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AUTOMATIC SHUT-OFF DISPENSING NOZZLE VALVE

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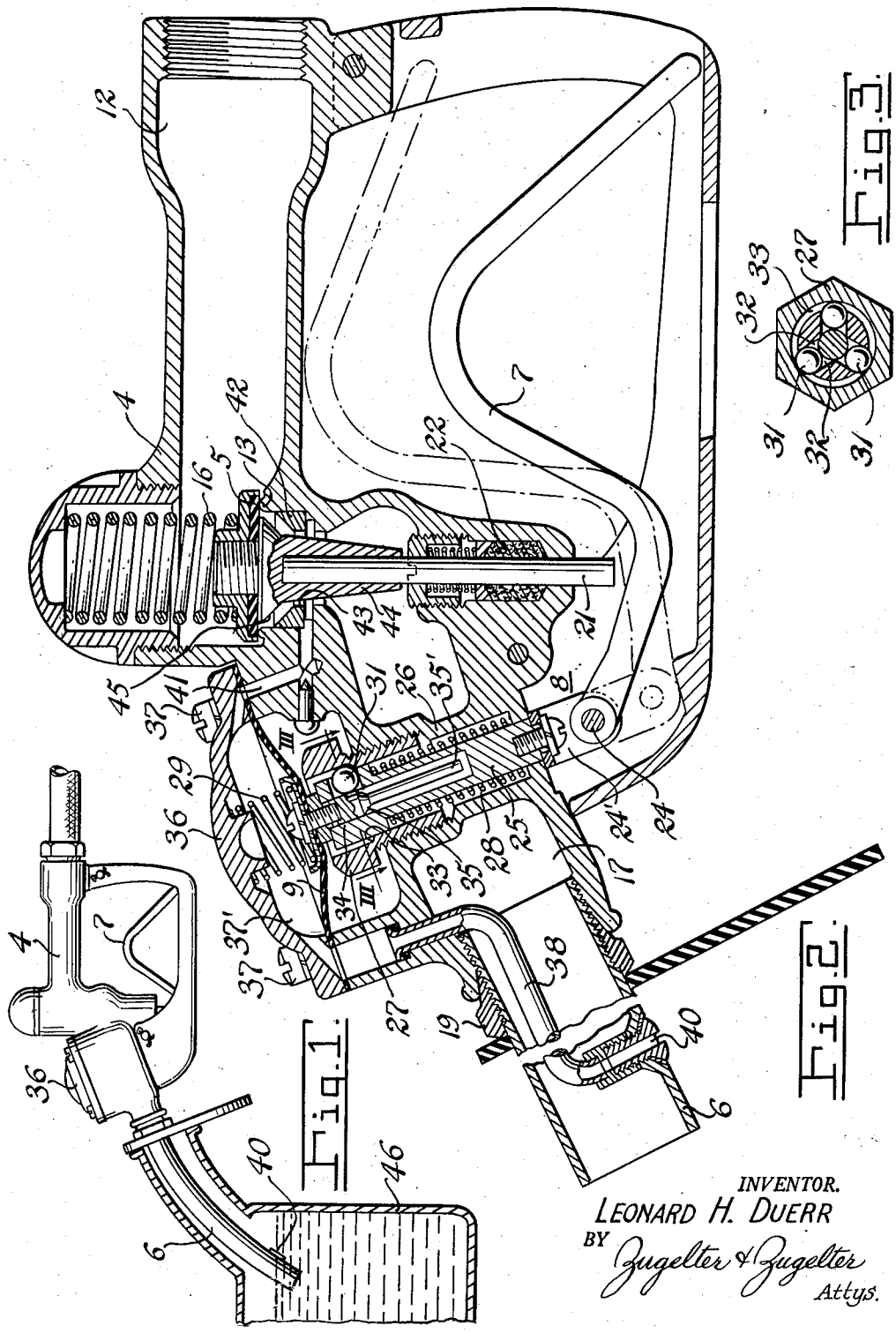


Fig. 1.

