June 17, 1958 W. M. ROSS 2,839,226

ANTI-DRIP DISPENSING VALVE AND NOZZLE

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Fig. 1a

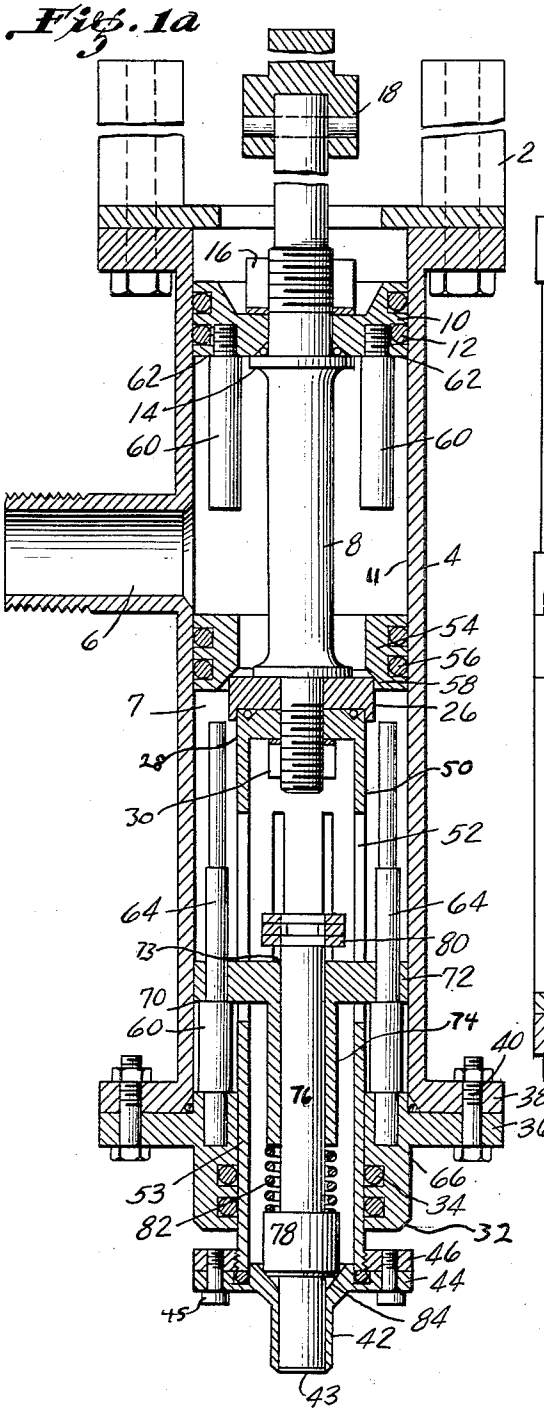
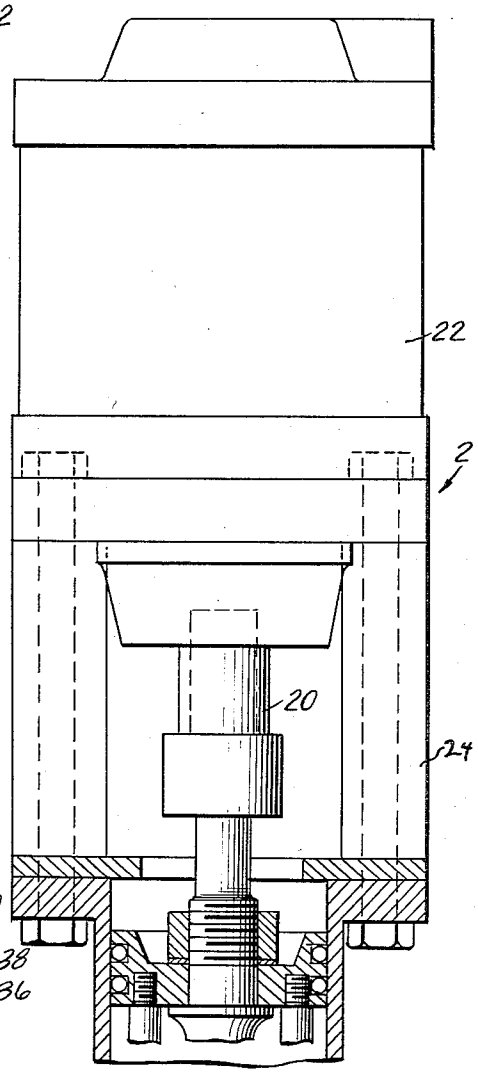


