

UNITED STATES PATENT OFFICE

2,470,566

FLUID CONTROL VALVE MECHANISM

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Application November 30, 1946, Serial No. 713,242

6 Claims. (Cl. 121—147)

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This invention relates generally to improve-
 ments in valve mechanisms for regulating the
 flow of fluid to and from fluid pressure cylinders
 or other fluid utilizing mechanisms. The present
 invention relates more particularly to a valve
 mechanism that may be used to advantage in
 conjunction with a variety of glassware forming
 machinery.

It is an object of this invention to provide an
 inexpensive, simple, reliable valve mechanism
 that can be used to regulate the flow of pres-
 surized fluid to a fluid utilizing device and the
 exhaust of fluid therefrom in a regulated timed
 sequence.

Another object of the present invention is the
 provision of a valve mechanism which may be
 used to regulate the movements of a reciprocable
 piston in both its directions of motion so that the
 piston may be moved without undesirably large
 decelerations during the latter portion of the
 piston's movement in either direction.

A still further object of the present invention
 is the provision of a fluid control valve that may
 be given a variety of predetermined fluid regu-
 lating positions by a rotary cam, the positions of
 the valve mechanism being mechanically fixed by
 a latching member.

A more specific object of the present invention
 is the provision of a unitary valve mechanism
 which may be operated to control the feeding
 and exhausting of fluid to and from both ends
 of a double-acting piston and cylinder mecha-
 nism to impart thereto a predetermined sequence
 of operations.

A still further object of the present invention
 is the provision of a valve mechanism for use in
 conjunction with a double-acting cylinder and
 piston mechanism, the valve being so con-
 structed as to permit a regulated exhaust of fluid
 from both ends of the cylinder simultaneously
 when the valve has a given predetermined posi-
 tion.

Additional objects and advantages of the pres-
 ent invention will be pointed out and will become
 apparent in the course of the following descrip-
 tion which has particular reference to the ac-
 companying drawing, in which:

Fig. 1 is a vertical sectional view of a preferred
 embodiment of the present novel valve mecha-
 nism in operative relationship with a portion of
 a rotary actuating cam assembly and a conven-
 tional double-acting piston and cylinder mecha-
 nism which is indicated by dot-and-dash lines, a
 movable spool member of the valve being shown
 in its lowermost operating position in which

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pressurized fluid may be fed to one end of the
 cylinder and fluid may be exhausted at a regu-
 lated rate from the other end of the cylinder;

Fig. 2 is a vertical sectional view of the valve
 mechanism showing the movable spool member
 in its intermediate operating position in which
 fluid may be exhausted from both ends of the
 cylinder to the atmosphere simultaneously;

Fig. 3 is a vertical sectional view of the valve
 mechanism showing the movable spool member
 in its uppermost operating position in which
 pressurized fluid may be fed to one end of the
 cylinder and fluid may be exhausted at a regu-
 lated rate from the end of the cylinder to which
 pressurized fluid is fed when the valve is in the
 position shown in Fig. 1; and

Fig. 4 is a side view of a portion of the rotary
 cam assembly showing a portion of a latching
 member of the valve mechanism and its spaced
 relationship with a valve lever of the valve
 mechanism.

The present invention contemplates the pro-
 vision of a valve body or housing and a spool-
 type movable valve member retained therein, the
 valve housing having a plurality of flow passages
 communicating with appropriately located
 throttle valves and pipe lines, certain of the pipe
 lines communicating with a conventional
 double-acting cylinder and piston device or other
 fluid utilizing mechanism. The present inven-
 tion also contemplates a valve lever and latching
 member which, when suitably actuated by radial
 projections on a rotary cam drum, will move the
 spool valve to any one of a variety of positions
 and maintain the spool valve in any given posi-
 tion, respectively, until the latching member is
 moved out of engagement with the valve lever
 by release members adjustably secured to the pe-
 riphery of the cam drum. The construction of
 the valve mechanism, as will be more fully de-
 scribed hereinafter, is such that either end of
 the associated cylinder may be pressurized while
 the opposite end of the cylinder is being ex-
 hausted to atmospheric pressure. The spool
 valve may be moved to and maintained in a
 suitable intermediate position whereby both ends
 of the cylinder may be exhausted to the atmos-
 phere simultaneously.