Fig. 3.

Fig. 2.

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AUTOMATIC SHUTOFF DISPENSING NOZZLE VALVE

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7 Claims. (Cl. 226—127)

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This invention relates to automatically operating flow control valves or nozzles of the type exemplified by such patents as Payne 1,550,738 and Davis 2,320,033 and wherein approximate filling of a receptacle by way of such nozzle serves to automatically close the valve.

In such devices, submergence of the discharge end of the nozzle in the dispensed liquid causes a flexible diaphragm to function and cause the main or flow control valve to close.

More particularly, this invention relates to a mechanism comprising a flexible diaphragm adapted to react to pressures upon opposite sides thereof for automatically operating a flow control valve to shut off the flow of liquid through dispensing devices of the character indicated.

A further object of this invention is to provide a nozzle valve of this type having a hand lever for manually opening the valve with an automatic trip which automatically resets to operative position when the valve actuating hand lever is released to its normal valve closing position, at which time the flow control valve is closed or on its seat.

A further object of this invention is to provide a diaphragm-operated trip for a nozzle valve which is adapted to shut off not only when the rate of liquid delivery is high but also when the rate of liquid delivery is low.

Another object is to provide a durable dispensing valve, the operating parts of which may be of substantial and sturdy construction, whereby the valve is adapted to withstand rough handling and abuse such as being dropped upon hard surfaces without impairing the proper functioning of the automatic operating parts thereof.

Another object of the invention is to provide a device that is simple in construction and operation and the manufacture and assembly of the parts of which may be accomplished expeditiously and economically.

The above and other objects and features of the invention will in part be obvious and will in part be apparent from the following detailed description, and the drawing, in which:

Figure 1 is a view in side elevation showing an automatic shut-off valve constructed in accordance with an embodiment of this invention, the discharge end of the valve being shown in a liquid container;

Fig. 2 is a view in lengthwise section of the valve illustrated in Fig. 1;

Fig. 3 is a sectional view taken along a line III—III in Fig. 2.

In the following detailed description, and the

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drawing, like reference characters indicate like parts.

As shown in Figs. 1 and 2, the shut-off valve comprises a body 4 having a normally closed main valve 5 therein, a dispensing nozzle 6, a valve handle or lever 7 provided with a fulcrum 8 and a pressure responsive diphragm mechanism 9. With any quantity of liquid flowing through the nozzle, mechanism 9 is arranged to trip or release the fulcrum 8 to a position when main valve 5 will automatically close when the discharge end of the nozzle is submerged in liquid to a predetermined depth. The body 4 is provided with an inlet passageway 12 which leads to a valve seat 13 on which main valve 5 is normally pressed or seated by a main spring 16. When the main valve is open, inlet passageway 12 communicates with an outlet passageway 17 which, in turn, is connected to the discharge nozzle 6. The tubular nozzle 6 is threaded into body 4 and is secured by a lock nut 19.

The main valve 5 is provided with a valve stem 21 which extends downwardly and outwardly of body 4 through a packing gland 22. The lower end of the stem is disposed to be engaged by hand lever 7 when the lever is actuated upwardly, to lift valve 5 off its seat against the force of spring 16.

Fulcrum 8 comprises a pin 24 on which the lever 7 is pivotally mounted. The pin is supported by a clevis or yoke 24' between the arms of which the pivoted end of lever 7 is disposed. The yoke is attached to the lower end of a connecting link or plunger 25. Plunger 25 is slideably disposed in a housing or sleeve 26 which is integral with the valve body 4, and an externally threaded sleeve 27, the latter being threaded into sleeve 26. Plunger 25 is urged upwardly by a coil spring 28 as shown, but is restricted in its travel by contact of fulcrum 8 with base of body 4. It is urged downwardly by spring 16 as will be explained later.

