July 3, 1934.

D. S. WILLSON

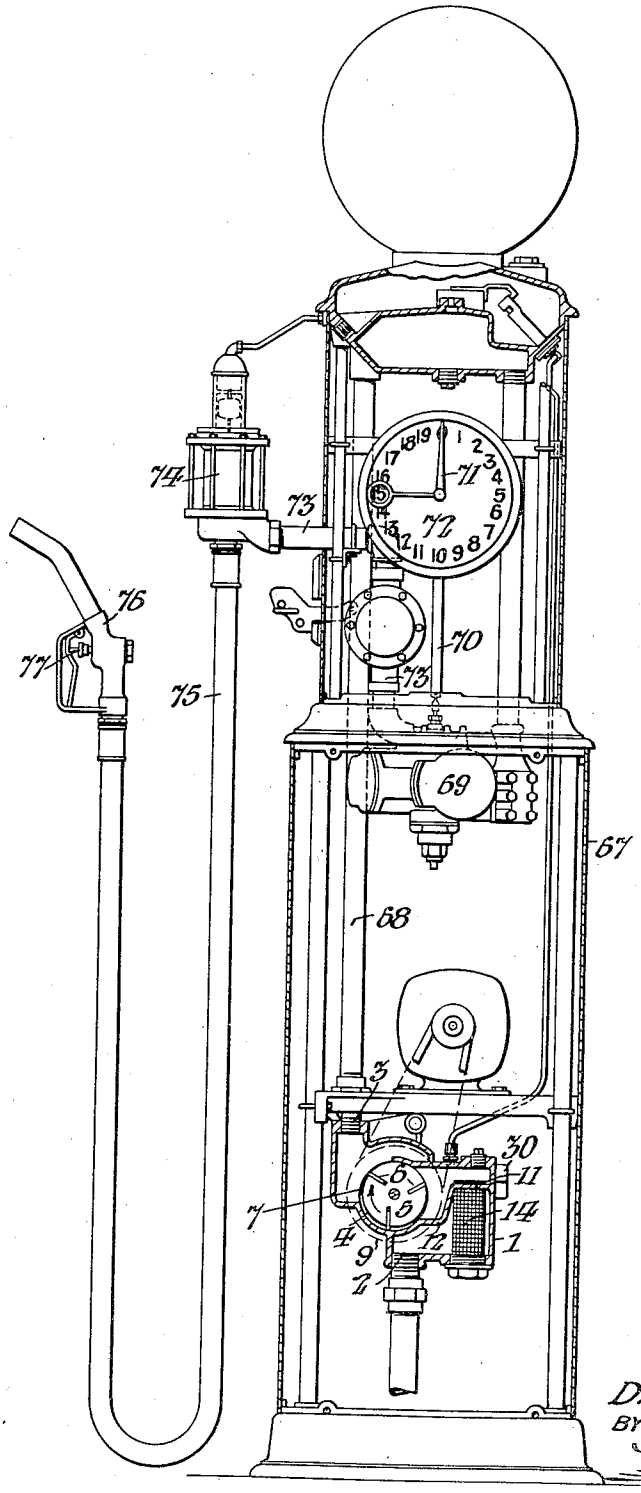
1,965,526

BY-PASS VALVE

Filed April 19, 1932

2 Sheets-Sheet 1

FIG. I.



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2 Sheets-Sheet 2

FIG. II.

