No. 687,002. Patented Nov. 19, 1901.

A. W. CASH.

PRESSURE REGULATOR.

(Application filed Mar. 14, 1901.)

(No Model.)

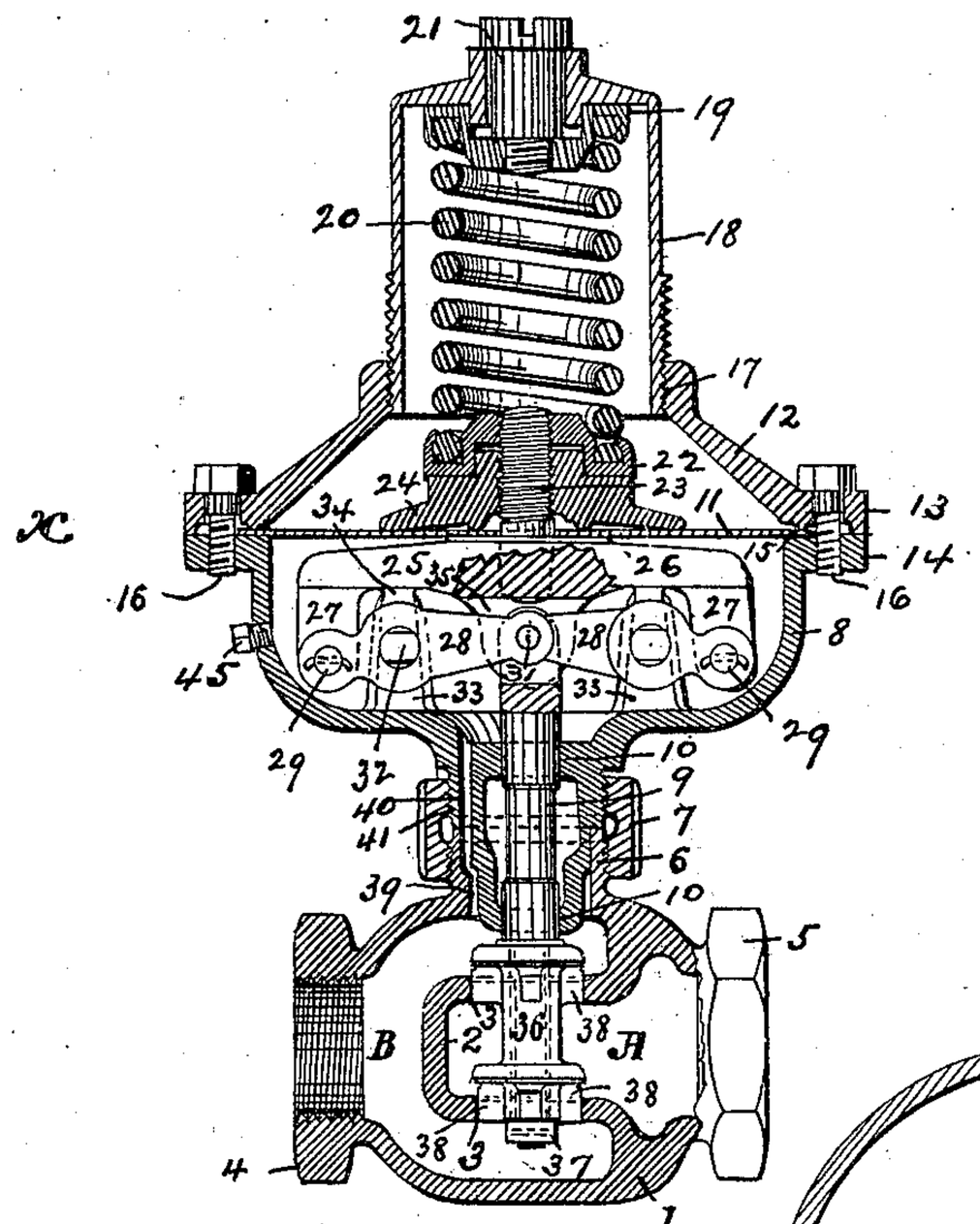

Fig. 1.