Normally, the plunger 25 is held in a fixed position by a locking mechanism comprising a plurality of balls 31 nested in radial openings 32 (see Fig. 3) in the plunger and an annular shoulder 33 on the interior of sleeve 27. The balls are held on shoulder 33, as shown, by a pin 34 secured to the underside of the diaphragm 9. The pin is provided with a tapered portion 35 at a location slightly below the balls. Below tapered portion 35, the pin includes a depending stem 35' which serves as a ball retainer. Thus, when the pin is raised to a position where the tapered portion is adjacent the balls, plunger 25 will be actu-

ated downwardly, provided hand lever 7 is in its valve opening position. This movement of the plunger results because of the strong force of spring 16 and the relatively weaker force of spring 28. When the plunger moves downward, fulcrum 8 is released to dotted line position shown in Fig. 2 whereby the valve stem is disengaged from hand lever 7.

The diaphragm is actuated upwardly by suction (or reduction in pressure) in the chamber above the diaphragm. The suction results from flow of liquid through the main valve. While the discharge end of the nozzle is not submerged, the pressure in the diaphragm chamber is not reduced sufficiently to deflect the diaphragm to the tripping position of the locking mechanism.

As shown in Fig. 2, the marginal edge of the diaphragm 9 is clamped between a cap 36 and the valve body by suitable screws 37. The space between the cap and the diaphragm is the suction chamber 37'. This chamber communicates with a tube 38 the open end of which is at 40 adjacent the outlet of the nozzle. Opening 40 extends through the side wall of the nozzle and is removed from the flow stream through the nozzle. The diaphragm chamber also communicates with the flow passageway 17 adjacent and immediately below valve 5, through a passageway 41. The flow passageway of the valve is designed to provide a Venturi effect on the diaphragm. As shown, a ring 42 is mounted in the passageway below the valve seat. The interior of the ring has a tapered surface which provides a converged or restricted throat 43. Immediately below the throat is an annular groove to which passageway 41 is connected.

In order that the restricted or Venturi passageway may be adjusted in flow area for various positions of valve 5, other than closed, and thereby insure that sufficient suction will be developed at low rates of flow say 2 or 2.5 G. P. M. as well as at high rates say 12 to 15 G. P. M., including the intermediate values of rates of flow, the upper part of the valve stem is provided with an inverted frusto-conic portion 44. The upper portion of section 44 has a frusto-conic section 45 of wider angle adjacent the valve seat. These frusto-conic sections so regulate the restricted flow area through the valve for the various open positions of valve 5 that a high degree of suction is developed at the inlet to the diaphragm chamber at the various rates of flow of liquid through the nozzle which are encountered in practice.

Assuming that the fulcrum is in its locked position and it is desired to fill the container 46 shown in Fig. 1, the nozzle is placed as shown. The operator then lifts the valve handle to the dotted line position of Fig. 2. Since the fulcrum 8 is held in fixed position, valve stem 21 will be lifted and valve 5 opened. As liquid flows into the container, air will be drawn into opening 40 through the tube 38 into diaphragm chamber 37' and thence from the chamber through passageway 41 to the liquid flowing through the valve. When opening 40 is submerged, air is evacuated from the diaphragm chamber whereby the differential pressure acting thereon causes the diaphragm to move upwardly against the force of spring 29. The diaphragm carries with it pin 34 whereby the balls 31 are released as previously described. The fulcrum plunger 25 and its fulcrum 8 are then moved downwardly by spring 16 acting through valve stem 21 whereby the main valve is automatically closed and the flow to the cointainer is shut off. When the valve handle 7 is released to closed position the fulcrum plunger is reset by spring 28 to the position where the balls will be deflected outwardly to their locking position, the balls being forced to this position by the conical surface 35 or taper on pin 34 which will have been released to its normal position by diaphragm spring 29 when the main valve is closed.

