No. 650,725. Patented May 29, 1900.

J. P. METZGER.

PRESSURE REGULATOR.

(Application filed Mar. 21, 1900.)

(No Model.) 2 Sheets—Sheet 1.

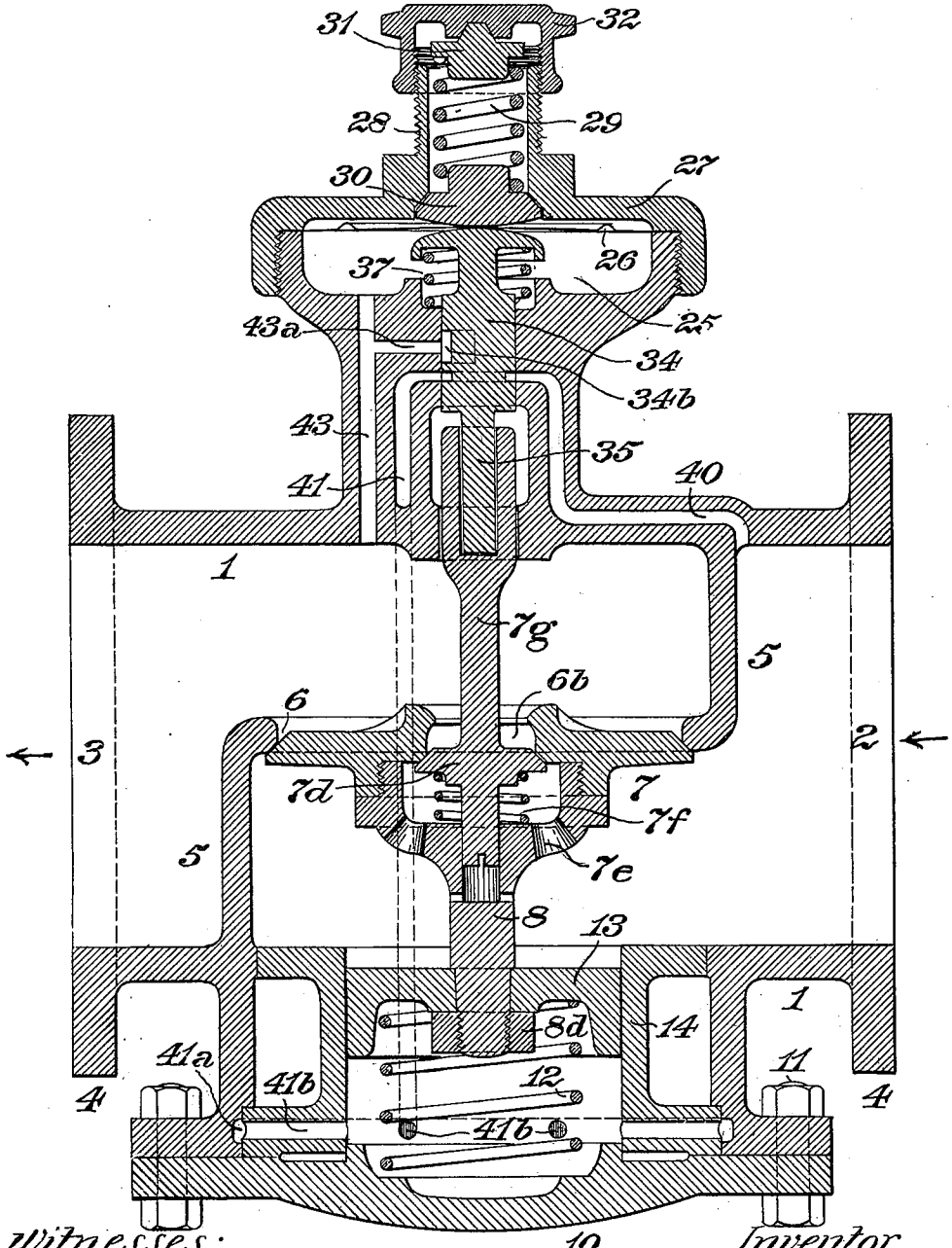


Fig. 1.

