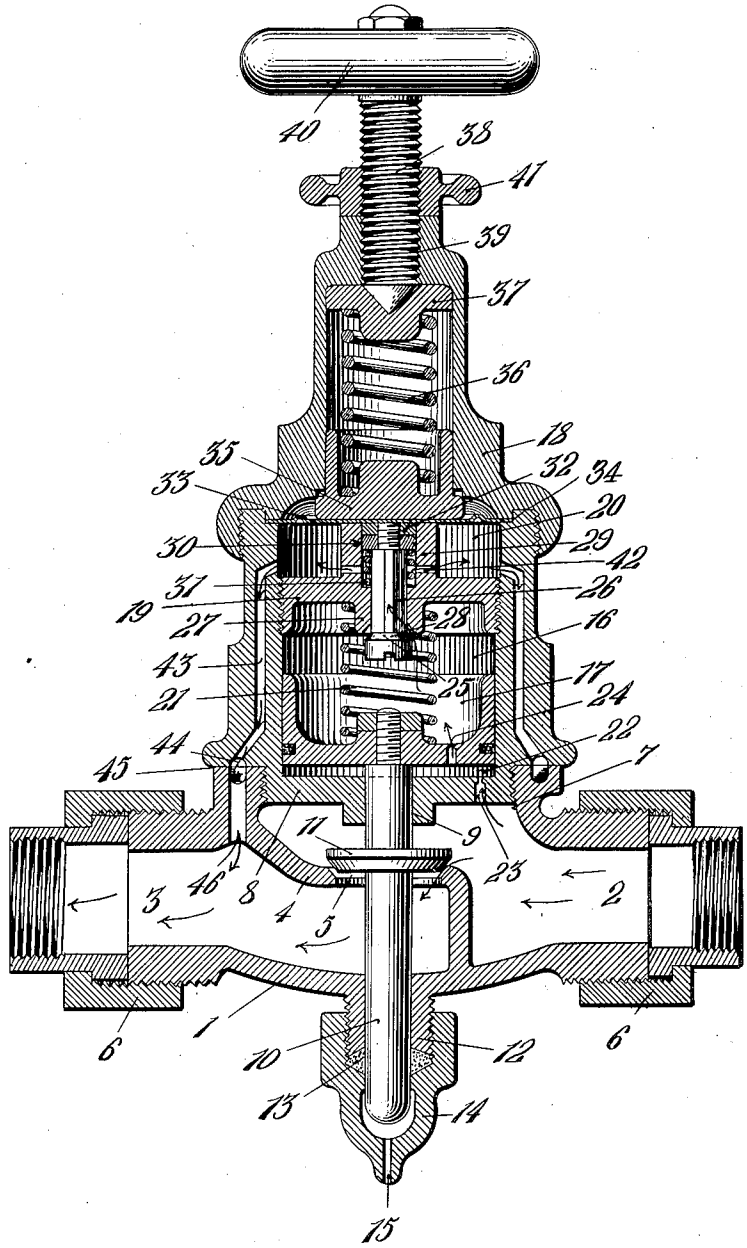
No. 836,306. PATENTED NOV. 20, 1906.

H. F. CUNNING.

REDUCING VALVE.

APPLICATION FILED JUNE 19, 1906.



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HARRY F. CUNNING, OF ROANOKE, VIRGINIA.

REDUCING-VALVE.

No. 836,306. Specification of Letters Patent. Patented Nov. 20, 1906.

Application filed June 19, 1906. Serial No. 322,454.

To all whom it may concern:

Be it known that I, HARRY F. CUNNING, a citizen of the United States, residing at Roanoke, in the county of Roanoke and State of Virginia, have invented a new and useful Reducing-Valve, of which the following is a specification.

This invention relates to a reducing-valve designed to effectively regulate the pressure of steam, air, water, or any other fluid desired to be regulated.

The invention has for one of its objects the provision of a valve mechanism that is adapted to deliver fluid at any desired constant pressure irrespective of changes in pressure at the source of supply or on the inlet side of the valve, automatically-actuated means being included that is controlled by the pressure on the delivery side of the valve to automatically maintain the pressure required.

A further object of the invention is to simplify and improve the construction and operation of valves of this character and to reduce the number of parts so as to lessen the cost of maintenance or wear and renewal of the parts, while at the same time diminishing the size and enhancing the neatness of the valve.

Another object of the invention is to provide a valve which is sensitive to variations in pressure, which will seat promptly when a certain predetermined pressure is reached, and by which a full port-opening can be obtained.

With these objects in view and others, as will appear as the nature of the invention is better understood, the invention comprises the various novel features of construction and arrangement of parts fully described hereinafter and set forth with particularity in the appended claims.