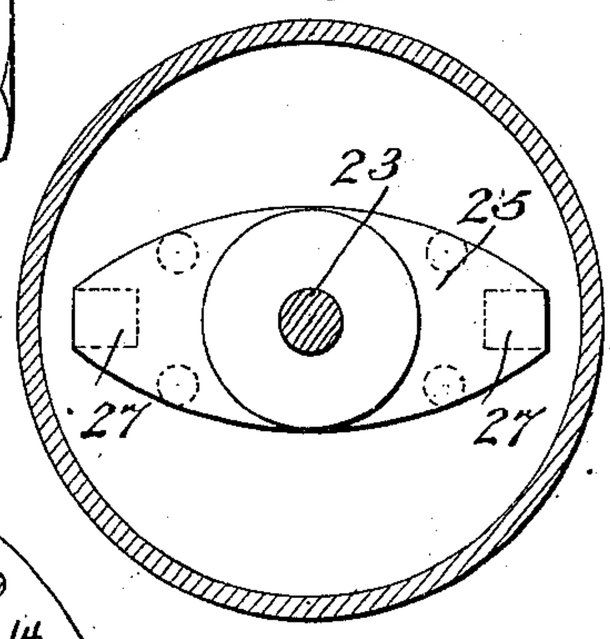

Fig. 3.

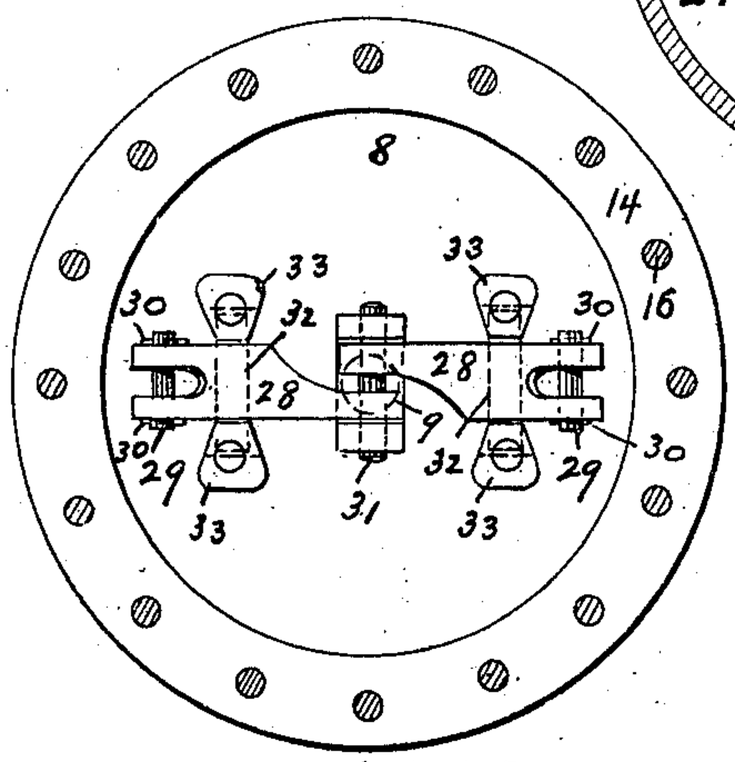

Fig. 2.

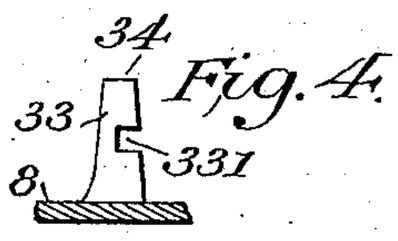

Fig. 4.

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ARTHUR W. CASH, OF NEWARK, NEW JERSEY.

PRESSURE-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 687,002, dated November 19, 1901.

Application filed March 14, 1901. Serial No. 51,043. (No model.)

To all whom it may concern:

Be it known that I, ARTHUR W. CASH, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Pressure Reducing and Regulating Valves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

This invention relates to certain improvements in that class of valves commonly known as "pressure reducing or regulating valves."

It has for its objects the reduction of the cost and the simplification of construction to secure a valve which will be effective and positive in its operations and one that is adapted for a wide range of service under greatly-varying conditions, and to obtain other advantages and results, some of which will be referred to hereinafter in connection with the description of the working parts.

