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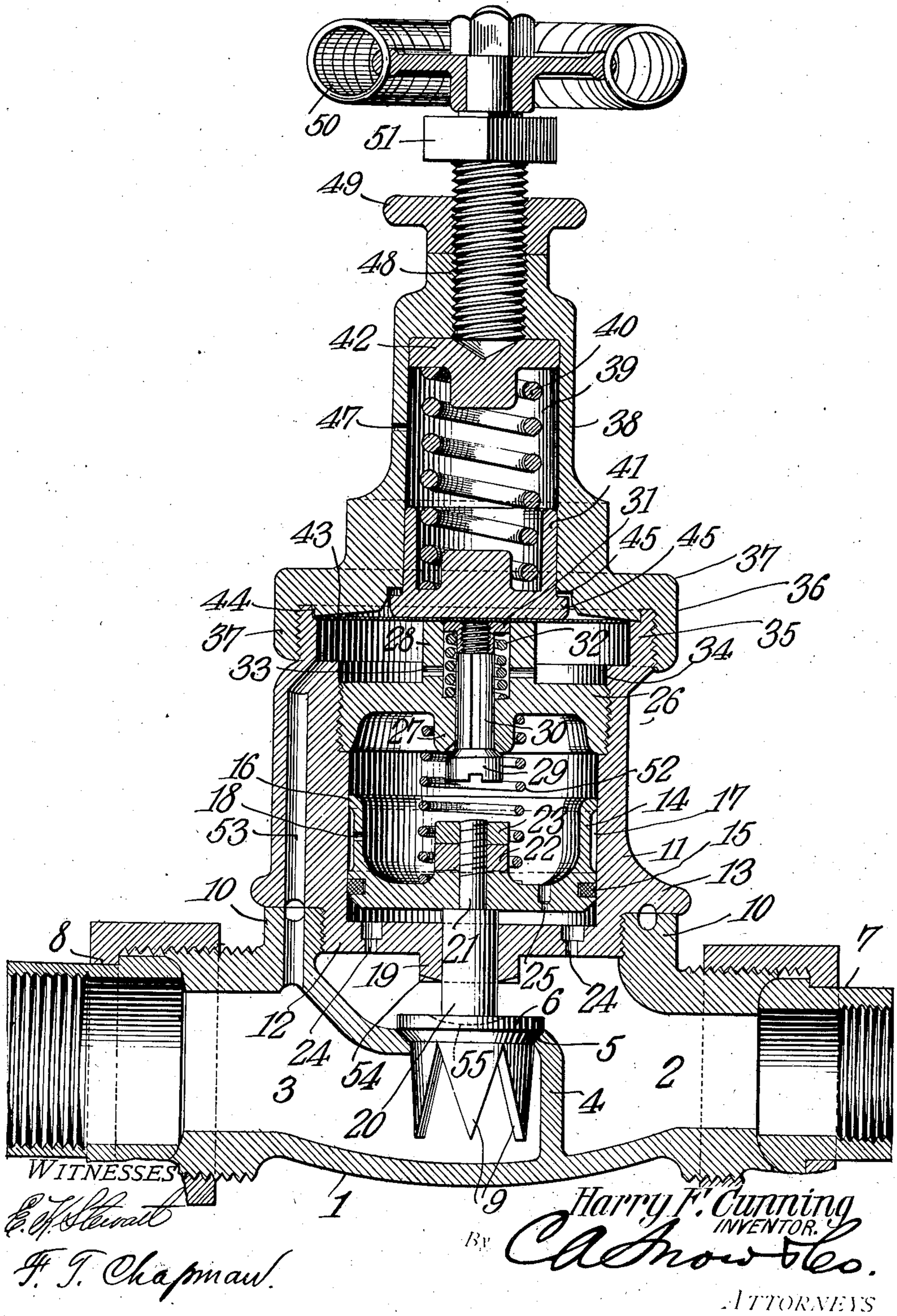
H. F. CUNNING.

REDUCING VALVE.

