

May 25, 1954

P. FISCHER ET AL

2,679,209

PUMPING APPARATUS

Filed Sept. 1, 1949

2 Sheets-Sheet 1

FIG.2.

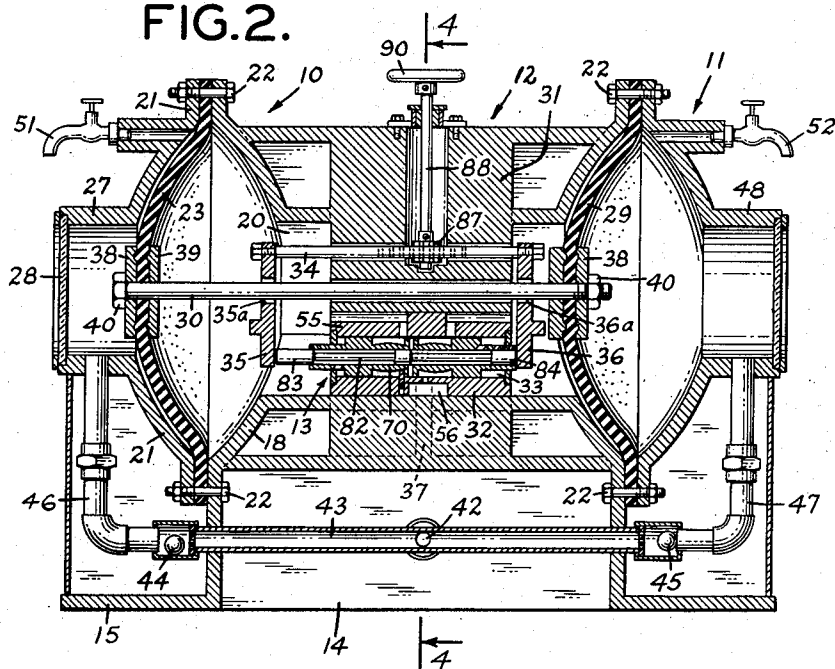


FIG.3.

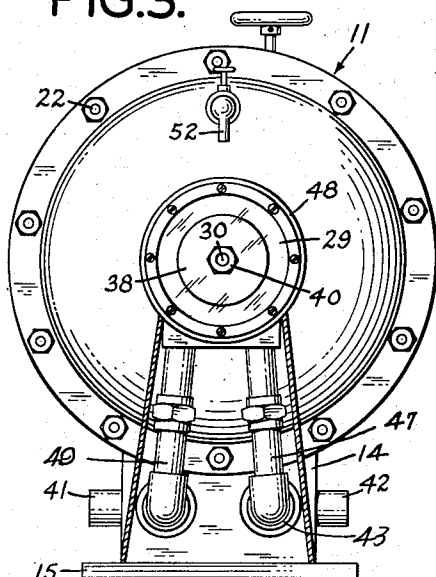
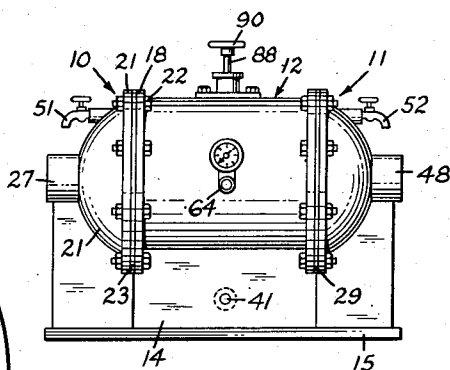


FIG.1.

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FIG. 5.

