Sept 17, 1957 L. A. MAXSON 2,806,448

CONTROL FOR ROCK DRILLS

Original Filed April 19, 1952 2 Sheets-Sheet 1

Fig. 1.

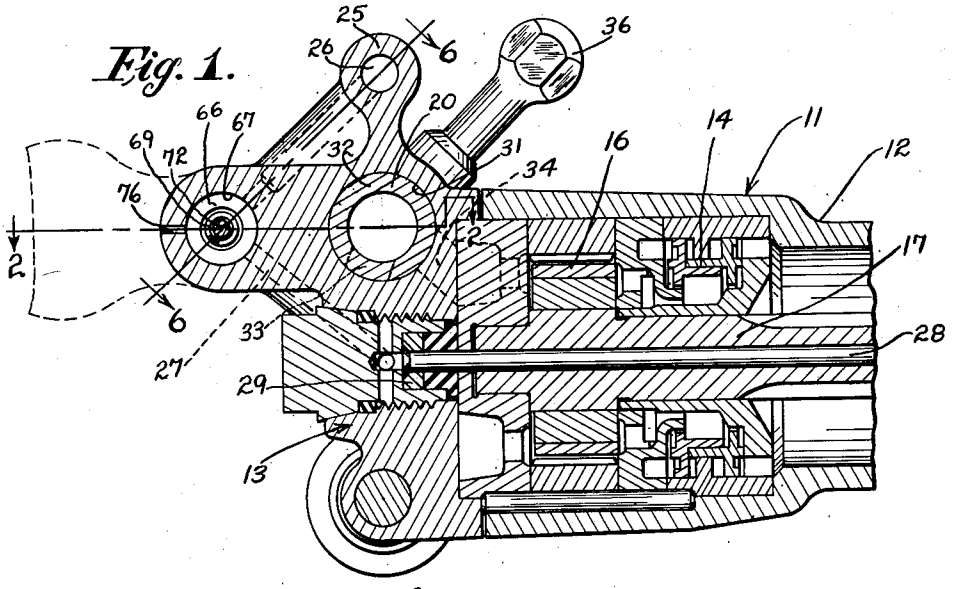


Fig. 2.

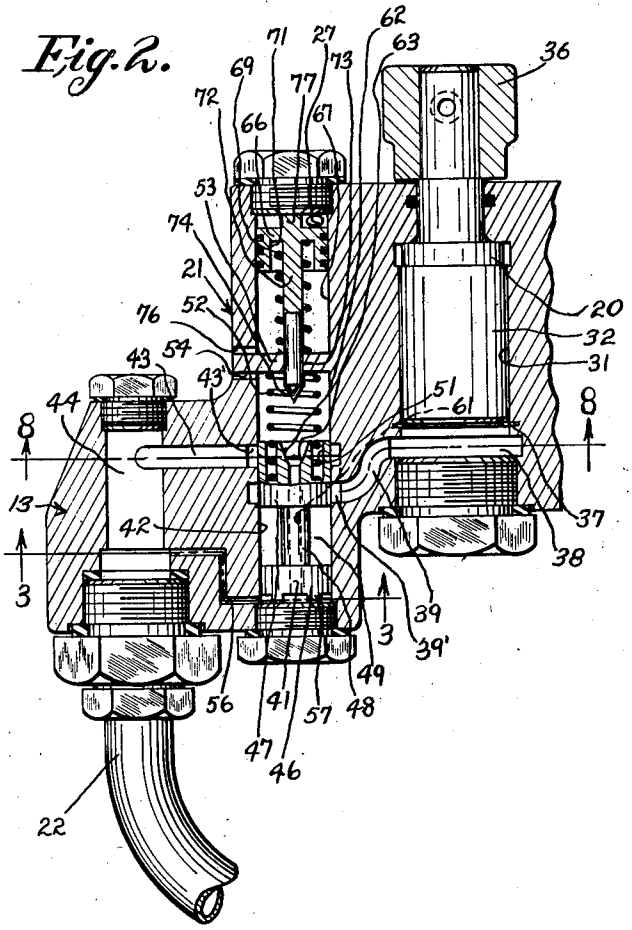
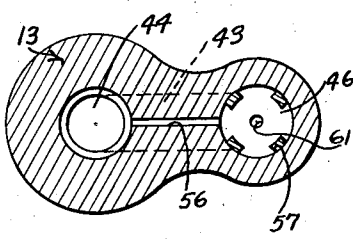


Fig. 3.



