure to pass through them from one end of the valve to the other. The stem 20, attached to valve 18, is surrounded at a point outside of the valve-chamber 17 by a spiral spring 25, which is tensioned between a nut 24, that is adjusted on a screw-threaded portion 23 of rod 20 and a stationary plate 34, bolted to a bracket 44, projecting from the side of the valve-body 1. The extremity of the rod 20 is connected to the diaphragm 27, being fastened to a casting 28, which is firmly secured centrally to the dia-

phragm 27. In this way it will be seen that the diaphragm and valve 18 are arranged to move in unison and that the spring 25 will have the function of depressing the diaphragm 27 and simultaneously moving the valve 18 to the opposite end of its stroke at such time as the pressure on the other side of diaphragm 27 is insufficient to overcome the resiliency of the spring 25.

The cylinder-ports 13 and 14 lead from the cylinder to a lateral chamber 42, and from said chamber 42 a port 16 leads to the low-pressure chamber 4, so that any exhaust from one side or the other of the piston 8 may make its way through either the port 13 or the port 14, accordingly as the valve 18 may be in a position to connect port 14 with chamber 42 or port 13 with chamber 42, the exhaust thus passing into the chamber 42 and thence into port 16, and through it into the low-pressure chamber and not into the atmosphere, there being in this valve no exhaust to the atmosphere, and it being also particularly noted that the main regulating-valve opens always into the low-pressure chamber and that the spring 25 is not situated inside of any chamber, but is entirely outside and clear of the valve-casing.

I will now explain the operation. Suppose, for example, that the parts are in the position in which they appear in Fig. 1: The main valve 6 has now been closed upon its seat 3 by the action of the high pressure against the under side of piston 8, the area of which is larger than the area of valve 6, for this high pressure has been introduced into the lower end of cylinder 9 through the ports 12 and 13, the auxiliary valve having been previously moved to a position which permits this. Simultaneously with the action of the high pressure against the lower side of piston 8 the pressure on the opposite side will, because of the connecting of port 14 with the exhaust, be allowed to pass out from the upper end of cylinder 9 through port 14, chamber 42, and port 16 to the low-pressure outlet-chamber 4. We have already seen that the pressure in chamber 4 communicates through passage 41 with chamber 26 and affects one side of the flexible diaphragm 27. Hence this diaphragm is always exposed to the action of the low pressure. It must also be remembered that the main piston 8, which controls the regulating-valve, is never moved except by the action of high-pressure fluid, which is introduced at one side or the other thereof, accordingly as the valve is to be opened or closed, this introduction being controlled by the auxiliary valve, the position of which valve is itself regulated by the action of the low-pressure fluid on the flexible diaphragm. Now suppose that the pressure in the low-pressure chamber 4—that is to say, the pressure below the main valve 6—becomes reduced below the desired point. This means that the pressure on the diaphragm 27 is similarly reduced, and the result of this reduction of pressure (which will obviously be to a degree below the power of the spring 25) will be to shift the auxiliary valve 18 from the position shown in Fig. 1 to a position in the opposite end of the casing 17, where it will cover and cut off from the high pressure, the lower cylinder-port 13 will cover and cut off the connection between the upper end of cylinder 9 and the exhaust 16, and will open the cylinder-port 14 to the upper end of the valve-chamber 17, so that high-pressure fluid flowing from chamber 5 through port 12 may pass through the perforations 19 in the valve 18, and thus reach the upper end of cylinder 9, and thereby open the valve 6, so that high pressure may pass into the low-pressure chamber 4. Although the movement of the valve 18, to which I have alluded, has cut off the port 13, so that it does not now act as a port for delivering high pressure to the lower end of cylinder 9, it has nevertheless connected said port with chamber 42, so that as the piston 8 descends the pressure on the advancing face thereof can pass out through the ports 13 and 16, and thus make its way to the low-pressure chamber 4. At this time pressure will continue to flow from chamber 5 to chamber 4 until the degree of pressure in chamber 4 and in chamber 26 against the diaphragm 27 rises to such a degree as to move the diaphragm 27 and change the position of the valve 18, when the operation of the reducing-valve will be such as to close the main valve 6, and thus prevent the further introduction of high-pressure fluid into the low-pressure chamber 4.

