J. R. BROWN.

PRESSURE REGULATOR.

APPLICATION FILED NOV. 20, 1909.

959,708.

Patented May 31, 1910.

2 SHEETS—SHEET 1.

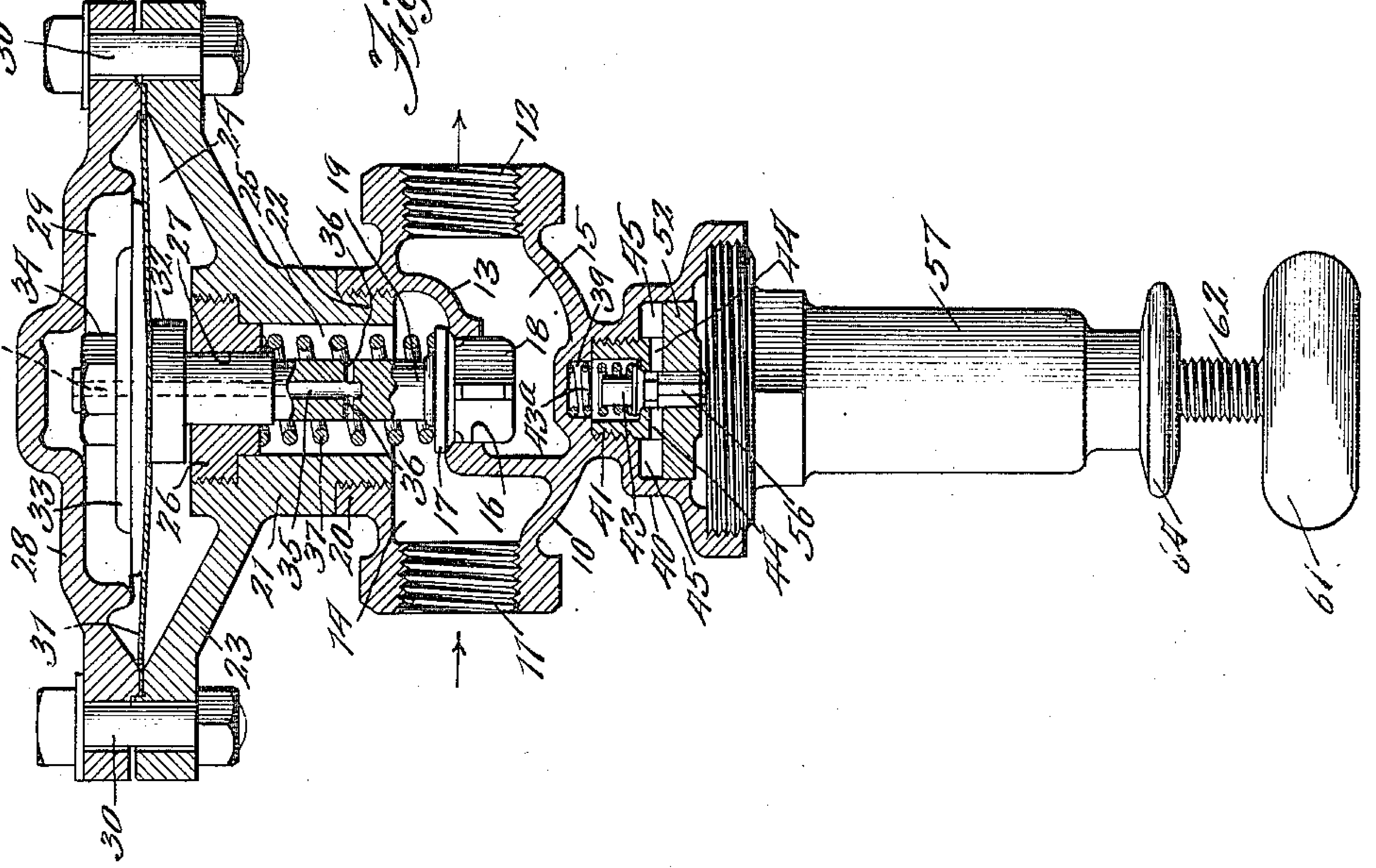

Fig. 2.