The invention consists in the improved pressure reducing or regulating valve and in the arrangements and combinations of parts of the same, all substantially as will be hereinafter set forth and finally embraced in the clauses of the claim.

Referring to the accompanying drawings, in which like characters of reference indicate corresponding parts in each of the views, Figure 1 is a central vertical section of a regulating or reducing valve of my improved construction; and Fig. 2 is a section taken at line x, a certain center yoke being removed to show the arrangement of yoke-operating levers more clearly. Fig. 3 is a plan of a yoke, indicating the location of the bearings on the under side for certain studs for limiting the downward movement of said yoke toward certain levers arranged beneath; and Fig. 4 is a detail side elevation of one of said studs.

In said drawings, 1 indicates a main valve body or casing having two separate compartments A and B, divided by a web or partition 2, shaped to lie concentric with or parallel to the outer walls of the casing or otherwise formed to permit the formation of two circular valve-ports 3 3 and seats disposed opposite one another and communicating one with the other. Said body 1 is provided with threaded ends 4 5 to receive inlet and exit pipes for the steam or compressed fluid, and at one side is open and threaded, as at 6, to receive a right and left threaded spanner-nut 7, by which said body 1 is connected to a bowl-shaped diaphragm-chamber casing 8, which is correspondingly threaded and is open to permit the passage therethrough of a valve-stem 9, which works longitudinally on suitable bearings 10 10, formed on said body and diaphragm-casing.

Across the open top of the diaphragm-casing 8 is secured a flexible diaphragm 11, which is held in position at or near its edges by the diaphragm-hood 12, which is flanged, as at 13, to engage a corresponding flange 14 on the casing and has a small annular head 15 near its outer edge adapted to rest on the diaphragm at or near its edge and make a fluid-tight joint when the hood is bolted or screwed down upon the said casing 8 by means of the bolts or screws 16.

The diaphragm 11 may be of any suitable material. It may be of one thin plate or a plurality of plates, as the pressure may require or render desirable.

The hood is centrally open and provided with a female thread 17, and in the opening is screwed a thimble-shaped dome 18, at the top of which is secured a pivotal spring-grip 19, adapted to engage the upper end of the spiral spring 20 and hold the spring up in place, the said grip being formed in any suitable manner to hold the spring and resist both tension and compression for purposes hereinafter described. The pivotal grip 19 is preferably screwed upon the inner end of a shouldered screw 21, arranged in a hole in the thimble or dome and adapted to turn therein or permit the thimble or dome to be screwed down with but disarranging the spring 20. The lower end of the spring 20 is also provided with a grip 22 similar to the grip first described, which is at the center provided with a female thread to permit of being screwed down tightly upon the upper end of a screw-stud 23. Said stud 23 passes through

a clamp-nut 24 and diaphragm 11 from a yoke 25 beneath the said diaphragm in the chamber of the casing 8. The said nut on the under side is provided with an annular rib 26, which extends around the central perforation of the diaphragm, clamping said diaphragm between the nut and yoke, so that the diaphragm is rendered impervious to the compressed fluid. Said yoke 25 at its opposite extremities extends downwardly or forms tongues 27, which enter between the prongs of bifurcated levers 28 and are pivotally held therebetween by pins 29, which are in turn held in place by cotter-pins 30. From said downwardly-extending tongues the said bifurcated levers extend oppositely inward toward one another and connect with the valve-stem 9 at its upper bifurcated extremity, the inner extremities of the levers 28 overlapping, as shown in Fig. 2, and being perforated to receive a pin 31, by which said levers and stem are pivoted together. The levers 28 are fulcrumed on pins 32, slidably arranged in fulcrumal studs 33, formed or cast integral with the casing 8, the ends of the said pins 32 being flattened, as in Fig. 1, and thus adapted to move in horizontal grooves 331, formed in said studs, to prevent the parts from jamming. Said studs 33 may be extended above the level of the tops of the levers and serve as stops or stems 34, adapted to limit the downward movement of the yoke and its connections. The pin 31 for connecting the levers and valve-stem is preferably held in operative position by means of downwardly-extending lugs 35, which extend to and lie at or near the opposite ends of the pin and prevent material longitudinal movement of the same.

