

May 27, 1952

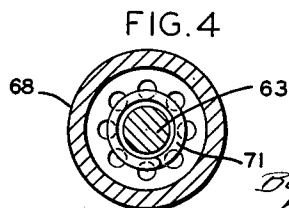
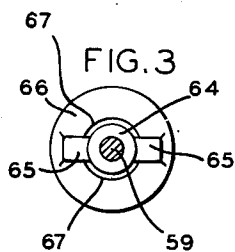
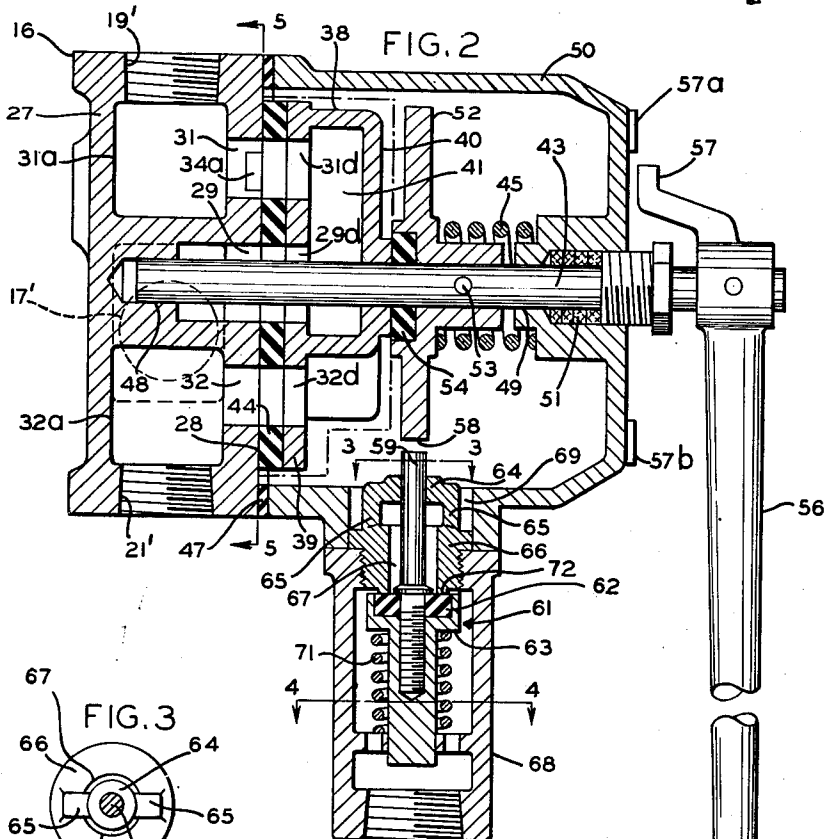
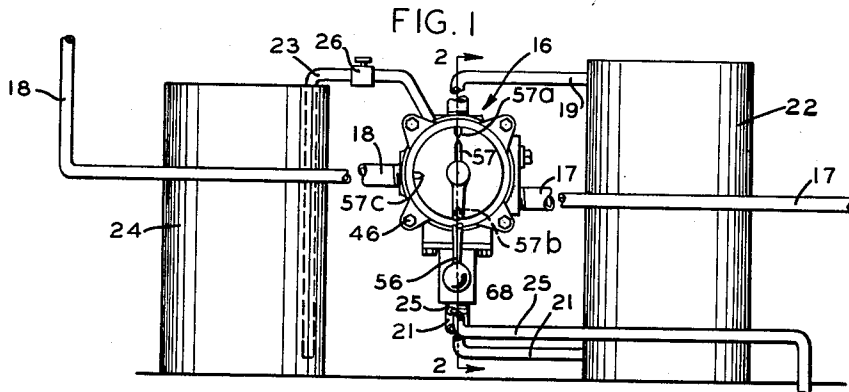
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2,598,362

MULTI-PORT ROTARY PLATE VALVE

Filed Nov. 28, 1945

4 Sheets-Sheet 1



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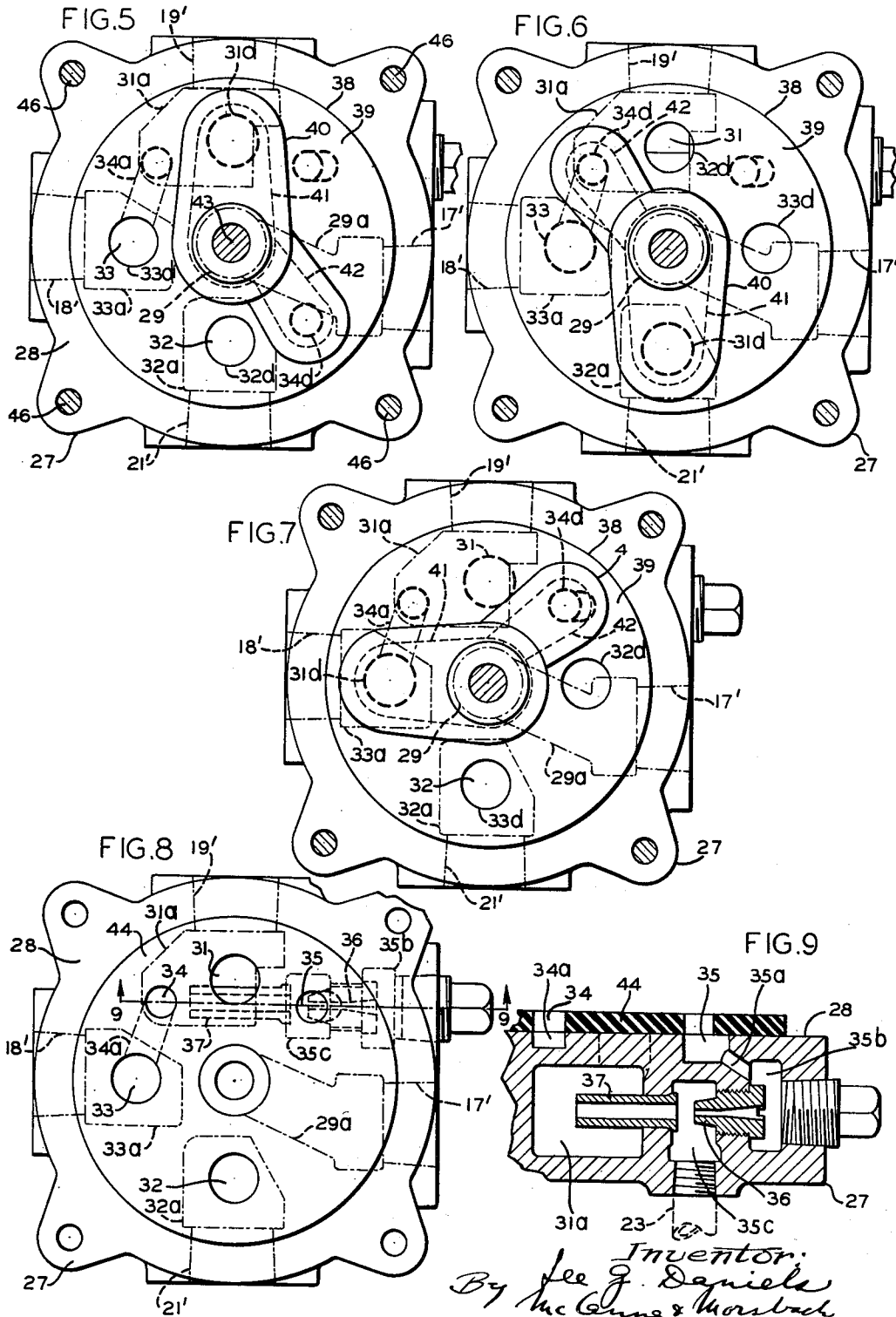
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FIG. 10

