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FLUID CONTROL VALVE

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Fig. 1

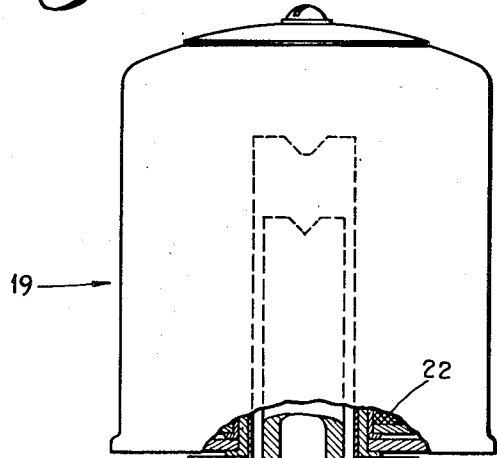
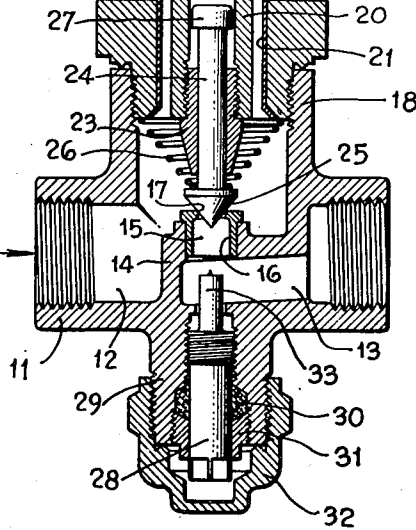
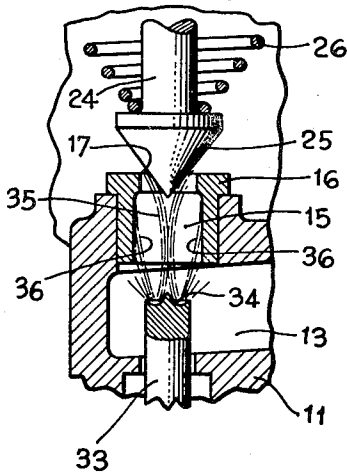


Fig. 2



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UNITED STATES PATENT OFFICE

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FLUID CONTROL VALVE

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7 Claims. (Cl. 251—20)

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My present invention relates to fluid control valves and more particularly to those of the type wherein means, such as a solenoid operator, is provided for applying a sudden force to the valve closure to move it out of engagement with its seat against the pressure of the fluid at the inlet of the valve. When the inlet pressure is relatively high, in order to effect opening of the valve without the expenditure of an excessive amount of energy it is customary to provide means for effecting a so-called "impact action" to initiate the opening movement of the closure. In valves of the solenoid-operated type there is for this purpose a lost-motion connection between the plunger and the closure so that when the plunger is attracted it can travel a short distance before force is applied to the closure so that the kinetic energy of the plunger is effective to initiate the opening movement whereupon, since the operating pressure differential is then reduced, the continued pull of the plunger is capable of effecting full-opening of the closure.

It is an object of the present invention to still further facilitate opening of a valve of the character described hereinabove, and I accomplish this object by providing means for reversing the general direction of flow of a portion of the fluid after it has passed the partially-open closure so as to raise the fluid pressure at the discharge side of the closure and thereby decrease the pressure differential across it.

A further object of the invention is to provide means for causing the fluid to flow past the partially-open closure substantially centrally of the port therebeyond, and means in the path of the discharged fluid for directing a portion of it back toward the side walls of the port.

For full understanding of the invention, and further appreciation of its objects and advantages, reference is to be had to the following detailed description and accompany drawing, and to the appended claims.

In the drawing:

Figure 1 is a sectional view of a valve embodying the invention; and

Figure 2 is an enlarged, fragmentary, sectional view wherein the valve closure is shown in partially-open position for the purpose of indicating the path of the fluid in the valve port.

Referring now more particularly to the drawing, the numeral 11 indicates a valve casing having an inlet 12 and an outlet 13 separated by a right-angled partition 14. In the horizontal portion of the partition is a discharge port 15 which

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is lined by a cylindrical sleeve or port-member 16, the reduced upper end of which constitutes a valve seat 17. Threadedly mounted in the hollow upper portion or neck 18 of the valve casing is an electromagnetic solenoid operator generally indicated at 19, this operator being of conventional construction and comprising a plunger 20 freely reciprocable in a guide sleeve 21 around which is an energizing coil 22. The plunger 20 is, of course, of magnetic material, and is generally square in cross-section; the section shown in the drawing being taken along a line through opposite sides of the square. Threaded in the hollow lower end of the plunger is a guide bushing 23 for a stem 24 which carries a conical closure 25 biased by a compression spring 26 normally into engagement with the valve seat 17. The stem 24 is freely slidable in the bushing 23 so that when, upon energization of the solenoid, the plunger is attracted the closure 25 remains seated until the head 27 of the stem 24 is engaged by the top surface of bushing 23, whereupon a sudden lifting force or impact is applied to the closure. If the pressure differential between the inlet and outlet of the valve is not excessive in comparison with the power of the solenoid, the closure is dislodged from its seat and, since the pressure differential across the closure is then somewhat reduced, continued upward movement of the plunger normally effects full opening of the valve.