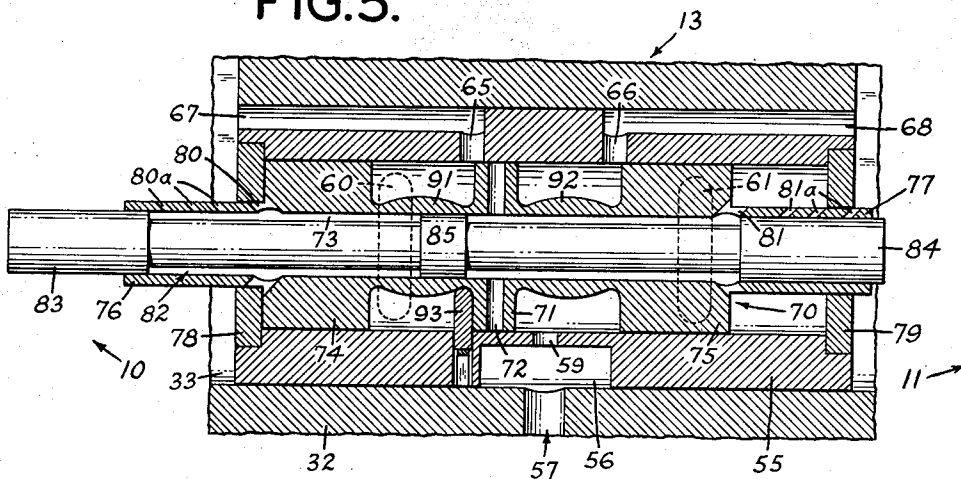
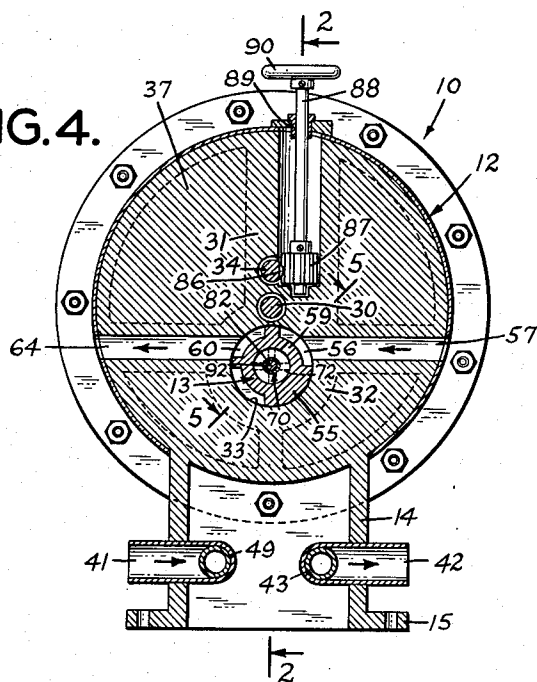


FIG. 4.



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PUMPING APPARATUS

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5 Claims. (Cl. 103—150)

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This invention relates to an improved form of sanitary type pump which may be used for pumping of pickling or curing brines and other edible liquids and the like. More particularly, the invention relates to an improved pump for the pumping of brine and other liquids for curing and pickling meat and the like.

Pumps of the type used heretofore for supplying brine or similar liquids to the needles for injection of the brine into meats and the like are of the piston, gear or lobe type in which one or more metallic elements come into direct contact with the brine so that these elements are subject to corrosion, with consequent contamination of the brine. Moreover, inasmuch as it is extremely difficult to prevent leakage of the brine through the bearings and gaskets surrounding moving parts, the brine acts upon these bearings and other parts and corrodes them even if they are formed, as in many cases, of relatively corrosion-resistant metals. In addition, inasmuch as these pumps must be tightly sealed to reduce leakage to a minimum, it is difficult to service and clean them.

In accordance with the present invention, the brine pump mechanism includes a pair of connected and movable diaphragms formed of rubber, synthetic rubber or other similar material arranged in such a way that these diaphragms may be moved to and fro by means of fluid pressure so as to assure a substantially continuous pumping operation.

More particularly, the new brine pump is formed of highly corrosion-resistant material and having the diaphragms and casings arranged in such a way as to afford easy access to the interior of the pump for cleaning and servicing. Moreover, all of the moving elements of the apparatus except the diaphragms are protected from contact with the brine or other corrosive liquid.