The details of construction of the present em-
 bodiment are clearly shown in Fig. 1. A valve
 body or housing, generally designated 1, is
 formed to define a vertical partial bore or valve
 chamber 2. Disposed therein is a movable spool
 valve, generally designated 3, spool valve 3 hav-
 ing upper and lower annular grooves 4 and 5,

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respectively, therein, thus providing vertically spaced valve members 3a, 3b and 3c, respectively, which fit closely but slidably in the valve bore or chamber 2. Indicated in Fig. 1 by dot-and-dash lines is a fluid pressure or pneumatic double-acting cylinder 6 having a reciprocable piston 7 disposed therein and defining therein upper and lower portions of the cylinder 6a and 6b, respectively. An inlet flow passage 8 is provided in housing 1, communicating with bore 2 10 and incoming feed pipe line 9. A flow passage 10 is provided above passage 8 in housing 1, communicating with bore 2 and pipe line 11 which is connected to the uppermost region of portion 6a of cylinder 6. Another flow passage 12, 15 located at a level below passage 8, communicates with bore 2 and pipe line 13 which is connected to the lowermost region of portion 6b of cylinder 6. Designated 14 and 17 in Fig. 1 are flow passages in valve housing 1 at a level above and below passage 8, respectively, through which exhaust products from portions 6a and 6b, respectively, of cylinder 6 may pass to pipe nipples 15 and 18, respectively. Adjustable throttling valves 16 and 19 are connected to pipe nipples 15 and 18, respectively.

The lower end portion or stem 20 of spool valve 3 extends downward from valve housing 1 through a reduced downward extension 2a of the bore 2 and is rounded to form a hemispherical tappet end 20a. A horizontally disposed pivoted valve lever 21 is mounted on pivot pin 22 for limited swinging movements in a vertical plane. A small projection 23 is provided on one end of lever 21 for a purpose to be more fully described presently. Disposed above spool valve 3 in bore 2 is a valve spring 24, the action of which is to force spool valve 3 downwardly to make bearing contact between tappet end 20a of the spool valve and valve lever 21. A latching member 25 is pivotally mounted on a horizontal pivot pin 26, the latching member having limited swinging movements in a vertical plane. Disposed between a portion of valve housing 1 and a face of the latching member is a compression coil spring 27, the tendency of which is to force latching member 25 into engagement with projection 23 of valve lever 21. Latching member 25 has lower and upper notches or recesses 28 and 29, respectively, disposed for cooperative engagement with projection 23 of member 21.

Operatively disposed beneath the valve mechanism is a rotary cam drum 30. Adjustably secured to the cam drum are actuating buttons 31 and 32. Also adjustably secured to cam drum 30 are latching member release members 33 and 34, respectively. A sloping face 35 is provided on a lower portion of the valve lever 21. Members 31 and 32 are of sufficient radial extent to make bearing contact with face 35 in the course of the rotation of those members about the rotational center line of the rotary drum. It will be noted that button 32 is of greater radial extent, that is, longer than button 31 and that button 31 will contact face 35 at an earlier time in the rotation of cam drum 30 than button 32.

When the movable parts are in the positions shown in Fig. 1, the spool valve will be in its lowermost position and valve lever 21 will be at rest in its lowermost position as determined by the butting of extension 36 of one end of the valve lever on a portion of valve housing 1. When spool valve 3 is in this position, pressurized fluid may flow from inlet pipe 9 through flow passage 8 to annular groove 4 and thence to flow passage 10.