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Fig. 4.

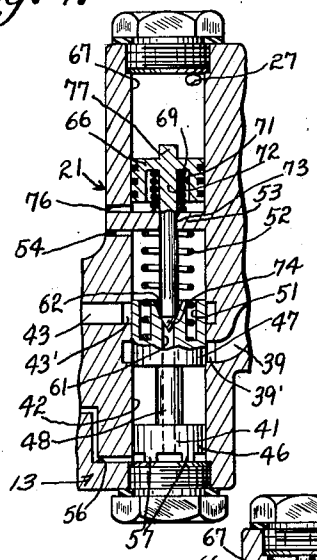


Fig. 5.

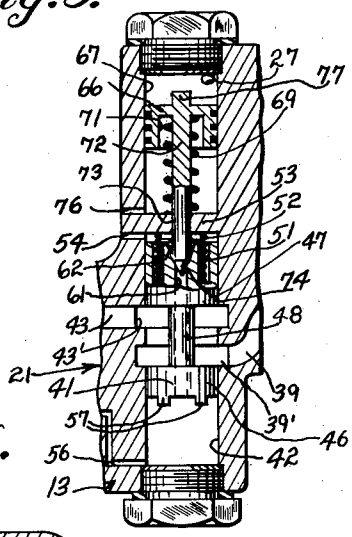


Fig. 6.

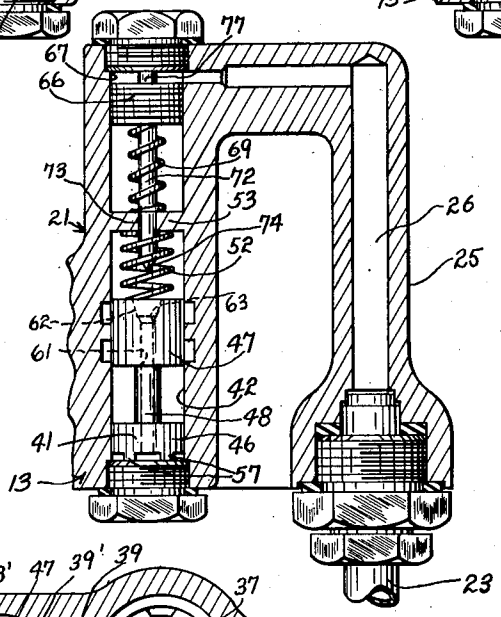


Fig. 7.

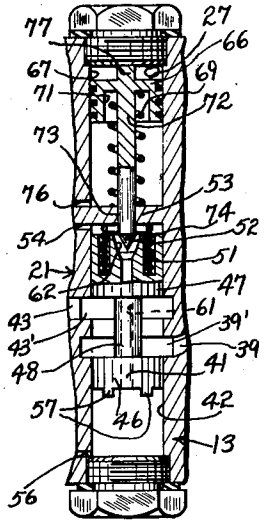


Fig. 8.

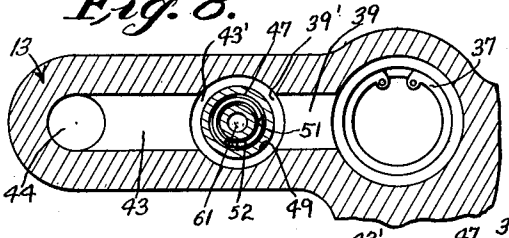
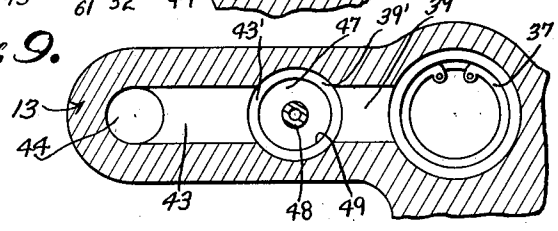


Fig. 9.



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2,806,448

CONTROL FOR ROCK DRILLS

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Application October 24, 1955, Serial No. 542,394

6 Claims. (Cl. 121—10)

This invention relates to rock drills and more particularly to rock drills of the wet type. It is concerned particularly with arrangements for controlling the supply of operating fluid to the rock drill in dependence upon the supply of cleansing fluid to the drill steel.