Fig. 1b



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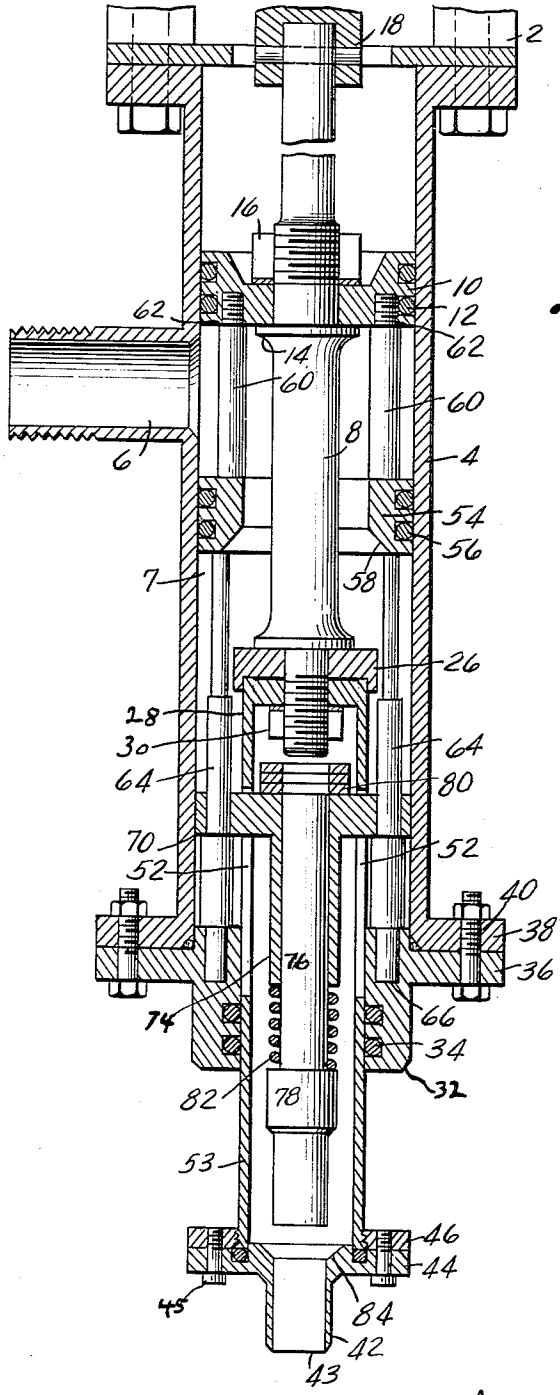

Fig. 2

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ANTI-DRIP DISPENSING VALVE AND NOZZLE

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12 Claims. (Cl. 222—446)

This invention relates to dispensing apparatus and, more particularly, to an anti-drip dispensing valve and nozzle.

In dispensing fluids, particularly highly viscous liquids or semi-liquids, from a supply conduit to a container, considerable difficulty was heretofore encountered in obtaining a sharp and complete cut-off so that the container could be filled with an accurately measured quantity of the fluid. A further problem resided in preventing dripping of the fluid from the dispensing nozzle after the main flow of fluid therethrough was cut off, the result being that containers into which the fluid was dispensed were frequently made messy by the residual drippings and droolings from the nozzle. The object of this invention is to provide a dispensing valve and nozzle which not only sharply cuts off the outflow of fluid therefrom, but which also sucks back fluid from the nozzle into the valve chamber so that it cannot dribble or drain from the nozzle.

Another object is to provide a dispensing valve and telescopically extensible nozzle arrangement wherein, when the valve opens, the nozzle extends outwardly from the valve casing and when the valve shuts off, the nozzle retracts back into the valve casing. This arrangement is intended particularly for filling containers which are placed, next after next, beneath the nozzle, the object here being to extend the nozzle down into the container as the valve opens to dispense fluid thereto, and subsequently to raise the nozzle upwardly to clear the container by the same motion which shuts off the valve and causes the residual fluid in the nozzle to be sucked back into the valve chamber. A still further object is to provide for the nozzle a check valve which functions when the nozzle is retracted into the valve casing so as to trap the sucked-back fluid in the valve chamber.

These and other objects will be apparent from the following specification and drawings, in which;

Figs. 1*a* and 1*b* are a vertical cross-section through the middle of the dispensing valve and nozzle showing the valve closed and the nozzle retracted; and,

Fig. 2 is a vertical cross-section through the portion of the device shown in Fig. 1*a*, showing the valve open and the nozzle extended.

