

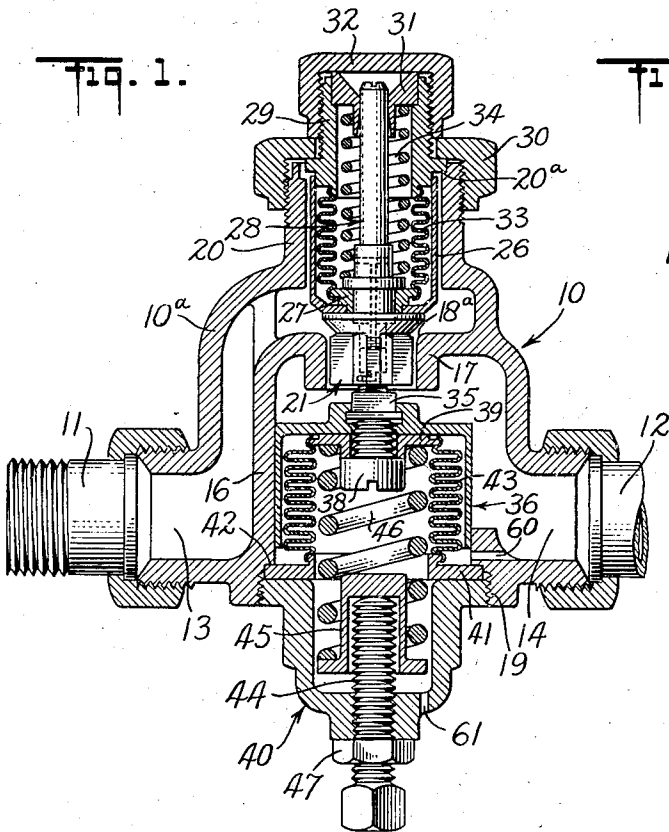
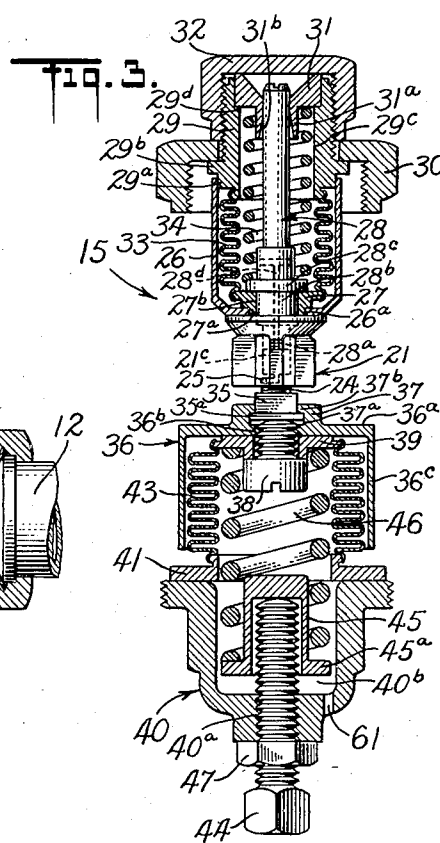
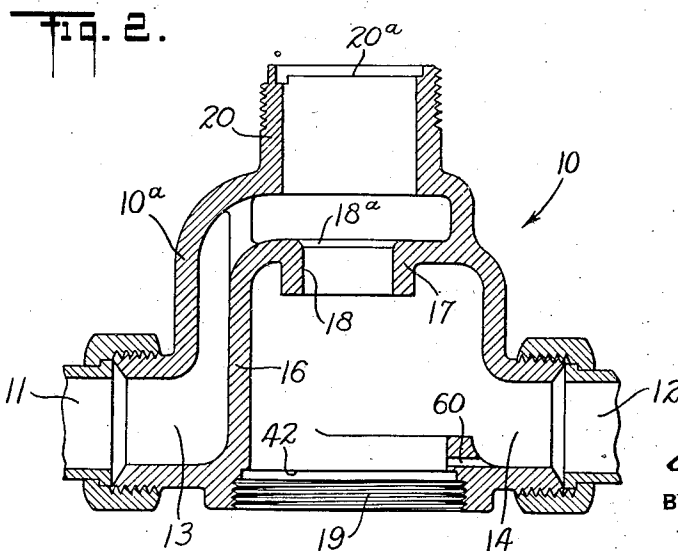
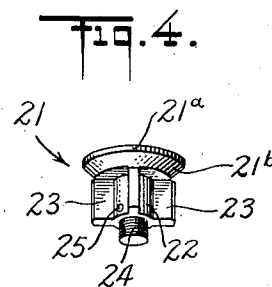
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2,154,901