Witnesses:
J. L. Lewis
Henry Whitehouse

Inventor
Julius P. Metzger
By J. Howden Bell
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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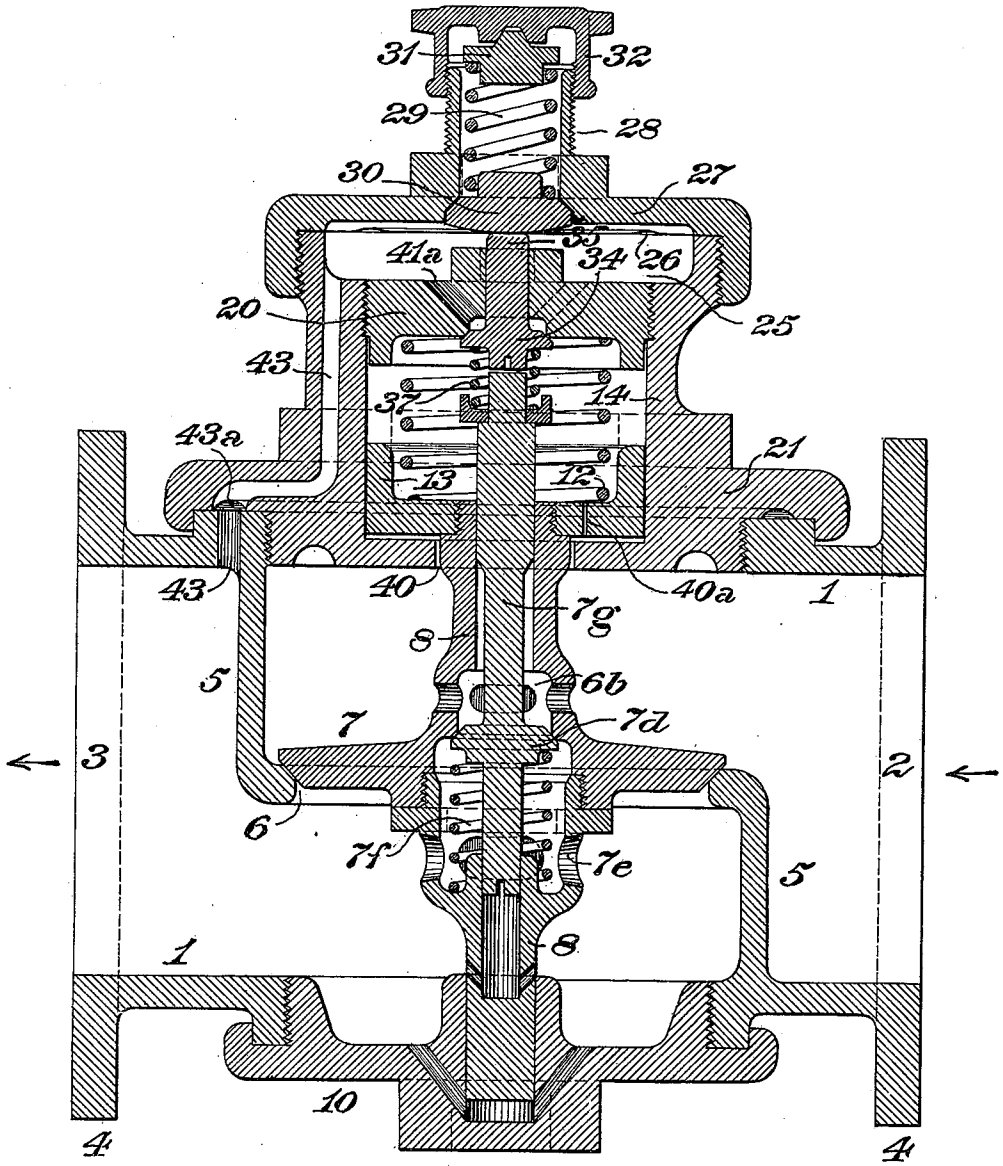


Fig. 2.

Witnesses:
J. L. Lewis
Henry White Lowe

Inventor
Jules P. Metzger
By J. Howden Bell
atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JULES P. METZGER, OF NEW YORK, N. Y., ASSIGNOR TO JOHN S. LESLIE, OF PATERSON, NEW JERSEY.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 650,725, dated May 29, 1900.

Application filed March 21, 1900. Serial No. 9,543. (No model.)

To all whom it may concern:

Be it known that I, JULES P. METZGER, of the borough of Manhattan, in the city and State of New York, have invented a certain new and useful Improvement in Pressure-Regulators, of which improvement the following is a specification.

My invention relates to pressure-regulating appliances of the general class which are exemplified in an application for Letters Patent of the United States filed by me November 24, 1899, Serial No. 738,125, (Case A,) and is an improvement upon certain features of the pressure-regulators set forth in my application, Serial No. 741,811, filed December 28, 1899, (Case C,) and in my application, Serial No. 9,542, filed of even date herewith, (Case D.)

In my two last aforesaid applications for the purpose of enabling a reduction to be made in the diameter of the valve-actuating piston and its chamber or cylinder—a consideration which is of substantial importance in all pressure-regulating appliances of the type to which those of said applications relate—I have illustrated the main or regulating valve as of the balanced double-beat puppet type.

