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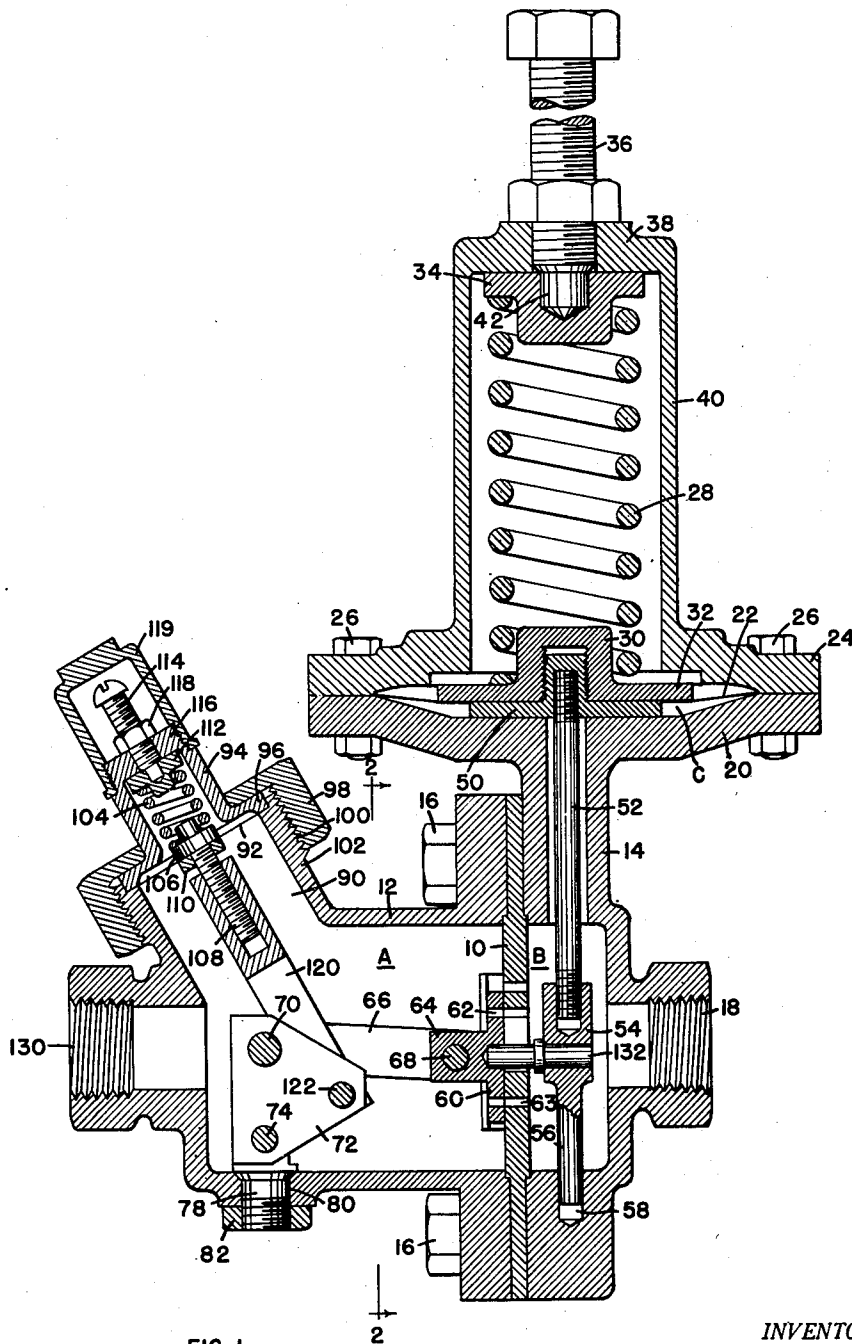
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DIAPHRAGM ACTUATED BALANCED GATE TYPE PRESSURE REGULATOR

Filed Oct. 19, 1949

2 Sheets-Sheet 1



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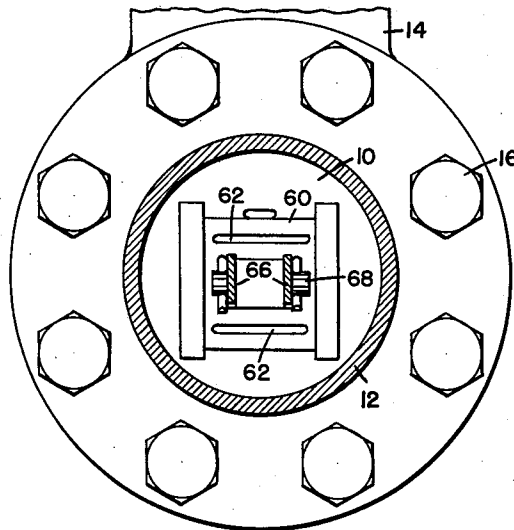