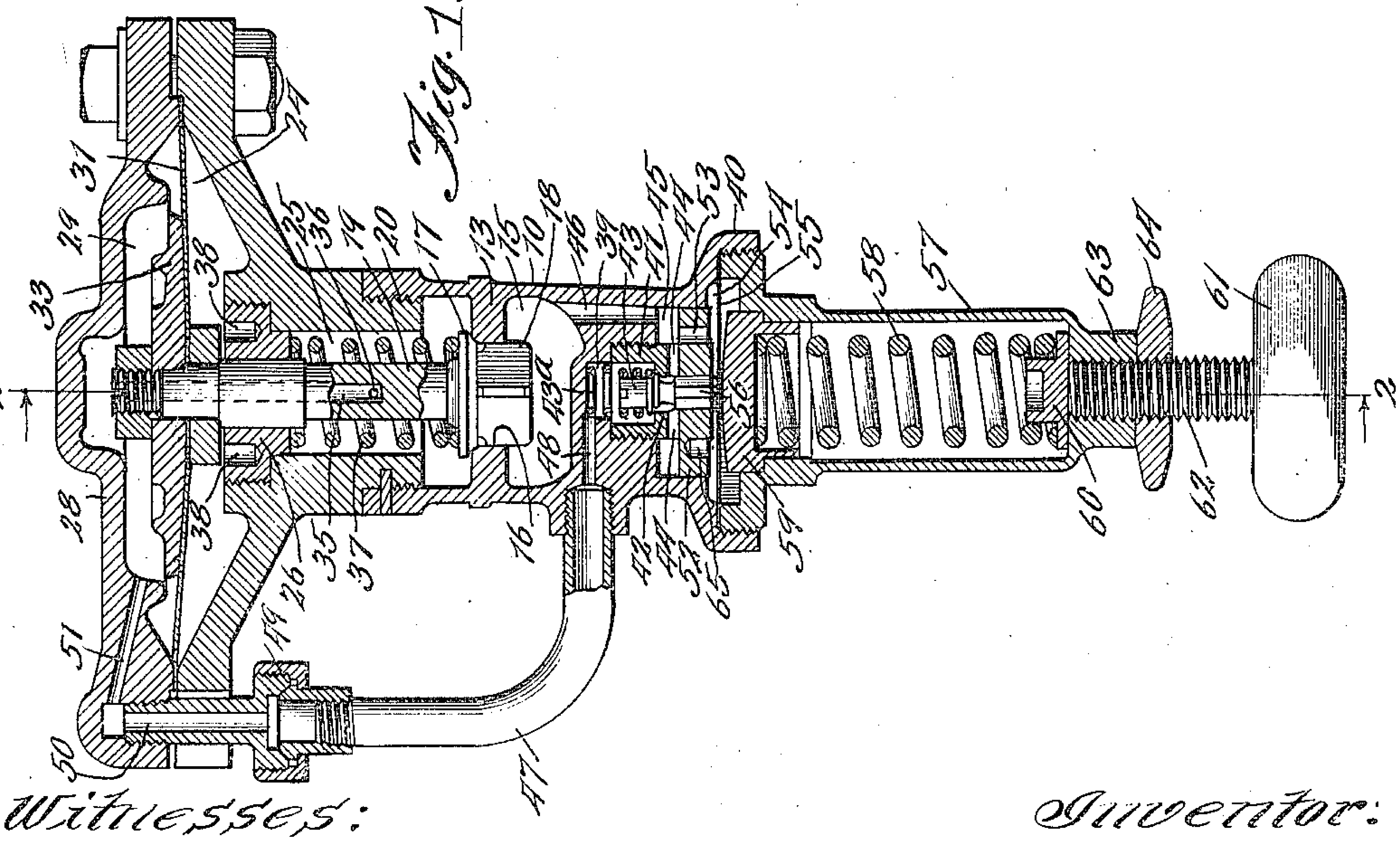

Fig. 1.

Witnesses:

Ira D. Perry

J. H. Jochum, Jr.

Inventor:

John Rowland Brown

By Brown & Hopkins

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2 SHEETS—SHEET 2.