A particular feature of the present invention is an improved form of valve mechanism whereby a quick change in the direction of movement of the diaphragms by shifting of the connections to a fluid pressure source may be obtained in order to reduce the lag in the pumping operation to a minimum and also to provide a positive operation of the valve without the need for springs or other supplemental actuating mechanism other than the reciprocation of the diaphragms themselves.

Another feature of the invention is the provision of a manual starting mechanism for the pump which may be rendered effective to start

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the pumping operation in the event that the pump requires assistance in starting, for any reason.

An additional feature of the invention is the provision of cleanout and inspection ports whereby the condition of the pump chambers can be readily ascertained and the chambers can be easily cleaned without tearing down the pump.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which:

Fig. 1 is a view in elevation of a pump embodying the present invention;

Fig. 2 is a view in vertical section through the pump;

Fig. 3 is an end view of the pumping mechanism disclosed in Fig. 1 with a portion of a cover plate broken away;

Fig. 4 is a view in section taken on line 4—4 of Fig. 2; and

Fig. 5 is a view in section taken on line 5—5 of Fig. 4 with certain of the parts shown in dotted lines.

The pump chosen for purposes of illustration is a dual chamber type of pump suitable for supplying a substantially continuous flow of brine or other liquid for curing meat and for other similar purposes.

Referring now to Figs. 1 and 2 of the drawing, a typical two chamber pump may have a pair of pump chambers 10 and 11 arranged at opposite ends of a casing member 12 within which is mounted the control valve 13 for the system and other actuating elements of the pump. As shown in Fig. 4, the casing member 12 is of hollow cylindrical shape and has a supporting base 14 of inverted channel shape having an outwardly extending flange 15 around its lower edge. The exact shape of the casing 12 and the base 14 are not important.

The pump casings 10 and 11 are alike, and, therefore, only one of them will be described. As shown in Fig. 1, the casing 10 includes an inner casing section 18 of a dish-like or concavo-convex shape which may be cast integrally with the casing 12. The casing section 18 is provided with a central aperture 20 in alignment with casing 12. The outer end of the casing 10 is formed of another concavo-convex casing section 21 which is secured to the inner casing section 18 by means of a series of bolts 22 around their peripheries. Interposed between the edges of the casing sections 18 and 21 is the edge of a disk-like flexible diaphragm 23 which may be

formed of natural rubber, synthetic rubber, flexible plastic material, impregnated fabric or the like. The diaphragm 23 is of such size and exhibity that it can be displaced readily from contact with the inner wall of the casing section 18 into contact with the inner wall of the casing section 21.

The outer casing section 21 is provided with a cylindrical tubular extension 27 having mounted in its end a glass pane or panel 28 to permit ready inspection of the interior of the pump casing 19 on the outside of the diaphragm 23. The pane or panel 28 may be mounted in a hinged frame or it may be securely screwed to the end of the collar 27 in liquid-tight relation but in such a way that it can be removed or opened to permit access to the interior of the casing 19.

The diaphragm 23 in the pump chamber 10 is connected to the diaphragm 23 in the pump chamber 11 by means of a rod or shaft 30 which extends lengthwise through the casing section 12 and is guided in the downwardly extending web 31 which extends lengthwise of the casing 12 as best shown in Figs. 2 and 4. The web 31 is generally rectangular in cross-section in its upper portion and has a cylindrical barrel 32 at its lower end.

The control valve 13 is mounted in a bore 33 extending lengthwise through the barrel 32. Also, the web 31 supports an actuating shaft 34 by means of which the valve 13 is controlled as will be explained hereafter. The shaft 34 carries on its opposite ends a pair of downwardly extending arms 35 and 36 which are provided with apertures 35a and 36a through which the piston rod 30 extends and in which the piston rod is freely movable.

The chambers 10 and 11 are separated from each other by means of a partition 37 extending transversely of the casing and formed integral therewith as indicated in Fig. 4.

The diaphragms 23 and 29 are connected to opposite ends of the rod 30 by means of plates 38 and 39 on opposite sides of the diaphragm and by means of nuts 40 threaded on the outer ends of the shaft so that the shaft partakes of the movements of the diaphragms in opposite directions.