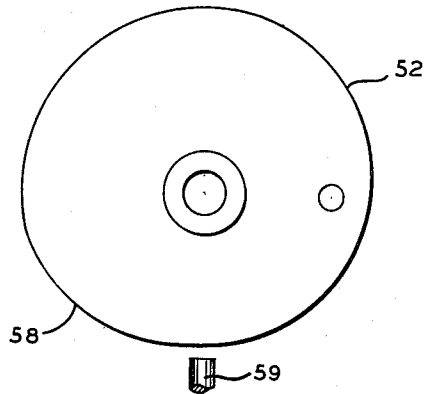


FIG. 11

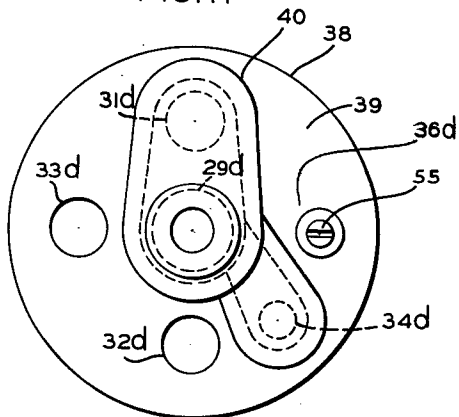


FIG. 13

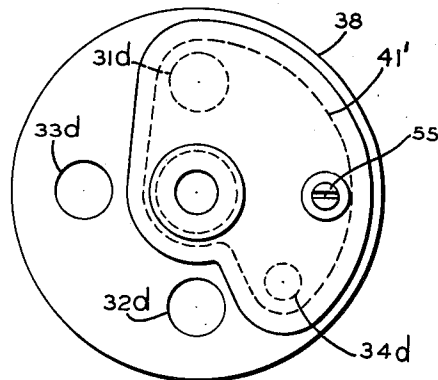
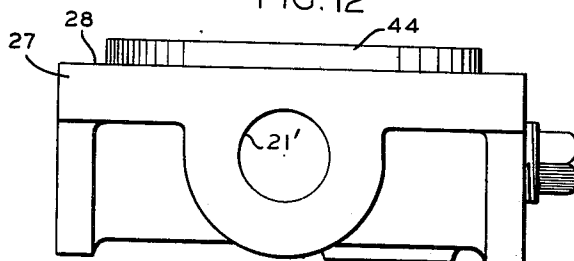


FIG. 12



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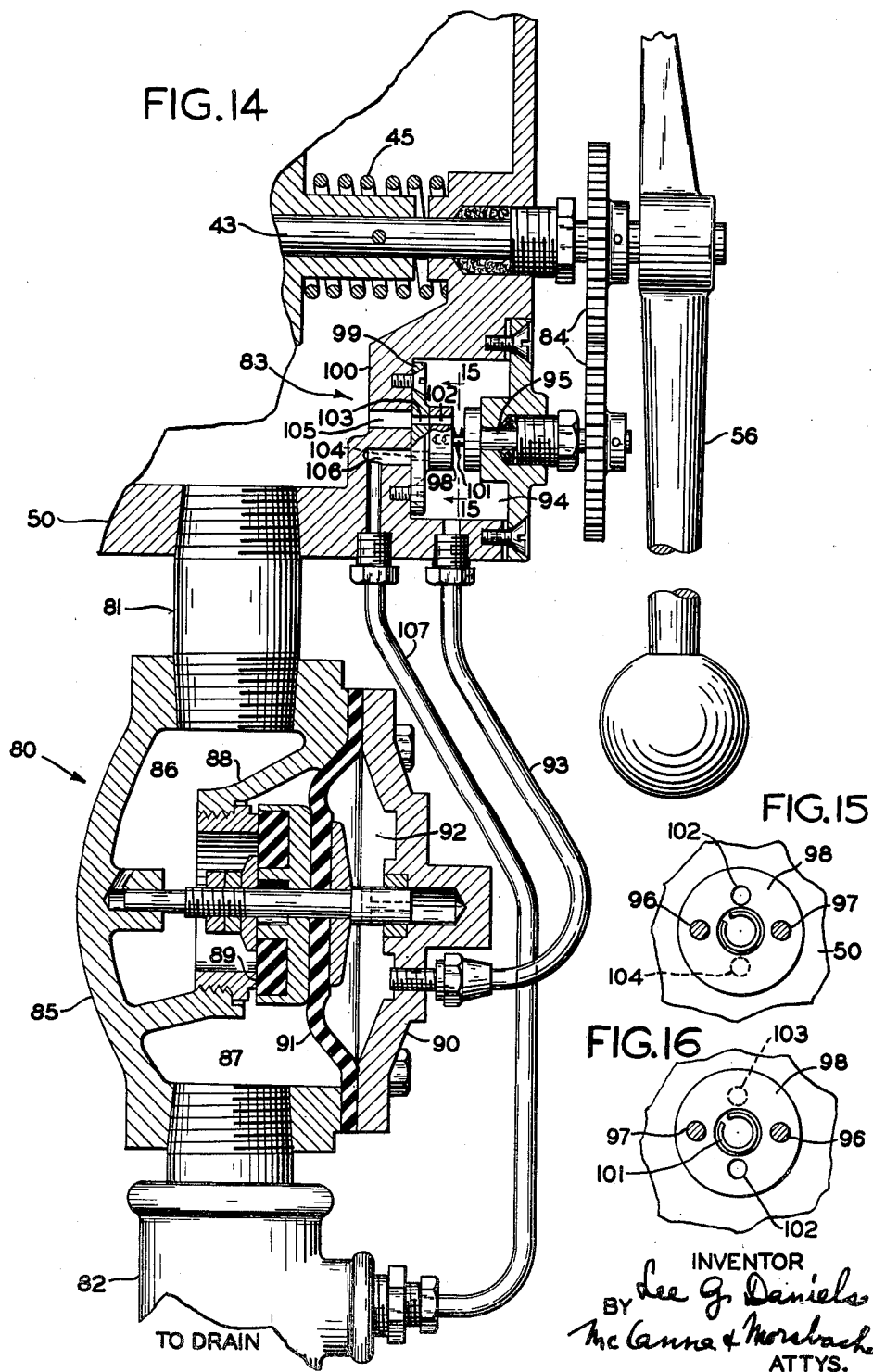
L. G. DANIELS