The yoke 25 is centrally fastened to the lower or inner side of the diaphragm 11 and extends oppositely a little beyond the studs 34, where they turn down to form the arms 27 and engage the outer ends of the levers above referred to. The intermediate fulcrums 32 are nearer to the arms 27 than to the valve-stem 9, and thus the length of movement is increased and the movement accelerated. Thus the limited movement of the single-sheet diaphragm effects a greater movement of the valve, ample to permit a free flow therethrough when opened. The movement of the diaphragm controls both the opening and closing movements of the valve.

The lower end of the valve-stem 9 passes loosely through a circular double-seated valve 36 and secured thereto by means of a nut 37, which may be locked by means of a cotter-pin at the lower extremity of said stem. Said valve may be provided with radial wings 38 38, adapted to engage the walls of the valve-ports 3 and hold the said valves centrally in proper operative position.

From the outlet-chamber B a small groove boring or channel 39 extends through the upper neck portion 6 of the body and communicates with a hole, channel, or port 40 through the lower threaded part 41 of the diaphragm-casing 8, so as to provide an open passage between said chamber B and the chamber on the under side of the diaphragm.

In operation steam or other fluid under pressure passes into the chamber A and flows through the ports 3 in the partition or web 2 into the chamber B should the valves be open, the said steam passing between the wings 38. From the chamber B the steam flows to a position to be utilized as a motive force or as a heating medium or otherwise through the end 4 and exit-pipe attached thereto. It also flows through the passage or channel 39 40 in the neck 6 41 of the device into the chamber in the casing 8 below the diaphragm 1, bearing on said diaphragm to flex the same and force upward the nut 24 against the power of the spring 20 and the yoke 25, bolted to said nut. The upward movement of the yoke tends in turn to lift the outer arms or ends of the levers 28 and lower the inner ends and with them the stem 9, forcing down said stem, and should the pressure be sufficient closing the valve against the valve-seats, so that a further flow of steam into the chamber B is prevented until the pressure in the chamber B is reduced. As above intimated, the power of the steam is counteracted and resisted by the power stored in the spring 20, which power may be increased or diminished by increasing or diminishing the tension or compression of the spring. The thimble may be turned in its threaded opening to increase or diminish said tension by means of a wrench applied to the shoulder 45, which may be square, hexagonal, or other shape in plan to permit the said wrench to turn the same. The pivotal pin 21 permits of the adjustment of the thimble without interference with the arrangement of the spring. The amount of adjustment of the thimble and spring is in accordance with the desired or predetermined pressure against the under side of the diaphragm. For example, should I desire to reduce the pressure in the chamber B and connections to five pounds per square inch I would by means of the adjustable thimble or dome adjust the compression-spring 20 so that its stored energy would be equal to a force of five pounds per square inch on the effective area of the under side of the diaphragm. Should the pressure in the lower diaphragm-chamber exceed five pounds per inch, then would it overcome the resistance of the spring and close the valve. A reduction of the pressure to or below the desired normal again effects an opening of the valve, as will be understood.

It is at times desirable to reduce the high pressure from or in the inlet-chamber A to a regulated pressure less than atmospheric pressure in the chamber B and its communicating pipes and to constantly maintain this low pressure regardless of the quantity or volume used. To such cases the grips at the opposite ends of the spring are made fast to said ends, so that at will the power of the spring may be changed from compression-

power to that of tension, the shouldered screw loosely fastening the upper end of the spring in such a manner that when the thimble or dome is screwed upward or away from the diaphragm the condition of said spring will be converted from that of compression to that of tension sufficient to resist or counteract any predetermined or required pressure acting on the diaphragm. For example, if it is desired to reduce the pressure in the outlet-chamber B to two pounds per square inch below normal atmospheric pressure the spring connection 18 will be run back or away from the diaphragm until the spring is under sufficient tension to just resist or counteract a force of two pounds per square inch on the effective area of the diaphragm. The pressure on the inner side of the diaphragm being now two pounds per square inch less than that of the atmosphere acting against the upper or outer surface of the diaphragm, whenever for any cause the pressure in outlet-chamber B and the diaphragm-chamber in communication therewith becomes less than two pounds vacuum the full atmospheric pressure acting against the outer side of the diaphragm forces the latter inward, and this movement being transmitted through the diaphragm center yoke 25, reversing levers 28 28, and stem 9 to the double-seated balanced valve 36 causes the latter to partially or entirely open, and thereby admit a renewed supply of pressure from the inlet-chamber A to the outlet-chamber B. Reversely, whenever the pressure in chamber B reaches a point nearer the atmosphere than the required two pounds vacuum it overbalances the atmospheric pressure acting against the opposite side of the diaphragm and in conjunction with spring 20 moves the diaphragm outward, which movement is transmitted, as before described, to valve 36, causing the latter to partially or entirely close, and thereby restrict or entirely cut off the supply of high pressure from the chamber A.