PRESSURE REDUCING DEVICE

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PRESSURE REDUCING DEVICE

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5 Claims. (Cl. 50—23)

This invention relates to a reducing valve construction or the like and more particularly to a valve capable of delivering a fluid, for example steam, at a substantially constant pressure.

One of the objects of this invention is to provide a reducing valve construction which is of sturdy and durable construction and reliable operation. Another object is to provide a device of the above nature which is simple in construction and thoroughly efficient in operation. Another object is to provide a device of the above nature which may be manufactured economically with inexpensive materials. Another object is to provide a device of the above nature well able to withstand the corrosive effects of high pressure steam or the like and corroding agents carried thereby. Another object is to provide a device of the above nature which will operate effectively for a long period of time without clogging or jamming any of the parts due to foreign matter in the steam. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawing in which is shown one of the various possible embodiments of my invention,

Figure 1 is a sectional elevation of the valve; Figure 2 is a sectional elevation of the valve casing;

Figure 3 is a sectional elevation of the interior parts of the valve; and

Figure 4 is a perspective of the main valve gate.

Similar reference characters refer to similar parts throughout the several views of the drawing.

In order that certain features of this invention may be more readily understood, certain difficulties encountered in devices of this nature should be considered. Valves of this general character are often used in air conditioning systems of the steam injector type as, for example, in railroad passenger cars or the like. In such a system it is highly desirable that the reducing valve be one which will hold the outlet pressure at a constant value for a wide range of relatively higher inlet pressures; the operation of such systems must be reliable in spite of small particles of dirt which are often found in the steam. Furthermore, many valves of this nature are characterized by a condition of unbalance

during operation which often results in delivery at depleted pressures for increases in inlet pressure. And still further, many such valves operate indifferently because of the formation of water traps or because of complicated construction which renders accurate seating highly difficult if not impossible. One of the objects of this invention is to rectify the above conditions in addition to many others of an equally disadvantageous nature.

Referring now to the drawing and to Figure 1 in particular, a valve casing generally indicated at 10 is provided with an inlet 11 (Figure 2) and an outlet 12 which are respectively in communication with a high pressure chamber 13 (Figure 1) and a low pressure chamber 14. Casing 10 may comprise a casting of any suitable material although it is preferable that this casing be of bronze. Substantially centrally disposed and extending vertically through casing 10 is a valve assembly generally indicated at 15 (Figures 1 and 3) and it is by means of this assembly that high pressure steam entering high pressure chamber 13 by way of inlet 11 is reduced to a constant low pressure in low pressure chamber 14, all as will be more specifically described hereinafter.

Referring to Figure 2, casing 10 includes an inner partition 16 which, with a wall 10a of the casing, forms high pressure chamber 13. Another partition 17 extends from the outer wall of the casing and forms the low pressure chamber 14 (see Figure 1). Partitions 16 and 17 have extending therethrough a bore 18 the top edge 18a of which is beveled to form a valve seat for the reception of a valve gate as will be more clearly described hereinafter. Casing 10 is also provided with a suitably threaded lower bore 19 and with an upwardly extending nipple 20 the exterior of which is threaded.

Valve assembly 15 (Figure 3) includes a main valve or gate generally indicated at 21 which, as is more clearly shown in Figure 4, has a substantially cylindrical top part 21a the lower edge of which is beveled as at 21b. Extending downwardly from top 21a substantially from the center thereof is a body 22 and on this body there are provided a number of radially extending wings of fins 23. Secured to body 22 and wings 23 is a threaded screw portion 24 which extends therebelow for a purpose to be described hereinafter.