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MULTI-PORT ROTARY PLATE VALVE

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,598,362

MULTI-PORT ROTARY PLATE VALVE

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Application November 28, 1945, Serial No. 631,453

26 Claims. (Cl. 251-90)

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This invention relates to multi-port rotary and plate type valves.

Valves of this type have been used in water treating apparatus such as filters and water softeners, and for other uses. In these valves the multi-port valve plate member is rotatively moved to different positions to control the flow of the fluid medium through different channels. Heretofore, leakage of the fluid across the ported face from one port or port area to another where comparatively high pressure differential exists, presented a difficult problem. Many attempts have been made to devise constructions intended to minimize such leakage.

The present invention aims to provide an improved valve of this type operating on a novel principle to effect flow controls, wherein high pressure differential across port areas is avoided and leakage tendencies are reduced to a minimum.

More particularly, my invention contemplates the provision of a valve having multi-port stator and rotor members arranged so that the initial flow is confined within such members and the return flow is through a cap or cover which encloses the rotor member and is provided with an auxiliary valve which controls a drain or waste outlet and which also functions in determining the passage of said return flow either to service or waste, and whereby the provision of such valve controlled outlet avoids or minimizes the abovementioned objectionable pressure differential between port areas. This combined port arrangement and auxiliary outlet valve provide a novel solution to the leakage problem.

Another object of my invention is to provide a multi-port rotary plate type valve characterized by a simplified and improved port arrangement giving new and beneficial results, as described more fully hereinafter.

Another object of my invention is to provide a valve of the character described which will be self-clearing or cleaning of waste materials and accumulations, thereby avoiding the destructive effects of such accumulations.

Another object of my invention is to provide a multi-port rotary or plate type valve constructed in such novel manner as to reduce the need for high precision manufacturing operations and to enable lower cost of manufacture together with improved performance.

Other objects and attendant advantages will be appreciated by those skilled in this art as the invention becomes better understood by reference to the following description when con-

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sidered in connection with the accompanying drawings, in which—

Figure 1 is a diagrammatic view showing a multi-port rotary valve embodying my invention applied to a water softener of the base-exchange type and with the valve in the service position;

Figure 2 is a vertical section through the valve taken substantially on the section line 2-2 of Figure 1;

Figures 3 and 4 are detail sections taken on the section lines 3-3 and 4-4, respectively, of Figure 2;

Figure 5 is a section through the valve substantially on the section line 5-5 of Figure 2;

Figure 6 is a sectional view similar to Figure 5, but showing the valve plate or rotor member in the "Backwash" position, that is, moved 180° in a clockwise direction from the position shown in Figure 5;

Figure 7 is a similar sectional view with the rotor member moved 90° further in a clockwise direction to a "Brine" or "Rinse" position;

Figure 8 is a face view of the multi-port stator or body member, looking at the face of the valve disk or gasket thereon and with the rotor member removed;

Figure 9 is a fragmentary sectional view taken on the section line 9-9 of Figure 8, through the injector nozzle;

Figure 10 is a detail view of a cam plate and the coacting stem of a waste valve which is operated by the cam plate;

Figure 11 is a view looking at the outer face member, removed;

Figure 12 is a side view of the stator or body member and its gasket;

Figure 13 is a view similar to Figure 11, of a modified rotor member;

Figure 14 is a sectional view showing an hydraulically operated waste valve coacting with a pilot valve as described hereinafter;

Figure 15 is a detail view of the pilot valve disk in the position in which the diaphragm valve is closed; and

Figure 16 is a similar view but with the valve disk in the position in which the diaphragm valve is open.

Referring to Figure 1, my improved valve designated generally by 16 has a number of flow communications as follows: water supply pipe 17; service outlet pipe 18; pipes 19 and 21 to the top and bottom, respectively, of a base-exchange softener tank 22; pipe 23 to a brine tank 24; and a drain pipe 25 to waste. A hand valve 26 in the

pipe line 23 is operable in the regenerating function, as described below, but other regenerating means may be employed, well known in this art.

