

May 6, 1958

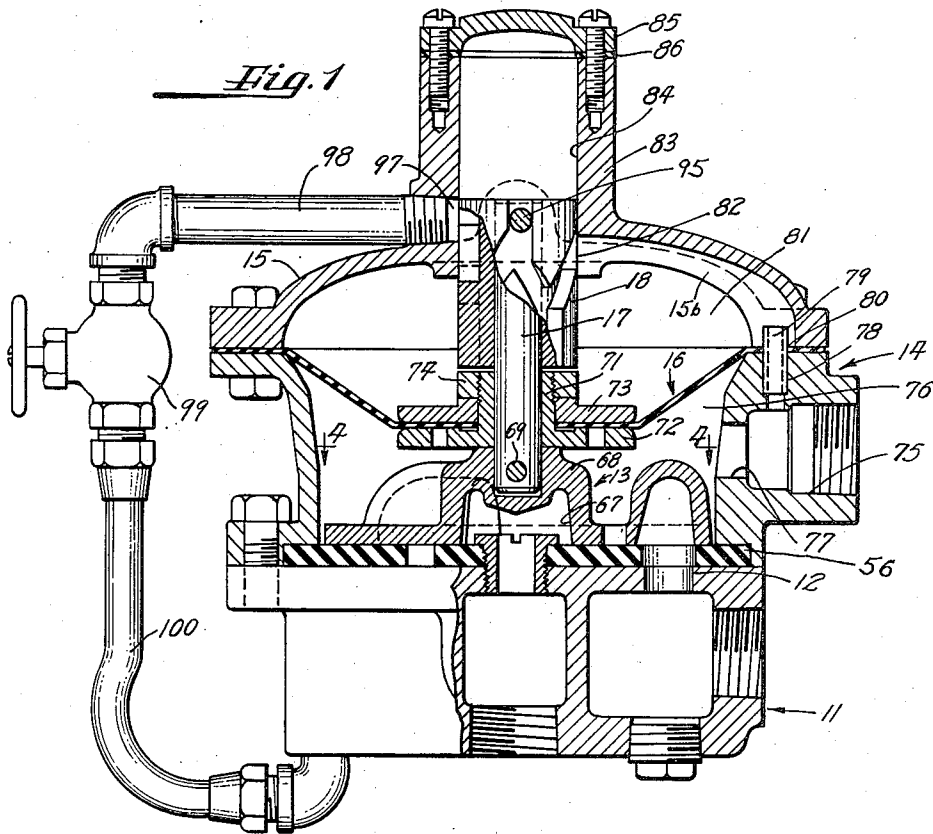
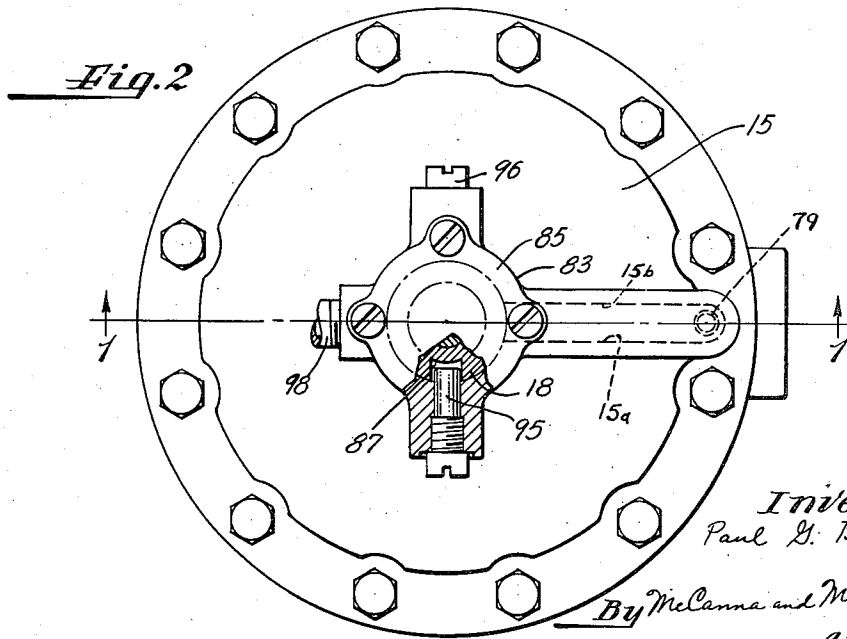
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2,833,309