In the accompanying drawing, which illustrates one of the embodiments of the invention, is shown a vertical central section of the valve mechanism.

Referring to the drawing, 1 designates the main valve-casing, which may be of any approved construction, having an inlet-opening 2, an outlet-opening 3 at opposite ends, and an intermediate partition 4, provided with a conically-seated port 5. The open ends of the casing are externally threaded for connecting the valve in the system adapted to be controlled by means of the fastening devices 6. Obviously any other means may be employed for coupling the valve to the pipes of the system. The top of the valve-casing is provided with a central opening 7, which is nternally threaded to receive a cover 8. The cover is provided with a central opening 9, in which is movably guided the upper end of the valve-stem 10, carrying the main valve 11. The lower end of the valve-stem extends through a hollow boss 12 at the bottom of the casing, and its lower end is exposed to the atmosphere, so as to facilitate the prompt seating of the valve. The end of the boss 12is beveled, so as to receive a fibrous packing 13 for the valve-stem, the packing being held under compression by a cap-nut 14, that screws on the boss. The cap is provided with an opening 15, so as to expose the interior of the cap to atmospheric pressure and preventing the pressure on the outlet side of the valve that might leak around the stem from acting on the latter with a tendency to open the valve.

The valve-cover 8 is preferably cast integral or otherwise constructed with a tubular extension forming a piston-cylinder 16, in which is guided the piston 17, rigidly connected with the stem 10, so as to open or close the valve 11, according to the variations in fluid-pressure acting on opposite sides of the piston. The piston-cylinder 16 is externally threaded at its upper end to receive a cap-nut 18 and internally threaded at a slight distance below its upper end to receive the head 19. This head coöperates with the cylinder to form on the lower side a fluid-tight piston-cylinder and on its upper side a diaphragm-chamber 20. Arranged axially of the piston 17 and head 19 and with its ends abutting them is a helical compression-spring 21, that normally maintains the main valve 11 on its seat. The cover 8 forms the other head of the piston-cylinder 16, and between this head and the piston is the high-pressure chamber 22, to which pressure is admitted through the port or passage 23 in the cover 8. The piston 17 is provided with a port or passage 24, whereby the pressure acting on opposite sides of the piston may be equalized.

In order to cause the piston 17 to actuate the valve 11, a secondary valve is employed to vary the pressure on the top side of the piston. The secondary valve (designated by 25) is provided with a guide-stem 26 of cross-shaped cross-section, that is guided in a central opening or bore in the head 19. The head is provided with a depending boss 27, forming part of the guide and having a valve-

seat 28 for the secondary valve and with an upwardly-extending boss 29 on its top side which is counterbored to form a chamber 30. The inner end of the chamber serves as an abutment for one end of the helical compression-spring 31, that is disposed around the secondary valve-stem and abuts at its opposite end one of the jam-nuts 32, screwed on the extremity of the valve-stem. The secondary valve is actuated by a diaphragm 33 of any preferred construction, which is confined at its periphery on shoulders 34 of the cylinder 16 and cap-nut 18. The upper jam-nut and the end of the valve-stem 26 impinge on the under surface of the diaphragm and are maintained in contact therewith by the spring 31, which spring normally tends to seat the secondary valve. The upper side of the diaphragm is reinforced by a piston-like follower 35, which is guided in the cap-nut 18, the latter having a cylindrical wall with which the follower engages. The cap-nut has its body portion hollow, so as to contain a helical compression-spring 36 for weighting the diaphragm, the spring abutting the follower at one end and an adjustable abutment 37 at the other end. The peripheral surface of the abutment 37 engages the interior wall of the cap-nut, so as to be guided longitudinally of the latter, and the abutment is moved or adjusted by the screw 38. The screw screws into a threaded opening 39 in the upper end of the cap-nut and carries at its upper end a hand-wheel 40. By this means the tension of the spring 36 can be varied, as desired, so as to determine the pressure in the diaphragm-chamber necessary to actuate the diaphragm. The adjusting-screw 38 is held in position by a knurled clamping-nut 41.

The fluid-pressure that passes from the top side of the piston 17 through the secondary valve discharges through a plurality of radial passages 42 in the upper boss 29 of the head 19 to the diaphragm-chamber. From here it is preferably conveyed to the discharge side of the main valve by means of a plurality of passages 43 in the wall of the piston-cylinder 16 and an annular passage 44, communicating with the passages 43 and formed by recesses arranged in registration in the surfaces 45 between the casing 1 and cover 18. The passage 44 communicates with the discharge side of the main valve by the conduit 46 in the wall of the casing 1. Through this same system of conduits the variations in pressure on the discharge side of the main valve are brought to bear upon the diaphragm so as to actuate the secondary valve in such a manner as to change the opposing pressures on the piston 17, and thereby actuate the main valve 11 to vary the supply of fluid through the casing 1 to maintain the pressure substantially constant on the delivery side of the system.