The valve structure shown is described as follows: A base stator or body member 27 is provided with threaded sockets or pipe connections 17', 18', 19', 21', 23', and 25', to which the pipes 17, 18, 19, 21, 23, and 25, respectively, are connected. The body member is formed to provide a pressure inlet chamber or passage 29-a, a top chamber 31-a, a bottom chamber 32-a and a side chamber 33-a, a passage 34-a and passages 35-a, 35-b and 35-c. The body is also formed to have a flat face 28, having a center inlet opening 29, three main ports 31, 32 and 33 and two auxiliary or intermediate ports 34 and 35. The main ports are all formed on an equal radius from the center inlet opening and the auxiliary ports 34 and 35 are formed on an equal radius from the center inlet opening. The pressure inlet passage 29-a establishes communication between the pipe connection 17' and the center inlet opening 29, the main port 31 communicates with the top chamber 31-a, the main port 32 communicates with the bottom chamber 32-a and the main port 33 communicates with the side chamber 33-a; the passage 34-a formed in the face communicating between the intermediate or auxiliary port 34 and the main port 33; and passage 35-a, 35-b, and 35-c, communicating between the intermediate port 35 and the chamber 31-a (Figure 9). An injector nozzle 36 provides communication between the passages 35-b and 35-c; and an injector tube 37 provides communication between the passage 35-c and chamber 31-a. This arrangement of main ports in the body face is distinctly novel in combination with a rotor member, for the purpose of a water softener valve or other use. Further novelty will be observed with respect to a broader application of main ports in accordance with my invention, as described below. A valve plate or rotor member has a confronting face to the face of the body member, this valve plate member designated generally by 38 preferably comprises a plate portion 39 and an enclosed passage portion 40. The valve plate member 38 is formed to provide an enclosed passage 40, having a large passage 41 and a small passage 42. The valve plate member 38 is also formed to provide a flat face having a center inlet opening or center passage 29-d, three main ports 31-d, 32-d, and 33-d, an auxiliary or intermediate port 34-d, and a blind portion 36-d. The passages 40 and 41 communicate with the center passage 29-d at right angles thereto. The main ports are all formed on an equal radius from the center inlet opening 29-d. The main port 31-d is an enclosed passage port opening into the interior of the enclosed passage 41. The main ports 32-d and 33-d are both open ports extending completely through the valve plate, and the main open port 32-d is adjacent the blind portion 36-d and the main open port 33-d is adjacent the enclosed passage. The auxiliary port 34-d is an enclosed passage port and opens into the interior of the passage 42. The main ports of the body and valve plate members are formed upon substantially equal radii and having substantially the same angular spacing. The main ports 31-d, 32-d and 33-d register with the main ports 31, 32 and 33 of the body member when the valve plate is in a first or service position as shown in Figure 5. The valve plate or rotor member is supported on a valve stem 43 to rotate therewith, as will presently be described.

To the flat face of the body member 28 is fixed a main gasket or valve disk 44 of hard rubber or other suitable material having properties suitable for maintaining an effective seal against water leakage across the face 28 of the ported base member in all preselected positions of the rotor member. The gasket should also have good wear resistance so as to avoid any tendency to scoring and grooving as a consequence of rotating the rotor, it being observed that the rotor is yieldingly pressed against the face 28 by a compression spring 45 and also by hydraulic pressure, as will presently be apparent. A cover bonnet or cap member 50 encloses the rotor member and is clamped or secured thereto by bolts 46, a soft rubber gasket 47 being interposed between the base and cover members. The valve stem 43 has bearing support at 48 in the base member and at 49 in the cover member. Suitable packing 51 seals the valve stem at its emergence from the cover member. The compression spring 45 acts against a cam plate, or heart shape cam 52 which is fixed as by a pin 53 to the valve stem, and the spring pressure is exerted by the cam plate against the rotor member through a sealing gasket 54 of soft rubber which is set into one side of the cam plate at its center. This gasket seals against leakage around the valve stem from within the enclosed passage of the rotor member. In this embodiment a pin 55 (Figure 11) connects the rotor member to the cam plate for rotation of the former by the latter. The valve stem may be rotatively moved by suitable means to operate the rotor member. In the present embodiment a hand lever 56 is fixed to the valve stem for rotating, turning or moving it, the handle member carrying an index finger 57 which coacts with "Service," "Backwash," and "Brine," markings on the face of the cover (indicated in Figure 1 by 57-a, 57-b, and 57-c, respectively,) to indicate the preselected position of the rotor member. The cam plate has a peripheral cam surface 58 designed to actuate the stem part 59 of a waste outlet valve of a spring closing type or a spring pressed lift valve designated generally by 61 which normally seals the waste outlet. In this embodiment a valve disc 62 of soft rubber or suitable material is clamped between the stem part 59 and a stem part 63. The stem part 59 has support in a bearing 64 which is joined by arms 65 to a part 66 which in turn provides a drain or waste passage 67 (Figures 2 and 3) and is threaded into the upper end of a waste outlet bracket 68. The stem part 63 has similar sliding support in the bracket 68 (Figures 2 and 4). This bracket 68 is bolted to the underside of the cover member as shown in Figures 1 and 2, with the drain or waste part 66 disposed in a sump 69 at the lowest point in the cover member. This is for the purpose of collecting foreign material and accumulations and discharging it to the waste outlet 67, as more fully described below. A coiled compression spring 71 acting between the bracket 68 and the stem part 63 constantly urges the valve disk 62 to closed position in which it is seated against the narrow, annular valve seat 72. This spring exerts sufficient force to keep the valve in a seated position against the hydraulic pressure within the cover member. The modified valve plate member shown in Figure 13 has only one large enclosed passage 41' forming a communication between the pressure inlet and ports 31-d and 34-d.

The operation in the respective valve positions is as follows:

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"Service" position, shown in Figures 1, 2, and 5. Water from the supply 17 communicates or flows through pressure inlet passage 29-a, center inlet openings 29 and 29-d, rotor passage 41, ports 31-d and 31, chamber 31-a, and pipe 19 to the top of the softener tank 22, downflow through the base-exchange mineral, through pipe 21 to the valve, through chamber 32-a, ports 32 and 32-d to the interior of the cover member, through ports 33-d and 33 to chamber 33-a, and thence to the service pipe 18.

"Backwash" position, shown in Figure 6, wherein the lever 56 has been moved 180° in a clockwise direction from the "Service" position. The blind portion 36-d closes the base port 31. Water now communicates or flows from supply pipe 17 through the pressure inlet 29-a, the center inlet opening 29 to rotor passage 41, through rotor port 31-d and base or body port 32 to base or body chamber 32-a, through pipe 21 to the bottom of the softener, upflow through the softener in a "backwash" operation, through pipe 19 to base or body chamber 31-a, through the stator port 31, the rotor plate port 32-d to the interior of the cover member, and thence to the waste outlet, the waste valve disk 62 being held unseated through the action of the cam surface 58 by movement of the lever 56 to the backwash position. In this position it will be observed that the intermediate valve plate port 34-d is in registration with port 34 so as to give communication between the pressure inlet 29-a and chamber 33-a through the passage 34-a, thus giving a limited supply of water to the service outlet 18 so that water may be drawn from the service line at any time during the backwash operation.