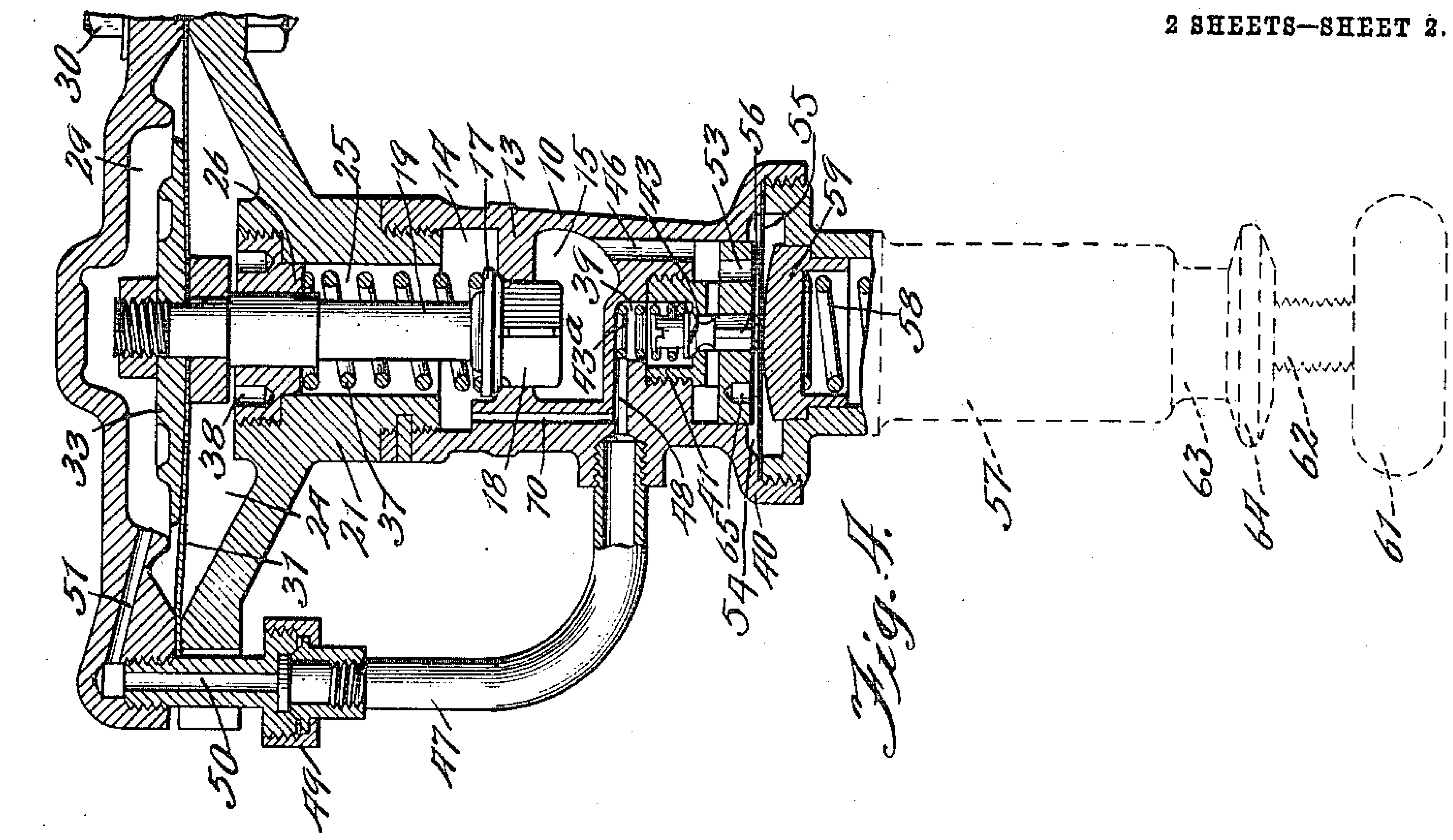

Fig. 4.