Referring now to the drawings, in which like reference numerals denote similar elements, the dispensing valve and nozzle 42 is enclosed within a generally cylindrical casing 4 having an inlet port 6 leading inwardly to the valve chamber 7. A reciprocatable valve shaft 8 is slidably supported within the casing by a piston 10, the piston being slidably sealed to the cylindrical inner wall 11 of the casing by O rings 12 and engaged between shoulder 14 and nut 16 on the valve shaft so that the shaft and piston move together. The upper end of shaft 8 is connected by a coupling 18 to the reciprocating rod 20 of a pneumatic motor 22 held by supports 24 on the upper end of casing 4 and connected to a suitable source of compressed air and controls (not shown) so that valve shaft 8 may be actuated axially in the valve chamber

from the position shown in Fig. 1*a* to that of Fig. 2. A valve plunger 26 and elongate cylindrical sleeve 28 are fastened by nut 30 on the lower end of valve shaft 8 so that they too reciprocate with the valve shaft, sleeve 28 being confined in and guided by a cylindrical bearing 32 on the lower end of casing 4. Leakage between the bearing 32 and sleeve is prevented by O rings 34 which provide a sliding seal, and flanges 36 and 38 on bearing 32 and casing 4 are connected by bolts 40 so that the mechanism may be readily assembled and disassembled. A downwardly opening nozzle 42 provided with an outlet opening 43 and a mounting flange 44 is secured by screws 45 to flange 46 on the lower end of sleeve 28. While the upper portion 50 of sleeve 28 has slots 52 to provide free passage of fluid to and from it, the lower sleeve portion 53 is solid and functions as a telescoping portion of the nozzle. Whenever shaft 8 and plunger 26 move downwardly from their Fig. 1*a* to those of Fig. 2, nozzle 42 is extended from casing 4 and, whenever shaft 8 and plunger 26 return to their Fig. 1 positions, nozzle 42 is retracted upwardly. These, as will be apparent hereinafter, are also the opening and closing motions of the valve.

A floating valve seat ring 54 slidably sealed by O rings 56 to the inner cylindrical wall 11 of casing 4 is provided with an inclined seat surface 58 for engagement with and by valve plunger 26. Normally, when the valve is in its position of closed repose, the floating valve seat ring rests against plunger 26 as illustrated in Fig. 1*a* and fluid flow therepast is blocked. However, when plunger 26 moves downwardly towards its Fig. 2 position, it is unseated from inclined seat surface 58 and fluid is permitted to flow through the annular floating seat ring 54 and around plunger 26, the floating seat ring 54 remaining in the position shown in Fig. 1 until it is engaged by push rods 60. Push rods 60 move downwardly with shaft 8 and constitute a lost motion connection between plunger 26 and floating seat ring 54 so that, after predetermined opening movement of plunger 26, push rods 60 push floating seat ring 54 downwardly against stop rods 64 so that the seat ring is positioned to be engaged by plunger 26 and to move along with it when the valve again closes.

The lower ends of stop rods 64 are mounted in sockets 66 in the cylindrical bearing portion 32 of casing 4, the stop rods also obtaining lateral support by engagement through holes 70 in a cross bar 72 which is rigidly affixed to stop rods 64 by set screws (not shown) and has a central aperture 73. Rigidly depending from cross bar 72 is a guide sleeve 74 in which reciprocates the stem 76 of a check valve 78, the downward movement being limited by the engagement of a stop collar 80 on stem 76 against cross bar 72, and a downward bias for which is provided by a compression spring 82 engaged against guide sleeve 74. Thus, whenever nozzle 42 is retracted, check valve 78 is yieldably held against a check valve seat 84 on the inner side of the nozzle. It will be apparent that during the first extending movement of the nozzle, check valve 78 follows its seat 84 downwardly so as to keep the nozzle closed, but thereafter, when stop collar 80 engages cross bar 72, nozzle 42 leaves check valve behind, and the nozzle is opened.