"Brine" and "Rinse" operations, shown in Figures 7, 8, and 9, wherein the lever 56 has been moved 90° in a clockwise direction from the backwash position. The blind portion 36-d closes the base port 31, and at this time the valve 26 will be opened to allow injection of brine solution into the water flowing to the softener, to regenerate the base-exchange material. Water now communicates or flows from the supply pipe 17 through the pressure inlet 29-a, the center inlet opening 29 into the rotor enclosed passage, through the small rotor passage 42, the port 34-d, passages 35, 35-a, 35-b, injector nozzle 36, passage 35-c, injector tube 37, and into chamber 31-a, through pipe 19 to the top of the softener, downflow through the softener and through pipe 21 to base or body chamber 32-a, through ports 32 and 33-d to the interior of the cover member, and thence to the waste outlet, the waste or drain valve disk 62 being held unseated by the cam surface 58. The discharge of water from the nozzle 36 into the tube 37 produces an injector action which induces flow through the pipe 23 and draws brine from the tank 24, the brine solution mixing with the water flowing to the chamber 31-a, as just described, and thence passing to the softener tank for the regenerating function. This flow of brine continues for a period determined by the operator who terminates the brine flow by closing the valve 26. The end of the brining operation may be determined in any suitable manner, by time or meter control, or by level of the brine in the tank 24, or other means known in this art. When the valve 26 is closed, water continues to flow through the multi-port valve as described with reference to Figure 7, the water flowing downflow through the softener tank in a rinsing operation to remove residual brine and

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restore the mineral bed to the desired condition for producing soft water. As is well known in this art when the water tests soft with a soap test, or after a predetermined rinsing determined by meter control or time, the valve lever is operated to move the rotor member to the first or service position, Figure 5. The valve 26 may now be opened to allow water to flow from the base chamber 31-a, through tube 37, passage 35-c and pipe 23, to the brine tank for refilling. The valve 26 will be closed when the desired water level in the brine tank has been reached. The softener has now been completely regenerated and restored to condition for service and for the next succeeding regeneration.

My invention as above stated, is applicable to uses other than water softening. For example, for a filter the novel valve structure characterized by only three main ports in the stator and rotor members combined with a waste outlet valve would efficiently serve to control a downflow through the filter for service and upflow for backwash purpose. It will be observed that for any use one of the features of my invention is the simplified port arrangement in combination with a controlled waste valve whereby new results are obtained. I wish to point out that only three main ports are used in the stator and rotor ports and that these members are constructed and arranged so that in the initial flow of water, that is, from supply through the valve and to the softener tank, the water is confined within the stator and the rotor members and that there is no port or port area open to the atmosphere as through a drain or waste outlet in the stator, consequently there is no large pressure differential across the ported face between one port and another. This will be more evident when it is observed that in accordance with my invention the usual registering drain or waste ports in the face of the valve are eliminated and I have provided a waste outlet normally closed by an effectively seating auxiliary valve such as a spring closing type or spring-pressed lift type valve. This type of valve inherently maintains its seal over a long life of use because of its relatively small seating area, the elimination of sliding movement between the seating members, and the simple provision of a coil compression spring to seat the valve against hydraulic pressure and to permit quick lifting and reseating of the valve in a rectilinear movement. It will be further observed that in the return flow of the water from the softener tank back through the plate type valve, the water flows through the open registering ports of the stator and rotor members and into the interior of the cap or cover, and thence through a second set of registering ports in the stator-rotor members to the service line. In this position, the service operation, the auxiliary or waste valve is sealed independently of the condition of the stator and rotor members which have confronting faces or one seated on or against the other and there is no tendency in the valve structure whereby the hydraulic pressure would cause leakage to a drain or waste outlet in the face of the stator as there is none. This will be more evident when it is considered that in prior structures the pressure differential existing at this stage between these ports through which the water flows at a high pressure and a port which is closed by the rotor but is open in the stator to atmospheric pressure, the hydraulic pressure tends to force its way through even the most minute openings or

grooves in the seating valve faces, with consequent leakage. Such prior plate type valves required, therefore, high precision machining and lapping of the confronting faces of the rotor and stator, with attendant high cost of manufacture. Also, the sliding, abrasive action of one face against another when coupled with a heavy spring pressure in trying to offset this high pressure differential promoted scoring and ultimately excessive leakage, which is avoided with the present invention. With my invention there is almost negligible pressure differential between the different registered ports and or into the interior of the cover, the small differential being due only to the flow through the mineral bed and to pipe friction.

It will be observed that the waste valve is opened when the valve stem and parts attached thereto are rotated from the first or service position and is held open until returned to the first position.

Another feature of my invention is the self-clearing of waste material or accumulations within the valve. As above noted, the auxiliary lift valve is arranged in a sump beneath the lowest level of the rotor and stator members so that particles of mineral, sand and other materials, as well as corrosion particles carried over from the softener tank and the brine tank, or otherwise accumulating in the valve, will collect in the sump and be carried out to waste when the waste valve is opened. Also, this waste valve is arranged so that it may be easily removed without disturbing the stator-rotor members and, obviously, the valve disk 62 may be easily replaced.

The construction is such as to require but little machining and no expensive valve lapping operations.

The specific valve structure here shown is intended for domestic water softeners. Where my invention is applied to large size valves I contemplate using hydraulic means for opening the waste valve. In this phase of my invention shown in Figure 14 I use a hydraulically operated diaphragm valve designated generally by 80 in the pipe line 81 from the cover 50 to the waste 82 and a pilot valve designated generally by 83 for supplying water pressure to the diaphragm chamber of the hydraulic valve to close the waste valve and hold it closed when the multi-port valve is in the service position and to open the diaphragm chamber to waste and thereby cause the hydraulic valve to open. When the multi-port valve is moved from the service position the waste valve will be opened and will stay open until the multi-port valve is returned to the service position. This hydraulic valve is substantially similar to the valves shown in my application for patent, Serial No. 487,239, now Patent No. 2,407,539, granted September 10, 1946. The pilot valve is subject to water pressure from the main water supply pipe, or from inside the cover, and has a set of gears 84 or other suitable mechanism (for instance, one gear on the rotary multi-port valve stem and the other gear on the pilot valve stem), to rotate the pilot valve whenever the rotary multi-port valve member is turned. Referring more particularly to Figure 14, the hydraulically operated valve comprises a body portion 85 having an inlet chamber 86 and an outlet chamber 87 separated by a partition 88 having a port surrounded by a seat 89. The body portion has a cap 90 and a diaphragm 91, the cap being shaped to provide a chamber 92 into which hydraulic pressure may be applied through a tube 93 connected with the