In practice, spring 29 is so designed that only a slight suction or reduction in pressure in the diaphragm chamber is required to lift the ball release pin to the fulcrum tripping position.

The shut-off valve described above and illustrated in the drawing is subject to structural modification without departing from the spirit and scope of the appended claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An automatic shut-off dispensing nozzle for fluids comprising a valve mechanism for controlling the flow of fluid through the nozzle, a diaphragm and a chamber associated therewith, said valve mechanism including a main valve having a valve opening on the discharge side thereof constricted in the direction of flow therethrough, said constricted passageway and said chamber being in communication with one another, an orifice disposed adjacent the discharge end of the nozzle, a tube leading from said orifice to said chamber whereby air is drawn from said orifice through the diaphragm chamber into said constricted passageway when fluid flows therethrough and said orifice is exposed, air being withdrawn from the diaphragm chamber when said orifice is submerged in the dispensed liquid, whereby a pressure differential acts on said diaphragm to deflect the same, a main spring constantly urging said valve to closed position, a plunger mounted to move toward and away from the diaphragm, a hand lever for operating the main valve, said hand lever having a fulcrum carried by said plunger, said plunger being movable between a fixed position in which the hand lever is adapted to open the main valve and a disengaged position in which the hand lever is rendered inoperative to open the main valve, said plunger having a plurality of radial openings, a stationary sleeve surrounding the plunger, said sleeve having a locking shoulder facing the plunger, the radial openings in the plunger being adapted to register with the locking shoulder when the plunger is in fixed position, a plurality of locking balls, one of said balls being disposed in each radial opening, said balls being adapted to engage said locking shoulder to lock the plunger in fixed position, said plunger having an axial opening in communication with the radial openings, a retainer pin attached to the diaphragm and slideable in said axial opening, said pin having a locking section adapted to engage said locking balls to hold said locking balls in engagement with said locking shoulder, and means urging the diaphragm and pin to ball engaging position, said diaphragm moving the pin out of ball engaging position in response to the development of pressure differential resulting when said orifice is submerged to release the balls from engagement with the locking shoulder, the valve spring being adapted to close the main valve and shift the plunger to disengaged position when the hand lever is raised and the balls are released.

2. An automatic shut-off dispensing nozzle for

fluids comprising a valve mechanism for controlling the flow of fluid through the nozzle, a diaphragm and a chamber associated therewith, said valve mechanism including a main valve having a valve opening on the discharge side thereof constricted in the direction of flow therethrough, said constricted passageway and said chamber being in communication with one another, an orifice disposed adjacent the discharge end of the nozzle, a tube leading from said orifice to said chamber whereby air is drawn from said orifice through the diaphragm chamber into said constricted passageway when fluid flows therethrough and said orifice is exposed, air being withdrawn from the diaphragm chamber when said orifice is submerged in the dispensed liquid, whereby a pressure differential acts on said diaphragm to deflect the same, a main spring constantly urging said valve to closed position, a plunger mounted to move toward and away from the diaphragm, a hand lever for operating the main valve, said hand lever having a fulcrum carried by said plunger, said plunger being movable between a fixed position in which the hand lever is adapted to open the main valve and a disengaged position in which the hand lever is rendered inoperative to open the main valve, said plunger having a plurality of radial openings, a stationary sleeve surrounding the plunger, said sleeve having a locking shoulder facing the plunger, the radial openings in the plunger being adapted to register with the locking shoulder when the plunger is in fixed position, a plurality of locking balls, one of said balls being disposed in each radial opening, said balls being adapted to engage said locking shoulder to lock the plunger in fixed position, said plunger having an axial opening in communication with the radial openings, a retainer pin attached to the diaphragm and slidable in said axial opening, said pin having a cylindrical locking section adjacent the diaphragm and adapted to engage said locking balls to hold said locking balls in engagement with said locking shoulder, a frusto-conic section extending inwardly therefrom remote from the diaphragm, and a stem depending from said frusto-conic section, the stem being disposed opposite the radial openings when the pin is out of ball-engaging position, and means urging the diaphragm and pin to ball-engaging position and adapted to drive the frusto-conic section of the pin past the radial openings when the plunger is in fixed position and the pressure differential is terminated to drive the balls into engagement with said locking shoulder, said diaphragm moving the pin out of ball-engaging position in response to the development of pressure differential resulting when said orifice is submerged to release the balls from engagement with the locking shoulder, the valve spring being adapted to close the main valve and shift the plunger to disengaged position when the hand lever is raised and the balls are released.