APPLICATION FILED FEB. 26, 1907.



WITNESSES

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REDUCING-VALVE.

No. 859,920. Specification of Letters Patent. Patented July 16, 1907.

Application filed February 26, 1907. Serial No. 359,330.

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 has reference to improvements in reducing valves, being designed more especially for use in steam or air pipes, and its object is to produce a valve which will deliver steam or air at practically constant pressure irrespective of the pressure on the receiving end of the valve, and when delivering steam will open to the full extent of the port regardless of the pressure at which the valve is set to deliver steam.

It is the purpose of the present invention to produce a valve of simplicity of structure and of comparatively small size that is not affected by the rise or fall of boiler pressure and is very sensitive to the slightest reduction of pressure on the delivery side, in fact, a valve which will automatically supply steam at uniform pressure regardless of changing conditions on either side of the valve.

The improved valve consists essentially of a valve located in the axis of the steam pipe, which valve is controlled by a piston one side of which is in communication with the boiler side of the valve and the other side of which piston is in communication with the boiler side through a leak passage extending through the piston. The piston is confined within a chamber normally closed by a valve through which the chamber on the side of the piston remote from that directly acted upon by the boiler pressure may be put into communication with the reduced side of the valve, and means are provided for adjusting the pressures upon the various parts by springs acted upon directly and indirectly by an adjusting screw and reacted upon by a diaphragm, one side of which is in communication with the reduced side of the valve.

The invention will be fully understood from the following detailed description wherein reference is made to the accompanying drawings forming part of this specification, in which,— the figure is a central vertical section of the improved valve.

Referring to the drawing, there is shown a valve body 1 of the ordinary globe type divided into two chambers 2—3 by a diaphragm 4 in which is formed a valve seat 5 receiving a valve 6. The chamber 2 is in communication through a swivel coupling 7 with the boiler side of the steam pipe, and the chamber 3 is in communication through a swivel coupling 8 with the reduced pressure side of the steam pipe. The couplings are of ordinary construction and need not be further described.

The valve 6 is provided with four wings 9—9 projecting downward into the chamber 3, and these wings have their contiguous faces joined at the upper ends and inclined away from each other toward the lower ends, the opening between the four wings being thus shaped like that of an inverted V.

The upper end of the chamber 2 extends over the valve seat and is surrounded by an annular collar 10, threaded on the inside and receiving a cylindrical casing 11 closed at its lower end by a web 12 and having an annular flange 13 engaging with the upper edge of the collar 10, the said casing 11 being screwed into the threaded portion of the collar 10.

Within the casing 11 is a piston 14 having near its lower edge an annular packing ring 15 and near its upper edge having a narrow bearing face 16 engaging the inner walls of the casing or cylinder 11. Between that portion of the piston carrying the packing 15, and the engaging face 16 the outside of the piston is reduced to form a shallow annular groove 17, and through the walls of the piston is a perforation 18 so that this groove 17 is in constant communication with the inside of the cylinder 11 through this perforation. It will be understood, of course, that more than one perforation 18 may be made in the walls of the piston if so desired. The web 12 at the lower end of the cylinder 11 is formed with a central downwardly-extending boss 19 through a central perforation in which the stem 20 of the valve 6 passes and finds a seat against the lower edge of the piston 14, the said stem 20 having a reduced extension 21 passing centrally through the piston and receiving at its other end, which is threaded for the purpose, a nut 22 and a clamp nut 23, so that the valve is securely fastened to the piston 14. Through the web 12 are a number of perforations 24, enlarged at their upper ends as shown so as to readily clean themselves of foreign matter and therefore not become clogged in use. Through the bottom of the piston 14 there is also provided a similar opening 25, or a number of such openings may be used.