At the start of an operating cycle, the parts are positioned as in Fig. 1*a*, plunger 26 being engaged against inclined seat 58 so that no fluid flows therepast, nozzle 42 is retracted, and check valve 78 is closed against its seat 84. When pneumatic motor 22 is actuated so as to shift shaft 8 downwardly, plunger 26 cracks away from seat 58 on floating seat ring 54, and nozzle 42 moves correspondingly downward, and check valve 78 follows its seat 84 for a short distance until stop collar 80 engages cross bar 72. Then, as nozzle 42 and plunger 26 move

further downwardly, fluid flows from inlet port **6** through chamber **7**, through floating seat ring **54**, around plunger **26**, through slots **52** in the upper portion **50** of sleeve **28** and out through nozzle **42**. As the parts near the fully open position of Fig. 2, push rods **60** engage floating seat ring **54** and force it downwardly against the tops of stop rods **64**.

When the desired quantity of liquid has been dispensed, presumably to a container into or towards which nozzle **42** has extended, pneumatic motor **22** is actuated to lift shaft **8** upwardly, thereby retracting nozzle **42** and engaging plunger **26** against seat **58**. Thereafter, the floating seat ring **54** and plunger **26** move together upwardly and away from nozzle **42** in the manner of a solid piston so as to increase the volume of the portion of chamber **7** on the outlet side, thereby sucking back liquid from the nozzle outlet **43** into the interior of chamber **7**. As nozzle **42** re-approaches its Fig. 1*a* retracted position, seat **84** engages the then downwardly extended check valve **78** so as to close the nozzle opening **43**. However, the suction produced by the piston action of plunger **26** and floating seat ring **54** is sufficiently greater than the expansive force of spring **82** to pop check valve **78** back off its seat **84**, thereby drawing back residual liquid from nozzle outlet **43** and trapping it in the chamber, this action occurring until the parts finally return to their Fig. 1*a* positions.

It will be apparent to those skilled in the art that the valve can be actuated by various suitable mechanisms, that it can be operated in other positions than with the nozzle disposed downwardly as illustrated, and is suited to many liquids other than the thick, oily, and highly viscous ones with which it has been successfully used for precisely and neatly filling open-top receptacles, the invention being limited only by the scope of the following claims:

I claim:

1. A dispensing device comprising a fixed casing defining a chamber having an inlet, a nozzle having an outlet, means mounting said nozzle in said casing for telescoping movement between inwardly retracted and outwardly extended positions with respect to the fixed casing, a valve in said chamber for controlling flow of fluid from said inlet to said nozzle outlet, a valve seat movable in said casing, said valve being engageable with said valve seat and movable between open and closed position with respect to said valve seat, and means connecting said valve and nozzle for extending and retracting the nozzle respectively in accordance with the opening and closing movement of said valve, said valve seat being engaged for movement by said valve when said nozzle is moved to the retracted position.

2. The combination claimed in claim 1, said nozzle having a second valve seat therein, and a check valve supported for limited movement in said casing, said check valve engaging said second seat to close the nozzle outlet when said nozzle is retracted, said second seat moving with said nozzle beyond the limit of movement of the check valve when the nozzle is extended.

3. The combination claimed in claim 1, the closing movement of said valve being contra to the direction of fluid flow from said inlet to said outlet, said valve seat cooperating with said valve upon closure thereof for increasing the volume of the chamber between the valve and the outlet, whereby to suck back fluid from said outlet.

4. The combination claimed in claim 1, said nozzle having a check valve seat therein, a check valve supported for limited movement in said casing, said check valve being disposed on the side of its seat which lies upstream in the flow of fluid from said inlet to said outlet and closing in the direction of said flow, said check valve seat moving with said nozzle when said nozzle is extended and the extending movement of the nozzle being greater than the range of movement of said check valve, whereby said check valve seat moves away from the check valve when said nozzle is extended.

5. The combination claimed in claim 4, and bias means for forcing said check valve in its closing direction, the force of said bias means being less than the force of suction applied by the first mentioned valve, whereby fluid is sucked back from said nozzle and trapped in said chamber by said check valve.

6. A dispensing device comprising, means forming a chamber with an inlet and an outlet, a valve seat mounted in said chamber for movement in first and second opposite directions respectively contra and with the flow of fluid from the inlet to the outlet, a valve plunger mounted in said chamber between said valve seat and said outlet for movement in said directions, means for moving said valve plunger in said directions, said valve plunger, upon movement thereof in the first direction, engaging said valve seat so as to prevent the flow of fluid therepast and to move the valve seat therewith from one position to another contra to the flow from the inlet to the outlet whereby said valve plunger and valve seat cooperate as a piston for increasing the volume of said chamber between the same and said outlet, said valve plunger, upon movement thereof in the direction of flow from the inlet to the outlet, moving away from said valve seat for a predetermined distance so as to permit the flow of fluid therepast, and lost motion means connecting said valve plunger and said valve seat for returning the latter to said one position after predetermined movement of said plunger in the direction of flow from the inlet to the outlet.