MULTIPLE PORT VALVES

Filed Dec. 26, 1952

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3

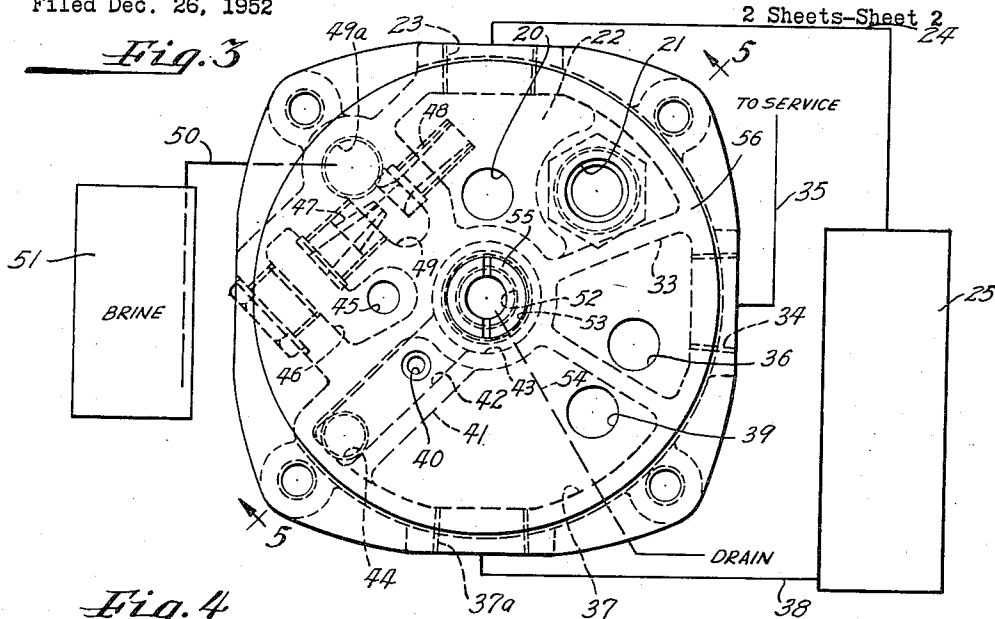


Fig. 4

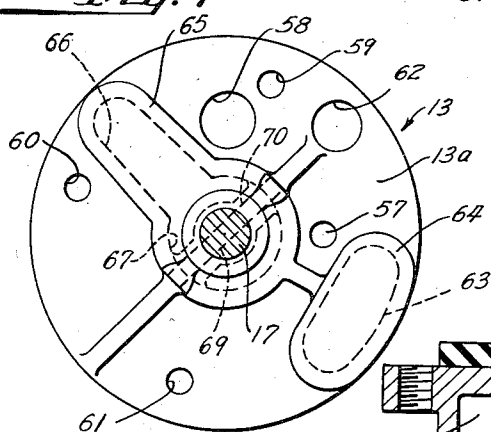


Fig. 5

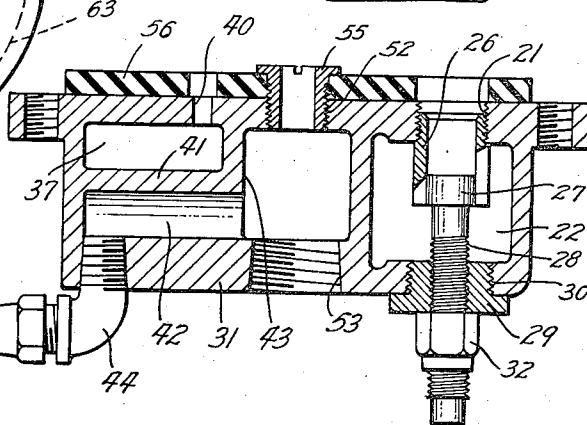
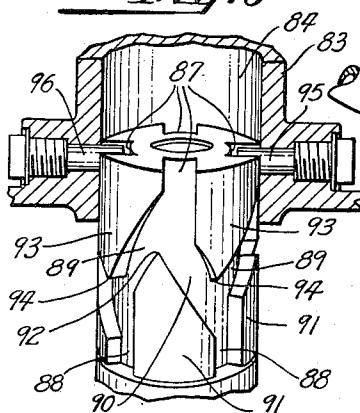


Fig. 6



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2,833,309

MULTIPLE PORT VALVES

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14 Claims. (Cl. 137—625.46)

This invention relates to a multiport valve, and particularly to a valve of this type for controlling water treatment apparatus.

It is an object of this invention to provide a novel multiport valve having improved operating characteristics.

It is also an object of this invention to provide a multiport lift turn valve having a fluid pressure operated arrangement for unseating, turning and reseating the rotor of the valve and a novel arrangement for insuring seating of the rotor when desired.

Also, an object of this invention is to provide a self-contained multiport valve having a fluid pressure operated mechanism for turning the rotor of the valve and an arrangement for controlling the operation of this fluid pressure operated mechanism by selectively passing through the multiport valve to drain the fluid acting against said fluid pressure operated mechanism.

Another object of this invention is to provide a multiport valve having a novel and simplified arrangement for guiding the movement of the valve stem while the rotor of the valve is being turned between its operative positions in the valve.

A further object of this invention is to provide a multiport valve having a fluid pressure operated mechanism for turning the rotor of the valve and a novel arrangement for relieving the fluid pressure acting against said fluid pressure operated mechanism to initiate turning of the rotor.

Other and further objects and advantages of the present invention will be apparent from the following description of a preferred embodiment thereof, which is shown in the accompanying drawings to illustrate the principles of the invention.

In the drawings:

Figure 1 is a longitudinal section through the middle of the multiport valve of the present invention, taken generally along the line 1—1 in Fig. 2 but with a portion of the cam shown in elevation;

Figure 2 is a top view, with parts broken away, of the valve;

Figure 3 is a top view of the body of the multiport valve of the present invention and showing the connections from the body to the various components of the water treatment system with which the valve is used;

Figure 4 is a top view of the rotor of the valve;

Figure 5 is a section through the body of the valve, taken along the line 5—5 in Fig. 3; and

Figure 6 is a fragmentary section at the cam in the Fig. 1 valve for turning the rotor of this valve.

Referring to the drawings, the multiport valve of the present invention includes a body or back plate 11 having a ported inner face 12, a rotor 13 overlying the ported face of the back plate, an annular bonnet or intermediate rotor housing member 14 attached to the back plate and extending around the rotor, a cover 15 attached to the housing member 14, a flexible resilient diaphragm 16 clamped at its periphery between the intermediate housing

2

member 14 and the cover 15, a valve stem 17 connected to the rotor, and a cam 18 carried on the upper end of the valve stem for turning the stem and rotor between successive rotative positions of the rotor in response to longitudinal movement of the valve stem.