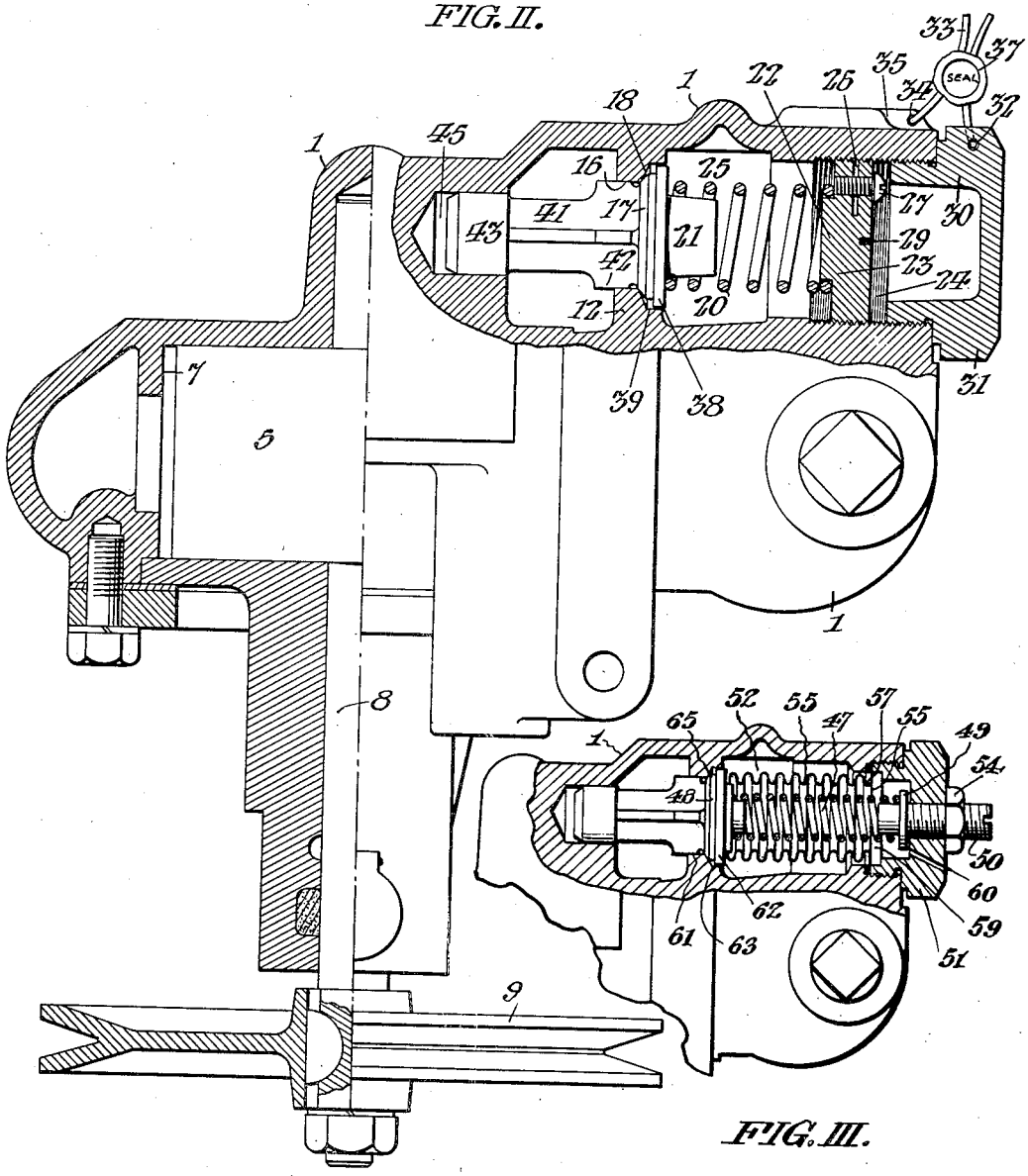


FIG. III.

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Patented July 3, 1934 1,965,526

UNITED STATES PATENT OFFICE

1,965,526

BY-PASS VALVE

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Application April 19, 1932, Serial No. 606,097

11 Claims. (Cl. 221—95)

My invention may be advantageously employed in apparatus for dispensing gasolene, from what is known as a curb stand, containing an electric motor controlled by a switch, at the stand, to operate a pump to suck the liquid from a subjacent tank and deliver it under pressure through a flow meter in the stand, and a dispensing hose which extends about ten feet from the stand, and has a manually operative nozle valve which is continually spring stressed toward its closed position. When the operator terminates a dispensing operation by releasing the nozle valve and permitting it to be closed by its spring; the electric motor and pump continue to operate until the operator returns to the stand and opens said switch. Therefore, by improved valve is included in the casing of such a pump to control a by-pass from the discharge side of the pump back to the intake side thereof, to relieve the pressure imposed by the pump when the nozle valve is closed, in order to prevent rupture of the hose or some other part of the apparatus.