In order to effect the full opening of the valve under higher fluid pressure conditions, means is provided adjacent the outlet end of the port 15 for increasing the fluid pressure in that port above its normal value when the closure is initially opened or "cracked." This means comprises a stem 28 adjustably threaded in an opening, coaxial with the port 15, through a thickened cylindrical portion 29 of the bottom wall of the valve casing. Around the outer end portion of this stem is a conventional sealing means comprising packing 30 and a gland 31; a threaded cap 32, encompassing the bottom of portion 29, serving as an additional sealing means. In the top surface of the reduced upper end portion 33 of the stem 28 is an annular recess or concavity 34 (Fig. 2).

When, as is shown in Fig. 2, the closure 25 is brought to its partially-open position (as under the effect of the plunger impact) the fluid stream tends to follow down the conical surface of the closure so that its path is generally central of the port, as indicated by the flow-lines 35. Upon reaching the concavity 34 a portion of the stream

is thereby directed backwardly, as indicated at 36, toward the side walls of the port so that the fluid pressure in the port is substantially increased and continued upward movement of the closure facilitated. By the improvement of the present invention, I have found that the operating pressure of an experimental valve, of the general construction shown in the drawing, was increased approximately 20%.

The specific embodiment of the invention herein shown and described is obviously susceptible of modification without departing from the spirit of the invention, and I intend therefore to be limited only by the scope of the appended claims.

I claim as my invention:

1. In a fluid control valve: a casing having a port through which the fluid is discharged, flow-controlling means at the inlet end of said port, and a member mounted in said casing having a surface so positioned in the path of the discharged fluid as to direct a portion of the fluid back into said port to raise the pressure of the fluid therein when in the opening movement of said flow-controlling means the same is in partially-open position, the area and position of said surface relative to the port being such as to have minimum effect on flow through the valve when the flow-controlling means is fully open.

2. In a fluid control valve: a casing having a port through which the fluid is discharged, flow-controlling means at the inlet end of said port, and a member mounted in said casing substantially axially of said port adjacent the outlet end thereof and having a surface so positioned as to direct a portion of the discharged fluid back into the port so as to raise the pressure of the fluid therein when in the opening movement of said flow-controlling means the same is in partially-open position, the area and position of said surface relative to the port being such as to have minimum effect on flow through the valve when the flow-controlling means is fully open.

3. In a fluid control valve: a casing having an elongated port through which the fluid is discharged, a movable closure cooperable with the inlet end of said port to control the flow there-through, said closure being so formed that when it is in a partially-open position the path of the passing fluid is substantially central of the port, and a member mounted in said casing having a surface so positioned in said fluid-path as to direct a portion of the fluid back toward the sides of the port when in the opening movement of said closure the same is in said partially-open position, the area of said surface and its position in said fluid-path being such as to have minimum effect on flow through the valve when the closure is fully open.

4. In a fluid control valve: a casing having an elongated port through which the fluid is discharged, a movable closure cooperable with the inlet end of said port to control the flow there-through, said closure being so formed that when it is in a partially-open position the path of the passing fluid is substantially central of the port, and a member mounted in said casing having an annular concavity concentric of the port, said concavity facing the port and being spaced outwardly from the outlet end thereof for directing a portion of the fluid in said path back toward the sides of the port when in the opening movement of said closure the same is in said partially-open position, the area of said concavity and its position in said fluid-path being such as to have

minimum effect on flow through the valve when the closure is fully open.

5. In a fluid control valve: a casing having an elongated port through which the fluid is discharged, a closure cooperable with the inlet end of said port and biased to closed position, said closure being arranged for movement along the axis of the port, means for applying a sudden opening force to said closure, and means for facilitating full-opening of the closure comprising a member mounted in said casing and having a surface adjacent the outlet end of said port so positioned as to direct a portion of the discharged fluid back into the port to raise the pressure of the fluid therein when in the opening movement of the closure the same is in partially-open position, the area and position of said surface relative to the port being such as to have minimum effect on flow through the valve when the closure is fully open.

6. In a fluid control valve: a casing having an elongated port through which the fluid is discharged, a closure cooperable with the inlet end of said port and biased to closed position, said closure being arranged for movement along the axis of the port, means for applying a sudden opening force to said closure, said closure being so formed that when it is in a partially-open position the path of the passing fluid is substantially central of the port, and means for facilitating full-opening of the closure comprising a member mounted in said casing having a surface so positioned in said fluid-path as to direct a portion of the fluid back toward the sides of the port when in the opening movement of said closure the same is in said partially-open position, the area of said surface and its position in said fluid-path being such as to have minimum effect on flow through the valve when the closure is fully open.

7. In a fluid control valve: a casing having an elongated port through which the fluid is discharged, a closure cooperable with the inlet end of said port and biased to closed position, said closure being arranged for movement along the axis of the port, means for applying a sudden opening force to said closure, said closure being so formed that when it is in a partially-open position the path of the passing fluid is substantially central of the port, and means for facilitating full-opening of the closure comprising a member mounted in said casing having an annular concavity concentric of the port, said concavity facing the port and being spaced outwardly from the outlet end thereof for directing a portion of the fluid in said path back toward the sides of the port when in the opening movement of said closure the same is in said partially-open position, the area of said concavity and its position in said fluid-path being such as to have minimum effect on flow through the valve when the closure is fully open.

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