7. A dispensing device comprising, means forming a chamber with an inlet and an outlet, a valve seat mounted in said chamber for movement in opposite directions respectively contra and with the flow of fluid from the inlet to the outlet, a valve plunger mounted in said chamber for movement in said directions, means for moving said valve plunger in said directions, said valve plunger, upon movement thereof in one direction, engaging said valve seat so as to prevent the flow of fluid therepast and to move the valve seat therewith from one position to another in said chamber whereby said valve plunger and seat cooperate as a piston for varying the volume of said chamber between the same and said outlet, said valve plunger, upon movement thereof in the other direction, moving away from said valve seat for a predetermined distance so as to permit the flow of fluid therepast, and lost motion means connecting said valve plunger and said valve seat for returning the latter to said one position after predetermined movement of said valve plunger in said other direction.

8. A dispensing device comprising, means forming a cylindrical chamber with an inlet and an outlet, an annular valve seat mounted in said chamber for reciprocating movement, a valve plunger body smaller in diameter than the inner diameter of said cylinder, but at least as large in diameter as the inner periphery of the valve mounted in said chamber between the valve seat and the outlet for reciprocating movement, means for reciprocating said valve plunger, said valve plunger, upon movement thereof away from the outlet, engaging said valve seat so as to prevent the flow of fluid therepast and to move the valve seat therewith in said chamber away from the outlet whereby said valve plunger and seat cooperate as a piston for increasing the volume of said chamber between the same and said outlet, said valve plunger, upon movement thereof towards the outlet, moving away from said valve seat for a predetermined distance so as to permit the flow of fluid therepast, and lost motion means connecting said valve plunger and said valve seat for returning the latter towards the outlet after predetermined movement of said valve plunger towards the outlet.

9. A dispensing device comprising, means forming a chamber with inlet and outlet ports, a valve seat and valve plunger mounted in said chamber for reciprocation in opposite directions respectively contra and with the

flow of fluid from the inlet port to the outlet port, said valve seat and valve plunger being relatively movable in said opposite directions for engagement and disengagement with one another respectively to close and open fluid passage through the chamber, lost-motion means connecting said seat and valve plunger for moving the same together after predetermined movement of one away from the other, and means for reciprocating one of said members, said valve seat and valve plunger, when engaged, cooperating with one another as a piston for varying the volume in said chamber between the same and said ports.

10. In a dispensing device, comprising a casing having a cylindrical inner wall defining a chamber having an outlet at one end thereof and an inlet spaced from said outlet; a shaft supported in said chamber for axial movement therein; a valve plunger on said shaft; means for moving said shaft axially in said chamber from a valve closing position in which said valve plunger lies between said inlet and outlet and relatively away from said outlet, and a valve opening position in which said valve plunger lies between said inlet and outlet and relatively towards said outlet; a valve seat comprising a ring slidably fitting said inner wall on the inlet side of said valve plunger; a pusher engageable with said ring and moving with said rod, said pusher constituting a lost-motion connection between the valve plunger and the ring for advancing the ring towards said outlet after predetermined opening movement of said valve plunger, said valve plunger engaging said ring upon closing movement thereof to block fluid flow from said inlet to said outlet and to return said ring towards said inlet, whereby said valve plunger and said ring constitute a piston for sucking back fluid into said chamber from said outlet; a nozzle telescopically

engaged in said outlet for outwardly extending and inwardly retracting movement; and means connecting said nozzle and valve plunger for movement together whereby said nozzle extends and retracts respectively with the valve opening and closing movements of said shaft.

11. The combination claimed in claim 10, the means connecting said nozzle and valve plunger comprising a cylindrical sleeve providing a fluid conduit to said nozzle, said casing having a cylindrical bearing surrounding said outlet for slidably supporting said sleeve, and aperture means in said sleeve providing passage for fluid from said chamber to said sleeve.

12. The combination claimed in claim 10, a check valve seat in said nozzle, and a check valve supported in said casing, bias means for moving said check valve towards said seat, the biased motion being in the direction of fluid flow from said chamber to said nozzle, and means for limiting the motion of said check valve to less amplitude than the extending movement of said nozzle.

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