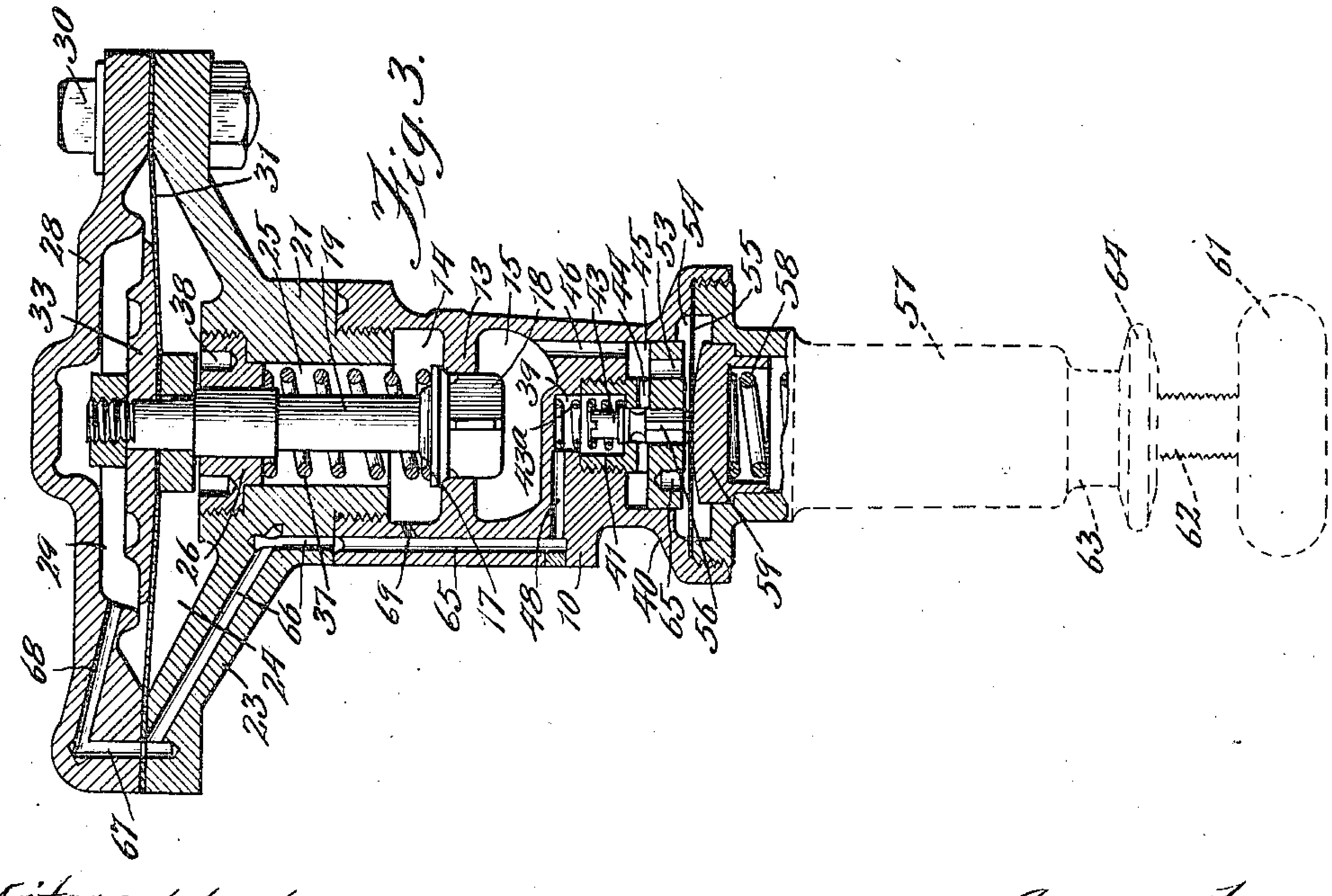

Fig. 3.

Witnesses:

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J. H. Jochum, Jr.

Inventor:

John Rowland Brown

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UNITED STATES PATENT OFFICE.

JOHN ROWLAND BROWN, OF MANSFIELD, OHIO, ASSIGNOR TO OHIO BRASS COMPANY, OF MANSFIELD, OHIO, A CORPORATION OF NEW JERSEY.

PRESSURE-REGULATOR.

959,708. Specification of Letters Patent. **Patented May 31, 1910.**

Application filed November 20, 1909. Serial No. 529,031.

To all whom it may concern:

Be it known that I, JOHN ROWLAND BROWN, a citizen of the United States, residing at Mansfield, in the county of Richland and State of Ohio, have invented certain new and useful Improvements in Pressure-Regulators, of which the following is a specification.

This invention relates to improvements in pressure regulators, and more particularly to fluid pressure reducing valves for reducing high pressure of fluid to low pressure for various purposes and uses, and one of the objects of the invention is to provide improved means for automatically controlling the operation of the main valve to regulate the pressure on the service side and for preventing the valve from opening when the pressure is first turned on to the valve.

A further object is to provide improved means for sustaining or causing the valve to float, when in service, thereby preventing the valve from opening and closing at intervals, the opening of the valve varying to meet the demands on the service side of the valve.

A further object is to provide an improved device of this character in which is employed a main valve and a valve for automatically controlling the operation of the main valve, and improved means whereby either of the valves may be removed independently of each other.

A further object is to provide an improved device of this character embodying a main valve and a valve for controlling the main valve, a regulating mechanism for the controlling valve, and improved means whereby the regulating mechanism of the controlling valve may be readily removed without shutting off the supply of fluid.

A further object is to provide an improved device of this character which will be simple in construction and effective and efficient in operation.

To the attainment of these ends and the accomplishment of other and useful objects as will appear, the invention consists in the features of novelty in the construction, combination and arrangement of the several parts hereinafter more fully described and claimed and shown in the accompanying drawings illustrating the embodiment of the invention, in which—

Figure 1 is a longitudinal sectional view of an improved device of this character constructed in accordance with the principles of this invention; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1, with some of the parts in elevation; Fig. 3 is a view similar to Fig. 1, of another form of valve with parts broken away; Fig. 4 is a view similar to Fig. 3, of still another form of valve mechanism.

Referring more particularly to the drawings and in the exemplification of the invention shown in Figs. 1 and 2, the numeral 10 designates generally a valve casing or housing provided with an inlet opening 11 for the supply of fluid or initial pressure, and an outlet opening 12 arranged on the service side of the valve. The housing 10 is provided with a partition 13 dividing the same into the usual chambers 14, 15, and this partition is provided with an opening 16 forming a communicating passage between the chambers 14 and 15. The main valve 17 is provided for controlling the opening 16 and this valve is provided with guide wings 18 entering the port or passage 16 and a stem 19 which projects above the valve and the main housing 10 of the valve.

