No. 648,592. Patented May 1, 1900.

J. P. METZGER.

PRESSURE REGULATOR.

(Application filed Dec. 28, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 2.

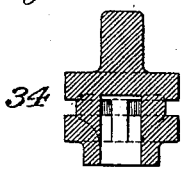
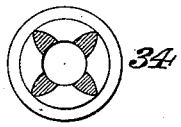


Fig. 3.



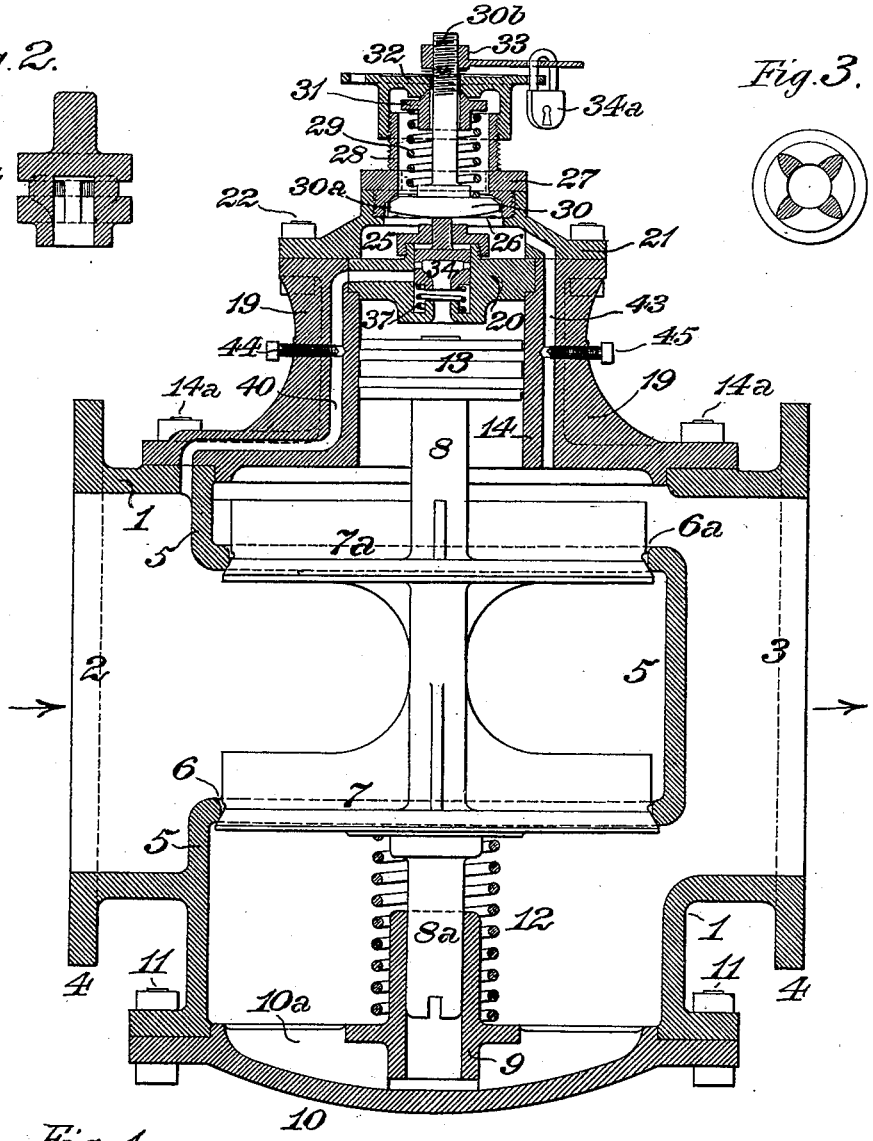
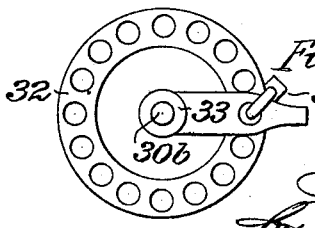


Fig. 1.

Fig. 4.



Witnesses:

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Atty.

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J. P. METZGER.

PRESSURE REGULATOR.

(Application filed Dec. 28, 1899.)