As is well known, it is common to discharge a stream of water through a drill steel for the purpose of washing the cuttings out of the bottom of the hole as the latter is drilled. In the event of failure of the water supply, damage may be done to the drill, and it is therefore desirable to provide means for precluding or interrupting the supply of air to the rock drill motor in the event that the water supply is not available or fails during operation.

It is an object of the invention to provide an improved arrangement for controlling the supply of air to a rock drill motor including improved means for preventing the supply of air to the motor if cleansing fluid supply is not taking place. It is another object of the invention to provide improved means for controlling the supply of air to the drill motor in dependence upon the supply of cleansing fluid, in a construction in which a throttle valve of standard construction is employed and an auxiliary valve arrangement is provided for controlling the air supply in accordance with whether or not cleansing fluid supply is taking place. A further object of the invention is to provide an arrangement of the character last set forth in which the auxiliary valve is made subject to cleansing fluid supply, but is operated pneumatically. Still another object of the invention is to provide an improved control of the character mentioned in which the auxiliary valve controlling the air supply is pneumatically actuated and has its movements controlled by a device responsive to the cleansing fluid. Still another object of the invention is to provide an improved arrangement of the character set forth in which a constant supply of air is delivered to an auxiliary control valve controlling the air supply to a drilling motor, and the movements of the auxiliary valve are governed by a vent-controlling valve responsive to cleansing fluid. Other objects and advantages of the invention will hereinafter more fully appear.

In a preferred embodiment of the invention a standard throttle valve of any well-known construction may have associated with it an auxiliary valve for controlling the supply of air from a supply connection en route to a drilling motor. Desirably the auxiliary valve may be arranged between the air supply and the throttle valve. Desirably the auxiliary valve may be constantly supplied with air pressure tending to move it in a direction to permit the supply of operating fluid to the drilling motor, and may have its movement in such direction yieldingly opposed by means which the air pressure is more than adequate to overcome. Desirably the auxiliary valve may have have associated with it a vent which when opened prevents the building up of such a pressure upon the auxiliary valve as to overcome the yielding means which opposes its movement. The vent may desirably have associated with it a control valve normally yieldingly held in open position, but having associated with it a device supplied with cleansing fluid when cleansing fluid is supplied for cleansing purposes. Desirably the vent and the vent valve may be so arranged that the vent valve is movable to closed position in a direction opposite the opening movement of the auxiliary valve, and the auxiliary valve, having had the vent closed by the vent valve, moves the vent valve with it as it itself moves to air supply-permitting position. The auxiliary and vent controlling valves may be incorporated desirably in the rear head construction of a drilling motor or they may be mounted in a separate casing, and desirably, in the first arrangement, they are disposed transversely to the longitudinal axes of the drilling motor so that their action may be affected to a minimum by the vibration of the drilling motor.

In the accompanying drawings, in which one illustrative embodiment of the invention is to be seen,

Fig. 1 is a fragmentary central longitudinal section through a drilling motor, showing the rear end of the motor cylinder, the distributing valve, a portion of the rotating mechanism, and the operating air and cleansing fluid supply arrangements.

Fig. 2 is a section on the plane 2—2 of Fig. 1, certain parts not visible in Fig. 1, because at the near side of the section plane, being visible in Fig. 2.

Fig. 3 is a longitudinal section through the rear head of the drilling motor taken on the lines 3—3 of Fig. 2.

Fig. 4 is a fragmentary section on the plane of Fig. 2 showing certain of the parts in another position.

Fig. 5 is another fragmentary section on the plane of Fig. 2, showing the parts in still another position.

Fig. 6 is a fragmentary section on the plane of the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary section on the plane of Fig. 2 showing a momentary position of the parts—the position they would occupy just after the supply of water is interrupted and just before the auxiliary air control valve is moved to cut off the supply of air to the motor.

Fig. 8 is a section on the lines 8—8 of Fig. 2.

Fig. 9 is a corresponding section, with the auxiliary valve in a different position.