The valve housing 10 is provided with a threaded aperture 20 preferably extending through the top thereof, and a member 21 is provided with a reduced threaded extremity 22 having peripheral screw threads adapted to engage the threads in the aperture or opening 20 when the extremity of the member 21 is projected thereinto for securing the member 21 to the valve housing. This member 21 is provided with a portion 23 having a diameter somewhat larger than the diameter of the portion 21 and is recessed or hollowed out to form an upwardly opening chamber 24. The member 21 is provided with an opening 25 extending therethrough which has communication with the chamber 14 in the valve housing at one end, and a guide nut or bearing 26 is removably seated in the member 21 adjacent the other end of the opening 25. This nut or bearing 26 is provided with an aperture 27 passing therethrough and through which aperture the stem 19 of the valve 17 loosely passes to form a restricted fluid passage, and the stem of the valve projects through the nut or bearing 26 and beyond the member 23. A cover or

cap 28 having a recess or cavity 29 is provided for the member 21 and is of a diameter substantially equal to the diameter of the portion 23. This cover or cap is removably secured in position in any desired or suitable manner, preferably by means of fastening devices 30 which pass therethrough and through the portion 23. Arranged within the compartment formed by the recessed portions 24, 29 is a fluid influenced element 31, which, in the present exemplification of the invention is shown as a diaphragm, and this diaphragm is arranged to divide the compartment into the two chambers 24, 29, one above the other. The stem 19 of the valve 17 is connected to the diaphragm 31 in any desired or suitable manner, preferably by means of a collar 32 on the lower side of the diaphragm and a hub 33 and fastening nut 34 on the other side of the diaphragm, and in such a manner that the stem of the valve will project through the diaphragm and terminate within the chamber 29 above the diaphragm. The hub 33 is preferably provided for the purpose of forming a support for the diaphragm to relieve it of excessive strain. A port or passage 35 is provided in the valve stem 19 extending longitudinally thereof and opening through the extremity of the stem to form a communication with the chamber 29 above the diaphragm. The valve stem is also provided with transverse ports or passages 36 which extend through the sides of the stem and form communications between the port or passage 35 and the chamber 14 on the inlet or initial pressure side of the valve.

An elastic member 37, such as a coil spring or the like, is provided for assisting in seating the main valve 17, and this elastic member 37 preferably surrounds the valve stem with one end engaging and resting against the valve 17 and the other extremity engaging and resting against the adjustable removable nut or bearing 26, which latter may be provided with suitable key seats 38 for adjusting the same. The valve housing 10 is also provided with a chamber 39 which preferably opens through the bottom of the housing and the housing is provided with an enlarged portion 40 surrounding the chamber and projecting therebeyond. Arranged within the enlarged portion of the valve housing 10 and to project into the chamber 39 is a removable controller valve seat 41 which is provided with a port or passage 42. A controller valve 43 is arranged within the port or passage 42 to control the latter and an elastic member 43ª, such as a coil spring or the like, is arranged within the chamber 39 for the purpose of seating the controller valve 43. The valve seat 41 is provided with ports or passages 44 having communication with the port or passage 42 and also with a chamber 45 formed in the enlarged portion 40 of the valve housing or casing 10 and a port or passage 46 is also provided in the valve housing or casing 10 which forms communication between the chamber 45 and the chamber 15 on the outlet or service side of the partition 13 in the valve housing 10, so that fluid may be discharged from the chamber 39 through the ports or passages 44 into the chamber 45 and from the chamber 45 to the chamber 15, through the medium of the port or passage 46, when the valve 43 is unseated.

A tubular member 47 is provided for connecting the chamber 29 with the chamber 39 and this tubular member 47 is removably secured by one extremity to the valve housing or casing 10 and has communication with a port or passage 48 in the body portion of the casing, which passage has communication with the chamber 39. The other extremity of the tubular member 47 is removably connected to the cap or cover 28 by means of a suitable coupling designated generally by the reference numeral 49. This coupling is provided with a tubular member 50 which has communication with a port or passage 51 formed in the cap or cover 28 and which port or passage has communication with the chamber 29 on the outlet side of the diaphragm 31, so that the fluid which enters the chamber 29 through the ports or passages 36, 35 in the valve stem 19 may be discharged therefrom through a port or passage 51, tubular member 50 of the coupling 49, tubular member 47, port or passage 48, into the chamber 39 and out of the chamber 39 when the valve 43 is unseated, in the manner already set forth.