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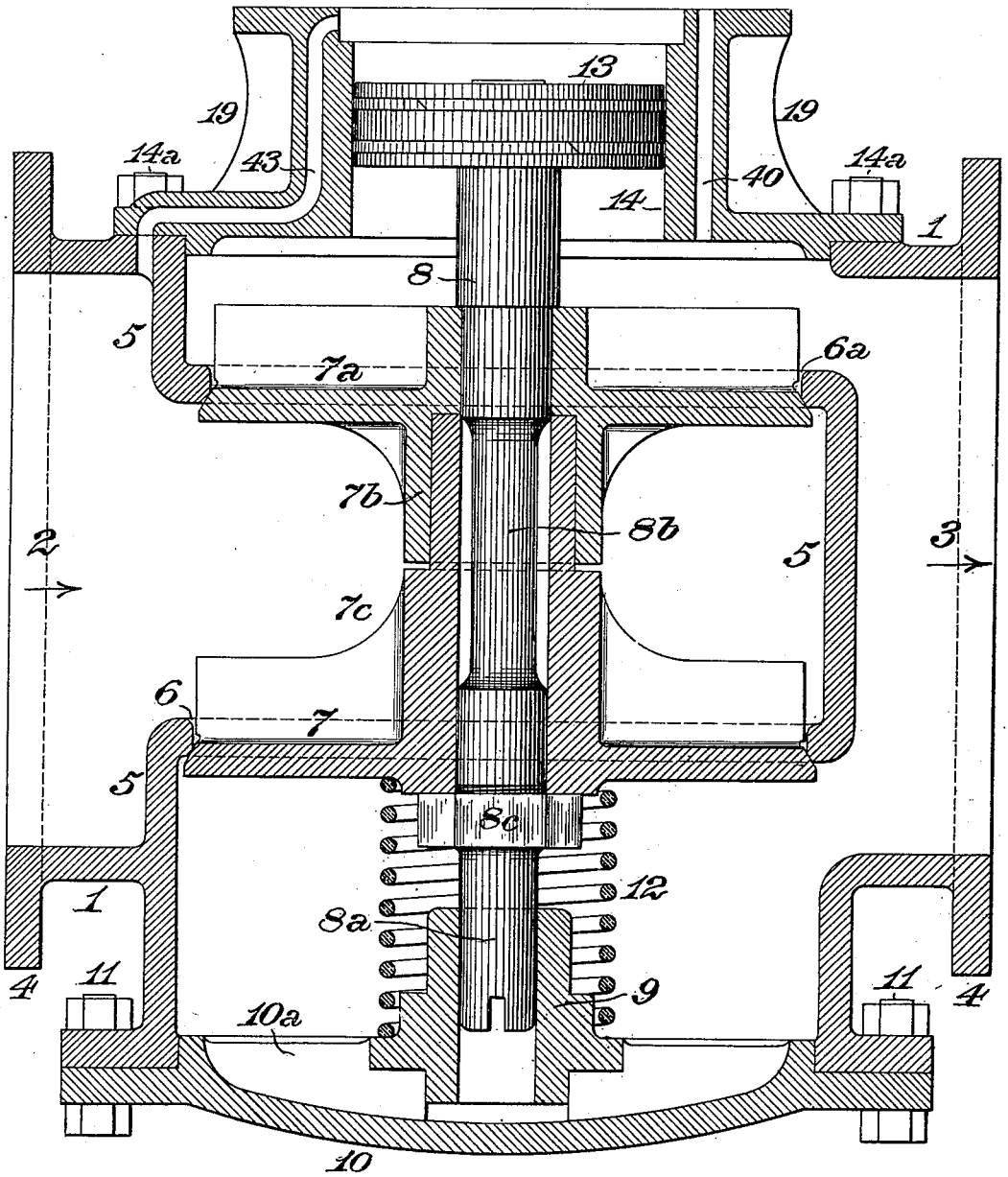

Fig. 5.

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UNITED STATES PATENT OFFICE.

JULES P. METZGER, OF NEW YORK, N. Y., ASSIGNOR TO JOHN S. LESLIE, OF SAME PLACE.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 648,592, dated May 1, 1900.

Application filed December 28, 1899. Serial No. 741,811. (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 is exemplified in an application for Letters Patent of the United States filed by me November 24, 1899, Serial No. 738,125, (Case A.)

My present invention is more particularly designed for application in pressure-regulators of the largest sizes that are used or required in present practice; and its object is to provide means whereby absolute reliability of action of the regulator may be attained within any range of variation of inlet and outlet pressures for which it may be set by the employment of a simple construction, which is capable of ready access for inspection or renewal of any of its parts.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a longitudinal central section, with the regulating-valve and piston in elevation, through a pressure-regulator, illustrating an embodiment of my invention; Figs. 2 and 3, vertical and horizontal sections, respectively, through the controlling-valve detached; Fig. 4, a plan or top view of the adjusting device; and Fig. 5, a partial longitudinal central section through a pressure-regulator, illustrating a structural modification of the main or regulating valve.