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From flow passage 10, pressurized fluid may flow by pipe line 11 to portion 6a of cylinder 6. At the same time, any pressurized fluid in portion 6b of cylinder 6 may flow through pipe line 13 to flow passage 12 and thence to annular groove 5 which, in turn, is in communication with flow passage 17. Pressurized fluid in passage 17 may pass through pipe nipple 18 to throttling valve 19 from which it may escape to the atmosphere at a rate determined by the amount of opening of the throttle valve. It will be obvious to those skilled in the art that under the hereinbefore described conditions, piston 7 will be forced downwardly under the action of the pressurized fluid in portion 6a of the cylinder. The flow passage through throttle valve 19 may be regulated to such a small size that the fluid in portion 6b of the cylinder will vent therefrom to the atmosphere at a relatively slow rate. Under these conditions, piston 7 will tend to compress the fluid in portion 6b of the cylinder and will thereby form an air cushion to gradually decelerate piston 7 during the latter portion of its downward movement.

After a predetermined displacement of piston 7 downwardly, the low actuating button 31 may contact face 35 of valve lever 21, thereby raising the valve lever to the position shown in Fig. 2. It will be noted that projection 23 of the valve lever will thereby become engaged with notch or recess 28 of latching member 25. This engagement will prevent valve lever 21 from moving downwardly thereafter until released subsequently. It will also be noted that spool valve 3 will be in contact with the valve lever and will be displaced upwardly from the position shown in Fig. 1. When the spool valve is in the position shown in Fig. 2, neither annular groove 4 nor groove 5 will be in communication with the incoming feed line 9, but, instead, annular groove 4 will be in communication with exhaust passage 14 and annular groove 5 will be in communication with exhaust passage 17. Thus, fluid may exhaust from portion 6a of the cylinder (not shown in Fig. 2) to passage 10 and thereafter to passage 14 by way of annular groove 4. At this same time, fluid may exhaust from portion 6b of the cylinder to flow passage 17 by way of passage 12 and annular groove 5. Thus, this position of the spool valve permits the exhausting of both ends of the cylinder to atmospheric pressure simultaneously.

As the cam drum continues to rotate, the high actuating button 32 will come into bearing contact with face 35 of the valve lever in a fashion similar to that hereinbefore described relative to button 31. Valve lever 21 and spool valve 3 will again be moved upwardly and projection 23 will become engaged with notch or recess 29 of the latching member. This valve position is shown in Fig. 3. It will be evident from Fig. 3 that, when the valve is in this position, pressurized fluid may flow from incoming line 9 to portion 6b of the cylinder by way of annular groove 5 and that fluid may exhaust from portion 6a of the cylinder to flow passage 14 by way of annular groove 4. Under these conditions, piston 7 will be moved upwardly under the influence of fluid pressure in portion 6b of the cylinder and, if a sufficient restriction be caused by a suitable adjustment of throttle valve 19, a substantial compression of fluid in portion 6a may result and thereby cushion piston 7 during the latter portion of its upward movement.

As shown in Fig. 4, cam drum 30 is formed to

define a plurality of circumferential grooves 37, each groove being of an essentially T-shaped cross section as shown at 38. Releasably secured at predetermined angular positions along one of these grooves 37 are buttons 31 and 32 and release members 33 and 34. It is to be noted that the width of latching member 25 is substantially greater than the width of valve lever 21 and is displaced to the right as viewed in Fig. 4. Release members 33 and 34 have radial projections 39 and 40, respectively, the projections extending outwardly at one side of the release members in position to contact with the depending end of latch member 25 but to by-pass lever 21 without interference therewith. It is also to be noted that projection 40 is of greater radial extent, that is, longer than projection 39 for a purpose to be hereinafter described.

The valve position will be changed from that shown in Fig. 3 to that shown in Fig. 2 by the contact of portion 39 of release member 33 with the lower depending end of latch member 25. Projection 23 of valve lever 21 will thereby be lowered one notch on the latching member. The same fluid flow conditions will again obtain as hereinbefore described with reference to Fig. 2. As projection 40 of release member 34 comes into bearing contact with the lower depending end of latching member 25, projection 23 of the valve lever will be released from notch 28 and the valve will return to the operating position shown in Fig. 1 with the same attendant fluid flow regulating conditions. During all the aforementioned movements of valve lever 21, spool valve 3 will be constrained to move with correlated movements by the downward acting force of valve spring 24.