The diaphragms are moved back and forth within the pump chambers 10 and 11 by means of water, air or other fluid pressure supplied from an exterior source under the control of the valve 13. The invention will be described hereinafter with reference to the use of water for driving the pump although compressed air or the like is equally suitable. The valve 13 is constructed and arranged to supply water to one of the pump chambers 10 and 11 behind the diaphragm therein and discharge water from the other pump chamber thereby moving the piston rod 30 in one direction. When the diaphragms come up against the wall of the chambers, the water is directed into the other chamber and the diaphragms are moved in the opposite direction.

The brine or other liquid to be pumped is drawn into the pump chambers 10 and 11 and discharged therefrom in the zones on the opposite sides of the diaphragms from that to which the water is delivered. Movement of the diaphragm 23, for example, to the right from the position shown in Fig. 1, will draw brine into the pump chamber 10 to the left of the diaphragm while at the same time brine is forced from the portion of the pump chamber 11 to the right of the diaphragm 29 as the water pressure forces the diaphragm 29 to the right.

The pump is provided with a brine inlet 41

(Figs. 1 and 3) at about the center of the base 14 and a brine outlet 42 on the opposite side of the base. Only the details of the outlet 42 and its connections are shown in Figs. 2 and 3 but they are generally similar to the inlet connections. The outlet 42 is connected to a conduit 43 extending lengthwise of the base 14. The conduit is provided with oppositely acting ball check valves 44 and 45 at its opposite ends, these valves, in turn, being connected by the conduits 46 and 47 to the extensions 27 and 48 of the chambers 10 and 11. These check valves permit flow of the brine out of the chambers 10 and 11. The inlet 41 is similarly connected by means of a U-shaped conduit 49 (Fig. 3) having interposed check valves (not shown) to the extensions 27 and 48. It will be understood that the check valves in the conduit 49 are so arranged as to permit the brine to flow into the pump chambers 10 and 11 while preventing it from flowing backwardly to the inlet 41.

The pump chambers 10 and 11 are provided with discharge faucets or spigots 51 and 52 near the top thereof so that air can be discharged from the chambers when the pump is first set into operation.

The valve 13 for controlling the operation of the pump is especially effective in controlling the operation of the pump and is dependent solely upon fluid pressure and the movement of the diaphragms for its actuation so that it is substantially foolproof in operation. The details of the control valve 13 and its connections are best shown in Figs. 4 and 5. The valve elements are fitted within the bore 33 of the web 31 so that opposite ends of the valve assembly are in contact with the water in the space between the partition 37 and the diaphragms 23 and 29. The valve consists of a sleeve member 55 which is provided in one side with a cut out portion forming a groove 56 in communication with a passage 57 to which water under pressure is supplied from a suitable source. The groove 56 is provided with a passage or port 59 communicating with the interior of the sleeve 55. The sleeve 55 also has a pair of ports 60 and 61 (Fig. 5), which, as shown in Fig. 5, are connected to a discharge passage 64 on the opposite side of the pump. In addition to the ports referred to above, the sleeve 55 has another pair of return ports 65 and 66 which communicate with the grooves 67 and 68, respectively, running lengthwise of the sleeve and communicating with the pump chambers 10 and 11.

A slide valve plunger 70 is slidably mounted within the sleeve 55 and controls the flow of liquid through the various ports referred to above. The plunger 70 includes a centrally located piston member 71 having a plurality of radial passages 72 therein permitting liquid to flow from the passage or port 59 into the center longitudinally extending bore 73 when the passages 72 are in alignment with the port 59. On opposite sides of the piston 71 are a pair of pistons 74 and 75 which act as valves to alternately cover and uncover the ports 60 and 61. In the position shown in Fig. 5, the port 60 is uncovered by the piston 74 and the port 61 is covered by the piston 75. The slide valve 70 has tubular guide sleeves 76 and 77 at its opposite ends which are slidably received in end closures or rings 78 and 79 secured in the ends of the sleeve 55. These rings limit the movement of the slide valve 70 and substantially seal the ends of the sleeve 55. At opposite ends of the pistons 74 and 75 are passages 80 and 81 extending from the exterior of the sleeves 76 and 77 to the bore 73. Additional

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groups of passages 80a and 81a extend through the sleeves 76 and 77 outwardly of the passages 80 and 81, respectively.