The body 11 at its ported inner face has a plurality of ports communicating respectively with chambers in the body. Referring to Fig. 3, the ports 20 and 21 in the ported inner face of the body communicates with a chamber 22 in the body which communicates through an opening 23 in the periphery of the body with a conduit 24 leading to the top of a water treatment tank 25. While the treatment tank 25 is in this instance of the type for softening water, it is to be understood that it might also be a water dimimeralizer or water filter. From Fig. 5 it will be noted that there is provided an adjustable throttling valve at the body port 21 for controlling the rate of flow therethrough. This throttling valve includes a slotted tubular member 26 threadedly received in the port 21 and a valve disk 27 attached to one end of a stem 28 which extends through the chamber 22 in the body. The valve disk 27 is shaped to be snugly received in the axial passage through the tubular member 26 for throttling the flow therethrough. An annular collar 29 is threadedly received in an opening 30 in the outer bottom wall 31 of the body and the stem extends threadedly through this collar. A lock nut 32 is threaded onto the end of the stem 28 projecting beyond the body for clamping the stem in the position to which it has been adjusted. Obviously, after loosening the clamping collar 29 for moving the valve disk 27 into or away from the tubular member 26 for selectively varying the flow therethrough, after which the clamping nut 32 may again be tightened to clamp the throttling valve disk 27 in this position.

Another chamber 33 in the body communicates through a passage 34 in the periphery of the body with a conduit 35 leading to service. A port 36 in the ported inner face of the body communicates with this body chamber 33.

Another chamber 37 in the body communicates through an opening 37a in the periphery of the body with a conduit 38 extending from the bottom of treatment tank 25 below the bed of treatment material therein. Ports 39 and 40 in the ported inner face of the body communicate with this chamber 37 therein.

As best seen in Figs. 3 and 5, at one end of the body chamber 37 there is provided a semi-cylindrical wall 41 separating the chamber 37 from an internal passage 42. Passage 42 extends between a drain passage 43 located at the center of the body and a pipe connection 44 extending through the lower outer wall of the body.

The body is also provided at its ported inner face with a port 45 communicating with a passage 46 leading to the inlet end of an adjustable ejector nozzle 47 mounted within the body. The nozzle 47 discharges into a Venturi shaped throat member 48 also mounted in the body, the outlet end of the throat communicating with the chamber 22 in the body. Between the discharge end of the ejector nozzle 47 and the inlet end of the throat 48 the body forms a chamber 49. A pipe 50 leading from a brine tank 51 communicates with this chamber 49 through an opening 49a in the bottom of the body. Thus, water discharged through the ejector nozzle 47 into the throat 48 is adapted to draw brine through pipe 50 into the passage 49 in the body and thence through the throat 48 of the ejector into the chamber 22 in the body leading to the top of the treatment tank.

At the center of its ported inner face the body is formed with a threaded opening 52 leading down into the drain passage 43. At its other end this drain passage has a threaded opening 53 to which a drain pipe 54 (Fig. 3) is connected. A ferrule 55 (Fig. 5) is threadedly received in the central drain opening 52 in the body

and serves to clamp a resilient gasket 56, of rubber or the like, overlying the ported inner face of the body. The gasket 56 is formed with holes therethrough which register with the above-described ports in the ported inner face of the body.

The rotor or stem plate 13 includes a plate portion 13^a having a flat under face adapted to seat on the gasket 56 overlying the ported inner face of the body. A port 57 extending through the rotor is positioned to register respectively with the ports 20 and 45 in the ported inner face of the body in pre-selected different rotative settings of the rotor. Three spaced ports 59, 60 and 61 which extend through the rotor are positioned respectively to register with the port 36 in the ported inner face of the body in different preselected rotative positions of the rotor. Another port 62 which extends through the rotor is positioned to register with the ports 21 and 39 in the ported face of the body in certain of the rotative positions of the rotor. The rotor is also formed with an elongated passage 63 in its underface which is disposed below a downwardly facing channel shaped rotor portion 64. In one of the rotative settings of the rotor the rotor passage 63 registers with both of the ports 36 and 39 in the ported face of the body. A downwardly facing channel portion 65 of the rotor overlies an elongated passage 66 extending radially in the underside of the rotor. This port 66 at its inner end communicates with a central port 67 in the underside of the rotor which overlies the central drain passage in the body in all of the rotative settings of the rotor.

Above its central port 67 the rotor is formed with a generally dome-shaped portion 68 to which the lower end of the valve stem 17 is connected, as by a cross pin 69 (Fig. 1) received snugly in the diametrically opposed holes 70 in the dome-shaped portion 68. As best seen in Fig. 1, the diaphragm 16, which is clamped at its periphery between the housing member 14 and the top cover 15, is formed with a central hole through which extends the upwardly extending tubular neck 71 of the lower diaphragm plate 72. An annular upper diaphragm plate 73 overlies the diaphragm. A nut 74 is threaded onto the upper end of the neck 71 of the lower diaphragm plate for clamping the upper and lower diaphragm plates tightly on opposite faces of the diaphragm. The valve stem extends snugly up through the passage formed in the tubular neck portion of the lower diaphragm plate and is capable of turning freely within this passage. The nut 74 is disposed directly beneath the bottom face of cam 18 to engage and lift this cam when the diaphragm moves upwardly, thereby unseating the rotor 13 through its connection to the stem 17 on which the cam is mounted.