With reference to Figure 1, fins 23 of gate 21 lie within bore 18, and bevel 21b is in registry with bevel 18a of bore 18 whereby communication between chambers 13 and 14 is increased or diminished depending upon the relationship of

the two bevels. As may be seen in Figure 3, gate 21 is provided with a central bore 21c which extends from top 21a a substantial distance downwardly through body 22. A port 25 extends through body 22 and opens into bore 21c.

With reference to Figures 1 and 3, a bellows guard 26 having a bore 26a rests upon top 21a of gate 21. A bellows bottom 27 having a reduced portion 27a which extends through bore 26a of bellows guard 26 likewise rests upon top 21a. A valve stem generally indicated at 28 has a threaded end 28a which is threadably received in bore 21c of gate 21. Stem 28 is also provided with a portion 28b which is received within a bore 27b extending through bellows bottom 27 and rests upon top 21a of gate 21. A collar portion 28c is formed on stem 28 and presses down upon the top of bellows bottom 27 when the stem is screwed into position in gate 21. Thus guard 26 and bottom 27 are securely clamped in assembled relation to gate 21 by means of the collar on valve stem 28.

As is more clearly shown in Figure 1, bellows guard 26 lies within the bore provided by nipple 20 and is slidably related to a cylindrical portion 29a of a bellows top 29. Bellows top 29 includes a collar portion 29b which rests on a shoulder 20a (see Figure 1) provided in the top of nipple 20, and is clamped in position on nipple 20 by means of a nut 30 threadably received on nipple 20.

As viewed in Figure 3, bellows top 29 has a centrally disposed bore 29c in which is cut a shoulder 29d for the reception of a stem guide 31. Stem guide 31 includes a downwardly extending portion 31a through which extends a tapered bore 31b provided for the reception of the top of stem 28. Guide 31 is held in position on shoulder 29d by a cap 32 threaded about bellows top 29, and if desired, a gasket (not shown) may be provided between the bottom of nut 30 and the top of collar 29b to seal hermetically the threaded relation between bellows top 29 and nut 30.

A bellows or the like 33 is secured to bellows bottom 27 and bellows top 29 thus forming a chamber in which is disposed a closing spring 34 which is coiled about valve stem 28 and is borne at each end by guide 31 and valve stem collar 28c respectively, this spring constantly urging gate 21 toward a closed position as viewed in Figure 1. Valve stem 28 (Figure 3) is provided with a passage 28d which opens into the interior of bellows at one end and into bore 21c of gate 21 at the other. Thus, as viewed in Figure 1, low pressure chamber 14 is in constant communication with the chamber formed by bellows 33 by way of port 25, bore 21c and passage 28d.

It may now be seen that top 21a (Figure 1) of gate 21 is completely shut off from communication with high pressure chamber 13, that is, the gate is not subjected or urged into a closing position by high pressure steam or the like. Furthermore by the provision of bellows guard 26 and its closely fitting relation with bellows top 29, bellows 33 is effectively guarded against the deleterious effects of very hot steam or corroding agents carried thereby. And still further, it may be seen that gate 21, bellows guard 26, bellows bottom 27, bellows top 29, stem 28, bellows 33, spring 34, guide 31, and cap 32 comprise a unit the several parts of which may be assembled independently of the remainder of the valve and installed as such a unit with a high degree of facility. Such a construction is advantageous in that it not only lends to a rapid assembly of the

valve originally but also permits of quick repair in the event of damage to any of the above-mentioned parts.

As pointed out above, a screw portion 24 (Figure 3) extends downwardly from gate 21. Threaded onto screw 24 is a T nut 35 which has a flange portion 35a. A bellows guard 36 has a top portion 36a provided with an upwardly extending boss 37 or the like. Boss 37 has extending there-through a milled channel or the like 37a provided with an overhanging lip 37b, and this channel receives T nut 35, the T nut being retained in channel 37a by the abutment of lip 37b and flange 35a of the T nut. Top 36a of guard 36 is also provided with a threaded bore 36b which threadably receives a screw 38. Screw 38 extends through a bore in a bellows top 39 and the head of screw 38 clamps bellows top 39 against top 36a of guard 36 when screw 38 is screwed into bore 36b. The end of screw 38 also bears against the bottom of T nut 35 to effect a tight relationship between lip 37b and flange 35a of boss 37 and T nut 35 respectively.

