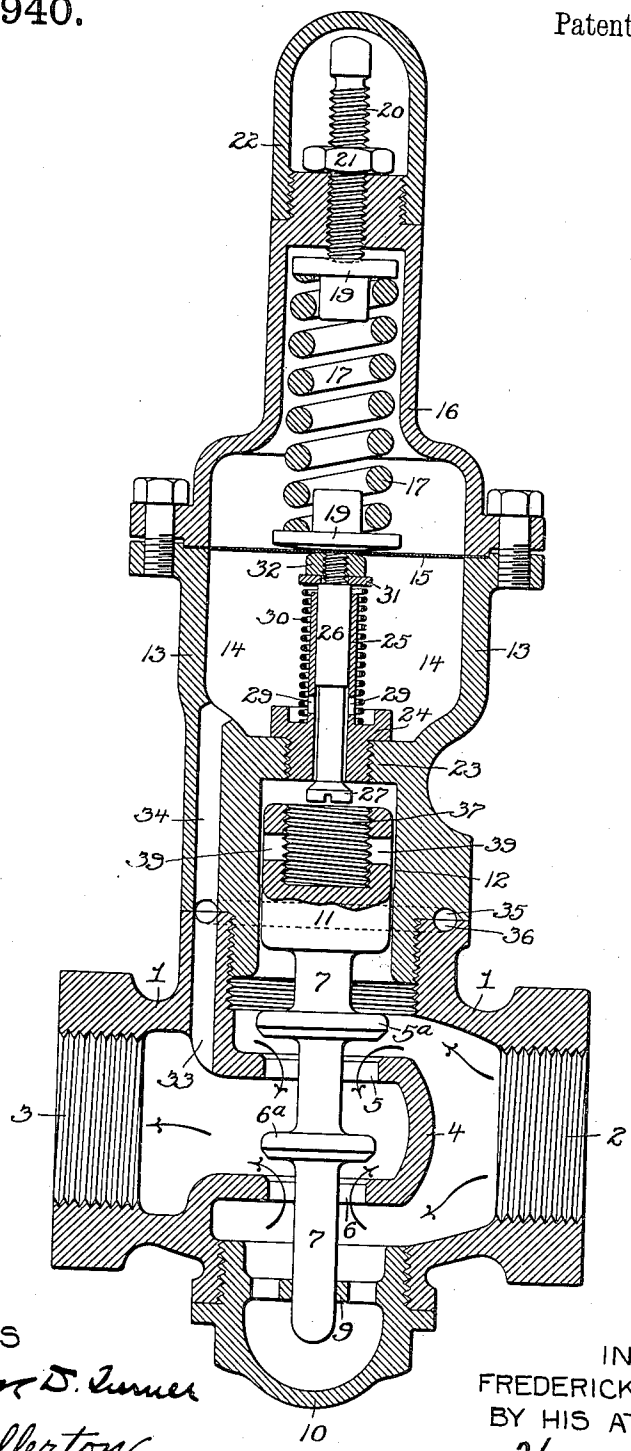
F. L. JAHN.

PRESSURE REDUCING VALVE.

APPLICATION FILED SEPT. 28, 1911.

1,084,940.

Patented Jan. 20, 1914.



WITNESSES

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PRESSURE-REDUCING VALVE.

1,084,940. Specification of Letters Patent. Patented Jan. 20, 1914.

Application filed September 28, 1911. Serial No. 651,807.

To all whom it may concern:

Be it known that I, FREDERICK L. JAHN, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Pressure-Reducing Valves, of which the following is a specification.

My invention relates to valves for regulating the flow of fluids, so as to maintain at the point of use a predetermined pressure, irrespective of the higher pressure, whether fixed or varying, maintained at the point of supply.

My invention relates to that class of such valves in which the main valve for regulating the flow from the high pressure to the low pressure side of the valve chest is connected to a piston operating in a chamber having a supplementary valve closed by means of a spring in coöperation with the low pressure fluid acting on a diaphragm which is acted upon in the opposite direction by a spring, whose tension can be regulated to accord with the desired low pressure, suitable means being provided for carrying the high pressure fluid through or around the piston connected to the main valve, whereby, when the low pressure falls below that desired, the supplementary valve will be opened and the pressure on that side of the piston farthest from the main valve will be relieved and said piston will rise so as to open the main valve and increase the flow of fluid from the high pressure to the low pressure side of the valve chest, an increase beyond the predetermined pressure at the low pressure side of the valve chest causing the supplemental valve to close and thereby permitting the high pressure to accumulate on the far side of the piston and move the same so as to close the main valve and reduce the flow of fluid from the high pressure to the low pressure side of the valve chest.

The object of my invention is to so construct such a valve as to prevent jumping or fluttering movement of the main valve in its opening or closing movements, and to insure the proper control of the movements of the valve-governing piston by the supplementary valve whatever position said piston may assume. This object I attain in the manner hereinafter set forth, reference being had to the accompanying drawing, which represents in vertical section a reducing valve constructed in accordance with my invention.