chamber 94 of the pilot valve 83. Hydraulic pressure may be suitably applied from the pilot valve to the diaphragm valve. In this case the pilot valve has a stem 95 operated by the gears 84. The stem 95 carries pins 96—97 which engage in corresponding holes in a valve disk 98 which in turn seats against a valve plate 99 fixed to a partition wall 100 of the cover member 50. A spring 101 yieldingly holds the disk 98 seated against the plate 99. The disk has a port passage 102 which is adapted to register with either port 103 or port 104 in the valve plate. Port 103 is in constant communication with passage 105 leading to the interior of the cover 50 and port 104 is in constant communication with passage 106 which is connected by tube 107 to the waste or drain pipe 82 below the diaphragm valve. As the ports are shown in Figure 14, the diaphragm valve is closed. This is a normal closed position which is made positive by the fluid pressure inside the cover acting through the passages 105, 103, 102, chamber 94, tube 93, chamber 92 and against the diaphragm 91 to hold this valve closed. When the rotor stem 43 is rotatively moved as above described the disk valve 98 will be rotated 180° from the position shown in Figure 15 to that shown in Figure 16, thereby closing the port 103 and opening the port 104 through port 102 to communicate the waste tube 107 with the tube 93 and consequently relieve the fluid pressure which tends to seat the diaphragm valve and allowing it to open.

While I have shown a particular embodiment of my invention, it will be understood that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

I claim:

1. A multi-port rotary plate type valve having, in combination, a stator member having a face provided with multiple ports and a center inlet opening, a rotary member having a center inlet opening registering with said center inlet opening in the stator member, and having an enclosed passage and ports that open into the interior of the passage, and having other ports that are open completely through the rotor member, the stator and rotor members having confronting faces, means including a stem for rotating the rotor member to preselected positions in relation to the stator member to give different registration of the ports, a cover on the stator member enclosing the rotor member, a waste outlet in the cover, a waste outlet valve for opening and closing said waste outlet, and means operated by rotative movement of the stem for actuating the waste outlet valve.

2. A multi-port valve as set forth in claim 1, in which the waste outlet valve is a normally closing type valve which is opened by hydraulic means.

3. A multi-port valve as set forth in claim 1, in which the waste outlet valve is a spring type closing valve which is normally seated by spring pressure, and including means operated by turning movement of the rotor member to unseat said waste valve against said spring pressure.

4. A multi-port valve as set forth in claim 1, in which the waste outlet valve is arranged in a sump below the confronting faces of the stator and rotor members.

5. A multi-port valve as set forth in claim 1, in which the waste outlet valve is a spring type closing valve which is normally seated by spring pres-

sure, and including a rotative valve stem coaxial and fixed with respect to the rotor member, and a cam member on said valve stem for actuating said waste valve to unseat it against said spring pressure upon rotative movement of the stem.

6. A multi-port plate type valve having a stator member provided with a ported face, a rotor member having a ported plate seated on said ported face and rotative thereon, a cover member on the stator member enclosing the rotor member and provided with a controllable auxiliary outlet valve, a stem extending from the rotor member through the cover member, a heart shape cam on the stem for controlling the opening and closing of the auxiliary outlet valve, and means attached to the stem for operating the rotor member and the outlet valve in predetermined relation one with respect to the other, the stator and rotor members being constructed and arranged so that in a service position of the rotor member the initial fluid flow is through both said members and the return fluid flow is back into the cover and out through the stator and the auxiliary valve is closed, and in a different operation position of the rotor member the initial fluid flow is through both said members and the return fluid flow is back into the cover and out through the auxiliary valve.

7. A multi-port valve as set forth in claim 6, in which the stator and rotor members each has three main ports adapted to register in different settings of the rotor member, and in which the auxiliary valve is closed in one such setting and open in each of the two other settings, as described.

8. A multi-port valve comprising, in combination, a stator member having a face provided with ports, a rotor member adapted to seat against said face and having ports coacting with the ports therein, a cover on the stator member enclosing the rotor member, a valve stem passing through the enclosure formed by the cover and having bearing support at one end in the stator member and at the opposite end in the cover, an outlet valve in the cover, a cam member on the valve stem arranged for actuating the outlet valve upon rotative movement of the stem, a seal between the cam member and the rotor member, and a spring acting between the cover and the cam member to urge said seal closed and to urge the rotor member against the face of the stator member.

9. A valve comprising: a stator member having a top chamber, a bottom chamber, and two side chambers, each of said chambers being provided with an opening for connection with a pipe, one of the side connection pipe chambers being for the supply of fluid and the other for outlet to service, said stator member having a face provided with a set of only three main ports, one of said main ports communicating with the outlet pipe chamber and the other main ports communicating one with the top chamber and the other with the bottom chamber, said stator member also having a center opening in its face communicating with its fluid supply chamber; a plate type rotor member arranged in confronting relation to the face of said stator member; a cover secured to said stator member and enclosing said rotor member; means for introducing fluid under pressure to said supply pipe connection; said rotor member having only three main open ports and a blind portion for cooperating with the three main ports of the stator member, the main ports of said stator and rotor members being formed

upon substantially equal radii and each having a first port registering with the other at said top chamber, a second port registering with the other at the bottom chamber, and a third port registering with the other at the service outlet chamber, said rotor member having a center inlet opening registering with the center inlet opening of the stator member; means on the rotor member providing an enclosed passage interconnecting its center inlet opening and its said first port; said rotor member being movable into a plurality of operative positions including a first position in which its said enclosed passage interconnects its center inlet opening and the said first port of the stator member and its said second and third ports are in registration with the second and third ports of the stator member, a second position in which its said enclosed passage interconnects its center inlet opening and the said second port of the stator member and its blind portion closes the said third port of the stator member, and a third position in which its said enclosed passage interconnects its center inlet opening and the said third port of the stator member and its blind portion closes the said first port of the stator member.