Screwed into the upper end of the cylinder 11 is a cap plate 26 having a downwardly-extending annular boss 27 and an upwardly-extending annular sleeve 28, all formed in one piece therewith. In the lower end of the boss 27 there is formed a valve seat for a valve 29, the stem 30 of which extends upward and into the interior of the sleeve 28 and has a nut 31 screwed on to its upper end and fitting snugly but at the same time free to move longitudinally in the interior of the sleeve 28. This nut 31 forms the upper abutment for a spring 32 which at the lower end abuts against the base of the chamber formed within the sleeve 28. Through the walls of the sleeve 28 are openings 33 into the space within the cylinder 11 above the head 26, which latter is inset for a distance into the upper end of said cylinder 11. The upper end of the cylinder 11 is widened out to form an annular interior shoulder 34 and the walls

35 of the cylinder above the shoulder 34 are externally threaded, as shown, and also provided on their upper face with an annular rabbet 36.

Screwed on to the threaded upper end of the cylinder 11 is the expanded internally-threaded end 37 of a casing 38 in which is formed a cylindrical chamber 39 containing a spring 40 resting at its lower end on a movable head 41 constituting the lower spring guide and movable in the chamber 39, and this spring at its upper end abuts against another head or spring guide 42. The lower spring guide 41 rests upon a diaphragm 43 seated at its edges in the rabbet 36 and clamped thereto by an annular shoulder 44 formed on the lower inner face of the expanded portion 37 of the casing 38. The lower face of the shoulder 44 is beveled so as to permit the movement of the diaphragm in an upward direction away from the top of the sleeve 28 upon which it is shown as resting in the drawing. The lower spring guide 41 has formed around its lower edge an annular flange 45 movable for a distance within a seat 46 formed in the body of the casing 38 at the lower end of the cylindrical chamber 39 above the diaphragm. Since there may be some leakage around the diaphragm 43 and past the lower spring guide 41, the casing 38 is provided with a perforation 47 putting it in communication with the outer air so that no pressure may accumulate within the chamber 39.

The upper end of the casing 38 is formed with a central nut for the reception of a regulating screw 48 which also receives a clamp nut 49 by which it may be securely clamped to the casing in any adjusted position desired. The screw 48 engages the upper spring guide 42 and is used to put the spring 40 under more or less tension and this screw 48 is provided with a manipulating handle 50 and with a square or polygonal head 51, by which latter it may be moved by a wrench should it from any cause become too firmly seated in the casing 38 to be turned by hand.

Between the cap 26 and piston 14 there is arranged a compression spring 52, and through the wall of the casing or cylinder 11 on the reduced side of the valve, where this wall is thickened for the purpose, there is a passage 53 between the chamber formed in the casing above the head or cap 26 and the chamber 3 on the reduced side of the valve.

When the valve 6 is raised to its greatest extent its upper face seats against the lower face of the boss 19 and in order to prevent any sticking between these surfaces the boss 19 may be formed on its lower face with a number of radial grooves 54.

With a valve constructed as described the operation will be as follows:—Steam from the boiler enters the chamber 2, the valve 6 being seated. The steam will find its way through the openings or ports 24 into the interior of the cylinder 11 below the piston 14 and will because of the larger area of the piston 14 cause the same to lift the valve from its seat until it is in engagement with the boss 19, at which position the valve is fully opened and the steam is free to flow from the chamber 2 into the chamber 3 and beyond. Any steam that may pass through the piston by way of the port or ports 25 will find its way past the valve 29, which is normally open, and by way of the passage 53 to the chamber 3. When the pressure on the reduced side of the valve has risen sufficiently to overcome the pressure of the spring 40 above the diaphragm the latter is forced upward against the action of the spring, thus permitting the spring 32 to close the valve 29. The steam under pressure below the piston now accumulates above the same until the pressure is equalized on both sides of the piston when the spring 52 will force the piston downward and close the valve 6, being aided in this operation by the initial pressure in the chamber 2. As soon as the pressure on the low-pressure side of the valve has fallen even slightly the diaphragm will be forced down by the spring 40, thus opening the valve 29 and allowing a reduction of the pressure above the piston 14, when the valve 6 will be again opened to its full extent and the steam will flow until the pressure has again risen sufficiently to move the diaphragm 43 and allow the closing of the valve 29. It will thus be seen that the valve 6 is opened to its full extent and then again closed tightly whenever the valve as a whole operates and that there is no partial opening or closing of the valve 6. This is an important feature of my invention. The wings 9 on the valve 6 beside acting as a guide for said valve also operate because of the triangular opening between them to maintain a uniform pressure as the valve opens, more especially when the volume on the outlet side of the valve is very small, for with a slight movement of the valve 6 the port opening through the valve seat 5 is smaller at the beginning of the movement of the valve 6 and proportionately increases as the valve moves upward to its seat on the boss 19.