At one side the generally annular intermediate housing member 14 of the multiport valve is formed with an inlet passage 75 for passing raw water into the rotor chamber 76 enclosed by the gasket 56, diaphragm 16 and the intermediate housing member 14. A flow restriction at 77 is provided between the inlet 75 and the rotor chamber 76 for the purpose of producing a pressure differential between the inlet 75 and the rotor chamber 76 when water is flowing from the inlet through the rotor chamber. An upwardly extending passage 78 is formed in the intermediate housing member 14, communicating with the inlet passage 75 ahead of the flow restriction 77. The passage 78 receives a short tube 79 which extends up through a hole 80 in the diaphragm into the pressure chamber 81 above the diaphragm, which is enclosed by the dome shaped cover 15. Thus, the pressure chamber 81 is at all times in fluid communication with the inlet passage 75.

The cam 18 attached to the upper end of valve stem 17 is substantially disposed in the pressure chamber 81 above diaphragm 16 when the rotor 13 is seated, as shown in Fig. 1. In this position, the upper end of the cam extends up through a central opening 82 in the

cover 15. A cam guide bushing 83 is suitably mounted on top of the cover 15 and is formed with a vertical cylindrical passage 84 aligned with the central opening 82 in the cover. A cap 85 bolted to the upper end of the guide bushing 83 closes the upper end of passage 84, there being provided a resilient gasket 86 between these members for preventing leakage. The passage 84 in the guide bushing 83 is dimensioned to snugly, yet slidably, receive the cam 18.

The cover 15 is formed on its underside with a pair of parallel depending ribs 15^a and 15^b which extend from the central opening 82 down to the passage 78 in the intermediate housing member 14. The diaphragm 16 is not sufficiently flexible to conform snugly to the channel formed by the ribs 15^a and 15^b in the top cover when the diaphragm is raised, so that water from tube 79 is free to pass along this channel to the central opening 82 in the cover 15.

As best seen in Fig. 6, the cam 18 is generally cylindrical in configuration and is formed in its periphery with a continuous cam groove. This cam groove includes four evenly spaced vertical upper groove portions 87, four evenly spaced vertical lower groove portions 88 disposed in staggered relation with respect to the vertical upper groove portions, inclined helical groove portions 89 extending between the upper end of each vertical lower groove portion 88 and the lower end of the adjacent upper groove portion 87 to the right in Fig. 6, and inclined helical groove portions 90 extending between the lower end of each vertical upper groove portion 87 and the adjacent vertical lower groove portion 88 to the right in Fig. 6. Between the groove portions of the cam groove there are provided lower cam segments 91 which have pointed upper ends 92 located to one side of the adjacent vertical upper cam groove portions 87, and upper cam segments 93 which have pointed lower ends 94 located to one side of the adjacent vertical lower cam groove portions 88.

As best seen in Fig. 6, the guide bushing 93 carries a diametrically opposed pair of stationary cam follower pins 95 and 96 which project into oppositely disposed portions of the cam groove. With the rotor 13 of the lift turn valve seated, the cam 18 is in its lowermost position and the pins 95 and 96 are received in the vertical upper portions 87 of the cam groove. When the rotor is lifted away from its seated position the cam 18 rises and the vertical upper cam groove portions 87 move upward past the respective cam follower pins 95 and 96 until the inclined faces of the respective lower cam elements 91 to the right of the points 92 engage these pins. As the cam continues to move upward these inclined faces ride over the pins 95 and 96 to turn the cam 45 degrees until the vertical lower cam groove portions 88 register with the pins 95 and 96. When the rotor is resealed the cam 18 passes down past the pins 95 and 96, with the vertical lower cam groove portions 88 initially moving down away from the pins. Continued downward movement of the cam brings the inclined lower faces of the upper cam segments 93 to the right of the cam points 94 into engagement with the pins, after which the cam turns an additional 45 degrees as these inclined faces ride over the pins 95 and 96. Finally, the vertical upper cam groove portions register with the pins 95 and 96 when the rotor is again fully seated. From the foregoing it will be seen that a complete reciprocation of the cam, valve stem and rotor causes the rotor to be turned ninety degrees, or one quarter turn.

From Fig. 1, it will be noted that the cam guide bushing 83 is formed with a passage 97 to which a conduit 98 is connected. The conduit 98 communicates with a valve 99, which in turn is connected to a conduit 100 connected to the above-described pipe fitting 44 leading to the internal passage 42 in the body extending to the drain passage 43. The passage 97 in the cam guide bushing is disposed midway between the cam follower pins 95 and 96,

so as to communicate through the cam groove with the pressure chamber 81 in all positions of the cam. When the valve 99 is opened the fluid pressure in the pressure chamber 81 above the diaphragm 16 is relieved through the cam groove, the passage 97, conduit 98, valve 99, conduit 100, pipe connection 44 and the internal passage 42 in the back plate leading to the central drain passage 43. This causes the diaphragm 16 to rise and unseat the rotor 13 and in so rising the described cam arrangement turns the rotor one-eighth turn. With the rotor unseated and the diaphragm 16 in its raised position water is free to pass from pipe 79 up along the channel above the diaphragm formed by the ribs 15a and 15b and thence to drain. When valve 99 is again closed this water is discharged from the channel between the cover ribs 15a and 15b at the centrally located clamping plate 73 on the diaphragm. Thus, it will be seen that the provision of these ribs 15a and 15b in the underside of the top cover enables the water pressure for reseating the rotor to be applied at the center of the diaphragm where it is most effective.