From the foregoing description, taken in connection with the accompanying drawing, the advantages of the construction and the method of operation will be readily appreciated by those skilled in the art to which the invention appertains.

The operation may be briefly described as follows: In the drawing the parts are indicated in their operative positions, fluid passing through the valve-casing, as indicated by the arrows. At the same time a certain portion of the fluid is passing from the inlet or high-pressure side of the casing through the port 23 to the high-pressure chamber 22 of the piston-cylinder. The pressure therein acts on the piston against the tension of the spring 21 and holds the main valve 11 open. While the upper side of the piston is in communication with the high-pressure chamber 22 on the lower side thereof through the port 24 the pressures are not equalized, for the reason that the secondary valve is open, thereby placing the upper side of the piston in communication with the delivery side of the main valve, which normally is at a lower pressure than the inlet side. If for any reason the pressure on the discharge side of the main valve should increase above a predetermined point that is obtained by the set of the diaphragm-spring 36, the diaphragm will be raised to a greater or less extent and correspondingly close the secondary valve. This will cause the pressure in the piston-cylinder on the upper side of the piston to increase and counterbalance the fluid-pressure in the chamber 22 on the lower side of the piston. In consequence the piston will be moved downwardly and the main valve closed to a greater or less extent. It will be noted that when the parts are in normal operation the upper end of the boss 29 will serve as an abutment or rest for the lower side of the diaphragm. It is obvious that by adjusting the screw 38 inwardly or outwardly within certain limits the critical pressure at which the secondary valve automatically closes may be changed. When it is desired to completely shut down the main valve, the adjusting-screw 38 is moved outwardly to such a point that the secondary-valve spring 31 will positively seat the secondary valve and hold it seated. By thus seating the secondary valve the avenue of discharge of the fluid from the piston-cylinder on the upper side of the piston is cut off, so that the pressures on the top and bottom of the piston will be equalized and the piston caused to move downwardly by the tension of the spring 21. The main valve 11 is thus closed and held on its seat by the said spring as long as the secondary valve is closed.

I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment therefor; but I desire to have it under-

stood that the apparatus shown is merely illustrative and that various changes may be made, when desired, as are within the scope of the invention.

What is claimed is—

1. The combination of a valve-casing, an apertured cover having a threaded engagement with the casing, a cylinder formed on the cover, a valve in the casing, a stem for the valve passing through the aperture of the cover, a piston in the cylinder on the side of the cover opposite from the valve, a threaded connection between the stem and piston whereby the valve and piston are detachably connected together and removable with the cover, and a mechanism supported on the cover and removable therewith for controlling the piston, said mechanism comprising a cap removably secured to the cylinder, a head threaded in the cylinder and dividing the same into an upper and a lower chamber, a diaphragm in the upper chamber, adjustable means in the cap for weighting the diaphragm, and a valve guided in the head and controlled by the diaphragm for varying the fluid-pressure acting on the piston.

2. The combination of a valve-casing, a valve-seat therein, a removable cover for the casing which is provided with a cylinder cast integral therewith, a cap-nut carried by the cylinder, a diaphragm secured between the cylinder and nut, an adjustable means in the cap-nut for weighting the diaphragm, a removable head in the cylinder for separating the upper end of the latter into a diaphragm-chamber, a piston in the cylinder for dividing the latter into high and low pressure chambers, a port arranged to communicate with both of the latter chambers, a valve in the casing, a stem connecting the valve with the piston, a port between the casing and cylinder, and a secondary valve carried by the said head and actuated by the diaphragm for controlling the pressures acting on opposite sides of the piston for moving the same.

3. The combination of a valve-casing, a valve-seat therein, a removable cover having a threaded engagement with the casing, a cylinder carried by the cover, a piston in the cylinder, a valve in the casing, a stem extending through the cover and having a threaded connection with the piston, a removable head for the cylinder, a cap which cooperates with the head to form a chamber, an unperforated diaphragm in the chamber, a secondary valve for controlling the piston, a spring for normally holding the valve seated and in engagement with the diaphragm, a follower arranged in engagement with the diaphragm and guided in the cap, a movable abutment in the cap, a spring between the abutment and follower, and an adjustable device carried by the cap and arranged to loosely engage the abutment for adjusting the latter.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

HARRY F. CUNNING.

Witnesses:

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M. O. FRANKLIN.