FIG. 2

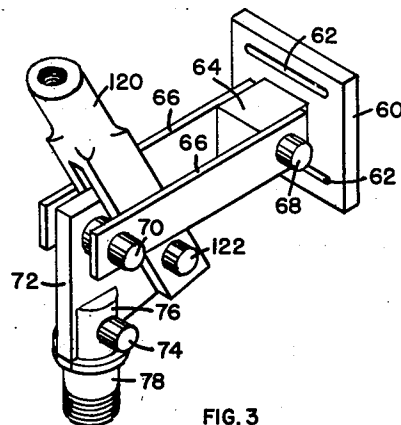


FIG. 3

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DIAPHRAGM ACTUATED BALANCED GATE
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This invention relates to valves and more particularly to that class known as automatic control valves.

An object of the invention is to provide an automatic control valve for fluids, whether liquid or gaseous, which valve is characterized by its inherent sensitivity and accuracy.

Another object of the invention is to provide a valve of the sliding gate type wherein the resultant frictional load applied to the gate by reason of the pressure differential existing on its opposite faces is reduced to a minimum, thereby insuring ease of operation of said gate.

A further object of the invention is to provide a control valve having a sliding gate which is constructed and arranged in such a manner as to effectively preclude the accumulation of scale, deposits of foreign material, or the like, which would otherwise impair the operating characteristics of the valve.

Still a further object of the invention is to provide a control valve, the operating characteristics of which may be controlled by any one of a variety of standard control mechanisms, such as, by way of example, diaphragms, bellows, electrical solenoids, and other remote control mechanisms, whether mechanical or electrical, including float type controls, and the like.

Still another object of the invention is to provide a pressure reducing valve having the hereinabove described characteristics and which is effective for reducing pressures throughout ranges as great as from 100 p. s. i. to one-half p. s. i.

These and other objects are attained by the means described herein and as disclosed in the accompanying drawings, in which:

Fig. 1 is a vertical section through a pressure reducing valve embodying the teachings of the present invention.

Fig. 2 is a section taken on line 2-2 of Fig. 1.

Fig. 3 is a perspective view of the gate control linkage assembly comprising a detail of the invention.

With reference now to Fig. 1, the numeral 10 indicates an orifice plate which defines or separates a high pressure chamber A and a low pressure chamber B. The orifice plate is securely though releasably mounted between adjacent faces of the high pressure housing 12 and low pressure housing 14 by means of bolts 16.

At this point it should be clearly understood that the instant invention is neither directed to nor concerned with the particular structural details of the operating mechanism of the valve; however, for completeness of disclosure and clar-

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ity of detail the operating mechanism may, in the case of adaptation of the invention to a pressure reducing valve, include the following elements:

A low pressure discharge conduit or fitting 18 is provided in open communication with the interior of low pressure chamber B. The pressure in chamber B is transmitted to chamber C, defined by flange 20 of housing 14 and diaphragm 22, which is disposed in spanning relationship between flanges 20 and 24, which are secured together by means of bolts 26, as illustrated.

A suitable means, such as spring 28, may be provided for selectively controlling the deflection of diaphragm 22. The lower end of spring 28 may terminate in a cap member 30, which includes a flange portion 32, the lower face of which bears against the upper face of diaphragm 22.

The upper end of spring 28 may be engaged a cap member 34 which is constructed and arranged for axial movement to increase or decrease the load on this spring by means of bolt 36, which threadably engages the upper portion 38 of spring housing 40, the lower end of which housing terminates in out-turned flange 24. If desired, the lower end of bolt 36 may be provided with a cylindrical bearing portion 42, which is dimensioned to be rotatably received within a complementary socket portion provided in the upper face of cap member 34.

Movement of diaphragm 22 is utilized for controlling the operating characteristics of the valve by means of a flanged stud 50 which is secured to and carried by cap member 30, and wherein the upper face of the flange portion of flanged stud 50 clampingly engages the lower face of diaphragm 22, whereby movement of the diaphragm will result in movement of cap 30 and flanged stud 50.

A control rod 52 is provided for interconnecting flanged stud 50 with gate actuator member 54, the lower end of which terminates in a guide rod portion 56 dimensioned for sliding engagement within socket 58 provided in housing 14, as illustrated.

As hereinabove stated, the present invention is not limited to nor concerned with the particular type of valve actuating means utilized for controlling the operating characteristics of gate 60. If desired, an electric solenoid may be utilized for actuating control rod 52, or a bellows may be used in lieu of the diaphragm 22, or a float control mechanism may be utilized, to mention a few of the various types of actuating means.