A threaded plug 41 may be provided at the upper end portion of bore 2 to centralize spring 24 and close off the upper end of the bore. Small vent holes 42 and 43 may be provided in plug 41 and the valve housing, respectively, to vent the portions of bore 2 above and below valve member 3, respectively, to the atmosphere. These vent holes will effectively discharge any leakage between the valve member 3 and bore 2 and will prevent undesirable vacuum formation in the course of movements of the valve member.

From the foregoing description, it will be evident that the disclosed valve mechanism may be moved to any one of three definite fixed positions: one position whereby fluid is fed to one end of the cylinder and slowly exhausted at a predetermined rate from the other end of the cylinder, the throttling of the exhaust forming an air cushion for the movement of the piston; a second valve position whereby fluid is exhausted from both ends of the associated cylinder; and a third position whereby fluid is admitted to the opposite end of the cylinder and exhausted from the first-mentioned end of the cylinder, the throttling of the exhaust forming an air cushion during the reversed motion of the piston opposite to the motion resulting from the first valve position.

It will be obvious to those skilled in the art that the sequence and timing of the movements of the valve may be varied at will by a suitable shifting of the angular location of buttons 31 and 32 and release members 33 and 34. It will also be evident that by removing one or more of the actuating buttons or release members, the sequence of movements of the valve mechanism may be changed at will to suit the conditions of operation of the associated fluid utilizing mechanism.

I claim:

1. In combination, a valve housing formed to define a bore therein and having a transverse fluid inlet passage, a pair of transverse fluid feed passages, and a pair of transverse fluid exhaust passages extending from said bore to the exterior of said valve body, a spool valve having a pair of annular grooves formed therein, said spool valve being movably disposed in said bore and having one end projecting from said valve housing to serve as a tappet member, a horizontal pivotally mounted valve lever cooperatively disposed with said end of said spool valve, a pivoted latching member secured for cooperative engagement with said valve lever, and actuating means cooperative with said valve lever and said latching member to position said spool valve in each of three operating positions, said three operating positions of said spool valve regulating the flow of pressurized fluid from said inlet passage to each of said feed passages and from said feed passages to said exhaust passages by way of said annular grooves, in timed sequence.

2. Apparatus as defined in claim 1, and, in addition, adjustable regulable valves to control the flow of exhaust fluid from said exhaust passages.

3. Apparatus as defined in claim 1 in which said actuating means comprises a cam drum, a pair of projecting actuating members radially projecting therefrom for coaction with said valve lever, and a pair of release members radially projecting from said cam drum for coaction with said latching member.

4. Apparatus as defined in claim 1, and, in addition, a compression coil spring to maintain said spool valve in bearing contact with said valve lever.

5. In combination, a valve body, a vertically movable valve disposed therein and extending therefrom to form a tappet face, a horizontal pivoted valve lever cooperatively disposed relative to said tappet face, a projection formed on one end of said valve lever, a vertical pivoted latching member having a pair of vertically spaced notches for cooperative engagement with said projection of said valve lever, and actuating means effective to raise said valve lever to its engaged position with the first notch of said latching member and after a predetermined time period to raise said valve lever to its engaged position with said second notch, thereafter to effect disengagement of said valve lever from said second named notch to release it for engagement with said first named notch and after a predetermined time period to effect disengagement of said valve lever from said first notch to permit it to return to its lowermost initial position, the movements of said valve lever imparting to said valve a sequence of predetermined definite upward movements followed thereafter by a sequence of predetermined downward movements to return said valve to its initial position.

6. Apparatus as defined in claim 5 wherein said actuating means comprises a rotary drum having a groove on its periphery, a pair of angularly adjustable actuating buttons of different lengths releasably secured in said groove for coaction with said valve lever but to by-pass said latching member, and a pair of angularly adjustable release members of different lengths releasably secured in said groove to by-pass said valve lever but to coact with said latching member to disengage said valve lever from its engage-

ment with the notches of said latching member in
timed sequence.

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file of this patent:

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