It will be observed that by having the grooves 54 on the under face of the boss 19 the steam under initial pressure is enabled to reach practically all of the surface of the top of the valve 6 which may also be somewhat dished, as indicated in dotted lines at 55, in order that the steam pressure may reach the portion of the top of the valve beneath the boss 19 through the passages 54.

The piston 14 is only in contact with the interior of the cylinder 11 at the packing end and at its upper edge 16, so that it moves very freely within the cylinder and the danger of sticking is reduced to a minimum and is practically eliminated. The valve 29 being out of direct communication with the steam coming from the boiler is not at all liable to receive any dirt or impurities which would prevent it from properly seating.

The diaphragm is made of a plain disk of metal without corrugations or dishing and the valve is so constructed that the movement of the diaphragm is very limited, being in practice only about 1-32 of an inch. This in itself will largely reduce the danger of breaking the diaphragm but the danger is practically eliminated by a broad seat for the diaphragm formed by the upper face of the sleeve 28 which limits its downward movement, while the upward movement when it is under the action of steam pressure is limited by the beveled face of the shoulder 44 and the bottom face of the lower spring guide 41.

I claim:—

1. In a reducing or pressure-regulating device, a valve seat interposed in the direct path between the initial pressure side and the reduced pressure side of the device, a valve adapted to said seat and extending through the same and provided with means for gradually increasing

the effective area of the opening through the valve seat during the entire length of travel of the valve, said valve having cut-away portions on its rear face, a back-stop for said valve having cut-away portions coacting with the cut-away portions on the rear face of the valve, a piston connected to said valve and movable under the action of the pressure on the initial pressure side of the valve to move the latter to the fully opened position, and other means for returning the valve to the fully closed position.

2. In a reducing or pressure-regulating device, a valve seat interposed between the initial pressure side and the reduced pressure side of the device, a valve adapted to said seat and provided with means for gradually increasing the effective area of the opening through the valve seat during the entire length of travel of the valve, said valve being provided with cut-away portions on its rear face, a back-stop for the valve having cut-away portions coacting with the cut-away portions on the rear face of the valve, a piston connected to and carrying said valve and movable in one direction under the action of the pressure on the initial pressure side of the valve, a spring tending to move the piston in a direction to seat the valve, another valve between the piston and the reduced pressure side of the device, and an operating diaphragm controlling the second named valve having a central seat on the side acting on the said second-named valve and a beveled annular seat on the side remote from said second-named valve.

3. In a reducing or regulating valve, a valve interposed between the initial pressure side of the device and the reduced pressure side of the device, a piston connected to said valve and operated upon by the steam on the initial side of the valve, and ports or openings leading to said piston and through the piston from the initial pressure side of the valve and of larger diameter at their exit ends than at their inlet ends.

4. In a reducing or pressure regulating device, a valve interposed between the initial pressure side and the reduced pressure side of the device, and a seat for limiting the movement of the valve when in the open position having passageways to reduce its area of contact with the valve.

5. In a reducing or pressure regulating device, a valve interposed between the initial pressure side and the reduced pressure side of the device, a back-stop for said valve, and cut-away portions in said back-stop coacting with cut-away portions in the corresponding face of the valve to reduce the area of contact between the back-stop and the back face of the valve.

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:
CHARLES PACK,
M. O. FRANKLIN.