Said by-pass valve is continually spring pressed to close it and the effective pressure of the spring upon the valve may be varied to variably determine at what pressure the valve shall open to bypass the liquid from the discharge to the intake side of the pump. For instance, I find it convenient to set said valve to open at a pressure of fifteen pounds per square inch, employed to dispense liquid at the rate of fifteen gallons per minute; but it may be set for any other desired pressure, in accordance with the rate of delivery desired, the height the liquid must be lifted, and the length of the conduit through which it is dispensed.

I am not the first to provide such a pump with a by-pass valve, but the valves heretofore employed have been found objectionable in that they impose upon the electric motor and the pump a greater load when by-passing the liquid through the pump than when dispensing the liquid through the hose. Whereas, my by-pass valve operates with less load on the motor and pump when by-passing than when dispensing the liquid.

My valve includes means affording a plurality of surfaces of different areas, successively subjected to pressure, whereby when a predetermined liquid pressure is attained, by the pump, said valve is opened by that pressure upon a minor area of the valve; whereupon, a greater area of the valve is exposed to the pump pressure but with a space around it permitting free passage of nearly the full volume of liquid pumped; so that the operator may diminish the flow at the nozle to, say, three gallons per minute, toward the end of the dispensing operation, to precisely control the volume dispensed, without further movement of the by-pass valve, but, when the nozle valve is closed, the increased flow and consequent pressure through the by-pass upon said greater valve area counterbalances the spring load and opens the by-pass valve widely and holds it open until the normal pressure is restored, by reopening the nozle valve or stopping the pump. When the nozle valve is reopened, without stopping the pump, the escape of liquid at the nozle, of course, correspondingly lessens the pressure of liquid upon the by-pass valve necessary to hold it open, and, consequently, said valve is automatically moved toward its closed position as the flow through the nozle is increased, until said valve is, normally, closed when the nozle flow reaches its maximum.

My invention includes the various novel features of construction and arrangement hereinafter more definitely specified, including means for counterbalancing the suction stress of the pump upon the valve; and a dash pot, of simple construction, which prevents hammering of the valve upon the seat.

In the drawings, Fig. I is a sectional elevation of a curb stand conveniently embodying my invention.

Fig. II is a fragmentary plan sectional view of said pump showing a preferred form of my valve.

Fig. III is a plan sectional view, similar to Fig. II, but showing a modified form of my invention.

Referring to Figs. I and II; the pump casing 1 has the liquid inlet 2 and the liquid outlet 3 respectively below and above the pump chamber 4 containing the rotor 5 carrying the circular series of blades 6 which, by the turning movement of said rotor, are centrifugally projected into contact with the inner wall 7 of said pump chamber. Said rotor 5 has the shaft 8 carrying the pulley 9 by which it is rotated in the direction of the arrow and with the effect of normally sucking the liquid into the pump chamber 4 from the inlet 2 and through the port 11 in the partition 12, and through the removable screen 14, and discharging it from said chamber 4 through the outlet 3.

Said partition 12 thus separates said inlet 2 from said outlet 3, but is provided with the by-pass port 16 controlled by the by-pass valve 17 which is normally closed upon its seat 18 by the pressure of the spring 20. The inner end of said spring 20 encircles the stem 21 on said valve, and the opposite end encircles the boss 22 on the adjustable spring abutment plug 23 which is ax-