The object of my present invention is to attain the same advantage as to reduction of the size of the piston and its chamber, while obviating the necessity for employing a double-beat valve, which necessitates a comparatively-large valve-casing.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a longitudinal central section through a pressure-regulator, illustrating an embodiment of my invention; and Fig. 2, a similar section through a pressure-regulator, illustrating a different location of the piston and piston-chamber.

The general combination of operative members and the operative principle thereof are in all essential particulars similar in my present invention to those of the appliances set forth in my several applications aforesaid, and the same need not therefore be herein fully and at length described. The members which are not herein claimed will therefore be referred to only so far as may be necessary to explain the relation thereto of my present invention.

Referring first to the construction shown in Fig. 1, the valve casing or shell 1 has an inlet-passage 2 at one end and an outlet-passage 3 at the other, each being provided with a screw-thread, for which a flange may be substituted in larger-sized regulators, for connection with a fluid-pressure pipe. The inlet and outlet passages are separated by a wall or partition 5, extending across the casing and having an opening or passage 6, controlled by a main or regulating valve 7, which is connected, preferably by screw-threads, as shown, to a stem 8 and seats upon a face on the lower side (being that next the inlet-passage) of the partition 5. The opening movements of the regulating-valve 7 are effected by a properly-packed piston 13, which is actuated by fluid under pressure from the inlet side of the casing, as presently to be described, and is fitted to traverse in a piston chamber or cylinder 14, formed upon or preferably, as shown, connected removably to the valve-casing 1 below and in line axially with the regulating-valve 7. The piston 13 is fixed upon the valve-stem 8, preferably, as shown, by being held thereon between a shoulder or collar and a nut 8^d, engaging a screw-thread on the end of the stem. In the instance shown, which is desirably applicable in practice, the piston-chamber 14, which is open at each end, is fitted in an opening in the casing 1 of sufficient size to admit of the insertion, removal, or inspection of the regulating-valve 7. The outer end of the piston-chamber is closed and the chamber firmly secured to the casing 1 by a removable head or cap 10, connected to the casing by bolts 11. The regulating-valve is subject to the pressure of a spring 12, which bears against the lower side of the piston 13 and against the cap 10 and acts in conjunction with the inlet-pressure to seat the valve.

The upper portion of the casing 1 is provided with a projecting portion, which receives a controlling-valve to be presently described and which is recessed at top to form a pressure-chamber 25, which communicates by a port 43 with the outlet side of the casing and is closed at top by a flexible dia-

phragm 26, which is fitted in a central opening in the projecting portion of the casing and is secured peripherally between the face around said opening and a diaphragm-holder 27, connected removably, as by screw-threads, to the casing. The diaphragm-holder and its accessories are substantially similar in all essential particulars to those of my applications aforesaid, and as it does not in and of itself form part of my present invention it need not be herein at length described further than to note that it incloses a lower spring-seat 30, which is pressed against the upper face of the diaphragm 26 by a diaphragm-spring 29.

A central passage 6^b is formed in the regulating-valve 7 and is controlled by an auxiliary or starting valve 7^d, formed upon or fixed to a stem 7^g and normally held seated on the lower or inlet side of the passage 6^b by a spring 7^f. The stem 8 of the regulating-valve is enlarged at and near its connection with said valve and is provided with an internal chamber, which is in constant communication with the inlet-passage 2 of the casing through ports 7^e and communicates with the passage 6^b of the regulating-valve and with the outlet-passage 3 of the casing when the auxiliary valve 7^d is unseated. The auxiliary valve is fitted to work in line axially with the regulating-valve 7, and its stem 7^g is guided at its lower end in the stem 8 of the regulating-valve and at its upper end in an opening in the casing 1.