10. A valve as set forth in claim 9, in which the face of the stator member has an intermediate port passage communicating its top chamber and its service outlet chamber, in which the rotor member is provided with an intermediate port adjacent to its second port and intermediate of its first and second ports, in which the enclosing means on the rotor member provides an enclosing passage interconnecting its center inlet opening and its said intermediate port, and in which the intermediate port in the rotor member communicates with said intermediate port passage in the stator member when the rotor member is in the second position.

11. A valve as set forth in claim 9, in which the face of the stator member has an intermediate port passage communicating its top chamber and its service outlet chamber, in which the rotor member is provided with an intermediate port adjacent to its second port and intermediate of its first and second ports, in which the enclosing means on the rotor member provides an enclosing passage interconnecting its center inlet opening and its said intermediate port, in which the intermediate port in the rotor member communicates with said intermediate port passage in the stator member when the rotor member is in the second position, and in which the stator member is provided with fluid injector means for discharging into the top chamber and its face is provided with a second intermediate port communicating with said fluid injector means, said second intermediate port being located adjacent to the first port and intermediate of the first and second ports, and the intermediate port of the rotor member registering with the said intermediate port of the stator member when the rotor member is in the third position.

12. A valve as set forth in claim 9, including a controllable outlet valve providing an outlet from the cover adapted to be opened and closed, means normally closing said outlet valve, and means operated by rotation of the rotor member to open said outlet valve in the second and third positions of the rotor member.

13. A multi-port valve of the kind having a body provided with a top chamber, a bottom chamber and two side chambers, each of said chambers being provided with an opening for a

pipe, said body having a face provided with ports communicating with certain of said chambers, the body also having an injector chamber with an injector nozzle therein arranged to discharge into the top chamber, a rotor member having a face arranged in confronting relation to said body face and having ports for coaction therewith, said member adapted for rotative movement with respect to the body face, a cover secured to said body and enclosing said rotor member, means for introducing fluid under pressure into one of said side chambers, and means for rotatively moving the rotor member to different settings of its ports with relation to these in the body face; the improvement comprising only three main ports and two intermediate ports in the body face, one main port communicating with the top chamber, one with the bottom chamber, and one with the side chamber opposite from that to which said fluid pressure is supplied, one of said intermediate ports communicating with the top chamber, the other intermediate port communicating with said injector chamber, a center opening in said body face communicating with the side chamber to which fluid under pressure is supplied, the rotor member having a plate portion having only three main ports in registration with said three main ports in the body face when the rotor member is in a first position and having an intermediate port located intermediate its top and bottom main ports when the rotor member is in said first position and adapted to register with the second mentioned intermediate port in the body face when the rotor member is moved clockwise 270° from said first position, the rotor member having a center opening in registration with said center opening in the body face, the rotor member having an enclosed passage communicating its center opening with its port which is in communication with said top chamber through the port in the body face and also communicating with its intermediate port.

14. A multi-port valve as set forth in claim 13, including a controllable auxiliary waste outlet valve outletting from the cover.

15. A multi-port valve as set forth in claim 13, including a controllable auxiliary waste outlet valve outletting from the cover, and means for causing opening and closing of the auxiliary valve in timed relation with rotative operation of the rotor member.

16. A valve comprising, a body having a pressure inlet, a top chamber, a bottom chamber and a side chamber, each of said chambers and said pressure inlet being provided with an opening for connection with a pipe, said body having a face provided with three main ports and a center opening communicating with said pressure inlet, each of said main ports communicating with one of said chambers, a valve plate arranged in confronting relation to said face of said body, a cover attached to said body and enclosing said valve plate, a waste outlet in said cover, a waste valve communicating with said waste outlet, said valve plate having three main ports, a blind portion and a center inlet opening for cooperation with the three main ports and the center opening of said body, the main ports of said body and valve plate being formed upon substantially equal radii and having the same angular spacing, means on said valve plate providing an enclosed passage interconnecting said pressure inlet and the outlet main port, the other two main ports being through-ports extending completely through said valve plate

and one being located adjacent said blind portion and the other one adjacent said enclosed passage, means for opening said waste valve when said valve plate is moved from a first position and to close said waste valve when said valve plate is moved back to said first position, said valve plate being movable into a plurality of operative positions including said first position in which said enclosed passage interconnects said pressure inlet and said top chamber and one of said main through-ports and establishing communication between said bottom chamber and the interior of said cover and the other said main through-port establishing communication between the interior of said cover and said side chamber, and another position in which said enclosed passage interconnects said pressure inlet and said bottom chamber and said blind portion closes said side chamber and one said main through-port establishes communication between said top chamber and the interior of said cover and said waste outlet establishes communication between the interior of said cover and the waste.

17. A valve as set forth in claim 16, in which the valve plate is moved to another position in which said enclosed passage interconnects said pressure inlet and said side chamber and said blind portion closes said top chamber and one of such main through-ports establishes communication between the bottom chamber and the interior of said cover, and said waste outlet establishes communication between the interior of said cover and the waste.

18. A valve comprising, a body having a pressure inlet, a top chamber, a bottom chamber and a side chamber, each of said chambers and said pressure inlet being provided with an opening for connection with a pipe, said body having a face provided with three main ports and a center opening communicating with said pressure inlet, each of said main ports communicating with one of said chambers, said body face also being provided with at least two auxiliary ports, one of said auxiliary ports communicating with said side chamber and another auxiliary port communicating with said top chamber, a valve plate arranged in confronting relation to said face of said body, a cover attached to said body and enclosing said valve plate, a waste outlet in said cover, a waste valve communicating with said waste outlet, said valve plate having three main ports, a blind portion and a center inlet opening for cooperation with the three main ports and the center opening of said body, the main ports of said body and valve plate being formed upon substantially equal radii and having the same angular spacing, means on said valve plate providing an enclosed passage interconnecting said pressure inlet and the outlet main port, the other two main ports being through-ports extending completely through said valve plate and one being located adjacent said blind portion and the other one adjacent said enclosed passage, said valve plate also having an outlet auxiliary port, means for opening said waste valve when said valve plate is moved from a first position and to close said waste valve when said valve plate is moved back to said first position, said valve plate being movable into a plurality of operative positions, said outlet auxiliary port being arranged to register in one operative position of said valve plate with the auxiliary port of said body communicating with said side chamber to establish communi-

cation between said pressure inlet and said side chamber, and in another operative position with the auxiliary port of said body communicating with said top chamber to establish communication between said pressure inlet and said top chamber.