ially adjustable in connection with the screw thread 24 in the spring chamber 25 in said casing 1. Said plug 23 has a saw-cut 26 in its circumference splitting about one-third of its circumference transversely to its axis. The screw 27 which extends across that split, parallel with the axis of the plug 23, is in screw threaded engagement with the plug at its inner end and its head is adapted to bear upon the outer surface of the plug to spring the two split portions of the plug toward each other to clamp the plug in any desired position of rotation. Said plug 23 is conveniently provided with the slot 29 for engagement with a screw driver by which it may be turned to shift it axially in the chamber 25 and thereby adjustably vary the pressure of said spring 20 upon said valve. As above noted; it may be adjusted so that the valve is opened by any pressure of the liquid in excess of fifteen pounds, or otherwise. The spring adjusting means aforesaid are secluded in the chamber 26 by the screw plug 30, conveniently provided with the hexagonal head 31. One of the six corners of said head 31 may be drilled as indicated at 32 to receive a sealing wire 33 which also extends through the drilled hole 34 in the rib 35 on said pump casing 1; the ends of the wire being connected by the lead seal 37, so that it is necessary to break said seal 37 and remove the wire 33 from the openings 32 and 34 to remove the plug 30 before it is possible to change the adjustment of the effective pressure of the spring 20 upon the valve. However, if and when said plug 30 is removed and the screw 27 turned backward a half-turn; said spring abutment plug 23 is released from its clamping engagement with the screw thread 24 and may be moved axially to vary the adjustment of the spring pressure.

Said valve 17 has the circumferential flange 38 in spaced relation with the annular recess 39 around said valve seat 18, so proportioned that when said valve 17 is displaced from its seat 18 by the back pressure of the liquid sufficient to overbalance the predetermined pressure of said spring 20, the liquid thus permitted to escape into the spring chamber 25 and thence into the intake 2 is available to further temporarily overbalance the spring 20 and open said valve wider and hold it widely open until the pump is stopped by the operator opening the switch controlling it; or until the hose nozle is opened sufficiently by the operator to partially or wholly reduce the back pressure.

Said valve 17 has opposite the stem 21, the stem 41 comprising four radial flanges 42 serving to guide it in said by-pass port 16, and said stem 41 carries the cylindrical dash pot piston 43, which is conveniently formed in unitary relation therewith, and which is slip fitted in the dash pot 45 in said pump casing 1. The effect of that construction and arrangement is that when the pump stops or when the hose nozle valve is opened and the pressure of the spring 20 is thus permitted to close said valve 17 upon its seat 18; such closure is retarded by the cooperation of said dash pot piston 43 and dash pot 45 so that the stress upon the by-pass valve is automatically controlled and that valve opens and closes slowly without any hammer action above contemplated.

Moreover, in Fig. III, I have shown a modified form of my invention in which the suction stress of the pump upon the valve is further counter- In that form of my invention, I have shown the balanced and may in fact be equalized by the exposure of the right hand side area of the valve to the atmosphere exterior to the pump casing. In that form of my invention, I have shown the spring adjusting means immediately accessible from the exterior of the pump casing.

Referring to Fig. III; the spring 47, which is substituted for the spring 20 shown in Fig. II, abuts at its inner end against the valve 48 which is similar to the valve 17 above described, and abuts at its opposite end against the flange 49 on the adjusting screw 50 which is in screw threaded engagement with the screw plug 51 which closes the end of the spring chamber 52, and said screw 50 may be locked in any position of axial adjustment by rotation of the lock nut 54. Said spring 47 is surrounded by the corrugated sheet metal bellows 55, the inner end of which is conveniently soldered to the valve 48. The outer end of said bellows 55 has the circumferential flange 56 which is clamped in fluid tight relation with the pump casing 1 by said screw plug 51, compressing the gasket 57. The chamber 59 within said bellows 55 is continually maintained in communication with the outer atmosphere through the air port 60, which is, conveniently, a small hole drilled through said screw plug 51. However, said bellows may be otherwise constructed, arranged, and secured, the essential feature being that the area exposed to the outer atmosphere is such as to balance the suction of the pump upon the valve.

In the form of my invention shown in Fig. III, the pressure of the spring 47 continually tending to close said valve 48 upon its seat may be initially overcome, and the valve slightly opened, by the predetermined pressure of the liquid upon the area of said valve 48 exposed in the by-pass port 61, and the valve may be widely opened by a greater liquid pressure upon the circumferential flange 62 which is mounted to reciprocate in the annular recess 63 around the valve seat 65, predetermined by the radially spaced relation of said flange in said recess, as above described with reference to Fig. II; but with the modified counterbalancing effect due to the fact that the major area of the right hand side of said valve shown in Fig. III is secluded in the bellows 55 and exposed to the outer atmosphere through the air port 60, instead of to the suction stress of the pump, and, consequently, a less powerful spring suffices to counterbalance the back pressure on the discharge side of the pump and hold the valve closed until the pressure increases to the predetermined value at which the valve starts to open.