In my application Serial No. 738,125 aforesaid I have indicated the objections which are encountered in practice from the distortion of the cylinder in which the actuating-piston of the regulating-valve operates and the resultant binding of the piston therein and have provided a radially-ribbed cylinder by the rigidity of which such distortion is prevented. It will be obvious that in pressure-regulators of this type the diameter of the cylinder must be increased proportionately to increase in the size of the appliance, inasmuch as the area of the piston must be greater than the area of the regulating-valve which is exposed to pressure in order to overcome such pressure and move the regulating-valve. The cylinder thus becomes extremely large in large-sized regulators and incidentally more difficult to design so as to properly and sufficiently resist the distorting action which is exerted upon it in operation. My present invention enables a much smaller cylinder to be employed than in the ordinary constructions and correspondingly reduces the liability to distortion and consequent unreliable and imperfect operation of the regulator.

The general combination of operative members and the operative principle thereof being in all essential particulars similar in my present invention to those of the appliance set forth in my application Serial No. 738,125 aforesaid, the same need not be herein fully and at length described, and 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.

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 flange 4 or otherwise adapted for connection with a fluid-pressure pipe. The inlet and outlet passages are separated by a wall or partition 5, in which are formed two concentric openings or passages 6 6^a, the space between which is open to the inlet-passage. Valve faces or seats which are preferably, as shown, beveled or inclined are formed on the lower sides of the openings 6 6^a, and a main or regulating valve 7 7^a of the double-beat-puppet type is fitted to seat on the valve-faces of and govern the passage of fluid through the openings 6 6^a of the partition 5. The members 7 7^a of the regulating-valve are preferably of substantially the same diameter, so that the valve shall be an equilibrium or balanced valve; but such equality of diameter is not an essential of my invention and may be departed from if for any reason the constructor may so desire.

The regulating-valve is rigidly connected in any suitable and preferred manner to a rod or stem 8, which is in turn secured to a properly-packed piston 13, fitted to traverse in an open-ended piston chamber or cylinder 14,

which in this instance is shown as cast separately from the valve-casing 1 and secured thereto by bolts 14ª, passing through a bottom flange on the piston-chamber, which abuts against a corresponding face on the valve-casing. The regulating-valve being, by preference, practically balanced, as before stated, only a comparatively-slight force is required to unseat it and to move it in opening direction, and the actuating-piston 13 may therefore be made of correspondingly-small diameter, it being found in practice that a piston which is less than one-half the diameter of the smaller valve member is amply adequate to the performance of the duty required. The valve-stem 8 is provided below the lower valve member 7 with an extension 8ª, which works in a guide 9, formed or fixed centrally upon a bottom cap 10, which closes an opening in the casing through which the regulating-valve is inserted and removed, as required, and is secured to the casing by bolts 11. The bottom cap and its guide are made rigid by radial ribs or brackets 10ª. A spring 12 bears against the lower member 7 of the regulating-valve and against a collar on the guide 9 and acts to seat the regulating-valve.

While a piston-chamber which is formed separately from and removably connected to the valve-casing 1 is not an essential of my invention, such construction is, particularly in pressure-regulators of comparatively large size, substantially advantageous and desirable, as it affords the most convenient facilities for inspection and repair and in some instances enables an economy to be effected by the utilization of the casing if the piston-chamber should be damaged by accident or require renewal for any other reason.

Fluid (which, for example, may be steam) from the inlet side of the casing is led through a port 40 to the upper side of the piston 13, the supply being regulated and governed by a controlling-valve 34, fitted in a controlling-valve chamber 20, which valve is moved in opposite directions in accordance with variations of pressure on the outlet side of the regulating-valve by a flexible diaphragm 26, extending across the top of a pressure-chamber 25, located above the piston-chamber and abutting against the stem of the controlling-valve, and by a spring 37, bearing against the lower side of the controlling-valve. Fluid under pressure is supplied to the lower side of the diaphragm 26 from the outlet side of the casing through a port 43, leading into a pressure-chamber 25, which is closed at top by the diaphragm 26 and at bottom by the controlling-valve chamber 20. Said chamber closes the top of the piston-chamber 14 and is held in position with the capacity of removal between the piston-chamber and a top cap 21, which is secured to the piston-chamber by bolts 22. Downward pressure is imparted to the diaphragm 26 by a diaphragm-spring 29, contained in an adjusting-case 28, fixed to a diaphragm-holder 27, by which holder the diaphragm is secured peripherally across a central opening in the cap 21. The spring 29 bears at its ends on upper and lower spring-seats 31 30, the latter of which abuts against the upper side of the diaphragm, and its tension may be varied and regulated as desired by an adjusting-cap 32, which bears on the upper spring-seat 31 and engages an external screw-thread on the adjusting-case 28. The adjusting-cap 32 is provided with a peripheral flange having a plurality of openings, and an adjusting-nut 33, having an arm provided with an opening adapted to register with any one of the openings of the adjusting-cap, engages a thread on a central stem 30ᵇ, fixed to the lower spring-seat 30. When the spring has been adjusted to the tension desired, the arm of the adjusting-nut 33 is locked in position by a padlock 34ª or other suitable fastening. The lower spring-seat 30 is held against rotation by a dowel 30ª. The ports 40 and 43 are respectively controlled by plug-valves 44 and 45.