Operation

In the operation of the multiport valve of the present invention, during the service run the rotor 13 is seated on the gasket 56 in confronting relation with the ported inner face of the body. At this time the rotor is at the rotative setting in which the rotor port 58 registers with the body port 20, the rotor port 62 registers with the body port 21, and the rotor port 63 registers with both of the body ports 36 and 39. Untreated water flows through the inlet 75 into the rotor chamber 76 and thence through the rotor ports 58 and 62 down through the respective body ports 20 and 21 into the chamber 22 in the body and thence through conduit 24 to the top of the treatment tank. After flowing down through the treatment tank the water flows through conduit 38 connected to the bottom of the tank into the chamber 37 in the body and from there up through body port 39, through rotor port 63 and thence down through body port 36 into the chamber 33 in the body and from there through conduit 35 to service.

When the bed of treatment material in the treatment tank 25 requires regeneration, the regeneration cycle is initiated by opening valve 99 to empty to drain the water in the pressure chamber 81 above the diaphragm 16. The resulting fluid pressure unbalance above and below the diaphragm causes the diaphragm to move upward and by its connection to stem 17 to unseat the rotor 13 upward away from the ported inner face of the body. As the rotor and stem move upward they are turned 45 degrees by the described cam arrangement. After the valve stem and rotor have been turned 45 degrees the valve 99 is reclosed so that water pressure is again applied against the upper face of diaphragm 16. At this time the pressure in the pressure chamber 81 builds up to that of the pressure in the inlet passage 75. Since at this time, with the rotor 13 unseated there is a continuous water flow from inlet passage 75 through rotor chamber 76 to the drain passage 43 in the body, the restriction 77 causes a pressure drop so that the pressure in rotor chamber 76 is a predetermined value below that of the pressure in the inlet passage 75 (and in the pressure chamber 81). This pressure unbalance above and below the diaphragm 16 causes the diaphragm to move downward to return the rotor to seated position. Thus, in the event that the cam 18 should tend to stick in its uppermost position, or if at any time the rotor should be unseated unintentionally while fluid pressure is still maintained in chamber 81, the flow through the chamber 76 causes a pressure differential on opposite sides of the diaphragm for insuring the seating of the diaphragm. The described cam arrangement effects an additional turning of the valve stem and rotor 45 degrees in the same direction as they move downward, so that when the rotor reseats on the

gasket 56 it has been displaced one quarter turn from its service position.

In this position of the rotor, the rotor port 62 registers with the port 39 in the ported inner face of the body, the rotor port 59 registers with the body port 36, and the rotor port 66 registers with the body port 21. Untreated water from the inlet passage 75 flows through the rotor chamber 76 down through the rotor port 62 and body port 39 into the body chamber 37 and from there through conduit 38 to the bottom of the treatment tank. After backwashing vigorously up through the treatment tank, the effluent flows from the top of the tank through conduit 24 to the body chamber 22 and thence up through body port 21 through the rotor passage 66 to the central rotor port 67 and thence to the drain passage 43 in the body and from there to the drain line 54. The adjustable throttling valve 27 at the body port 21 controls the flow rate through the treatment tank during backwash. Also, at this time a portion of the untreated water supply is bypassed through rotor port 59, body port 36 and body chamber 33 to service.

Following the backwash step, the rotor is again unseated, as described before, and is turned successively through additional quarter turns for successively establishing the reagent injection and rinse steps in the regeneration cycle for the treatment tank.

In the reagent injection and slow rinse position of the rotor, the rotor port 57 registers with the port 45 in the ported inner face of the body, the rotor passage 66 registers with the body port 39, and the rotor port 60 registers with the body port 36. At this time raw water from the inlet 75 passes through the rotor chamber 76 and down through the chamber 46. From here the water flows through the ejector nozzle 47 and the throat 48, drawing brine through pipe 50 from brine tank 51, into the body chamber 22 and from there through conduit 24 to the top of the treatment tank. The effluent from the bottom of the tank flows through conduit 38 to the chamber 37 in the body and thence up through body port 39 into the rotor passage 66 and thence through central rotor port 67 to drain. After a predetermined amount of brine has been withdrawn from brine tank 51, a float valve (not shown) at the brine tank automatically shuts off the flow of brine. At this time the water flow through the ejector to the top of the softener tank continues, for the slow rinse of the exchange material in the softener tank. The adjustment of ejector nozzle 47 determines the flow rate during the slow rinse step. A portion of the untreated water is bypassed to serve through rotor port 60, body port 36, body chamber 33 and service line 35.

Finally, in the fast rinse position of the rotor, the rotor port 57 registers with the port 20 in the ported inner face of the body, the rotor passage 66 registers with the body port 40, the rotor port 61 registers with the body port 36, and the rotor port 58 registers with the body port 45. In this position, raw water from the inlet passage 75 passes down through rotor port 57 and body port 20 into the chamber 22 in the body and from there through conduit 24 to the top of the treatment tank. At the same time, raw water also passes down through rotor port 50 and body port 45 into the body chamber 46. From here this flow passes through the ejector to the body chamber 22 connected to the top of the treatment tank. The effluent from the bottom of the softener tank flows through conduit 38 to the body chamber 37 and from there up through body port 40 into the rotor passage 66 and thence through the central rotor port 67 to drain. A portion of the raw water supply to the valve is also bypassed to service through the rotor port 61, body port 36, rotor chamber 33 and service conduit 35.

While in the foregoing description and in the accompanying drawings there is disclosed a specific preferred embodiment of the present invention, it is to be understood that various modifications, omissions and refine-

ments departing from the disclosed form of the invention may be resorted to without departing from the spirit and scope of the present invention.