I have provided means whereby the spring 25 or the diaphragm 27, either or both, may be removed while pressure is on the valve, so as to permit either a new diaphragm or a new spring to be put in within a very short time without affecting the operation of the valve. In order to do this, I provide a suitable device—as, for example, a forked wedge 36, (shown in detail at the left-hand side of Fig. 1)—which wedge is adapted to embrace the valve-rod 20 and to be forced in between the plate 34 and a fixed collar 38, which is pinned to the rod 20, the effect of thus thrusting in the wedge between plate 34 and collar 38 being to lift the rod 20 and the valve 18, so that the latter will be held for the time being in the upper end of the chamber 17. If now the cock 31 be closed, the passage 41 shut off, so that pressure cannot pass to the diaphragm-chamber 26, the nut-provided pipe unscrewed from the diaphragm-chamber 26, and one or more bolts that secure the sections of the diaphragm-chamber together be removed, the old diaphragm can be taken out and a new one substituted therefor, or a new spring can be substituted for the old one, or in case no repairs or substitution of new parts is needed the wedge 36 will perform a very important function at such times, as a stop-valve may be needed in lieu of a reducing-valve to convert my present reducing-valve into a stop-

valve, for by applying the wedge in the manner described the valve may be used as a stop-valve, for when the wedge is in its position the low pressure will be effectually closed against the high pressure and the main regulating-valve be kept closed and unused, a condition which will continue until the wedge has been removed.

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

1. In a pressure-reducing valve, the combination of a main-valve chest having a high-pressure inlet-chamber and a low-pressure outlet-chamber, a valve between the two chambers, a cylinder on the valve-chest, a piston in said cylinder, which piston is connected to the main valve and is reciprocated only by the action of the high pressure as it is applied to one side or the other thereof, a valve-chamber on the wall of the cylinder, an auxiliary valve in said chamber for controlling the admission of the high pressure to the said valve-operating piston, and a diaphragm-containing chamber together with its diaphragm for moving the valve in one direction, which diaphragm is constantly exposed on one side to the low pressure, together with means for moving the auxiliary valve in the other direction.

2. In a pressure-reducing valve, the combination of the main-valve chest having a high-pressure inlet-chamber and a low-pressure outlet-chamber, and a valve-seat between the two chambers, a main regulating-valve arranged in connection with said seat, a cylinder contiguous to the valve-chest, a piston in said cylinder whose rod is connected to the main valve, a valve-chamber on the cylinder and an auxiliary valve in said chamber for controlling the admission of high pressure to the cylinder in order that it may act on one side or the other of the piston for the purpose of opening or closing the main valve, said auxiliary valve having passages running through it from one end to the other, a diaphragm-chamber containing a flexible diaphragm which is connected to the stem of the auxiliary valve, a passage between the low-pressure chamber and the diaphragm-chamber which causes low pressure to be constantly applied to one side of the diaphragm, and a spring for moving the auxiliary valve in a direction opposite to that in which it is moved by the diaphragm.

3. In a pressure-reducing valve, the combination of a main-valve chest having a high-pressure inlet-chamber and a low-pressure outlet-chamber, a valve between the two chambers, a cylinder on the valve-chest, a piston in said cylinder which piston is connected to the main valve and is reciprocated by the action of the high pressure as it is applied to one side or the other thereof, an auxiliary valve having a valve-rod, a diaphragm on said valve-rod which is exposed to the low pressure, and means adapted to engage the valve-rod for the purpose of so locating the auxiliary valve as that the main valve will temporarily remain closed and thus the whole reducing-valve mechanism be temporarily converted into a stop-valve.

4. In a pressure-reducing valve, the combination of a main-valve chest having high-pressure and low-pressure chambers, a valve between the chambers, a cylinder on the valve-chest having a piston whose stem is connected to the main valve, said piston being of larger area than the valve and being actuated only by high-pressure fluid, an auxiliary valve controlling ports leading into opposite ends of the cylinder, said auxiliary valve itself having ports running through it from one end to the other, a valve-chamber on the wall of the cylinder for containing said auxiliary valve, an exhaust-port for conveying high-pressure fluid from one side or the other of the piston to the low-pressure chamber, a diaphragm-containing chamber connecting through a passage with the low-pressure chamber, said passage being provided with a cock, a diaphragm in said chamber connected to the auxiliary-valve rod and exposed on one side to low pressure and a spring for moving the auxiliary valve in a direction opposite to that in which it is moved by the diaphragm.

Signed at New York city this 26th day of October, 1901.

CHARLES H. BUCKELEW.

Witnesses:
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RITA BRADT.