The removable controller valve seat 41 is preferably provided with an enlarged portion 52 which forms one of the walls of the chamber 45, and a passage 53 is formed in this enlarged portion, which passage forms communication between the chamber 45 and a chamber 54. A controlling diaphragm 55 extends across the chamber 54 to form one wall thereof, which diaphragm is arranged to be acted upon by the fluid discharged in the chamber 54 so that the movement of the diaphragm in one direction will be controlled by the pressure of the fluid thereon. The controlling valve 43 is preferably provided with guide wings 56 which extend through and beyond the removable seat so as to engage and rest against the diaphragm 55 and within the chamber 54 so that when the diaphragm 55 is moved in the opposite direction or against the pressure of the fluid thereon, the controlling valve 43 will be unseated against the tension of the elastic member 43ª. The fluid which enters the chamber 54 when the controlling valve 43 is unseated, will be discharged from the chamber 54 and into the chamber 15 in the valve housing 10 on the service side of the

valve through the medium of the port 53, chamber 45 and port or passage 46. With this improved construction it will be apparent that the controlling diaphragm 55 is subject to the pressure on the service side of the valve. The diaphragm 55 may be removably supported and held in position in any desired or suitable manner, but preferably by means of a casing 57, one end of which is removably secured to the portion 40 of the valve housing or casing 10, which portion is shouldered to receive the diaphragm. Arranged within the casing 57 is an elastic regulating member 58, such as a coil spring or the like, one extremity of which engages a hub or head 59, which latter engages and rests against the side of the diaphragm 55 opposite to that against which the wings 56 of the controlling valve 43 engage. The other extremity of the elastic member 58 has engagement with an adjustable member 60, which latter is controlled by an operating handle 61 secured to the extremity of an adjusting screw 62, and which latter has a bearing in a portion 63 of the casing 57, so that by the operation of the member 61 the adjusting screw 62 will be moved in its bearing 63 to vary the tension of the elastic member 58, and consequently, the pressure of the head or hub 59 on the diaphragm 55. A suitable lock nut 64 is provided for locking or holding the screw 62 in its adjusted position.

With this improved construction it will be apparent that by unscrewing or detaching the casing 57, the regulating spring or elastic member 58 and the diaphragm 55 for controlling the valve 43, may be readily removed without turning or shutting off the fluid from the valve, and this forms a convenient method or means whereby it may be determined whether the controlling valve fits tightly upon its seat. Access may be had to the controlling valve 43 by removing or unscrewing the valve seat 41, for which purpose key seats 65 may be provided in the seat 41. By removing the cover or cap 28, it will be apparent that access may be had to the main fluid influenced element or diaphragm 31, and access may be had to the guide nut or bearing 26, and after detaching the latter, the main valve 17 and the elastic member or spring 37 may be readily lifted out. In assembling the parts, there is no adjustment necessary and it is only necessary to have all of the parts and the passages clean and to have the joints tight.

Referring to the form of the invention shown in Fig. 3, the tubular member 47 is dispensed with, and in its place the valve housing or casing 10 is provided in its body portion with a port or passage 65, which has communication with a port or passage 66 in the member 21 and the enlarged portion 23 thereof. This port or passage 66 has communication with a port or passage 67 in the cap or cover 28 corresponding with the port or passage formed by the tubular member 50 of the coupling 49 shown in Fig. 1, and this port or passage 67 has communication with a port or passage 68 in the cap or cover 28 corresponding with the port or passage 51 of Fig. 1, and which port or passage 68 has communication with the chamber 29. In this form of the invention the ports or passages 35, 36 in the valve stem 19 are dispensed with and a port or passage 69 is provided in the body portion of the valve housing or casing which has communication with the port or passage 65 and the chamber 14 on the inlet or initial pressure side of the valve and serves the same function as the passages 35, 36 in the valve stem, to wit—for conveying fluid into the chamber 29 above the diaphragm 31.

In the form shown in Fig. 4, the tubular member 47 is retained, but the ports or passages 35, 36 in the valve stem are dispensed with and in their place, there is provided a port or passage 70 which is arranged in the body portion of the valve housing or casing 10 and has communication with the port or passage 48 and the chamber 14 on the supply or initial pressure side of the valve and serves as a means for conveying fluid into the chamber 29 above the diaphragm 31 when the controlling valve 43 is seated.

From the above description it is thought that the operation will be clearly understood, but briefly stated, it is as follows; reference being had particularly to Figs. 1 and 2, although the operation is the same in all forms of the invention, with the exception of the changes above noted. The supply or initial pressure of fluid enters the valve housing or casing 10 through the inlet opening 11 into the chamber 14 and passes into the chamber 25 through the restricted fluid passage formed between the valve stem and the adjustable bushing or nut 26, into the chamber 24 and beneath the main fluid influenced element or diaphragm 31, and at the same time fluid will flow through the ports 36, 35 in the valve stem 19 to the chamber 29 on the opposite side of the fluid influenced element or diaphragm 31. With the pressure balanced on both sides of the element or diaphragm 31, the fluid pressure and the spring or elastic member 37 will hold the main valve 17 closed. If the handle 61 should now be adjusted and a compression put upon the elastic member or spring 58, the diaphragm 55 will be forced upwardly through the medium of the head or hub 59 until there is sufficient pressure on the upper side of the diaphragm to balance the compression of the elastic member 58. When the diaphragm 55 is forced upwardly, it lifts the controlling valve 43 from its seat and permits fluid to flow from the chamber