I claim:

1. A multiport lift turn valve comprising a body having a ported face and flow passages communicating with the ports in said face, means defining a fluid supply chamber at one side of said ported face, a rotor in said supply chamber mounted to be seated in confronting relation with said ported face and to be unseated away from said ported face, turned, and reseated at different rotative settings in confronting relation with said ported face, said rotor having ports therein arranged to register with different ports in said ported face to pass fluid from said supply chamber through the ported face in the different rotative settings of the rotor, movable pressure responsive means operatively connected to the rotor for unseating and reseating the rotor and exposed on one side to the fluid pressure in said fluid supply chamber, means operatively connected to said rotor for turning the latter between successive positions in response to movement of the rotor from a seated position to an unseated position and back, a fluid inlet for passing fluid into said fluid supply chamber, means defining a pressure chamber at the opposite side of the movable pressure responsive means and communicating with said fluid inlet for receiving fluid therefrom to establish fluid pressure at said opposite side of the pressure responsive means equalling the fluid pressure at said inlet, means communicating with said fluid inlet after the communication of said pressure chamber therewith and defining a flow restriction between said fluid inlet and said fluid supply chamber for effecting a pressure drop between the fluid inlet and the fluid supply chamber when fluid is flowing through the fluid supply chamber to establish a lower pressure at said one side of the pressure responsive means than at said opposite side thereof for maintaining the rotor seated, and means for selectively emptying fluid from said pressure chamber to lower the pressure at said opposite side of the pressure responsive means below the pressure at said one side thereof to effect movement of the pressure responsive means for unseating the rotor.

2. A multiport lift turn valve comprising a body having a ported face and flow passages communicating with the ports in said face, means defining a fluid supply chamber at one side of said ported face, a rotor in said supply chamber mounted to be seated in confronting relation with said ported face and to be unseated away from said ported face, turned, and reseated at different rotative settings in confronting relation with said ported face, said rotor having ports therein arranged to register with different ports in said ported face in the different rotative settings of the rotor to pass fluid from the supply chamber through said ported face, movable pressure responsive means operatively connected to the rotor for unseating and reseating the rotor and exposed on one side to the fluid pressure in said fluid supply chamber, means operatively connected to the rotor for turning the latter from one position to a succeeding position in response to movement of the rotor from a seated position to an unseated position and back, a fluid inlet for passing fluid into said fluid supply chamber, means defining a pressure chamber at the opposite side of the movable pressure responsive means and communicating with said fluid inlet for receiving fluid therefrom to establish fluid pressure at said opposite side of the pressure responsive means equalling the fluid pressure at said inlet, means disposed between said fluid inlet and said fluid supply chamber for effecting a pressure drop between the fluid inlet and the fluid supply chamber when fluid is flowing through the fluid supply chamber to establish a lower pressure at said one side of the pressure responsive means than at said opposite side thereof for maintaining the rotor seated, and means for selectively emptying fluid from said pressure chamber to lower the pressure at said opposite side

of the pressure responsive means below the pressure at said one side thereof to effect movement of the pressure responsive means for unseating the rotor.

3. A multiport lift turn valve comprising a body having a ported inner face provided with a plurality of ports and flow passages communicating with said ports, housing means defining a fluid supply chamber at one side of said ported face, a ported rotor in said supply chamber mounted to seat in confronting relation with said ported face and to be unseated away from said ported face, turned, and reseated at different rotative settings in confronting relation with said ported face, said rotor having ports therein arranged to register with different ports in said ported face in the different rotative settings of the rotor to pass fluid from the supply chamber through said ported face, a flexible diaphragm extending across said supply chamber and exposed on one side to the fluid pressure therein, a connection between the diaphragm and the rotor for effecting corresponding movement of the rotor upon movement of the diaphragm in either direction, means operatively connected to said rotor for turning the latter between successive positions in response to movement of the rotor by the diaphragm, a fluid inlet for passing fluid into said supply chamber, means defining a fluid pressure chamber for supplying fluid pressure against the opposite side of the diaphragm, a passage extending between said fluid inlet and said pressure chamber for passing fluid from said fluid inlet into said pressure chamber to establish fluid pressure at said opposite side of the diaphragm equalling the fluid pressure at said fluid inlet, a flow restriction interposed between said fluid inlet and said supply chamber after said passage to the pressure chamber for effecting a fluid pressure drop between the fluid inlet and the supply chamber when fluid flows from the fluid inlet through the supply chamber to establish a lower pressure at said one side of the diaphragm than at said opposite side thereof for maintaining the diaphragm positioned toward said ported face to hold the rotor seated in confronting relation with said ported face, and a valve communicating with said pressure chamber for selectively emptying the fluid therefrom to lower the pressure at said opposite side of the diaphragm below the pressure at said one side thereof to move the diaphragm away from said ported face for unseating the rotor.

4. A multiport valve comprising a body having a ported inner face provided with a plurality of ports, means defining a fluid supply chamber at one side of said ported face, a ported rotor in said supply chamber mounted in confronting relation with said ported face and mounted to be turned to different rotative settings in confronting relation with said ported face for establishing different flows through the body, a flexible diaphragm having one side thereof exposed to the pressure in said supply chamber, a connection between the diaphragm and the rotor for turning the rotor in response to movement of the diaphragm, housing means defining a fluid pressure chamber at the other side of the diaphragm, an inlet for passing fluid into said pressure chamber and said supply chamber to apply fluid pressure against both sides of the diaphragm, said housing means carrying a pair of ribs disposed within said pressure chamber and extending from said inlet to a central portion of the diaphragm, said ribs defining a channel for supplying fluid pressure from said inlet against said central portion of the diaphragm at said other side thereof, and means communicating with said pressure chamber adjacent the central portion thereof for selectively discharging fluid therefrom.