Although in both forms of my invention chosen for illustration I have shown a valve provided with but two differential areas subjected to fluid stresses, it is to be understood that such valves may have three or more such areas, as described and claimed in my copending application (16—32) Serial No. 612,481 filed May 20th, 1932, for Letters Patent of the United States; the claims in the present case being limited to the combination of such a valve with a fluid pump to control the by-pass of the latter.

In Fig. I, I have indicated a typical curb stand including an outer casing 67 inclosing the pump casing 1, the outlet 3 of which is connected by the conduit 68 with the flow meter 69 including means whereby the flow of liquid therethrough turns the shaft 70 to rotate the index hand 71 with respect to the circular graduated dial 72. Said flow meter is connected by the conduit 73 with the sight gage 74 from which depends the flexible hose 75 provided with the nozle 76 controlled by the valve 77.

My improved valve is advantageous in such a combination in the attainment of the several effects above contemplated; viz., first, when the by-pass valve is opened, rendering the pump operative at less than its maximum working load when the back pressure is nearly sufficient to unseat the valve. Second, permitting a higher initial spring load on the valve, against the maximum back pressure and suction during maximum dispensing flow, and yet, third, holding the valve wide open with less back pressure when the nozle is closed. Fourth, gradual opening and closure of the valve from minimum to maximum effective area without hammer action. Fifth, greater ease in the throttling action upon the nozle at the end of the flexible hose through which the liquid is dispensed by said pump, under the control of the operator; and, sixth, stopping the meter if the tank runs dry, so that only air or vapor would be pumped.

Some of those effects may be varied over a wide range in accordance with the relative proportions of the elements of the structure which cooperate to produce those effects. For instance; first, the pump discharge pressure may be varied in accordance with the height the liquid is to be lifted and the resistance to flow of the liquid in the conduit from the supply tank to the dispensing outlet. Second, with a given pump pressure and suction, the pressure at which the by-pass valve is initially opened may be variably determined by varying either the area of the by-pass port or the strength of the valve spring, or both. Third, the pressure at which the by-pass valve is widely opened may be variably determined by varying the area of the space around the annular flange on the valve which is greater in area than the surface of the valve exposed to the pressure when the valve is shut. Fourth, that variation may be effected by variation in the radius of that flange or of the recess in which it reciprocates, or both. If that valve flange be closely fitted like a piston in its recess aforesaid, the initial unseating of the by-pass valve by pressure upon its minor area, (equal to that of the by-pass port,) would be practically instantly followed by wide opening movement of that valve, and by-passing of all the liquid pumped, thus stopping the dispensing operation. Provision for more or less leakage past that flange permits the operator to diminish and control the rate of flow at the dispensing nozle by manipulating the nozle valve as above contemplated, and without interruption of the dispensing flow, so that he can stop the dispensing operation when precisely the volume of liquid desired has been dispensed. However, when the nozle valve is closed at the end of a dispensing operation, the full pump pressure and suction (or reduced pressure) then applicable to respectively opposite sides of said valve flange, widely open the latter to by-pass all of the liquid displaced by the pump and with less load upon the pump and electric motor than with the ordinary single area by-pass valve, and such load may be less than when effecting a dispensing operation. In the embodiment shown, such load is conveniently decreased from three to five pounds less per square inch of cross section of the stream of liquid.

Therefore, I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention, as defined in the appended claims.