For convenience, I will refer to steam as the fluid whose flow is to be regulated by the valve.

In the drawing, 1 represents the main valve chest which has an inlet branch 2 for the high pressure steam and an outlet branch 3 for the discharge of the steam under a lowered pressure. The valve chest 1 has a hollow partition 4 with upper and lower openings 5 and 6, providing for the flow of steam from the high pressure to the low pressure chamber of the chest, these openings having seats for the reception of upper and lower valves 5^a and 6^a, both carried by a stem 7 which is suitably guided in a bearing 9 secured to or forming part of a cap 10, the latter closing an opening in the bottom of the chest 1. Also secured to the valve stem 7 is a piston 11 fitting loosely in a cylinder 12 in a casing 13, which screws within an opening in the top of the valve casing 1 and projects above the same, the upper portion of this casing 13 containing a chamber 14, closed at the top by means of a diaphragm 15, the latter being secured to the top of the casing 13 by means of a hood 16 which contains a coiled spring 17, the latter having at each end a plug 19.

The plug at the lower end of the spring 17 bears upon the diaphragm 15 and the plug at the top of the spring is acted upon by an adjusting screw 20 which is threaded for adaptation to a threaded opening in the top of the hood 16 and is provided with a lock nut 21 bearing upon the top of the hood, the projecting portion of the screw 20 being covered by a cap 22 which is screwed onto the top of the hood 16 so as to prevent such tampering with the adjusting screw 20 by mischievous or irresponsible persons as would cause improper operation of the valve.

The piston chamber of the casing 13 is separated from the upper chamber 14 by means of a partition 23 having in it an opening of contracted diameter which is closed by a plug 24, having an upwardly extending tubular guide 25 for the stem 26 of a valve 27, the latter being adapted to a seat at the lower end of the plug 24 and the space between the contracted lower portion of the valve stem 26 and the walls of the guide 25

being in free communication with the chamber 14 through openings 29 formed in said guide. By reason of the contracted diameter of the threaded portion of the plug 24 a powerful leverage can be exerted upon the same to unscrew it when its removal becomes necessary and the rusting of a plug immovably in position is prevented, whereas if the threaded portion of the plug was of the full diameter of the piston chamber the leverage exerted upon the plug to unscrew it would be correspondingly diminished and the rusting of the plug immovably in position would very likely result.

Surrounding the guide 25 is a coiled spring 30 which rests upon the top of the plug 24 and presses upwardly against a washer 31 upon which bears a nut 32 screwed upon the threaded upper end of the valve stem 26, the upward pressure of the spring 30 serving to maintain this nut constantly in contact with the under face of the diaphragm 15.

In the main valve chest 1 is a passage 33 leading from the low pressure chamber of said chest and in the casing 13 is a corresponding passage 34 communicating at its upper end with the chamber 14, registering semi-circular grooves 35 and 36 formed, respectively, in the under face of the casing 13 and the upper face of the valve chest 1 providing an annular passage which communicates at all times with the passages 33 and 34 irrespective of whether the said passages 33 and 34 are or are not in vertical register with one another.

The loose fit of the piston 11 in the cylinder 12, provides at all times for a flow of high pressure steam upwardly around the piston, which has a central recess 37 extending some distance below the top of the same, openings 39 extending through the side walls of this recess so that said recess is always in communication with the space between the sides of the piston and the side walls of the piston chamber.

Supposing that there is pressure on the high pressure side of the valve chest and no pressure on the low pressure side of the same, the parts will assume the position shown in the drawing, the valve 27 will be opened by reason of the downward pressure of the spring 17 upon the diaphragm 15 so as to provide an escape for any steam which may pass upwardly around the loose fitting piston 11, consequently there is practically no pressure on the upper face of said piston while pressure is exerted on the under face of the piston and upon the under end of the valve stem 7, the pressure upon the valve disks 5^a and 6^a being equalized. The valve disks 5^a and 6^a will therefore be raised and steam will flow through the valve chest in the direction of the arrows and pressure will accumulate in the low pressure chamber of the chest until such pressure reaches the predetermined limit and overcomes the downward pressure of the spring 17 upon the diaphragm 15, whereupon the latter will be raised and will permit the spring 30 to raise the valve stem 26 and close the valve 27 against its seat on the plug 24. The steam now passing around the piston 11 will accumulate in the chamber above the same, and the weight of the piston 11 will then cause it to descend, the valve disks 5^a and 6^a approaching their seats and restricting the flow of steam through the openings 5 and 6 to the required extent, the downward flow of steam around the disk 5^a also tending to draw it toward its seat and this tendency being only partially counteracted by the upward flow of steam around the disk 6^a, since the latter is of somewhat less diameter than the disk 5^a.