3. An automatic shut-off dispensing nozzle for fluids comprising a valve mechanism for controlling the flow of fluid through the nozzle, a diaphragm and a chamber associated therewith, said valve mechanism including a main valve having a valve opening on the discharge side thereof constricted in the direction of flow therethrough, said constricted passageway and said chamber being in communication with one another, an orifice disposed adjacent the discharge end of the nozzle, a tube leading from said orifice to said chamber whereby air is drawn from said orifice through the diaphragm chamber into said

constricted passageway when fluid flows therethrough and said orifice is exposed, air being withdrawn from the diaphragm chamber when said orifice is submerged in the dispensed liquid, whereby a pressure differential acts on said diaphragm to deflect the same, a main spring constantly urging said valve to closed position, a plunger mounted to move toward and away from the diaphragm, a hand lever for operating the main valve, said hand lever having a fulcrum carried by said plunger, said plunger being movable between a fixed position in which the hand lever is adapted to open the main valve and a disengaged position in which the hand lever is rendered inoperative to open the main valve, said plunger having a plurality of radial openings, a stationary sleeve surrounding the plunger, said sleeve having a locking shoulder facing the plunger, the radial openings in the plunger being adapted to register with the locking shoulder when the plunger is in fixed position, a plurality of locking balls, one of said balls being disposed in each radial opening, said balls being adapted to engage said locking shoulder to lock the plunger in fixed position, said plunger having an axial opening in communication with the radial openings, a retainer pin attached to the diaphragm and slidable in said axial opening, said pin having a locking section adapted to engage said locking balls to hold said locking balls in engagement with said locking shoulder, a compression coil spring coaxial with the plunger and urging the diaphragm and pin to ball-engaging position and adapted to set the diaphragm and pin in ball-engaging position when pressure in the diaphragm chamber is normal, said diaphragm moving the pin out of ball-engaging position in response to the development of pressure differential resulting when said orifice is submerged to release the balls from engagement with the locking shoulder, the valve spring being adapted to close the main valve and shift the plunger to disengaged position when the hand lever is raised and the balls are released, and a plunger resetting compression coil spring surrounding and coaxial with the plunger and urging the plunger to fixed position, the plunger resetting spring being adapted to hold the plunger in fixed position when the hand lever is released, whereby the plunger is advanced lengthwise of the pin and is locked when the hand lever is released and the pressure in the diaphragm chamber is normal.

4. An automatic shut-off dispensing nozzle for fluids comprising a valve mechanism for controlling the flow of fluid through the nozzle, a diaphragm and a chamber associated therewith, said valve mechanism including a main valve having a valve opening on the discharge side thereof constricted in the direction of flow therethrough, said constricted passageway and said chamber being in communication with one another, an orifice disposed adjacent the discharge end of the nozzle, a tube leading from said orifice to said chamber whereby air is drawn from said orifice through the diaphragm chamber into said constricted passageway when fluid flows therethrough and said orifice is exposed, air being withdrawn from the diaphragm chamber when said orifice is submerged in the dispensed liquid, whereby a pressure differential acts on said diaphragm to deflect the same, a main spring constantly urging said main valve to closed position, a plunger mounted to move toward and away from the diaphragm, a hand lever for operating the main valve, said hand