Threaded into bore 19 (Figure 1) of casing 10, I provide a cap generally indicated at 40 which clamps a bellows bottom 41 in position against a shoulder 42 formed in valve casing 10. The skirt 36c of bellows guard 36 depends downwardly to guard a bellows 43 secured at its top and bottom respectively to bellows top 39 and bellows bottom 41. Cap 40 is provided with a threaded bore 40a which threadably receives a screw 44. Screw 44 extends into a chamber 40b of cap 40 and supports therein a spring guide 45. Spring guide 45 has a collar 45a which, with bellows top 39, comprises the end supports for a gate opening spring 46. The tension of spring 46 may be readily adjusted by the vertical displacement of screw 44 which may be locked in any desired position by means of a lock nut 47. Preferably, opening spring 46 is stronger than closing spring 34 and normally tends to hold gate 41 in an open position.

Preferably the space within bellows guard 36 and around bellows 43 is in communication with low pressure chamber 14 by way of a channel 60 (Figures 1 and 2) formed in casing 10. Thus lower bellows 43 and upper bellows 33 are always subject to the same pressure which further assures balanced operation. The interior of bellows 43 is in communication with atmospheric pressure by way of a channel 61 (Figures 1 and 3) formed in cap 40 and this channel prevents the formation of a condition of partial vacuum or compression within bellows 43 upon the upward or downward movement of valve 21.

It may now be seen that the lower part of valve assembly 15 is likewise a unit comprised of T nut 35, bellows guard 36, bellows top 39, screw 38, bellows bottom 41, cap 40, spring 46 and bellows 43 the elements of which, as in the case of the top unit, may be assembled separately from the rest of the valve and installed with great facility as a unit. Preferably the lower unit is first installed whereupon the upper unit is secured to the lower by means of screwing screw portion 24 of gate 21 into T nut 35.

From the above it may now be seen that gate 21 (Figure 1) is always urged toward a closed position by closing spring 34. Thus the closing of the valve is accomplished by spring 34 and the closing occurs when the pressure in low pressure chamber 14 acting to collapse bellows 43 is sufficient to overcome the pressure of spring 46 and the atmospheric pressure within bellows 43. Ac-

Accordingly, if the pressure increases beyond the desired point in low pressure chamber 14, bellows 43 collapses and assists closing spring 34 in overcoming the bias of opening spring 46, in narrowing the passage between bevels 18a and 21b to close off the pressure of high pressure steam or the like. Conversely, a decrease in pressure in low pressure chamber 14 decreases the pressure about lower bellows 43 thus permitting the tension in opening spring 46 to compress closing spring 34, gate 21 accordingly being open to permit a freer flow of high pressure steam to build up the low pressure to the desired value.

In operation high pressure steam or the like enters high pressure chamber 13 in casing 10 by way of inlet 11. From high pressure chamber 13 the steam or the like enters low pressure chamber 14 by way of bore 18 past gate 21. If the low pressure in chamber 14 is at the desired value, the position of gate 21 does not change. Assuming, however, that the pressure of the high pressure steam increases, the pressure in low pressure chamber 14 tends to increase slightly. Upon such increase, however, an increase in pressure about lower bellows 43 immediately results because the pressure thereabout is always that of the low pressure chamber because of the communication provided by way of channel 60. Accordingly, this increased pressure destroys the equilibrium of the opening and closing forces and collapses bellows 43 slightly against the opening tendency of spring 46 and partially closes gate 21. Upon such closing the pressure on the low pressure side rapidly falls to the desired value. However, if it falls below the desired value, then the pressure about lower bellows 43 decreases to permit the tension of opening spring 46 to overcome partially the tension of closing spring 34, the result being that gate 21 opens slightly to permit freer passage of high pressure steam or the like. Hence the valve is immediately responsive to the slightest variations in pressure on the low pressure side.