29 above the fluid influenced element or diaphragm 31 through the port or passage 51, tubular member 50, tubular member 47, port or passage 48, into the chamber 39, from the chamber 39 and through the port or passage 42, passages 44, chamber 45, port or passage 46 to the chamber 15 on the service side of the valve. The area of the fluid influenced element or diaphragm 31 is preferably arranged so as to be approximately twenty-five to thirty times the area of the main valve 17 and with this proportion it is only necessary that the pressure in the chamber 29 drop below that in the chamber 24 an amount equal to one twenty-fifth (1/25) of the difference of the pressure at the inlet and service sides of the valve. With these proportions the maximum difference of pressure between the chambers 29, 24 need therefore never be in excess of eight pounds, and generally less than five pounds, disregarding the presence of the elastic member or element 37, which element does not change the conditions to any extent.

With this improved construction the fluid influenced element or diaphragm 31 is therefore not subject to any great strain due to differences in pressure on opposite sides thereof, but when the pressure in the chamber 29 drops sufficiently, the fluid influenced element or diaphragm 31 will lift the main valve 17 from its seat and deliver fluid to the service side of the valve. The service pressure, as before stated, acts upon the diaphragm 55 through the passage 46, chamber 45 and passage 53, and as soon as it is great enough to overcome the tension of the elastic element or spring 58, it moves the diaphragm 55 so as to permit the controller valve 43 to be seated. This operation prevents any flow of fluid from the chamber 29 and the pressure will build up through the ports 36, 35 until the main valve 17 closes. In service the valve will not open and close at intervals, but practically floats; the opening of the valve varying to meet the demands on the service side of the valve, and, furthermore, the chamber 24 with the restricted passage through the nut prevents the valve from immediately opening when the pressure is first turned on to the valve and before the pressure has had time to build up in the chamber 29. It also acts as a cushion when the valve closes.

As above set forth, the operation of the forms of the invention shown in Figs. 3 and 4 is identical, with the exception of the pressure building up in the chamber 29 through the ports or passages 36, 35 in the valve stem. The pressure will build up in these chambers from the fluid passing respectively through the ports, 69, 70 in Figs. 3 and 4 from the chamber 14 on the supply or initial pressure side of the valve.

In order that the invention might be fully understood, the details of the foregoing embodiments thereof have been thus specifically described, but

What is claimed as new is—

1. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of fluid therethrough, a fluid influenced element with which the said valve is connected for operation, a chamber on one side of the said element, a restricted passage connecting said chamber with the initial pressure side of the valve, a chamber on the other side of said element, a passage leading from the last said chamber to the initial pressure side of the valve, a port or passage leading from the last said chamber to the service side of the valve, and means for automatically controlling the last said passage to regulate the pressure on the service side of the valve.

2. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of fluid therethrough, a fluid influenced element, with which the said valve is connected for operation, a chamber on the opening side of the said element, a restricted passage connecting said chamber with the initial pressure side of the valve, a chamber on the closing side of said element, a passage connecting the last said chamber with the initial pressure side of the valve, a port or passage leading from the last said chamber to the service side of the valve, a second valve for controlling the last said port or passage, and means for automatically operating the last said valve to regulate the pressure on the service side.

3. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of fluid therethrough, a fluid influenced element with which the said valve is connected for operation, a chamber on the opening side of the said element and having a restricted passage connecting it with the initial pressure side of the valve, a chamber on the closing side of said element, a port or passage connecting the last said chamber with the initial pressure side of the valve, a port or passage leading from the last said chamber, a second valve for controlling the last said passage, means for automatically operating the last said valve to regulate the pressure on the service side, and means whereby either of said valves may be removed independently of the other valve.

4. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of the fluid therethrough, a fluid influenced element with which the said valve is connected for operation, a chamber on the opening side of said element and having a restricted passage connecting it with the initial pressure side of the valve, a chamber on the closing side of said element, a port or passage connecting the last said chamber with the initial pressure side of the valve, a port or passage leading from the last said chamber to the service side of the valve, a valve controlling the last said passage, a chamber having communication with the service side of the valve, and a fluid influenced element in the last said chamber and operating to control the movement of the last said valve.

5. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of the fluid therethrough, a fluid influenced element with which the said valve is connected for operation, a chamber on the opening side of said element and having a restricted passage connecting it with the initial pressure side ofthe valve, a chamber on the closing side of said element, a port or passage connecting the last said chamber with the initial pressure side of the valve, a port or passage leading from the last said chamber to the service side of the valve, a valve controlling the last said passage, a chamber having communication with the service side of the valve, means for seating and means for unseating the last said valve to regulate the pressure on the service side, and means for automatically controlling the movements of the last said valve.

6. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of the fluid therethrough, a fluid influenced element with which the said valve is connected for operation, a chamber on the opening side of said element and having a restricted passage connecting it with the initial pressure side of the valve, a chamber on the closing side of said element, a port or passage connecting the last said chamber with the initial pressure side of the valve, a port or passage leading from the last said chamber to the service side of the valve, a valve controlling the last said passage, a chamber having communication with the service side of the valve, means for seating and means for unseating the last said valve to regulate the pressure on the service side, and a fluid influenced element in the last said chamber for automatically controlling the said valve seating and unseating means.

7. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for regulating the passage of fluid therethrough, a fluid influenced element with which the valve is connected for operation, a chamber on the opening side of the element, a restricted passage connecting the chamber with the initial pressure side of the valve, a chamber on the closing side of the said element and separate from the first said chamber, a port or passage leading from the initial pressure side of the valve and discharging into the second said chamber, a port or passage also having communication with the second said chamber and with the service side of the valve, and a valve for automatically controlling the last said passage to regulate the pressure on the service side.

8. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for controlling the passage of fluid therethrough, a valve stem connected with the valve, a fluid influenced element with which the valve stem is connected for operation of the valve, a chamber on the opening side of the said element, a restricted passage connecting said chamber with the initial pressure side of the valve, a chamber on the closing side of the said element and separate from the first said chamber, said valve stem being provided with a passage therethrough forming a communication between the initial pressure side and the second said chamber, a port or passage connecting the second said chamber with the service side of the valve, a valve for controlling the last said passage, and means for automatically operating the last said valve.

9. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for controlling the passage of fluid therethrough, a valve stem connected with the valve, a fluid influenced element with which the valve stem is connected for operation of the valve, a chamber on the opening side of the said element, a restricted passage connecting said chamber with the initial pressure side of the valve, a chamber on the closing side of the said element and separate from the first said chamber, said valve stem being provided with a passage therethrough forming a communication be-

tween the initial pressure side and the second said chamber, a port or passage connecting the second said chamber with the service side of the valve, a valve for controlling the last said passage, a chamber adjacent the last said valve, said chamber having communication with the service side of the valve, and a fluid influenced element in said chamber for controlling the action of the last said valve.

10. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with the seat for controlling the passage of fluid therethrough, a valve stem connected with the valve, a fluid influenced element with which the valve stem is connected for operation of the valve, a chamber on the opening side of the said element, a restricted passage connecting said chamber with the initial pressure side of the valve, a chamber on the closing side of the said element and separate from the first said chamber, said valve stem being provided with a passage therethrough forming a communication between the initial pressure side and the second said chamber, a port or passage connecting the second said chamber with the service side of the valve, a valve for controlling the last said passage, a chamber adjacent the last said valve, said chamber having communication with the service side of the valve, a fluid influenced element in said chamber for controlling the last said valve, and means whereby access may be had to either of the said fluid influenced elements, without interfering with the other of the said fluid influenced elements.

11. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat disposed between said inlet and outlet, a valve coöperating with said seat for controlling the passage of the fluid therethrough, a fluid influenced element with which the said valve is connected for operation, a chamber on the opening side of the said element, a restricted passage connecting said chamber with the initial pressure side of the valve, a chamber on the closing side of said element, an external port or passage having communication with the last said chamber and the service pressure side of the valve, a port or passage also having communication with the last said chamber and the initial pressure side of the valve, a valve for controlling the connection of the said external port or passage with the service pressure side, and means for automatically controlling the last said valve.

12. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat between the inlet and outlet, a valve coöperating with the seat for controlling the passage of fluid therethrough, a fluid influenced element with which the valve is connected for operation, a chamber on one side of said element, a restricted passage connecting the chamber with the initial pressure side of the valve, a chamber on the other side of the said element, said chamber having communication with the initial pressure and the service sides of the valve, a regulating valve for controlling the connection of the second said chamber with the service side of the valve, means for automatically controlling the said regulating valve from the service side, and means whereby access may be had to said regulating valve without shutting off the fluid from the regulator.

13. In a pressure regulator, a casing having an initial pressure inlet and a service pressure outlet, a valve seat between the inlet and outlet, a valve coöperating with the seat for controlling the passage of fluid therethrough, a fluid influenced element with which the valve is connected for operation, a chamber on one side of said element, a restricted passage connecting the chamber with the initial pressure side of the valve, a chamber on the other side of the said element, said chamber having communication with the initial pressure and the service sides of the valve, a regulating valve for controlling the connection of the second said chamber with the service side of the valve, a chamber adjacent the regulating valve, a fluid influenced element in the last said chamber for controlling the regulating valve, the last said chamber having communication with the service side of the regulator, and means whereby access may be had to the last said fluid influenced element without shutting off the supply of fluid to the regulator.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 15th day of November A. D. 1909.

JOHN ROWLAND BROWN.

Witnesses:
C. V. MARKS,
G. L. BUCHAN.