lever having a fulcrum carried by said plunger, said plunger being movable between a fixed position in which the hand lever is adapted to open the main valve and a disengaged position in which the hand lever is rendered inoperative to open the main valve, said plunger having at least one transverse opening, a stationary member having a locking shoulder disposed adjacent and exteriorly of the plunger, the transverse opening in the plunger being adapted to register with the locking shoulder when the plunger is in fixed position, a locking member slideably mounted in said transverse opening and adapted to engage said locking shoulder to lock the plunger in fixed position, said plunger having a retainer opening parallel to the axis of movement thereof and communicating with the transverse opening, a retainer pin attached to the diaphragm and slideable in said retainer opening, said pin having a locking section adapted to engage the locking member to hold the locking member in engagement with said locking shoulder, and means urging the diaphragm and pin to locking position, the diaphragm moving the pin out of locking position in response to the development of a pressure differential resulting when said orifice is submerged to release the locking member from engagement with the locking shoulder, the valve spring being adapted to close the main valve and shift the plunger to disengaged position when the hand lever is raised and the locking member is released.

5. In a diaphragm operated, automatic shut-off liquid flow control valve of the type having a diaphragm cavity, a diaphragm therein dividing the cavity, a suction tube extending from the nozzle of the valve and communicating with the diaphragm cavity on one side of the diaphragm, a tube communicating at one end with said cavity at said one side of the diaphragm and having its other end exposed to a liquid flow through the valve, and a main valve controlling the flow of liquid therethrough, the combination of a fulcrum carrying plunger mounted on the other side of said diaphragm for sliding toward and away from said diaphragm, a hand lever for operating the main valve, said hand lever having a fulcrum carried by said fulcrum carrying plunger, the fulcrum being movable with said fulcrum carrying plunger between an operative position in which the hand lever is adapted to swing on the fulcrum between a raised position for opening the main valve and a lowered position for releasing the main valve, and a disengaged position in which the hand lever is inoperative for opening the main valve, spring means for normally holding the main valve closed, a pin reciprocably mounted in a lengthwise opening in said fulcrum carrying plunger for sliding parallel to the axis of sliding of the fulcrum carrying plunger, said pin being attached to said diaphragm, said pin having a central section and a lower section of reduced diameter, the central section and the lower section of the pin being slideable in said lengthwise opening, said fulcrum carrying plunger having at least one opening transverse to the direction of sliding and connecting with the lengthwise opening, a locking member slideably mounted in said radial opening, and a stationary member exteriorly of said fulcrum carrying plunger and having a lock shoulder facing the diaphragm, said locking member being adapted to engage said lock shoulder when the pin is in a lowered locked position with the central section of the pin opposite said radial opening, the pin and the diaphragm being advanceable away from the fulcrum when the pressure in the diaphragm cavity is reduced whereby the lower section of the pin is disposed opposite the transverse opening of the plunger and the locking member is released when the pressure in the diaphragm cavity is reduced, the valve spring being adapted to close the main valve and shift the hand lever and the fulcrum carrying plunger to disengaged position when the hand lever is raised and the locking member is released.