Slidably mounted in the bore 73 is a control plunger 82 which has piston-like enlargements 83 and 84 at its opposite ends in liquid-tight engagement with the sleeves 76 and 77. The major portion of the control plunger 82 is of reduced section so that the plunger fits loosely within the bore 73 except at its mid-portion where a piston 85 is provided. The control plunger 82 is slidable back and forth in the slide valve 70 to move the piston 85 from one side of the radial passages 72 to the other. The pistons 83 and 84 are spaced so that they do not completely close the passages 80 and 81 at opposite ends of the pistons 74 and 75 simultaneously. The pistons 83 and 84 can cover both groups of passages 80a and 81a or uncover either group selectively.

In operation of the pump and with the parts in the position shown in Figs. 1 and 5, the water under pressure flows through the passage 59 around the exterior of the slide valve 70 between the pistons 71 and 75, out through the passage 66 and the groove 68 into the pump casing 11 behind the diaphragm 29, thereby urging it to the right and forcing brine in the chamber on the right-hand side of the diaphragm out through the discharge passage 42. The diaphragm 23 at the same time is moving to the right so that the brine is being drawn into the chamber 10 to the left of the diaphragm through the inlet port 41. The water in chamber 10 flows through the passage 67, port 65 to the outlet port 60 and is discharged through the passage 64. As the diaphragm and the piston rod 30 approach the limit of travel, the retaining plate for the diaphragm 23 engages the left-hand end of the shaft 34 and begins to displace it to the right. Inasmuch as the plates 35 and 36 are substantially in contact with opposite ends of the control plunger 82, the control plunger begins to move to the right. As a result, the piston 85 on the plunger 82 moves into a position first covering and then uncovering the radial passages 72 and closing the ports 80a and uncovering the ports 81a so that the piston 85 is then to the right of the passages 72. Continued movement of the rod 34 will finally bring the plate 35 into engagement with the end of the sleeve 76 and will begin to displace the slide valve plunger 70 toward the right. Nothing occurs except a slight reduction in the rate of flow of water through the inlet port 59 until the radial passages 72 come into alignment with the port 59. At that time, water under pressure will be forced through the passages 72 and inasmuch as the plunger piston 85 is to the right of these passages, the water will flow to the left along the passage 73 and be discharged between the outer end of the piston 74 and the closure ring 78, thereby forcing the entire slide valve plunger 70 rapidly to the right and reversing the connections between the water inlet port and the pump chambers. Water to the right of the piston 75 is discharged through the ports 81a inasmuch as they are uncovered by the piston 84 and at least one of them is outside the closure ring 79 at all times, as shown in Fig. 5. With the slide valve plunger shifted to the right, the water then flows through the passage 65, the groove 67 into the pump chamber 10 behind the diaphragm 23 forcing it and the connected diaphragm 29 to the left. The water behind the diaphragm 29 is forced through the groove 68, the port 66 into

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the discharge port 61 and out through the discharge connection 64 while brine is then drawn into the pump chamber 11 to the right of the diaphragm 29 from the inlet 41 and the brine to the left of the diaphragm 23 is discharged from the pump casing through the outlet 42.

From the preceding description of a typical operating cycle, it will be understood that the control valve is completely responsive to the movement of the diaphragms and to the pressure of the water and that it is unnecessary to provide springs or toggle mechanisms for snapping the valve rapidly from one position to another, reversing the cycle.

Under some circumstances, for example, if the pump has not been operating for a long period of time, it may need assistance to start it operating. In order to start the pump under these conditions, the rod 34 is provided with rack teeth 86 which may be engaged by a gear 87 on the end of a shaft 88 mounted in a bushing 89 on the top of the casing 12. The shaft is rotated by a hand-wheel 90 to shift the rod 34 back and forth to loosen and start the pump.