Referring to the drawings, and first to Fig. 1, it will be noted that a drilling motor 11 has a cylinder 12 and a rear head generally designated 13. In the rear head a distributing valve mechanism 14 is arranged, and a conventional rotating mechanism, including a ratchet and pawl mechanism 16 and a rifle bar 17, is illustrated. The rear head carries a throttle valve 20, and an auxiliary air control 21, later more fully described, and has a connection 22 for the supply of air and a connection 23 for the supply of cleansing fluid. The cleansing fluid supply takes place through a transverse handle-like element 25 via a passage 26 and the passage 26 is connected by a further passage portion 27 with a cleansing fluid supply tube 28 mounted in the drilling motor 11 by means of a gland structure 29.

The throttle valve 20 includes a valve receiving bore 31 in which a hollow throttle valve proper 32 is rotatable, this throttle valve having a passage 33 through which fluid is adapted to be admitted by way of a passage 34, and through spaces in the rotating mechanism, to the distributing valve 14. The throttle valve 32 has an operating handle 36 and is held in position by split ring 37, and controls the supply to the motor of pressure fluid supplied to an enlarged space 38 at the end of the bore 31 by a passage 39.

The auxiliary control 21 includes, for the control of passage 39, a piston valve 41 reciprocable in a transverse bore 42 in the head structure 13. The passage 39 opens into the bore 42, as does also another passage 43, which connects with an air supply space 44 to which the air connection 22 leads. The passages 39 and 43 communi-

cate respectively with grooves 39' and 43' which are spaced apart axially of the bore 42. The piston valve 41 has spaced heads 46 and 47 which are spaced apart by a reduced portion 48 whereby a fluid conducting groove 49 is formed between the heads. The groove 49 is adapted, in the position of the auxiliary valve 41 shown in Fig. 5, to connect the grooves 39' and 43' and permit air supplied from the air supply connection 22 to reach the throttle valve. The heads 46 and 47 are close sliding fits for the bore 42, and the head 47 is adapted, in the position of the valve shown in Figs. 2, 4 and 6, to prevent communication between the grooves 39' and 43' and so prevent supply of air to the drilling motor, regardless of the position in which the throttle valve 32 may be. It has been noted that the throttle valve is hollow, and air admitted to the space 38 is adapted to flow through the interior of the throttle valve and out of the passage 33 and to the passage 34 leading to the motor.

The head 47 of the auxiliary valve 41 is provided with an annular spring receiving groove 51 of such depth as nearly, but not quite, completely to receive a spring 52, one end of which is received in the groove and presses the auxiliary valve 41 toward the position shown in Figs. 2, 4 and 6. The other end of the spring engages a septum 53 which forms an upper end for the bore 42. A vent 54 connects the upper end of the bore 42 to atmosphere. Head 47 can never move to a position occluding this vent. A constantly open connection 56 of relatively small flow area connects the air supply space 44 with the lower end of the bore 42, and the head 46 of the auxiliary valve 41 is provided with a notched rim 57 so that air flowing from the passage 56 may always have access to the lower end of the head 46. The head 46 in the lower end of the bore 42 constitutes the movable element of an expansible chamber device for moving the valve 41.

The piston valve 41 is traversed lengthwise and, as shown, axially, by a vent passage 61 having a slight enlarged end portion 62 at the junction of which with the remainder of the passage there is a frusto-conical valve seat 63. It will be appreciated, since the vent passage 61 and the vent 54 are made of adequate size readily to permit the escape of fluid which passes through the passage 56, that, with the spring 52 of appropriate strength, the piston valve 41 will remain in the position of Figs. 2, 4 and 6 so long as the vent passage 61 is not closed, and will return to that position—if out of it—upon opening of the vent passage.

Arrangements are provided for closing the vent when cleansing fluid is being supplied. This includes a piston 66 reciprocable in a bore 67, which is coaxial with the bore 42. The end of the bore 67 remote from the septum 53, which also furnishes an end wall for the bore 67 as well as for the bore 42, is connected in communication with the cleansing fluid supply passage 26. A spring 69 acts between the septum 53 and the piston 66 and extends into a groove 71 of suitable depth in the piston. This groove is of such depth as to permit most, but not all, of the spring 69 to be received in it in the position of the piston 66 shown in Fig. 4.