5. A multiport valve comprising, in combination, a body having a ported face, means defining a fluid supply chamber at one side of said ported face, a ported rotor in said supply chamber mounted in confronting relation with said ported face for movement to different rotative settings in confronting relation therewith to establish different flows through the valve, movable pressure re-

sponsive means exposed on one side to the fluid pressure in said supply chamber, means for supplying fluid to said supply chamber, means defining a pressure chamber communicating with the opposite side of said pressure responsive means for applying fluid pressure thereagainst, means for supplying fluid to said pressure chamber, a cam connected to the rotor for turning the rotor responsive to movement of said pressure responsive means, said cam having a cam groove in its periphery communicating with said pressure chamber, a conduit communicating with said pressure chamber through said cam groove in the cam, and a valve in said conduit for controlling the pressure condition in said pressure chamber to control the position of said movable pressure responsive means.

6. A multiport lift turn valve comprising, in combination, a body having a ported face, means defining a fluid supply chamber at one side of said ported face, a ported rotor in said supply chamber mounted in confronting relation with said ported face for movement to different rotative settings in confronting relation therewith to establish different flows through the valve, movable pressure responsive means exposed on one side to the fluid pressure in said supply chamber, means for supplying fluid to said supply chamber, means defining a pressure chamber at the opposite side of said movable pressure responsive means for applying fluid pressure against said opposite side of said movable pressure responsive means, means for supplying fluid to said pressure chamber, a stem movable with said pressure responsive means and connected to the rotor and extending into said pressure chamber, a cam connected to said stem for turning the stem and the rotor in response to movement of said pressure responsive means, means defining a cam guide bushing for snugly receiving the cam, said cam having a cam groove in its periphery communicating with said pressure chamber and extending into said cam guide bushing, a conduit connected to said cam guide bushing and communicating through said cam groove with said pressure chamber, and a valve in said conduit operative when opened to empty the fluid from said pressure chamber through the cam groove and said conduit for establishing a fluid pressure unbalance on opposite sides of said movable pressure responsive means to move said movable pressure responsive means to turn the rotor.

7. A multiport lift turn valve comprising, in combination, a body having a ported face provided with a plurality of ports, means defining a fluid supply chamber at one side of said ported face, a ported rotor mounted in said supply chamber to be seated in confronting relation with said ported face and to be unseated away from said ported face, turned, and reseated at a different rotative setting in confronting relation with said ported face for establishing different flows through the body in different rotative settings of the rotor, movable pressure responsive means operatively connected to the rotor for unseating and reseating the rotor in response to movement of said movable pressure responsive means, said movable pressure responsive means being exposed on one side to the fluid pressure in said supply chamber, means for supplying fluid to said supply chamber, means defining a pressure chamber at the opposite side of said movable pressure responsive means for applying fluid pressure against said opposite side of said movable pressure responsive means, means for supplying fluid to said pressure chamber, a valve stem connected at one end to the rotor and extending through said movable pressure responsive means into said pressure chamber, a cam mounted on the opposite end of the valve stem, said cam being cylindrical and having a cam groove formed in its periphery which communicates with said pressure chamber, a cam guide bushing defining a cylindrical passage snugly receiving the cam to form a bearing for the cam for guiding the movement of the rotor toward and away from said ported face, a cam follower means received in said cam groove for turning the cam, valve stem and

rotor as the rotor is moved toward and away from said ported face, a conduit connected to said cam guide bushing and communicating through said cam groove with said pressure chamber, and a valve in said conduit operative when opened to empty the fluid from said pressure chamber through the cam groove and said conduit for establishing a fluid pressure unbalance on opposite sides of said movable pressure responsive means to move said movable pressure responsive means to unseat the rotor away from said ported face.

8. A multiport valve comprising a body having a ported face provided with a plurality of ports, one of said ports being located centrally at said ported face and communicating with a central drain passage in the body, a ported rotor mounted in confronting relation with said ported face and mounted to be turned to different rotative settings for establishing different flows through the body, said body being formed with an internal passage which extends from an outer wall of the body into communication with said central drain passage, means including movable pressure responsive means for turning the rotor between preselected rotative settings, means defining a pressure chamber communicating with said movable pressure responsive means, means for supplying fluid to said pressure chamber, conduit means extending from said pressure chamber and connected to said outer wall of the body at said internal passage therein for passing fluid from said pressure chamber to said internal passage and thence to the drain passage, and a valve in said conduit means controlling the emptying to drain of the fluid in said pressure chamber for effecting movement of said movable pressure responsive means.

9. A multiport valve comprising a body having a ported inner face, housing means defining a fluid supply chamber at one side of said ported face, a rotor in said supply chamber mounted to be turned to different rotative settings in confronting relation to said ported face and having ports and passages therein for establishing different flows through the ported face, a diaphragm mounted in said housing having one side thereof exposed to the pressure in said supply chamber, means including a connection between the diaphragm and the rotor for turning the rotor in response to reciprocation of the diaphragm between an initial position and a displaced position, a cover member on said housing defining a fluid pressure chamber on the other side of said diaphragm and adapted to contact the latter when the diaphragm is in its displaced position to limit distention of the diaphragm, an inlet in said housing means communicating with said supply chamber and with said pressure chamber adjacent the outer periphery of the cover member for passing fluid into said pressure chamber and said supply chamber, means in said cover member defining a passage extending from said inlet to the central portion of the cover member for applying fluid pressure from said inlet against the central portion of the diaphragm, and control valve means communicating with the pressure chamber for selectively discharging fluid therefrom.