I claim:

1. The combination with a liquid pump casing having a liquid inlet and a liquid outlet and means for forcing liquid from said inlet through said outlet; of a dispensing hose connected with said outlet; a nozle valve at the discharge end of said hose; a by-pass conduit including a port between said inlet and said outlet; a by-pass valve controlling said by-pass port, hose and nozle; a spring continually stressing said by-pass valve toward its closed position, in which it presents a minor area against the pressure of liquid upon the side of said port toward said outlet, and against the suction of the liquid upon the side of said port toward said inlet; a flange on the suction side of said by-pass valve, supplementing said minor area, when said valve is unseated; and means in said casing, including a recess wall, encircling said valve flange, for limiting the leakage of liquid past said flange, to a predetermined invariable degree; whereby a predetermined portion of the pressure of liquid through said port is directed upon said flange, after initial opening movement of said valve, until a greater pressure of liquid on said valve, in excess of said leakage, overbalances the closing stress of said spring, and widely opens said by-pass valve, with its flange beyond said limiting means, and maintains it open until the pressure of liquid flowing through said port is diminished below a predetermined value, by opening said nozle valve or stopping said pump; whereupon said by-pass valve is closed by its spring; whereby said apparatus operates with less load on said motor and pump when by-passing the liquid through the pump than when dispensing the liquid through the hose.

2. The combination with a liquid pump casing having a liquid inlet and a liquid outlet and a rotor for forcing liquid from said inlet through said outlet; of a dispensing valve controlling said outlet; an electric motor operatively connected with said rotor; a by-pass in said pump casing including a port between said inlet and said outlet; a by-pass valve controlling said by-pass port; a spring continually stressing said valve toward its closed position and against the pressure of liquid upon the side of said port in communication with said outlet and against the suction of the liquid upon the side of said port toward said inlet; a flange on the suction side of said valve, of greater area than the area exposed upon the pressure side of said valve; and cylindrical means in invariable radially spaced relation with the perimeter of said flange, for limiting the flow of liquid past said flange and thereby concentrating the pressure of liquid upon said flange after initial opening movement of said valve and until said valve is opened to present its flange beyond said limiting means; whereby the liquid pressure upon said valve flange counterbalances the closing stress of said spring after the valve is unseated and is effective to widely open the valve and maintain it open until the pressure of liquid flowing through said port is diminished below a predetermined value, by opening said dispensing valve or stopping said pump, and the by-passing operation is effected with less load upon said motor and pump, when the dispensing valve is shut, than the normal load of dispensing operation.

3. The combination with a liquid pump casing having a liquid inlet and a liquid outlet and

means for forcing liquid from said inlet through said outlet; of a dispensing valve controlling said outlet; a by-pass in said pump casing including a port between said inlet and said outlet; a by-pass valve controlling said by-pass port; a spring continually stressing said valve toward its closed position and against the pressure of liquid upon the side of said port in communication with said outlet and against the suction of the liquid upon the side of said port toward said inlet; means on said valve affording a plurality of plane areas transverse to the valve axis and of different extent, for successive exposure to pressure, the least of said areas being exposed upon the pressure side of said valve, when the valve is closed; means for directing the pressure of liquid upon a larger such plane area after initial opening movement of said valve and until said valve is widely opened; whereby the liquid pressure upon said valve counterbalances the closing stress of said spring after the valve is unseated and is effective to widely open the valve and maintain it open until the pressure of liquid flowing through said port is diminished below a predetermined value, by opening said nozle valve or stopping said pump, and the by-passing operation is effected with less load upon said pump, when the nozle valve is shut, than the normal load of dispensing operation.

4. The combination with a liquid pump casing having a liquid inlet and a liquid outlet and means for forcing liquid from said inlet through said outlet; of a by-pass in said pump casing including a port between said inlet and said outlet; a by-pass valve controlling said by-pass port; a spring continually stressing said valve toward its closed position and against the pressure of liquid upon the side of said port in communication with said outlet and against the suction of the liquid upon the side of said port toward said inlet; a flange on the suction side of said valve, in a plane at right angles to the axis of said shaft and of greater area than the area exposed upon the pressure side of said valve; and a wall in said casing encircling said valve flange in such radially spaced relation therewith as to limit the flow of liquid past said flange, to a predetermined degree, and thereby concentrate the pressure of liquid upon said flange after initial opening movement of said valve and until said valve is opened to present its flange beyond said recess; whereby the liquid pressure upon said valve flange in said recess counterbalances the closing stress of said spring after the valve is unseated and is effective to widely open the valve and maintain it open until the pressure of liquid flowing through said port is diminished below a predetermined value; whereby said apparatus operates with less load on said motor and pump when by-passing the liquid through the pump than when dispensing the liquid.