From the above it may be seen that the pressure on the top and bottom of gate 21 is always constant in that both sides of the gate are subjected to the existing pressure on the low pressure side only, and this because the area of the top of gate 21 within bellows 33 is substantially the same as the area of the bottom of gate 21 which lies in the low pressure chamber. The top and bottom of gate 21 are, therefore, subjected to the same pressure and the particular value of the outlet pressure has no effect on the closing of the valve except as it operates on lower bellows 36. Also as the top of gate 21 is sealed from high pressure chamber 13 by bellows 33, the high pressure has no effect on the opening or closing of the valve. Accordingly, any increase in pressure on the high pressure side does not act directly on the operating parts of the valve, i. e., the valve is always in a condition of balance to efficiently accommodate wide variations in inlet pressure. It will further be seen that inasmuch as gate 21 is rarely completely closed there is no possibility of dirt particles or the like lodging between the valve seats to affect the operation of the valve. Furthermore, bellows 33 and 43 are effectively guarded against the direct impact of high pressure steam and hence are not subject to the deleterious effects thereof nor to the effects of any corroding agents which might be carried by the steam. It will also be apparent that the presence of an excess of water in the steam has no effect upon the operation of the valve in that there is

no space in which such water could be trapped to interfere with the accurate operation of any of the parts.

Accordingly, it may be seen that I have produced a valve in which the several objects hereinbefore mentioned, in addition to many others, are accomplished in a thoroughly practical and efficient manner.

As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawing, is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In regulating valve construction, in combination, means forming a casing having high pressure and low pressure sides, means forming a valve seat in said casing between said sides, a gate member registering with said seat to control the flow of fluid from said high pressure side to said low pressure side, a member secured to said casing and said gate member and hermetically sealing said gate member from said high pressure side, said gate member having a passage connecting the interior of said member with said low pressure side whereby both sides of said gate member are subjected to substantially equal pressures, spring means connected to said gate member for regulating its position with respect to said seat, and means for preventing moisture from collecting in the bottom of said casing.

2. In regulating valve construction, in combination, means forming a casing having high pressure and low pressure sides, means forming a valve seat in said casing between said sides, a regulating valve disc cooperating with said valve seat to control the flow of fluid from said high pressure side to said low pressure side, a spring for closing said valve disc, a spring for opening said valve disc, means imperviously connected to said casing for isolating said disc from said high pressure side whereby both sides of said valve disc are subjected to substantially equal pressures, and a guard member encasing said last-mentioned means to segregate fluid in said casing therefrom.

3. In regulating valve construction, in combination, means forming a casing having high pressure and low pressure sides, means forming a port having a valve seat in said casing between said sides, a single seated valve in said port in registry with said seat to control the flow of fluid from said high pressure side to said low pressure side, a member connected to said valve and said casing and isolating said valve from said high pressure side, said valve having a passage connecting the interior of said member with said low pressure side whereby both sides of said valve are subjected to substantially equal pressures, spring means connected to said valve for regulating its position with respect to said seat, pressure responsive means connected to said valve and adapted to supplement the action of said spring means, and guard means for said member and said pressure responsive means for segregation thereof from fluid within said casing.

4. In regulating valve construction, in combination, means forming a casing having a high pressure and a low pressure side, means forming a port having a valve seat in said casing between said sides, a single-seated valve in said port in registry with said seat to control the flow of liquid from said high pressure side to said low pressure side.

- sure side, a member connected to said valve and said casing and isolating said valve from said high pressure side, said valve having a passage connecting the interior of said member with said low pressure side whereby both sides of said valve are subjected to substantially equal pressures, a closing spring connected to said valve, an opening spring connected to the opposite side of said valve, means for changing at will the tension of said closing spring, means for changing at will the tension of said opening spring, and separate guard means for each of said springs to segregate them from the fluid within the casing.
5. In regulating valve construction, in combination, means forming a casing having a high

pressure and a low pressure chamber therein, a valve in said casing between said chambers and operable to decrease or increase the flow of a fluid from said high pressure chamber to said low pressure chamber, a spring for closing said valve, a spring for opening said valve, a bellows connected to said casing and to one side of said valve and enclosing one of said springs, a second bellows connected to said casing and to the other side of said valve and enclosing the other of said springs, and guard means disposed about each of said bellows to prevent direct impingement of said fluid thereagainst.

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