The present invention is directed to the struc-

tural details of the high pressure side of the valve, and particularly to the provision of simple, effective, means for decreasing the frictional load or seating force normally applied to sliding gate 60 by reason of the pressure conditions existing within high pressure chamber A. Quite obviously the greater the seating pressure, the greater will be the frictional drag to be overcome by the gate actuating mechanism. It is, therefore, one of the prime objects of the present invention to enable an operator to reduce the effective seating force on gate 60 to a minimum, while insuring effective and efficient operation of the valve.

As best disclosed in Figs. 1 and 2, it will be noted that gate 60 is disposed on the high pressure side of orifice plate 10. Suitable openings, denoted generally by the numeral 62, are provided in gate 60, it being noted that complementary openings 63 are provided through orifice plate 10.

In Fig. 1 gate 60 is illustrated in its full open position wherein openings 62 and 63 are in full alignment for permitting maximum flow of fluid from chambers A to B.

Normally, gate 60 will be urged against and in seating relationship with the high pressure face of orifice 10 by the fluid pressure existing within chamber A. In those instances in which the valve is utilized as a pressure reducing valve and particularly when the degree of pressure reduction effected between chambers A and B is pronounced or extreme, the seating pressure normally exerted on gate 60 is of such a magnitude as to require the application of large forces for moving it with respect to orifice plate 10.

Gate 60 may be provided with a boss 64 to which one end of each of a pair of links 66 is pivotally secured by means of pivot pin 68. The other end of each of links 66 pivotally engages a pivot pin 70, which extends through and is carried by a linkage plate 72, which is, in turn, pivotally secured to a pivot pin 74, which spans a pair of laterally spaced boss elements 76 of a mounting stud 78.

The mounting stud is constructed and arranged to be received within an opening 80 provided through high pressure housing 12, whereby the free outer end of stud 78 may be threadably engaged by nut 82.

With reference now to Fig. 1, it will be noted that pivot pin 70 and 74 are disposed in substantial vertical alignment.

High pressure housing 12 is provided with an opening 90 provided therein, which opens into the atmosphere. A diaphragm 92 spans opening or aperture 90, being secured in place by means of cap member 94 having a diaphragm engaging periphery 96, which is drawn into diaphragm engaging and sealing relationship by means of nut 98, which threadably engages threaded portion 100 of extension 102, which defines opening 90 in the high pressure chamber.

In the preferred embodiment of the invention, the operating characteristics of diaphragm 92 are controlled by means of spring 104, one end of which bears against cap member 106, which is secured relative to the outer or atmospheric side of diaphragm 92 by means such as, by way of example, a stud 108, which extends through the diaphragm and into cap 106. A nut 110 threadably engages stud 108 on the chamber side of diaphragm 92 for providing a fluid tight seal therewith.

The upper end of spring 104 engages member

112, which is constructed and arranged in such a manner as to be axially shifted by bolt 114, which threadably engages portion 116 of cap member 94. Suitable means, such as a nut 118, may be provided for locking bolt 114 in adjusted position. A closure cap 119 may be provided for housing the upper end of bolt 114 and lock nut 118, as illustrated, it being observed that said closure member may threadably engage the upper outer portion of the cap member.

The lower end of stud 108 is operatively secured to linkage plate 72 by means of link 120, the lower end of which is pivotally secured to the linkage plate by pivot pin 122. It will be noted that link 120 is pivotally secured to linkage plate 72 between pivot pins 70 and 74, and forwardly thereof, that is, toward gate 60.

From the foregoing it will be observed that the pressure existing between chamber A will be transmitted not only to gate 60 but also to the chamber side of diaphragm 92. In the preferred embodiment of the invention the area of diaphragm 92 exceeds the area of gate 60, whereby the total effective load applied to diaphragm 92 will exceed the seating pressure exerted on gate 60. This force differential is transmitted from diaphragm 92 to gate 60 by means of the linkage assembly comprising stud 108, link 120, lever plate 72, and links 66, for imparting an unseating force to gate 60 which is opposed to the normal seating force exerted thereon by the pressure conditions within chamber A.

Bolt 114 may be manipulated for selectively controlling the deflection of diaphragm 92, which in turn controls the effective seating pressure, or frictional load with which gate 60 engages orifice plate 10.

The numeral 130 denotes generally an intake fitting which is in open communication with the interior of high pressure chamber A.

It will be noted that actuation of gate 60 throughout its open and closed cycle is controlled by means of control rod 52, said gate being operatively secured thereto by means of pin 132.

Extensive tests have conclusively proven that the gate of the present valve will not become clogged with foreign material in the fluid being controlled, nor will scale or other undesirable foreign deposits accumulate on the adjacent faces of gate 60 and orifice 10, whereby the operating characteristics of the valve are such as to qualify it for lifetime service.

In conclusion, it will be noted that actuating forces of small magnitude may be utilized for actuating gate 60, wherefore the range of applications of the valve is too great to warrant encumbering the record with specific applications.