If the pressure in the low pressure chamber of the chest is reduced below the predetermined limit, the spring 17 depresses the diaphragm 15 and causes the opening of the valve 27 so as to relieve the pressure in the cylinder 12 above the piston 11, thereby permitting the pressure in the high pressure chamber of the valve chest to lift the piston and the valve disks 5^a and 6^a, and increase the flow from the high pressure to the low pressure chamber of the chest, this condition continuing until the pressure in the low pressure chamber again reaches the predetermined limit, whereupon the operations before described are repeated and the flow from the high pressure to the low pressure chamber of the chest is again restricted to the required extent. As the steam passes downwardly around the disk 5^a and upwardly around the disk 6^a there is a certain checking or cushioning action upon the movement of said valves which prevents that jumping or spasmodic movement of the same likely to occur in the absence of such checking or cushioning tendency and which, in previous valves of the type to which my invention relates, has required the employment of cushioning springs or like devices in connection with single valves.

The central recess 37 and side openings 39 in the piston 11 insure the access of steam to the valve 27, even although the piston 11 is raised to the top of the cylinder 12 and bears firmly against the partition 23, and the loose fit of the piston in its cylinder prevents said piston from sticking and therefore interfering with the proper operation of the valve.

In the present construction, the pistons and valves, by reason of their novel construction, float, as it were, in the fluid passing through the regulating valve, the movements of the valve will be gentle and all shocks, fluttering and hammering are avoided without the use of springs, while it will be positively operated to follow the requirements.

Pistons with steam tight rings are subject to friction and are much more liable to stick, causing a variation. This valve is operated by a small loose fitting piston and requires neither springs or dash-pots to keep it quiet. It can be made in any size and is easily taken apart on the pipe for examination or repairs. Almost any reducing valve will operate successfully, in certain conditions, that is, they will reduce from a steady fixed pressure to another lower steady desired pressure, but if the inlet pressure varies or the requirements decrease or increase on the outlet, where there are tight pistons and dash-pots, there will be more variation, due to the friction in the same; consequently, ill results. In valves directly connected and controlled by a diaphragm, a spring is required to follow the full movement of the valves and when the valve opens far, the spring has changed its tension and varying pressure is the result. It is particularly on these points that the valve embodied in the present application is a distinct improvement in the art and different from any valve that I am aware of, either practically or as disclosed in prior patents, and it is by reason of the construction in the present valve that a distinct advantage and improved result is obtained. To illustrate: If you wanted a reducing valve to use for one engine or steam pump, to reduce the pressure from 100 to 50 pounds with a load uniform, or nearly so, any reducing valve made will do the work very satisfactorily, but, if you want a reducing valve to reduce from a varying steam pressure, say ranging from 80 to 100 lbs., to 50 lbs. and supplying, say two engines, three or four pumps and other connections, requiring a great deal of steam at one time and very little at other times, then it requires a very exact frictionless valve which must be positively operated to follow the requirements, and maintain the desired reducing pressure, regardless of the volume, which is what led to the making of this valve.

I claim:

1. In a fluid-pressure reducing valve, a valve-chest provided with high-pressure inlet and low-pressure outlet and formed with a hollow partition the interior of which communicates with the outlet and formed with valve-seats of different areas, a valve-stem carrying valves of different areas and fitted to said valve-seats and the larger of said valves closing with the high-pressure and the smaller of said valves opening with said pressure, a diaphragm-chamber having communication with the low-pressure outlet, a diaphragm in said chamber and having resilient means acting against the pressure in said chamber, a piston-chamber having one end communicating with the high-pressure portion of the valve-chest, a piston in said chamber and upon the valve-stem and having the face exposed to the high pressure of less area than the opposite face and fitted in said piston-chamber to admit of passage of pressure-fluid past it into said chamber against its greater area, and a valve opening into said chamber from the diaphragm chamber and having resilient means for closing it and connected to be acted upon by said diaphragm and its resilient means to open it.

2. In a fluid-pressure reducing valve, a valve-chest provided with high-pressure inlet and low-pressure outlet and formed with a hollow partition the interior of which communicates with the outlet and formed with registering valve-seats of different areas, a piston-cylinder in axial alinement with said valve-seats and having a closed end and an open end communicating with the high-pressure chamber of said valve-chest and opposite the larger of said valve-seats, a valve-stem having valves of different areas seated upon said seats to have the larger area valve close with the pressure and the smaller area valve open with the pressure, a piston in said cylinder and upon said valve-stem and providing a by-pass for the fluid past it into the closed end of the cylinder and having the area of its face opposite the large area valve of less area than its other face, a diaphragm-chamber having communication with the low-pressure chamber of the valve-chest, a diaphragm in said diaphragm-chamber, resilient means acting upon said diaphragm against the pressure within said chamber, a valve opening into the piston-chamber and having its stem bearing against said diaphragm, and resilient means for closing said valve and forcing its stem against said diaphragm.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

FREDERICK L. JAHN.

Witnesses:
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