10. A multiport valve comprising a body having a ported inner face, housing means defining a fluid supply chamber at one side of said ported face, a rotor in said supply chamber mounted to be turned to different rotative settings in confronting relation to said ported face and having ports and passages therein for establishing different flows through the ported face, a diaphragm mounted in said housing having one side thereof exposed to the pressure in said supply chamber, means including a connection between the diaphragm and the rotor for turning the rotor in response to reciprocation of the diaphragm between an initial position and a displaced position, a cover member on said housing defining a fluid pressure chamber on the other side of said diaphragm and adapted to contact the latter when the diaphragm is in its displaced position to limit distention of the diaphragm, an inlet in said housing for passing

fluid into said pressure chamber and said supply chamber, a flow passage defining a flow restrictor communicating said inlet with said pressure chamber adjacent the outer periphery of said cover member for limiting the flow of fluid into the pressure chamber to a predetermined rate, means communicating with said pressure chamber adjacent the central portion of said cover member for selectively discharging fluid therefrom at a rate greater than said predetermined rate whereby the pressure in the pressure chamber may be selectively reduced to effect movement of the diaphragm, and means in said cover member defining a fluid passage extending from said flow restrictor to the central portion of said cover member for applying fluid pressure against the central portion of said diaphragm.

11. A multiport valve comprising a ported inner face, housing means defining a fluid supply chamber at one side of said ported face, a rotor in said supply chamber mounted to be turned to different rotative settings in confronting relation with said ported face and having ports and passages therein for establishing different flows through the face, movable pressure responsive means in said housing exposed on one side to the pressure in said supply chamber, a connection between the pressure responsive means for turning the rotor to different rotative settings in response to movement of the pressure responsive means from an initial position to a displaced position and back, means defining a pressure chamber on the other side of said pressure responsive means, said housing means having an inlet therein for passing fluid into the pressure chamber and the supply chamber, means defining a first flow restrictor in said housing between said inlet and said supply chamber for effecting a predetermined pressure drop between the fluid inlet and the fluid supply chamber when fluid is flowing through the supply chamber, means in said housing defining a second flow restrictor between said inlet and said pressure chamber for effecting a pressure drop between said inlet and said pressure chamber when fluid is flowing through said pressure chamber that is greater than said predetermined pressure drop, and means communicating with said pressure chamber for selectively discharging the fluid therefrom at a rate greater than the rate of fluid flow through the second flow restrictor.

12. A multiport valve comprising a body having a ported face and flow passages communicating with the ports in said face, a rotor mounted in confronting relation with said ported face and having ports and passages therein for establishing different flows through the body in different rotative settings of the rotor, a casing attached to said body and overlying said rotor, a stem attached to said rotor, an elongated cylindrical cam member surrounding said stem and fixedly attached to the stem adjacent one end thereof, said cam member having cam grooves formed on the external periphery thereof, a cam follower on said casing extending into said groove for effecting rotation of the stem and rotor between different rotative settings in response to reciprocation of said stem, means engaging said stem for reciprocating the stem, means on the casing defining a cam guide bushing snugly surrounding the external periphery of the cam member and defining an upper bearing for guiding the movement of the cam member and stem during reciprocation and turning of the rotor, said cam guide bushing communicating with said casing through the grooves in said cam member, and a cover plate on the end of said bushing remote from said casing for sealing the end of said bushing.

13. A multiport valve comprising a body having a ported face and flow passages communicating with the ports in said face, a rotor mounted in confronting relation with

said ported face and having ports and passages therein for establishing different flows through the body in different rotative settings of the rotor, a casing attached to said body and overlying said rotor, a stem attached to said rotor and extending laterally of one side thereof, an elongated cylindrical cam member surrounding said stem at the end thereof remote from said rotor and fixedly attached to the stem for movement therewith, said cam member having cam grooves formed on the external periphery thereof, a tubular cam guide bushing on said casing snugly surrounding the external periphery of said cam member and defining the sole bearing for guiding the movement of the cam member and stem during reciprocation and turning of the rotor, said guide bushing communicating with said casing through the grooves in said cam, a cover member on the end of said bushing remote from said casing for sealing the end of said bushing, a cam follower on said guide bushing engageable with the cam groove in said cam member for turning the stem and rotor between different rotative positions in response to reciprocation of the stem, and means engaging said stem for selectively reciprocating the stem to thereby effect turning of the rotor between different rotational positions.

14. A multiport valve comprising a body having a ported face and flow passages communicating with the ports in said face, a rotor mounted in confronting relation with said ported face and having ports and passages therein for establishing different flows through the body in different rotative settings of the rotor, a casing attached to said body and overlying said rotor, a stem attached to said rotor and extending laterally of one side thereof, an elongated cylindrical cam member surrounding said stem at the end thereof remote from said rotor and fixedly attached to the stem for movement therewith, said cam member having cam grooves formed on the external periphery thereof, a tubular cam guide bushing on said casing snugly surrounding the external periphery of said cam member and defining the sole bearing for guiding the movement of the cam member and stem during reciprocation and turning of the rotor, said guide bushing communicating with said casing through the grooves in said cam, a cover member on the end of said bushing remote from said casing for sealing the end of said bushing, a cam follower on said guide bushing engageable with the cam groove in said cam member for turning the stem and rotor between different rotative positions in response to reciprocation of the stem, a diaphragm extending across said casing and having the periphery thereof secured to the casing, diaphragm clamping plates attached to the diaphragm and rotatably mounted on said stem, said rotor and said cam member engaging opposite sides of said clamping plates to limit movement of the clamping plates axially of said stem whereby said stem and rotor are reciprocated in response to movement of said diaphragm, and means for selectively controlling the application of fluid pressure to the diaphragm for moving the latter.

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