It should be understood that various changes in the structural details of the device may be made, within the scope of the appended claims, without departing from the spirit of the invention.

In those instances when it is desired to increase, rather than decrease the seating force applied to a sliding gate, as in those instances when the present invention is applied to control valves other than those classified as pressure reducing, the desired results may be obtained by merely adjusting the setting of stud 108.

What is claimed is:

1. In combination with the sliding gate of a pressure reducing valve of the type which includes an orifice plate between high and low pressure chambers, of means entirely on one side

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of said orifice plate for decreasing the frictional load applied to the sliding gate by reason of the seating force exerted thereagainst by the pressure in the high pressure chamber, said means comprising a pressure responsive diaphragm located in an opening provided in said high pressure chamber, a link secured to and carried by said diaphragm, a link secured to and carried by said gate, a lever within and pivoted to the housing defining said high pressure chamber, each of said links independently pivoted to said lever for imparting an unseating force normal to the sliding axis of the gate in opposition to the seating force induced by the fluid pressure on the high pressure side of the gate, and means operable exteriorly of said high pressure housing for controlling the deflection of said diaphragm for varying the intensity of the unseating force applied to said gate.

2. In combination with the sliding gate of a pressure reducing valve of the type which includes an orifice plate between adjacent high and low pressure chambers, wherein the gate slidably engages the orifice plate on the high pressure side thereof, and wherein gate actuating means are provided on the low pressure side of the orifice plate, of means for selectively controlling the effective frictional seating load applied to the sliding gate by the pressure existing within said high pressure chamber, said members comprising a pressure actuated member within the high pressure chamber, a link secured to and carried by said member, a link secured to and carried by said gate, a lever within and pivoted to the housing defining said high pressure chamber, and means independently and pivotally securing each of said links to said lever.

3. In combination with the sliding gate of a pressure reducing valve of the type which includes an orifice plate between adjacent high and low pressure chambers, wherein the gate slidably engages the orifice plate on the high pressure side thereof, and wherein gate actuating means are provided on the low pressure side of the orifice plate, of means for reducing to a minimum the effective frictional seating load applied to the sliding gate by the pressure existing within said high pressure chamber for lessening the frictional drag to be overcome by said gate actuating means incident to movement of said gate, said means comprising a pressure actuated member within the high pressure chamber, a link secured to and carried by said member, a link secured to and carried by said gate, a lever within and pivoted to the housing defining said high pressure chamber, means independently and pivotally securing each of said links to said lever, and means exteriorly of the high pressure chamber engaging said pressure actuated member for varying its responsiveness to pressure conditions within said high pressure chamber.

4. In combination with the sliding gate of a pressure reducing valve of the type which includes an orifice plate between adjacent high and low pressure chambers, wherein the gate slidably engages the orifice plate on the high pressure side thereof, and wherein gate actuating means are provided on the low pressure side of the orifice plate, of means for selectively controlling the effective frictional seating load applied to

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the sliding gate by the pressure existing within said high pressure chamber, said means comprising a linkage assembly including a link pivotally secured to the high pressure side of said gate, said high pressure chamber having an aperture therein open to the atmosphere, a diaphragm spanning said aperture, a lever and a second link operatively secured to and interconnecting said first mentioned link to said diaphragm for exerting a force on said gate at variance with the normal seating force exerted thereon by the pressure existing within said high pressure chamber, and means for controlling the deflection of said diaphragm for varying the seating force applied to said gate by said linkage assembly, whereby the degree of friction opposing free sliding of the gate on the orifice plate is selectively controllable.

5. In combination with the sliding gate of a pressure reducing valve of the type which includes an orifice plate between adjacent high and low pressure chambers, wherein the gate slidably engages the orifice plate on the high pressure side thereof, and wherein gate actuating means are provided on the low pressure side of the orifice plate, of means for selectively controlling the effective frictional seating load applied to the sliding gate by the pressure existing within said high pressure chamber, said means comprising a linkage assembly including a link pivotally secured at one end to the high pressure side of said gate, said high pressure chamber having an aperture therein open to the atmosphere, a diaphragm spanning said aperture, a second link operatively secured to the pressure side of said diaphragm, a linkage plate pivotally secured to and interiorly of said high pressure chamber, the free end of said second link pivotally secured to said linkage plate above and toward the gate with respect to the pivotal connection of said plate with said high pressure chamber, the other end of said first link pivotally secured to said linkage plate above the pivotal connection of said second link therewith and in substantial vertical alignment with the pivotal connection of said plate with said chamber, said links, plate and diaphragm constructed and arranged to exert a counterforce on said gate in opposition to the seating force normally exerted thereon by the pressure existing within said high pressure chamber, and means for selectively controlling the deflection of said diaphragm for determining the counterforce applied to said gate by said linkage assembly whereby the friction opposing free sliding of the gate on the orifice plate is reduced to a minimum.

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