6. In a diaphragm operated, automatic shut-off liquid flow control valve of the type having a diaphragm cavity, a diaphragm therein dividing the cavity, a suction tube extending from the nozzle of the valve and communicating with the diaphragm cavity on one side of the diaphragm, a tube communicating at one end with said cavity at said one side of the diaphragm and having its other end exposed to a liquid flow through the valve, and a main valve controlling the flow of liquid therethrough, the combination of a fulcrum carrying plunger mounted on the other side of said diaphragm for sliding toward and away from said diaphragm, a hand lever for operating the main valve, said hand lever having a fulcrum carried by said fulcrum carrying plunger, the fulcrum being movable with said fulcrum carrying plunger between an operative position in which the hand lever is adapted to swing on the fulcrum between a raised position for opening the main valve and a lowered position for releasing the main valve, and a disengaged position in which the hand lever is inoperative for opening the main valve, spring means for normally holding the main valve closed, a pin reciprocably mounted in a lengthwise opening in said fulcrum carrying plunger for sliding parallel to the axis of sliding of the fulcrum carrying plunger, said pin being attached to said diaphragm, said pin having a central section and a lower section of reduced diameter, the central section and the lower section of the pin being slidable in said lengthwise opening, said fulcrum carrying plunger having at least one opening transverse to the direction of sliding and connecting with the lengthwise opening, a locking member slidably mounted in said radial opening, a stationary member exteriorly of said fulcrum carrying plunger and having a lock shoulder facing the diaphragm, said locking member being adapted to engage said lock shoulder when the pin is in a lowered locked position with the central section of the pin opposite said radial opening, the pin and the diaphragm being advanceable away from the fulcrum when the pressure in the diaphragm cavity is reduced whereby the lower section of the pin is disposed opposite the transverse opening of the plunger and the locking member is released when the pressure in the diaphragm cavity is reduced, the valve spring being adapted to close the main valve and shift the hand lever and the fulcrum carrying plunger to disengaged position when the hand lever is raised and the locking member is released, and the spring means urging the diaphragm and pin toward the fulcrum when the pressure in the diaphragm cavity on said one side of the diaphragm is normal, to normally hold the diaphragm and pin in position for locking the fulcrum carrying plunger.

7. In a diaphragm operated, automatic shut-off liquid flow control valve of the type having a diaphragm cavity, a diaphragm therein dividing

the cavity, a suction tube extending from the nozzle of the valve and communicating with the diaphragm cavity on one side of the diaphragm, a tube communicating at one end with said cavity at said one side of the diaphragm and having its other end exposed to a liquid flow through the valve, and a main valve controlling the flow of liquid therethrough, the combination of a fulcrum carrying plunger mounted on the other side of said diaphragm for sliding toward and away from said diaphragm, a hand lever for operating the main valve, said hand lever having a fulcrum carried by said fulcrum carrying plunger, the fulcrum being movable with said fulcrum carrying plunger between an operative position in which the hand lever is adapted to swing on the fulcrum between a raised position for opening the main valve and a lowered position for releasing the main valve, and a disengaged position in which the hand lever is inoperative for opening the main valve, a spring means for normally holding the main valve closed, a pin reciprocably mounted in a lengthwise opening in said fulcrum carrying plunger for sliding parallel to the axis of sliding of the fulcrum carrying plunger, said pin being attached to said diaphragm, said pin having a central section and a lower section of reduced diameter, the central section and the lower section of the pin being slidable in said lengthwise opening, said fulcrum carrying plunger having at least one opening transverse to the direction of sliding and connecting with the lengthwise opening, a locking member slidably mounted in said radial opening, a stationary member exteriorly of said fulcrum carrying plunger and having a lock shoulder facing the

diaphragm, said locking member being adapted to engage said lock shoulder when the pin is in a lowered locked position with the central section of the pin opposite said radial opening, the pin and the diaphragm being advanceable away from the fulcrum when the pressure in the diaphragm cavity is reduced whereby the lower section of the pin is disposed opposite the transverse opening of the plunger and the locking member is released when the pressure in the diaphragm cavity is reduced, the valve spring being adapted to close the main valve and shift the hand lever and and the fulcrum carrying plunger to disengaged position when the hand lever is raised and the locking member is released, a coil spring means surrounding and urging the fulcrum carrying plunger to operative position when the hand lever is released, and a coil spring means coaxial with the first mentioned coil spring means for urging the diaphragm and the pin toward the fulcrum when the pressure in the diaphragm cavity on said one side of the diaphragm is normal, whereby the fulcrum carrying plunger is advanced lengthwise of the pin and is locked when the pressure in the diaphragm cavity on said one side of the diaphragm is normal and the hand lever is released.

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The following references are of record in the file of this patent:

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Number	Name	Date
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