The exhaust and admission of fluid under pressure from and to the piston-chamber 14 on the lower side of the piston 13 for the purpose of instituting the opening and closing movements, respectively, of the regulating-valve 7 and the opening movements of the auxiliary or starting valve 7^d are effected and regulated by a secondary or controlling valve 34, formed upon or fixed to a stem 35 and adapted to move vertically in a socket formed in the projecting upper portion of the casing 1 in line axially with the diaphragm-spring 29 and with the regulating-valve stem 8. The lower end of the controlling-valve stem 35 fits truly in and bears against the bottom of a socket formed in the upper end portion of the stem 7^g of the auxiliary or starting valve. The controlling-valve 34 is of cylindrical form and is provided with a peripheral groove adapted to establish communication between a port 40, leading from the inlet-passage 2 of the casing to the socket of the controlling-valve, and a port 41, leading from said socket to a communication with the piston-chamber 14 on the lower side of the piston 13. A lateral recess 34^b, formed in the controlling-valve, establishes communication in another position of said valve between the port 41 and a port 43^a, leading from the socket of the controlling-valve to the port 43, which, as before stated, leads to the outlet-passage 3 of the casing. The stem of the controlling-valve is held to a bearing on the inner side of the flexible diaphragm 26 by a spring 37, abutting against a collar on the stem and against a face at the end of the socket in which the controlling-valve is fitted. The port 41 leads downwardly from the controlling-valve socket to an annular groove or recess 41^a, formed in the casing 1, surrounding a flange on the piston-chamber, which fits in a recess or counterbore in the casing, and ports 41^b lead from the recess 41^a to the piston-chamber on the lower side of the piston 13.

When in readiness for operation, the parts being in the positions shown in Fig. 1, fluid under pressure admitted to the inlet-passage 2 passes through the ports 40 and 41, recess 41^a, and ports 41^b to the piston-chamber 14, and the regulating-valve will be held seated by the pressure on the excess of its area above that of the piston and by the spring 12. Upon the depression of the flexible diaphragm 26 and controlling-valve 34 by screwing down to the adjusting device, so as to impose the desired degree of pressure on the diaphragm, the controlling-valve will cut off communication between the supply-port 40 and the port 41 and piston-chamber 14, and the port 41 will be put into communication with the ports 43^a and 43 by the recess 34^b of the controlling-valve. Fluid will thereby be exhausted from the piston-chamber to the outlet-passage of the casing, and fluid from the inlet-passage 2 will act upon the upper side of the piston without opposition from fluid-pressure on the lower side. The auxiliary or starting valve 7^d will be coincidently unseated by the downward movement of the controlling-valve, and fluid under pressure will pass from the inlet-passage 2 to the outlet-passage through the openings 7^e and 6^b in the regulating-valve 7. The regulating-valve being now subject to pressure on both sides, it will be unseated by the unbalanced pressure, which acts on the upper side of the piston 13 and imparts downward movement thereto, and the auxiliary or starting valve will be carried downward with the regulating-valve. The controlling members thereupon operate to effect the desired regulation of pressure substantially in the same manner as those of my several applications aforesaid, except that if there should be a sudden demand for a large quantity of fluid and the regulating-valve should partially close the auxiliary valve would remain unseated and the flow of fluid through the passage 6^b would again more nearly balance it and cause it to again open more fully and afford the desired supply. The auxiliary-valve stem being guided at both its upper and lower ends and the regulating-valve stem being guided by the piston and its chamber, the true axial movement of regulating-valve is insured under all conditions of service.

The modification shown in Fig. 2 accords in all substantial structural and operative

features with that first described and differs therefrom only as to the location of the piston-chamber and the disposition of the ports connected therewith. In this instance the piston-chamber 14 is formed in a top cap 21, secured removably, as by screw-threads, to the casing 1 on the upper side of the regulating-valve 7. An annular recess 43^a is formed in the face of the top cap, which abuts against the casing, so as to maintain continuous communication between the portion of the port 43 leading to the pressure-chamber 25, which is located in the top cap, and the portion which is formed in the casing, regardless of the position which may be assumed by the top cap when screwed down to its adjusted relation to the casing. The top of the piston-chamber 14 is closed by a removable head 20, between which and the piston 13 is interposed the closing-spring 12 of the regulating-valve 7. The controlling-valve 34 is in this instance of the puppet type and is fitted to seat upwardly on a face on the lower side of the head 20 and controls a port 41^a, leading from the piston-chamber 14 to the pressure-chamber 25. Fluid under pressure is admitted from the inlet-passage 2 to the piston-chamber 14 on the lower side of the piston through a port 40, which is shown as formed by a loose fit of the controlling-valve stem 8, to the upper end of which the piston is secured in the wall of the casing which separates the piston-chamber from the inlet-passage 2. It will, however, be obvious that, if desired, the lower end of the piston-chamber might be left entirely open, in which case the open end would perform the function and constitute a mechanical equivalent of the port 40. (Indicated on the drawings.) The piston 13 could also in such case be formed integral with the regulating-valve stem. A restricted port 40^a, formed in the piston 13, permits a limited traverse of fluid from the lower to the upper side thereof.