Inadvertent movement of the valve plunger 70 may be prevented by forming cam surfaces 91 and 92 between the piston 71 and the pistons 74 and 75 and mounting a spring biased plunger 93 in the sleeve 55 for engaging one of these cam surfaces and resiliently retaining the plunger in either of its limit positions. The provision of the two cam portions permits the plunger 70 to be turned end for end, if desired, so that care in assembly is not required. Also, if greater resistance to movement of the valve plunger 70 is desired, two plungers may be included, one engaging the cam surface 91 and the other engaging the cam surface 92.

While in most cases, a dual chamber pump of the type described above is satisfactory for producing a substantially continuous discharge, two or more of these pumps may be connected by means of a series of check valves like those described above to a common source of supply and discharging through a common conduit to supply brine without substantial pulsation in the flow.

It will be understood that brine pumps of the type described above will be made with stainless steel or other corrosion-resistant casing portions or fittings wherever contact with the brine may occur, with the exception of the diaphragms. In the interest of economy, the casing section 12 and the various actuating elements such as the valve and the like may be formed of aluminum, brass or bronze while the shaft 30 and the outer clamping discs and nuts 38 and 40 and the outer casing sections 21 and the fittings for conveying the brine may be formed of Monel, stainless steel or the like or even of glass or other similar materials.

From the preceding description of a typical pump embodying the present invention, it will be apparent that we have provided a brine pumping apparatus which is simple, highly reliable in operation and meets all sanitary requirements as well as being foolproof and positive in operation. It may be understood, of course, that the size of the pump may be varied depending upon requirements and that there may be modifications in the shape and design of the various parts of the pump. Therefore, the form of the invention disclosed herein should be considered as illustrative and not as limiting the scope of the following claims.

We claim:

1. A dual diaphragm pump comprising a hollow casing, inner disk-like housing members at opposite ends of said casing and having openings therein communicating with opposite ends of said casing, outer disk-like housing members confronting said inner housing members and defining therewith pump chambers, flexible diaphragms dividing said chambers into inner and outer compartments, a partition at about the middle of said casing, a first rod slidably mounted in said partition, means at the opposite ends of said rod connecting it to said diaphragms, a second rod slidably mounted for endwise movement in said partition parallel with said first rod, end plates on said second rod engageable with the means at the ends of said first rod for shifting the second rod endwise, a valve mounted in said partition for supplying fluid under pressure selectively to the outer ends of said casing for displacing said diaphragms, means on said valve engageable by said end plates in response to displacement of said diaphragms for actuating said valve to supply fluid to and discharge it from opposite ends of said casing alternately a manually movable member mounted in said partition, and means to connect said member with said second rod to move the latter and actuate said valve.

2. A control valve comprising a valve casing, a sleeve in said casing having an intake port to be connected to a source of fluid under pressure, a pair of discharge ports on opposite sides of said intake port and a pair of return ports for discharging fluid from said casing, a valve member slidable axially of said sleeve and having end portions projecting beyond the ends of said sleeve, end closure members in said sleeve slidably receiving said end portions, piston elements on said valve member spaced apart a lesser distance than the spacing between said discharge ports to cover both of said discharge ports simultaneously or selectively uncover one of them, another piston element on said valve member movable therewith to either side of said intake port and to a position covering it when both the discharge ports are covered, an axial bore extending from end to end of said valve member, radial passages in said another piston element for delivering fluid from said intake port to said bore when the latter is covered by said another piston, a control rod slidable axially of said bore and extending outwardly beyond the ends of said valve member, an enlargement on said rod movable selectively therewith to opposite sides of said radial ports to direct fluid therefrom along said bore, ports in said valve member outwardly of said spaced apart piston elements connecting said bore to the sleeve between said end closures and said spaced apart piston elements, and means on the opposite ends of said control rod for selectively covering and uncovering the last-mentioned ports.