5. The combination with a liquid pump casing having a liquid inlet and a liquid outlet and means for forcing liquid from said inlet through said outlet; of a by-pass in said pump casing including a port between said inlet and said outlet; a by-pass valve controlling said by-pass port; a spring continually stressing said valve toward its closed position and against the pressure of liquid upon the side of said port in communication with said outlet and against the suction of the liquid upon the side of said port toward said inlet; means on said valve affording a plurality of areas of different extent, in planes at right angles to the axis of said valve, for successive exposure to pressure, the least of said areas being exposed upon the pressure side of said valve, when the valve is closed; means for directing the pressure of liquid upon a larger such plane area after initial opening movement of said valve and until said valve is widely opened; whereby the liquid pressure upon said valve counterbalances the closing stress of said spring after the valve is unseated and is effective to widely open the valve and maintain it open until the pressure of liquid flowing through said port is diminished below a predetermined value; whereby said apparatus operates with less load on said motor and pump when by-passing the liquid through the pump than when dispensing the liquid.

6. A structure as in claim 2; including a dash-pot in the pump casing and a piston carried by the by-pass valve in cooperative relation with said dash pot for controlling the rate of movement of said valve and preventing hammer action thereof.

7. A structure as in claim 5; including a dash-pot in the pump casing and a piston carried by the by-pass valve in cooperative relation with said dash pot for controlling the rate of movement of said valve and preventing hammer action thereof.

8. A structure as in claim 2; including a bellows connecting the outer end of the by-pass valve with the pump casing and means connecting the interior of said bellows in communication with the atmosphere exterior to said casing; whereby suction stress upon said valve by said pump is counterbalanced by the area of said valve and bellows exposed to the outer atmosphere.

9. A structure as in claim 5; including a bellows connecting the outer end of the by-pass valve with the pump casing and means connecting the interior of said bellows in communication with the atmosphere exterior to said casing; whereby suction stress upon said valve by said pump is counterbalanced by the area of said valve and bellows exposed to the outer atmosphere.

10. The combination with a pump having a liquid inlet and a liquid outlet and means for forcing liquid from said inlet through said outlet; of a dispensing hose connected with said outlet; a nozle valve at the discharge end of said hose; a by-pass conduit including a port between said inlet and said outlet; a by-pass valve controlling said by-pass port; a spring continually stressing said by-pass valve toward its closed position, in which it presents a minor area against the pressure of liquid upon the outlet side of said port, and against the suction of liquid upon the inlet side of said port; and means for lessening the effective spring pressure on said valve when said nozle valve is shut, including a flange on the suction side of said by-pass valve, extending in a plane at right angles to the axis of said valve and supplementing said minor area, to a predetermined invariable extent, when said valve is unseated; whereby when said valve is unseated the pressure of liquid through said port is directed upon said flange, overbalances the closing stress of said spring, and widely opens said by-pass valve, and maintains it open until the pressure of liquid flowing through said port is diminished below a predetermined value, by opening said nozle valve or stopping said pump; whereupon said by-pass valve is closed by its spring; whereby said apparatus operates with less load on said motor and pump when by-passing the liquid through the pump than when dispensing the liquid.

11. A structure as in claim 10, wherein the by-pass port is large enough to pass all of the liquid

displaced by the pump, with less load upon the pump than when dispensing such volume of liquid through the hose, including means for affording leakage of liquid past said valve flange at a predetermined rate when the valve is unseated for preventing the concentration of the full amount of pressure of liquid through said port upon said flange and thus preventing the widely opening movement of said by-pass valve during movement of the nozle valve toward its closed position, by the operator, to thus permit the operator to control and vary the rate of dispensation of liquid through said hose, in a continuous stream, before the by-pass port is open to its full capacity.

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