The piston 66 has a stem 72 which extends slidably through a bore 73 in the septum 53 and which is surrounded by the spring 69 and which has at its lower end a conical seating portion 74 which is adapted to engage the frusto-conical seat 63 and interrupt venting of fluid from the lower end of the bore 42 through the axial vent passage 61 in the auxiliary valve 41. The lower end of the bore 67 is vented as at 76. The piston 66 can never close this vent. The strength of the spring 69 need not be large, as it is simply designed to maintain, or return and maintain, piston 66 and its connected valve-forming stem in the position shown in Figs. 2, 6 and 7 when no cleansing fluid supply is taking place. The piston 66 has a projection 77 of small diameter at its upper end for the purpose of preventing the piston 66 from closing the mouth of the passage 26. Reference to Fig. 4 will show that the length of the spring 69 is such as to prevent closing of the vent 76 when the piston 66 is in its extreme position remote from the passage 26. Reference to Fig. 5 will show that the spring 52 is of such length as when fully collapsed to prevent the head 47 of the auxiliary valve 41 from closing the vent 54. Reliance upon the springs to limit valve movements is of course unnecessary as suitable stops might obviously be employed.

The mode of operation of the structure described will be readily understood. Fig. 2 represents the position of the parts when no operating air is being supplied to the drilling motor and no cleansing fluid is being supplied to the passage 26 and to the water tube 28. Air may be supplied to the space 44, but cannot pass the head 47 of the valve 41 and obtain access to the space 38. This is because the piston valve 41 is maintained in the position shown by the spring 52, a thing which is possible because the air flowing from the space 44 through the passage 56 is freely vented through the axial vent passage 61, the upper end of bore 42, and the vent passage 54.

Now, if cleansing fluid is supplied through the connection 23, it will be observed that, en route to passage 27, it will pass through the conduit 26 into the upper end of the bore 67 and act on the piston 66 and force it to the position shown in Fig. 4. This will bring the valve portion 74 into sealing engagement with the valve seat 63 and interrupt the venting of fluid through the passage 61. It will be noted that the water pressure acting on the considerable area of the piston 66 will be more than sufficient to maintain the valve portion 74 in sealing engagement with the seat 63 against full air pressure acting on the end of the stem 72, but it will not be sufficient to prevent air pressure acting on the full transverse area of the head 46 of the valve 41 from promptly moving that valve, as soon as venting is interrupted, to the position shown in Fig. 5 in which the grooves 43' and 39' are brought into communication with each other through the groove 49 so that air can be delivered to the space 38 in communication with the interior of the throttle valve 32. It will be evident that as the auxiliary valve 41 moves from the position of Fig. 4 to the position of Fig. 5 it will force the piston 66 back against the water pressure, for the air pressure will be sufficient not only to overcome the water pressure, but to compress the spring 52. It will be evident that if water and air pressures vary greatly in relation to each other some modifications of proportions may be necessary to insure the desired result, but in general it will be understood that the effective area of the piston 66 will always be great enough, under the water pressure available, to overcome the spring 69 and to maintain the valve portion 74 seated in the mouth of the axial passage 61, that the spring 52 will always be sufficiently strong to maintain the piston valve 41 in the positions of Figs. 2, 4 and 6 so long as the axial vent passage 61 is open, and that the cross sectional area of the piston valve 41 will always be so selected that, with the air pressure available, the valve 41 will move, when the vent passage 61 is closed, from the position of Fig. 4 to the position of Fig. 5 against the pressure exerted by the spring 52 and the pressure of the water acting on the piston 66.

With the parts in the position shown in Fig. 5 if the water pressure fails the spring 69 will move the valve portion 74 further upward and open the axial vent 61 and permit the pressure to bleed away beneath the head 46, with the result that the piston valve 41 will move down to the position of Figs. 2, 4 and 6 and cut off the air supply by interrupting the connection between grooves 43' and 39'.

Fig. 7 is included to show the valve portion 74 moved up and the axial vent 61 opened, but the piston valve 41 still in open position. Such a position is but momentary, if indeed some downward movement of the piston valve 41 would not already have commenced. The terms "up-

ward" and "downward" are used with reference to the figures, not actual normal positions, as the piston valve 41 normally will move horizontally.

It will be evident that the motor cannot be started if there is no water, and that if with the motor running, water delivery fails, the motor will be stopped.