3. A snap-action valve, comprising a casing, a sleeve in said casing having a centrally located intake port for connection with a source of fluid under pressure, a pair of spaced apart return ports on opposite sides of said intake port and a pair of discharge ports spaced apart outwardly of said return ports, a slide valve plunger reciprocable in said sleeve, piston members at opposite ends of said plunger spaced apart a distance less than the distance between said discharge ports to cover one of the latter and uncover the other at the ends of its reciprocating movement and cover both when the plunger is substantially

centrally positioned in said sleeve, a centrally located piston member on said plunger movable therewith from one side of said intake port to the other and covering said intake port in a central position of said plunger in said sleeve, an axial bore in said plunger, radial passages extending from the outer periphery of the centrally located piston member to said axial bore, a control rod in said bore, means on said rod and said plunger for directing fluid flowing through said radial passages when said intake port is covered by said centrally located piston selectively to one end of said plunger to shift said plunger bodily, ports at opposite ends of said slide valve plunger, means at opposite ends of said control rod to cover and uncover the last-mentioned ports, said rod and said plunger being shiftable successively to divert fluid through said valve to suddenly shift said plunger reversing the flow of fluid through said valve.

4. A snap-action valve comprising a casing, a sleeve in said casing having an intake port, a pair of spaced apart discharge ports on opposite sides of said port and a pair of spaced apart return ports, a valve member slidable mounted for axial movement in said sleeve, said valve member having a centrally located piston and spaced apart enlargements adjacent its opposite ends, said piston and enlargements being spaced to cover said intake and discharge ports simultaneously and to uncover said intake port and selectively one of said discharge ports to connect one of said return ports with the intake port and the other return port with the uncovered discharge port, a bore extending lengthwise of said valve member, substantially radial passages extending through said piston for connecting said bore with said intake port when the latter is covered by said piston, hollow extensions on the ends of said valve member, end closures for said sleeve slidably receiving said extensions, a control rod slidable axially of said bore having enlargements at its ends fitting in said extensions and an enlargement at about its mid-portion for covering and uncovering said radial passages, said control rod being shiftable to either side of said radial passages, and passages at the outer ends of said enlargements of said valve member for introducing fluid from said bore between said end closures and said enlargements.

5. A snap-action valve comprising a casing, a sleeve in said casing having an inlet port, a pair of spaced apart discharge ports on opposite sides of said intake port and a pair of spaced apart return ports, a valve member slidable mounted for axial movement in said sleeve, said valve member having a centrally located piston and spaced apart enlargements adjacent its opposite ends, said piston and enlargements being spaced to cover said intake port and selectively one of said discharge ports to connect one of said return ports with the intake port and the other return port with the uncovered discharge port, sleeve extensions at opposite ends of said valve member extending through and beyond the ends of the casing for shifting said valve member axially, an axial bore in and extending through said valve member and said extensions, a control rod longer than the combined lengths of said valve member and extensions slidably mounted in said bore and having its opposite ends projectable beyond the outer ends of said extensions, and valve elements at about the middle of and adjacent to the ends of said control rod and passages in said valve member and extensions com-

municating with said bore and said casing at opposite ends of said valve member and co-operating with said valve elements for directing pressure from said intake port to the space between the outer end of one of said enlargements and said casing and to discharge liquid from between the outer end of the other enlargement and said casing through the passages in the sleeve extension thereon in response to relative movement of said valve member and rod in the same direction to move said valve member farther in the same direction and reverse the connections between said intake, discharge and return ports.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
424,686	Patten -----	Apr. 1, 1890
491,116	Keeney -----	Feb. 7, 1893
541,608	Weatherhead -----	Feb. 13, 1894
1,119,640	Roettger -----	Dec. 1, 1914
1,764,366	Stuebing -----	June 17, 1930
1,885,457	Lord -----	Nov. 1, 1932
1,914,600	Hewitt -----	June 20, 1933
2,260,306	Ferguson -----	Oct. 28, 1941
2,453,812	Phelan -----	Nov. 16, 1948
2,500,450	Carleton -----	Mar. 14, 1950