In the operation of the construction of Fig. 2 fluid from the inlet-passage 2 fills the piston-chamber comparatively slowly through the restricted port, and upon screwing down the adjusting-cap 32 to the proper degree the fluid is exhausted from the piston-chamber to the outlet-passage 3 through the ports 41^a and 43 by the unseating of the controlling-valve 34. The downward movement of the controlling valve simultaneously unseats the auxiliary or starting valve 7^d, as in the instance first described, and fluid passes from the inlet-passage 2 to the outlet-passage 3 through the openings 6^b and 7^e. As the inflow of fluid to the lower side of the piston 13 through the port 40 or through the open lower end of the piston-chamber, as the case may be, is so much more rapid than the passage of fluid through the restricted port 40^a in the piston the pressure below the piston raises the piston and unseats the connected regulating-valve 7, when said valve is exposed to pressure on its opposite sides by the unseating of the auxiliary or starting valve, as in the former instance.

It will be obvious that various structural modifications of the members herein described may be made by those skilled in the art without departure from the essential features and operative principle of my invention, particularly as to the details of connection of the piston and valve chambers and the valve-casing, the regulating-valve and stem, and the form and location of the ports. I do not therefore limit my invention to the specific embodiments thereof which are herein shown and described.

I claim as my invention and desire to secure by Letters Patent—

1. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages separated by a partition, a main or regulating valve controlling a passage in said partition, a piston-chamber on the casing, a piston fitting in said chamber and adapted to impart movement to the regulating-valve, a flexible diaphragm subject to pressure from the outlet-passage, a pressure device bearing on said diaphragm, and means, actuated by the movement of said diaphragm, for facilitating the unseating of the regulating-valve by establishing communication through said valve, while seated, between the inlet and the outlet passages of the casing.

2. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages separated by a partition, a main or regulating valve controlling a passage in said partition, a piston-chamber on the casing, a piston fitting in said chamber and adapted to impart movement to the regulating-valve, a flexible diaphragm subject to pressure from the outlet-passage, a pressure device bearing on said diaphragm, and means, actuated by the movement of said diaphragm, for exhausting pressure from one side of the piston and coincidently establishing communication through the regulating-valve, while seated, between the inlet and outlet passages of the casing.

3. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages separated by a partition, a main or regulating valve controlling a passage in said partition, a piston-chamber on the casing, a piston fitting in said chamber and adapted to impart movement to the regulating-valve, a flexible diaphragm subject to pressure from the outlet-passage, a pressure device bearing on said diaphragm, an auxiliary or starting valve controlling a passage through the regulating-valve, a controlling-valve actuated by movement of the flexible diaphragm and governing the supply and exhaust of fluid to and from the piston, and intermediate connections through which opening movement is imparted to the auxiliary valve in and by movement of the controlling-valve.

4. In a pressure-regulator, the combination of a valve shell or casing having inlet and out-

let passages separated by a partition, a main or regulating valve controlling a passage in said partition, a piston-chamber on the casing, a piston fitting in said chamber and adapted to impart movement to the regulating-valve, a flexible diaphragm subject to pressure from the outlet-passage, a pressure device bearing on said diaphragm, an auxiliary or starting valve controlling a passage through the regulating-valve, ports for the supply and exhaust of fluid to and from the piston-chamber, and a controlling-valve actuated by movement of the flexible diaphragm to coincidently open ports for the exhaust of fluid from the piston-chamber and unseat the auxiliary or starting valve.

5. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages separated by a partition, a main or regulating valve controlling a passage in said partition, a piston-chamber on the casing, a piston fitting in said chamber, said piston being constantly subject, on one side, to pressure from the inlet-passage of the casing and intermittently subject, on its opposite side, to said pressure, a stem connecting the piston and regulating-valve, a flexible diaphragm subject to pressure from the outlet-passage, a pressure device bearing on said diaphragm, and a controlling-valve, actuated by the movement of said diaphragm and governing ports through which pressure is exhausted from one side of the piston.

6. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages separated by a partition, a main or regulating valve controlling a passage in said partition, a piston-chamber on the casing, in line axially with the regulating-valve, a piston fitting in said chamber, a stem connecting the piston and regulating-valve, a flexible diaphragm fixed in a pressure-chamber on the side of the casing opposite to the piston-chamber and subject to pressure from the outlet-passage, a pressure device bearing on said diaphragm, an auxiliary or starting valve controlling a passage through the regulating-valve, ports for the supply and exhaust of fluid to and from the piston-chamber, a controlling-valve bearing on and actuated by movements of the flexible diaphragm, and governing said supply and exhaust ports, a stem fixed to the auxiliary or starting valve and bearing on the controlling-valve, a lower guide for said stem in the stem of the piston and regulating-valve, and an upper guide for said stem in the valve shell or casing.

JULES P. METZGER.

Witnesses:
A. LOEFFLER,
HENRY WHITEHOUSE.