This present application is a continuation of my application Serial No. 283,180, filed April 19, 1952, for Control for Rock Drills, and now abandoned.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim is:

1. In a rock drill, in combination with a motor for actuating a hollow drill steel and having a passage for conducting cleansing liquid to the hollow drill steel, a valve controlling the flow of operating medium to said motor, said valve having an area thereon upon which the action of fluid at an appropriate pressure serves to effect movement of said valve in a direction to permit the passage of operating medium to said motor, means including a restricted passage for supplying operating fluid to said area, means for venting fluid from said area at a rate to prevent the building up by fluid flowing through said restricted passage of a pressure adequate to move said valve in said direction, and a valve for controlling said venting means having a control responsive to the pressure of cleansing fluid supplied to said first mentioned passage.

2. In a rock drill, in combination with a motor for actuating a hollow drill steel and having a passage for conducting cleansing liquid to the hollow drill steel, a valve controlling the flow of operating medium to said motor, said valve having an area thereon upon which the action of fluid at an appropriate pressure serves to effect movement of said valve in a direction to permit the passage of operating medium to said motor, means including a restricted passage for supplying operating fluid to said area, means including a passage extending through said valve for venting fluid from said area at a rate to prevent the building up by fluid flowing through said restricted passage of a pressure adequate to move said valve in said direction, and a valve for controlling said venting means having a control responsive to the pressure of cleansing fluid supplied to said first mentioned passage.

3. In a rock drill, in combination with a motor for actuating a hollow drill steel and having a passage for conducting cleansing liquid to the hollow drill steel, a valve controlling the flow of operating medium to said motor, said valve having an area thereon upon which the action of fluid at an appropriate pressure serves to effect movement of said valve in a direction to permit the passage of operating medium to said motor, means including a restricted passage for supplying operating fluid to said area, means including a passage extending through said valve for venting fluid from said area at a rate to prevent the building up by fluid flowing through said restricted passage of a pressure adequate to move said valve in said direction, and a valve coaxial with the passage extending through said valve for controlling said venting means having a control responsive to the pressure of cleansing fluid supplied to said first mentioned passage.

4. In a rock drill, in combination with a motor for actuating a hollow drill steel and having a passage for conducting cleansing liquid to the hollow steel, a valve controlling the flow of operating fluid to the motor and having opposite positions in which it opens a passage for and prevents flow of operating fluid to said motor, means for yieldingly maintaining said valve in the latter of said positions, and means for moving it to the first of said positions including a surface subjected to operating fluid and having a restricted supply to it of operating fluid, means for venting operating fluid from said surface at a rate to preclude the movement of said valve to a position opening a passage for operating fluid to said motor, and means responsive to cleansing fluid for controlling said venting means.

5. In a rock drill, in combination with a motor for actuating a hollow drill steel and having a passage for conducting cleansing liquid to the hollow steel, a valve controlling the flow of operating fluid to the motor and having opposite positions in which it opens a passage for and prevents flow of operating fluid to said motor, means for yieldingly maintaining said valve in the latter of said positions, and means for moving it to the first of said positions including a surface subjected to operating fluid and having a restricted supply to it of operating fluid, means for venting operating fluid from said surface at a rate to preclude the movement of said valve to a position opening a passage for operating fluid to said motor, and means responsive to cleansing fluid for controlling said venting means, including a valve having means for yieldingly holding it open and a surface subjected to cleansing fluid, when cleansing fluid is being supplied to said passage, for moving said last mentioned valve to closed position.

6. In a rock drill, in combination with a motor for actuating a hollow drill steel and having a passage for conducting cleansing liquid to the hollow steel, a valve controlling the flow of operating fluid to the motor and having opposite positions in which it opens a passage for and prevents flow of operating fluid to said motor, means for yieldingly maintaining said valve in the latter of said positions, and means for moving it to the first of said positions including a surface subjected to operating fluid and having a restricted supply to it of operating fluid, means for venting operating fluid from said surface at a rate to preclude the movement of said valve to a position opening a passage for operating fluid to said motor, and means responsive to cleansing fluid for controlling said venting means, including a valve having means for yieldingly holding it open and a surface subjected to cleansing fluid, when cleansing fluid is being supplied to said passage, for moving said last mentioned valve to closed position, said first and second mentioned valves movable in opposite directions against the yielding means associated with them, and coaxially arranged, and the first having, as a part of the venting means for operating fluid, a conduit traversing it axially and said second valve adapted to seal said axial passage.

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