It frequently becomes desirable or necessary to control the operations of the valve by the steam or fluid pressure from some distant point, as from a large reservoir or receiver supplied by a comparatively long and small pipe and a small reducing-valve. In such cases, owing to friction, it is often necessary to have a considerably higher pressure immediately at the outlet side of the valve in order to supply the large volume required in the receiver. For such purposes the closable port-openings 39 40 have been provided, whereby in loosening the right and left spanner-nut 7 and partially rotating the diaphragm-chamber 8 the ports 39 40 are thrown out of register, and thereby direct communication between outlet-chamber B and the diaphragm-chamber is cut off. In order to govern the supply of steam or fluid passing through the valves, it now becomes necessary to connect the diaphragm-chamber 8 to the distant receiver by a small separate pipe, which is connected to diaphragm-chamber 8 by removing the threaded plug 45. (Shown in Fig. 1.)

Having thus described the invention, what I claim as new is—

1. In a pressure reducing or regulating valve, the combination with a suitable casing, of a valve and its valve-stem, and a flexible diaphragm attached to said stem, and a spring gripped at one end to an adjustable fixture and at the opposite end gripped to the said diaphragm and valve-stem and adapted to be converted from a state of compression to one of tension, or vice versa, substantially as set forth.

2. In a pressure reducing or regulating valve, the combination with a suitable casing having a flexible diaphragm therein, of a yoke at one side of said diaphragm and a spring-grip at the other attached to said yoke, a spring gripped to said yoke and adapted to be converted from a state of tension to a state of compression and vice versa, levers pivoted to said yoke at their outer ends and at their inner ends pivoted upon a common valve-stem, said levers, intermediate of their pivots, each having fulcrums within said casing and a balanced valve, all arranged and combined substantially as set forth.

3. In a pressure-reducing valve, the combination with the casing, flexible diaphragm and spring, of a yoke attached to said diaphragm, and at its opposite ends having a pair of reversing-levers 28, 28, connected thereto and extending toward one another into connection with a valve-stem and fulcrumal bearings interposed between the yoke and stem connections of said levers whereby downward movement of the diaphragm and yoke will effect an upward movement of the stem and valve, said fulcrumal bearings extending toward the yoke and serving to limit the movement of the yoke in the direction of the levers, substantially as set forth.

4. In a pressure reducing and regulating valve, the combination with the main valve-body having two separate compartments A, B, divided by a web having parallel parts with opposite communicating valve-ports 3, 3, said body having only three ways or openings out therefrom one of which communicates with a flexible diaphragm-chamber, formed in a casing attached to said valve-body, a diaphragm arranged in said chamber, a spring outside of said diaphragm and connected at one end to said diaphragm, a yoke attached to the inside of said diaphragm and extending oppositely from the point of attachment to said diaphragm beyond the fulcrumal bearings of the reversing-levers, a pair of said reversing-levers connected at their outer ends to said yoke, and at their inner ends to a valve-stem and fulcrumed between said connections, the fulcrumal bearings of said levers being disposed nearer to the connections of said levers with said yoke than to the connec-

tions with the valve-stem, and said valve-stem extending through the opening of communication between the casing and body and being provided with a balanced valve insertible through said opening of communication to the opposite seats provided for said balanced valve, substantially as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 26th day of February, 1901.

ARTHUR W. CASH.

Witnesses:
CHARLES H. PELL,
DANIEL BRADLEY.