19. A valve comprising, a body having a pressure inlet, a top chamber, a bottom chamber and a side chamber, each of said chambers and said pressure inlet being provided with an opening for connection with a pipe, said body having a face provided with three main ports and a center opening communicating with said pressure inlet, each of said main ports communicating with one of said chambers, said body face also being provided with an auxiliary port communicating with said top chamber, a valve plate arranged in confronting relation to said face of said body, a cover attached to said body and enclosing said valve plate, a waste outlet in said cover, a waste valve communicating with said waste outlet, said valve plate having three main ports, a blind portion and a center inlet opening for cooperation with the three main ports and the center opening of said body, the main ports of said body and valve plate being formed upon substantially equal radii and having the same angular spacing, means on said valve plate providing an enclosed passage interconnecting said pressure inlet and the outlet main port, the other two main ports being through-ports extending completely through said valve plate and one being located adjacent said blind portion and the other one adjacent said enclosed passage, said valve plate also having an outlet auxiliary port adapted to register in one operative position of said valve plate with the auxiliary port of said body communicating with said top chamber, means for opening said waste valve when said valve plate is moved from a first position and to close said waste valve when said valve plate is moved back to said first position, and said valve plate being movable into at least three preselected positions in each of which said enclosed passage connects said pressure inlet with said top chamber or said bottom chamber of said body.

20. A valve comprising, a rotary multiple port body having a pressure inlet, a top chamber, a bottom chamber and a side chamber, each of said chambers and said pressure inlet being provided with an opening for connection with a pipe, said body having a face provided with three main ports and a center opening communicating with said pressure inlet, each of said main ports communicating with one of said chambers, said body face also being provided with an auxiliary port communicating with said top chamber, a valve plate arranged in confronting relation to said face of said body, a cover attached to said body and enclosing said valve plate, a waste outlet in said cover, a waste valve communicating with said waste outlet, said valve plate having three main ports, a blind portion and a center inlet opening for cooperation with the three main ports and the center opening of said body, the main ports of said body and valve plate being formed upon substantially equal radii and having the same angular spacing, means on said valve plate providing an enclosed passage interconnecting said pressure inlet and the outlet main port, the other two main ports being through-ports extending completely through said valve plate and one being located adjacent said blind portion and the other one adjacent said enclosed passage, said valve plate also having an outlet

auxiliary port adapted to register in one operative position of said valve plate with the auxiliary port of said body communicating with said top chamber, means for opening said waste valve when said valve plate is moved from a first position and to close said waste valve when said valve plate is moved back to said first position, said valve plate being movable into at least three preselected positions in each of which said enclosed passage connects said pressure inlet with one of said main ports of said body.

21. A rotary multiple port valve comprising, a body having a pressure inlet, a top chamber, a bottom chamber and a side chamber, each of said chambers and said pressure inlet being provided with an opening for connection with a pipe, said body having a face provided with three main ports and a center opening communicating with said pressure inlet, each of said main ports communicating with one of said chambers, said body face also being provided with at least two auxiliary ports, one of said auxiliary ports communicating with said side chamber and another auxiliary port having a passage way communicating with said top chamber, said passage way being provided with an opening for a pipe connection, injector means in said passage way, a valve plate arranged in confronting relation to said face of said body, a cover attached to said body and enclosing said valve plate, a waste outlet in said cover, a waste valve communicating with said waste outlet, said valve plate having three main ports, a blind portion and a center inlet opening for cooperation with the three main ports and the center opening of said body, the main ports of said body and valve plate being formed upon substantially equal radii and having the same angular spacing, means on said valve plate providing an enclosed passage interconnecting said pressure inlet and the outlet main port, the other two main ports being through-ports extending completely through said valve plate and one being located adjacent said blind portion and the other one adjacent said enclosed passage, said valve plate also having an outlet auxiliary port, means for opening said waste valve when said valve plate is moved from a first position and to close said waste valve when said valve plate is moved back to said first position, said valve plate having a plurality of positions including said first position and at least two other positions in which said enclosed passage connects said pressure inlet with two of said chambers, and in these two positions said waste outlet is open to the waste.

22. A rotary multiple port valve comprising a body member having multiple ports and a pressure inlet, a rotor member having multiple ports and passages, the rotor member having a center passage and other passages at right angle relation to the center passage and communicating therewith, the body and rotor members having confronting faces, means including a stem attached to the rotor member for rotating the rotor member to preselected positions in relation to the body member to give different registration of the ports, a cover attached to the body member enclosing the rotor member, the cover having a waste outlet, a waste outlet valve for opening and closing the waste outlet, a cam attached to the stem for opening the waste outlet valve, and means including a spring for closing the waste outlet valve.

23. A multiple port rotary valve as set forth in claim 22, in which as the rotor member is rotated from a service position the cam opens the

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waste outlet valve and keeps the waste outlet valve open in the other positions, said spring being arranged for closing the waste outlet valve when the rotor member is in the service position.

24. A multiple port rotary valve comprising a body member having multiple ports and a pressure inlet, a rotor member having multiple ports and passages, the body and rotor members having confronting faces, means including a stem attached to the rotor member for rotating the rotor member to preselected positions in relation to the body member to give different registration of the ports, a cover attached to the body member enclosing the rotor member, the cover having a waste outlet, an hydraulically operated valve attached to the waste outlet for controlling the flow of fluids through the waste outlet, a pilot valve for controlling the opening and closing of the hydraulically operated valve, and means operative between the stem and the pilot valve for actuating the hydraulically operated valve by rotative movement of the stem.

25. A valve as set forth in claim 24, in which as the stem rotates the rotor member from a service position the pilot valve allows the hydraulically operated valve to open and keeps the hydraulically operated valve open in the other positions and as the stem rotates the rotor member back to the service position the pilot valve closes the hydraulically operated valve.

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26. A multiple port rotary valve comprising a body member having multiple ports and a pressure inlet, a rotor member having multiple ports and passages, the body and rotor members having confronting faces, a cover attached to the body member enclosing the rotor member, means including a stem attached to the rotor member for turning the rotor member to preselected positions in relation to the body member to give different registration of the ports, the cover having a waste outlet, a waste outlet valve for opening and closing the waste outlet, means including a cam attached to the stem for opening the waste outlet valve as the rotor member is turned from a service position, the cam serving to keep the waste outlet valve open in the other positions, and spring means for closing the waste outlet valve as the rotor member is turned back to the service position.

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