Fig. 5 illustrates a preferred form of construction of the regulating-valve and the stem by which it is connected to the piston 13. The stem is integral and consists of a piston portion 8, a middle portion 8ᵇ, of reduced diameter, and a lower extension 8ª, which fits in the guide 9 of the bottom cap 10. The upper valve member 7ª fits against a shoulder at the lower end of the piston portion 8 of the stem and is provided with a central sleeve 7ᵇ, which fits around a corresponding sleeve 7ᶜ on the lower valve member 7, the upper end of the sleeve 7ᶜ abuting against the lower side of the upper valve member 7ª. The upper and lower members 7ª 7 are clamped and held firmly together on the stem by a nut 8ᶜ, which engages a screw-thread on the stem at the upper end of the lower extension 8ª. By this construction the valve members may be readily fitted on the stem, securely held in position thereon, and easily removed when required. The objection also experienced in the ordinary constructions of strain upon the valve-seats due to axial expansion in large valves is also overcome, as the reduction of diameter at the middle portion of the stem enables the latter to slightly yield under strain, so that the proper axial relation of the valve-members and their seats is not disturbed and strain or distortion thereof is avoided.

The general features of operation of the appliance are similar to those of others of the same class heretofore known in the art. The piston 13 is moved downwardly to impart opening movement to the regulating-valve 7 7ª by fluid from the inlet side of the casing through the port 40, the controlling-valve 34 being depressed by the spring 29 and diaphragm 26 to effect such admission. Upon excess of pressure being exerted in the outlet portion of the casing the diaphragm is raised by pressure of fluid entering through

the port 43, the controlling-valve is raised by its spring 37, and the regulating-valve 7 7ª is wholly or partially closed by its spring 12.

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, a partition separating said passages and having an opening therethrough, a regulating-valve controlling said opening, a piston chamber or cylinder of less internal diameter than said regulating-valve and connected to the casing in line axially with said partition-opening, and a piston working in said cylinder and adapted to impart opening movement to the regulating-valve.

2. In a pressure-regulator, the combination of the valve-casing having inlet and outlet passages, a partition separating said passages and having an opening therethrough, a balanced regulating-valve controlling said passage, a piston chamber or cylinder of less internal diameter than said valve and connected to the casing in line with said partition-passage and a piston working in said cylinder and adapted to impart opening movement to the regulating-valve.

3. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages, a partition separating said passages and having two concentric passages or openings, a double-beat-puppet regulating-valve controlling said passages, a piston chamber or cylinder detachably connected to the casing in line axially with the passages in the partition thereof, and a piston working in said cylinder and adapted to impart opening movement to the regulating-valve.

4. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages, a partition separating said passages and having two concentric passages or openings, a piston chamber or cylinder fixed on the casing in line axially with the passages in the partition thereof, a piston fitting and working in said chamber, a stem fixed to said piston and having its middle portion reduced in diameter, and a regulating-valve controlling the passages in the partition and composed of an upper and a lower member having central sleeves fitting loosely one within another, said members being held between a shoulder and a nut on the stem on opposite sides of the reduced portion thereof.

5. In a pressure-regulator, the combination of a valve shell or casing having inlet and outlet passages, a regulating-valve controlling communication between said passages, a piston connected to said regulating-valve, a controlling-valve governing the admission of fluid under pressure to said piston, a flexible diaphragm transmitting pressure to the controlling-valve, a spring acting on said diaphragm in opposite direction to the action of fluid under pressure thereon, a spring-seat interposed between the spring and diaphragm and having a central threaded stem, a spring-seat at the opposite end of the spring, through which seat the stem passes freely, an adjusting-case inclosing the spring, an adjusting-cap engaging a thread on the adjusting-case and having peripheral openings, and a locking device engaging the thread of the stem and having an arm adapted to be locked to one of the peripheral openings of the adjusting-cap.

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A. LOEFFLER.